



Health and Environment Conference Proceedings

Edited By

Prof. Syed Anwar Dr. Moetaz El Sergany Prof. Ahmed Ankit

Hamdan Bin Mohammed Smart University P.O. Box 71400, Dubai Academic City, Dubai United Arab Emirates

ISSN# 2414-6102

Table of Contents

ealthcare Management	••••••
Drivers of Hospital Safety Culture of Quality in Emerging Economi	ies: The Case of
Colombia	
Mario Ferrer	
Ricardo Santa	
A Capstone Project: "One-System-Network" of an Electronic Healt	h Record Smartphon
App	
Leugim J. Suriba, BSN, RN, MN	
Knowledge and Awareness about Cervical Cancer Vaccine (HPV) A	Among Parents in
Sharjah	
Health Literacy among UAE Adolescents Using the NVS Instrumer	nt
Niyi Awofeso, Ahmad Al Zarooni, and Zahour Al Haj Rabih	
Perceptions and Motivations of Volunteers in the United Arab Emir	ates – Health Servic
Implications	
Niyi Awofeso and Mohammed Guleid	
The Efficacy of Eaulier Rehabilitation Therapies in 44 Patients with	n Parkinson's Diseas
ZHANG Jun	
The Fiction of TQM Implementation in Healthcare Organizations	
Uche Nwabueze	
A Customized Change Management Process System in the Health C	Care Industry
Abdul Qureshi	
A Survey of Energy Drink Consumption and Negative Health Effec	ets: A Random Samp
of Emirati Higher Education Students	
Supporting Healthcare Management through Mobile Technologies:	BH Hospitals' And
Humam Elagha, Hanan Bamasood and Navla Albinali	
Impact of Traffic Congestion on Drivers Commuting between Shari	iah and Dubai Emira
impact of frame congestion on Drivers Communing between Sharj	jan ang Dubai Enilla
Amal Hussein	
Insights into the Diagnosis Related Group (DRG) payment method	in Abu Dhabi Healtl
care system)	
Saeed Abdullah Mohammed Hussein	
nvironmental Studies	•••••••••••••••••••••••••••••••••••••••
Public Awareness about Electromagnetic Radiation Pollution in Bas	sra Community
Safaa M. Imran, Khulood M.Omran, and Qussay Mohammed	-

The Effect of Noise, Heat Stress and Efficiency of Safety Performance on Workers' S in Small Metal Workshops	Safety 170 <i>170</i>
The Blue Port with a Shade of Green: The Case Study of Skyros Island Antonopoulos, K Valentina Plaka, Adamantini Mparmpakonstanti, Despoina Dimitriadou, and Constantina Skanavis.	175 175 175 175
Ecotourism as an Educating Tool for Encouraging Sustainable Development: The Ca Skyros Island <i>L Constantina Skanavis and Aristea Kounani</i>	se of 188 <i>18</i> 8
Middle School Students' Environmental Literacy Assessment in Thessaloniki, Greece Ilias Nastoulas, Kalliopi Marini, and Constantina Skanavis	e 198 <i>19</i> 8
Is an Ecovillage Type of Living Arrangement a Promising Pathway to Responsible Environmental Behavior?	210
Performance Evaluation of a Management Scheme in Order to Upgrade the Diversion	1 of
MSW: Full Scale Application in Kalamata (Greece) D.F. Lekkas [*] and E.E. Klontza	220 220
Al Bastakiya: Passive Design Techniques in Traditional Architecture Isra Abu Zayed	223 223
Survey on Households Solid Waste Management among Emirati Households Aysha Almansoori and Mayada Moussa	227 227
How Eco-Friendly are Abu Dhabi Residents?	238 <i>238</i>
Educators' Perceptions Concerning the Reactions of Students in the Presence of Environmental Education Jana Bou Reslan	244 244
Recycling Attitude, Knowledge, and Behavior of Sharjah Households Mahra Khalfan Al-Kitbi and Mayada Moussa	255 255
Case Study: Change in the Approach of Chemical Control on <i>Oryctes</i> Leads to Better Control, Cost Reduction, and Less Environmental Pollution	: Pest 261 261
The Environmental Problems of the Current Landfill in Ajman Waleed Abdulla Saif Alshehhi	267 267
Integrated Management System of Wadi Wuarayah National Park, Fujairah, UAE Laila Al Ameri	273 273
Environmental Laws and Regulation (ERM602_01): Assessment (4) Final Project: U and London Convention (International Convention on the Prevention of Marine Pollu by Dumping of Waste and Other Matter)	AE ition 280 280
United Nations Convention on Climate Change and UAE's Efforts Towards it	289 289
Assessment of the Environmental Management Practices to Combat Overfishing in th UAE	ne 298 298

The Amount of Waste Produced By Family Households Living in Dubai	306
Nourah Al Takarli and Mayada Moussa	306
Evaluation of the Environmental Status of the M-35 Industrial Zone in the Musaffah	
Industrial Area in Abu Dhabi	313
Mark Turner, Ahmed Rady, Samer Akl, Mohammad Al Ashram, and Senathipathi Kalimut	hu.313
Khalid Al Hajeri and Faisal Al Hammadi	313
Jennifer Lloyd	313
Risk Characterization and Hazard Evaluation System as a Decision Making Tool in	
Evaluation of Risks of Hazardous Materials Storage Facilities in Musaffah, Abu Dha	bi.327
Mark Turner, Ahmed Rady, Samer Akl, Mohammad Al Ashram, and Senathipathi Kalimut	hu.327
Khalid Al Hajeri and Faisal Al Hammadi	327
Jennifer Lloyd	327

Foreword

Prof. Syed Anwar Dr. Moetaz El Sergany Prof. Ahmed Ankit

The Health and Environment Conference held under the auspices of Innovation Arabia10 continues HBMSU's tradition of bringing together academics, learners and practitioners from all parts of the world. The conference particularly facilitated the interactions of learners and younger academics with the established scholars in various sessions. The papers contributed leading-edge knowledge in areas such as environment and sustainable development, CSR, health policy and welfare.

The papers presented in these proceedings reflect state-of-art knowledge; they would certainly provide great impetus for generating innovative research ideas in various parts of the world. We thank all authors and participants for their contributions

We would like to take this opportunity to thank Dr. Mansoor Al Awar, Chancellor of HBMSU for his help, guidance and support at every stage of the conference. Thanks also go to Mr. Wissam Steitie, Congress Chair and his team for effectively organizing the conference. We must thank Professor Adi Arida, Dean, School of Health and Environmental Studies and the technical committee members for painstakingly reviewing the papers. Finally, we would like to express our sincere appreciation of the great efforts made by Mrs. Reem Asqoul in organizing the papers for these proceedings.

Research Papers

Healthcare Management

Drivers of Hospital Safety Culture of Quality in Emerging Economies: The Case of Colombia

Erick Calvo Universidad del Atlantico, Colombia

Mario Ferrer Al Faisal University

Ricardo Santa ICESI University, Colombia

Abstract

The objective of this study is to identify the elements that contribute most to the culture of quality in patient safety in Colombia North Coast hospitals and clinics. Additionally, this study seeks to establish and test a model to determine relations between the drivers of safety culture. In order to test the proposed hypotheses, self-administered а questionnaire was submitted to 1739 clinic and hospital workers in the Colombian North Coast. Research findings indicated that the safety culture in Colombian North Coast hospitals is based on their systems related to feedback about errors. auality of documentation and organizational learning.

Key Words: Hospital, Safety Culture, Documentation, Feedback about Errors, and Colombia.

Introduction

Patient safety culture is regarded as a prevention of patient injuries or adverse events resulting from the processes of health care delivery. The patient safety initiative originated in the mid - 1970s and 1980s, when, due to medical malpractice claims, health care leaders adopted continuous quality improvement principles and recognized the need for the risk management health care profession. (Chen, et al. 2012). Patient safety is also seen from a strategic point of view as making simple operational designs that can prevent minor errors from coming into being and taking necessary precautions to determine, report, and correct the errors before they affect the patient (Ocak, Koseoglu and Bertsch, 2015)

The issue of patient safety culture has been generously examined in recent years in western countries, but it has not been extensively considered in a research setting in Colombia.

The work of Collazos (2013) based on The World Health Organization (WHO) Safe Surgery Saves Lives Campaign which relies on the appropriate use of a checklist to improve surgical safety and Gaitan-Duarte (2008) triggered an interest in hospital quality and safety related research in the ever-growing sector of health care in Colombia. The healthcare system in the Colombia is classified as a national healthcare system in which the government provides various healthcare services through a number of public and private agencies.

The most recent healthcare system in Colombia was approved in 1993 by a universal health insurance scheme (Law 100) whereby all citizens, irrespective of their ability to pay, are entitled to a comprehensive health benefit package. In Colombia's system of universal health insurance, people participate in one of two regimes depending on income: the Contributory Regime (CR), which covers workers and their families with monthly incomes above a minimum monthly amount (approximately US\$273 per month), and the Subsidized Regime (SR), which covers those identified as being poor through a proxy means test. (Giedion & Villar, 2009).

The healthcare sector is provided with significant resources but the attention delivered to patients is criticized frequently by users and the delays in attention in most of the insurers known as EPS is very common. Quality is one of the factors to be expected to be the differential factor among insurers since prices and benefits are both determined by the government and any competition among these would be expected to be based on this key factor.

Despite the extraordinary increase in criticism of Law coverage, 100 is omnipresent in Colombia, and calls for its complete overhaul are not uncommon. According to some critics, the benefits of the current health system are unclear and that the transformation of supply to demand subsidies has not advanced quickly enough, leading to inefficiencies in the allocation of resources. (Gaviria, et al, 2006)

Most private hospitals serve those who pay in cash or through private insurance, which is compulsory for the roughly 40% of Colombians who hold "formal" jobs. In theory, it should also serve the remaining 60% of Colombians, who are covered by government-subsidized insurance, which is provided free of charge. Dr. Alfredo Pinzon, an internal medicine specialist that works at Hospital Simon Bolivar in the Colombian capital of Bogotá, explains that unfortunately it is unusual for a person with [government] subsidized insurance to go to a private hospital. Very few such people would even bother trying. And if they do, they might expect to be sent onwards, to a public hospital. Colombian Senator Jorge Enrique Robledo argues that: "The health system faces financial collapse, in large part because it totally lacks auditing and accountability". It's an indicator of raging inequities within Colombia's health care system, which has been lauded for providing near-universal coverage but widely criticized for providing dramatically inferior care to the less affluent. So severe is the disparity in care that in 2010, after a court order forced the government to begin paying for more equitable care, the government took the rather extraordinary legislative step of labelling the inequities a "social emergency" in order to implement changes to the financing of public health services. (Webster, 2012)

According to the World Health Organization (WHO), Colombia spent 7.2% of its gross domestic product on health in 2014, or roughly \$27.21 billion (www.who.int/countries/col/en/). In comparison, the Canadian Institute for Health Information says that Canada spent 10.4% of its gross domestic product on health in 2014, or roughly \$228.05 billion. According to the World Bank, the Colombia government covered 75.1% of overall health expenditures. In Canada, public expenditures are about 70.9%. Health expenditure per capita was 569.18 dollars in Colombia in 2014 and in Canada in the same period was 5291.74 dollars, almost 9.29 times more than Colombia. According to the United States Central Intelligence Agency, there were 1.5 physicians per 1000 population in Colombia in 2014, while there were 2.1 per 1000 in Canada in 2014. (World Bank, 2017)

A recent report from The Organisation for Economic Co-operation and Development (OECD) specifies how Colombia has significantly improved its health system over the past 20 years, leading to a rise in life expectancy and a fall in infant mortality. Infant mortality has fallen from 40 deaths per 1000 live births in 1970 to 12.8 and life expectancy at birth reached 75.2 years in 2013. To maintain its ambition of universal, high-quality health care, Colombia should now focus on improving efficiency and strengthening financial sustainability (OECD, 2015). The report also says that almost every Colombian now has access to health care. with coverage nearly quadrupling from 23.5% of the population in 1993 to 96.6% in 2014. Health insurance coverage increased most rapidly among the poorest 20% of the population (from 4% in

1993 to 89% in 2013) and in rural areas (from 6.6% in 1993 to 92.6% in 2013).

Despite the huge positive steps that the Government of Colombia has taken to improve healthcare systems, they still face challenges.

Wagner et al. (2012) in their study emphasised that a strong patient safety culture is fundamental for accreditation and sustainability in health care organisations and requires solid and proactive study of factors such as quality of communication, feedback about errors, non-punitive response to errors, and structured documentation, amongst others.

The role of leadership at medical and nursing committed embed levels to and communicate patient safety culture amongst all the hospital staff, and through them to reach families, communities and nation, is essential to prevent adverse events, errors, and accidents, and provide quality of patient safety culture in all healthcare organisations (Ulrich & Kear, 2014; Zuhal & Sonjul, 2015). This research seeks ways to evaluate the factors that contribute most to the culture of quality in patient safety in Colombian hospitals.

Literature Review

1) Safety Culture

Murphy et al. (2006) argued that in order to visualize a culture of safety, it is imperative to understand the concept of "organisational culture". Organisational culture is regarded as the set of values, guiding beliefs, or ways of thinking that are shared among staff members of an organisation. Staff members often resist changing the way they do things but they also try to change the culture in which they live or work. In schools of medicine, nursing, and allied health, providers have traditionally been taught, through incident reporting procedures and behaviour of other staff members, that when things go wrong they should find out, "Who did it?" The focus has been on individual failures. On the other hand, a safety culture asks, "What happened?" Safety culture looks at the system, the environment, the knowledge, the workflow, the tools, and other stressors that may have affected healthcare staff behaviour. In other words, it is a subset of organizational culture that in healthcare is defined as the integration of safety thinking and practices into clinical activities (Bahrami et al., 2013).

Turkmen et al (2013) found that, in order to create a sustainable patient safety culture, leaders and employees need to internalize this process and the leaders need to adopt the strategy of "using errors as an instrument for learning, not for punishing. Similarly Sweis et al (2013) concluded that top management commitment, attitudes and behavior are related to improvements in organizational cultures, such as patient safety. The empirical studies on safety culture show that healthcare institutions with a dedicated focal point on organisational processes improvement and the development of quality management systems have been shown to have greater potential for improving patient safety culture. Furthermore, voluntary quality accreditation leads to reductions in deficiency citations and in improved quality of care outcomes. Therefore, healthcare organisation а attempting to implement any continuous improvement methodology without first undertaking a fundamental philosophical transformation will fail (Giraldo et al., 2015).

2) Feedback about Errors

Medical errors are unfortunately common in healthcare practices worldwide. Zineldin et al argues about how systematic methods of patient safety and quality assurance in healthcare are still evolving in developed and developing countries.(Zineldin, 2014).

Laidoune and Gharbi argue that the healthcare system is an open sociotechnical system in which human reliability, information, safety, and service quality are enhanced by sociocultural factors such as feedback about the experience. Reporting events and providing feedback when errors occur are important determinants of a safety culture (Who, 2008). Reporting incidents is thus essential to achieving a learning culture in healthcare organizations and can only happen in a non-punitive environment where events can be reported without people being blamed. However, the actual number of errors is probably much higher than the quantity reported, as many errors might be hidden because of (founded or unfounded) fears of public humiliation or punitive consequences, or the belief that reporting will not result in any effective changes whatsoever (Vangest & Cummins, 2003).

А recent study in Colombia from Universidad de la Sabana (Faculty of Nursery and Rehabilitation) concludes that 180.000 people died every year due to medical errors, and that about 80 percent of these accidents could be avoided. Seventy percent of the adverse events are due to wrong procedures, lack of attention and resources and delays in transportation of harmed people (El Espectador, 2016). In the USA a research from Johns Hopkins University suggests that more than 250.000 deaths per year are due to medical error. Martin Makary who is a professor of surgery at aforementioned university claims that "the medical coding system was designed to maximize billing for physician services, not to collect national health statistics, as it is currently being used" (Makari & Daniel, 2016)

In an assessment of patient safety culture performed in Palestinian public hospitals researchers Hamdan and Alra'oof Saleem found that the reluctance of staff to report incidents is probably linked to the prevalence of a punitive response to error and blame culture. The staff in Palestinian hospitals worry that mistakes they make are kept in their personnel file and fear that they will be addition. held against them. In the insufficient feedback and communication about error contributed to that staff to be less informed about errors that occur, or feedback about changes implemented and ways to prevent errors are not properly discussed (Hamdan & Alra'oof Saleem, 2013). In Italy for example, Bagnasco et al assessed health professionals' awareness of patient safety culture who worked in a public hospital. Their findings allowed them to conclude that their study was linked to the theory of human failure. Sixty percent of the respondents gave positive replies to the survey questions related to feedback and communication about errors allowing them to conclude that certain progress towards the Culture of Safety is being made (Bagnasco, et al, 2011). Employees who do not deal directly with the patients are usually more willing to report errors. As mentioned in Jones et al. work in considered laboratory units is more organized than in other units since it is controlled by more professional standards, and because errors investigated in these units are done as a group. On the contrary, when an error is committed by a nurse, the nurse is investigated as an individual rather a member of a medical team (Jones et al, 2008)

3) Organizational Learning

The organizational learning theory applied to patient safety" had its beginning in the work of Argyris's on personal and organizational effectiveness, which focused on how individuals design their actions to achieve the intended results in challenging situations. popularized the organizational Senge learning theory, which evolved since its roots in the theories of Deming, Juran and Crosby. Senge is known for being who popularized the concept and integrated it with the general systems theory (Senge, 1990; Edwards, 2016). In addition, through the years health care leaders worldwide have struggled to make measurable progress in patient safety, and how the requirements for high reliability the large gap between current and performance and the putative target of zero preventable harm, many still scoff at the suggestion that it is achievable (Edward, 2016).

Following it, Got et al also consider that the healthcare field lacks of patient safety discussions that includes understanding organizational culture, communication failures, degree to which an environment is conducive to change and more importantly, workers' ability to learn from preventable adverse events and to view these as learning opportunities. Through an extensive literature review Goh et al argue that in the conceptual literature is found that a safety culture and learning are closely linked, where a safety culture can also promote collective learning. (Goh et al, 2013)

Several researchers like Kathri et al argue that healthcare needs to move from a blame to a just or learning culture, which they define as "an environment supportive of open facilitate safe practices". dialogue to However, this requires a comprehensive understanding of the organizational attributes or antecedents that can cause blame or just cultures (Kathri, 2009). Ginsburg et al examined the relationship between organizational leadership for patient safety and five types of learning from patient safety (PSE). Their main findings indicate events that formal organizational leadership for patient safety is an important predictor of learning from minor, moderate, and major near-miss events, and major dissemination. They also argue that some progress in subjecting theorical models of what is needed to create safer systems to more rigorous empirical examination is being made (Ginsburg, 2010).

4) Documentation

A key issue in health care quality is the accuracy of documentation in patient medical records. Poor documentation may be the underlying cause of poor performance in quality measures, and may also negatively affect the provider's ability to receive the appropriate payment for services rendered. Furthermore, there is a risk that when patients' medical records are incomplete, they might receive inappropriate care. Documentation in the medical scheme originally attempted to provide a record of a patient's care and to improve communication among health care providers (Penoyer et al., 2014). This documentation can be executed by paper records or electronically. Currently, it is vital to ensure a proper record according to the standards of patient care and changes in technological advancements. Further, a recent qualitative case study by Hewitt and Chreim (2015) where they interviewed 40 healthcare practitioners in a tertiary care hospital in Ontario, Canada, found that only in a very few cases healthcare providers documented patient safety errors after fixing the problem.

Since many hospitals around the world continue documenting on paper and creating useless formats, advances in health care documentation demonstrate the necessity to use an Electronic Health Record, called Electronic Medical Record (Healy et al., 2008). The Electronic Health Record system abolishes illegible handwriting; nonsense notes and eliminates the arduous assignment of alphabetical cataloguing. This type of documentation also brings other advantages, for example, it organises patient records, gathers evidence for medical legal cases, provides backup for reimbursement, decreases transcriptions costs, ensures less duplication of treatments, improves record accessibility, and provides information for measuring quality control and regulatory purposes. Also, it alerts personnel to potential patient safety events, which enables selective targeted review of high-risk patients.

Avers et al. (2009) demonstrated that nurses have mixed perceptions about the Electronic Health Record. Kossman and Scheidenhelm (2008), reported that 73 percent of nurses claimed spending at least 50 percent of their time using the Electronic Health Record, which leaves less time for patient care. Similarly, some nurses reported that using the Electronic Health Record reduces their critical thinking and this documentation is lacking in the detail needed by physicians for a complete understanding of the patient's physical and physiological status. However, Pizziferri et al. (2005) tested how the Electronic Health Record was perceived and the results showed 86 percent acceptance. Physicians reported that they enjoyed using the system and preferred it above the paper record. Also, the overall time spent per patient during clinical sessions decreased with the new system. At the end, a majority of physicians believed that using the Electronic Health Record resulted in quality improvement.

5) Interrelatedness between Variables

As shown in the literature review, safety culture depends on different factors and it serves as a guide to show how employees will behave in the workplace. According to Aboul-Fotouh et al. (2012),the characteristics of a strong and proactive safety culture include the commitment of the leadership to discuss and learn from errors (feedback about errors), to document and improve patient safety, to encourage and practice teamwork, open communication (Quality of communication), to spot potential hazards, to use systems for reporting and analysing adverse events (documentation) and to celebrate workers as heroes improving safety rather than as villains committing errors (Non-punitive response to errors). Although multiple investigations indicate that hospitals aiming at implementing a safety culture need to consider different variables as drivers, it is important to explain how these drivers (feedback about errors, non-punitive response to errors, quality of communication documentation) and interrelate with each other and impact on safety culture. Fracica et al. (2006) correlate the non-punitive response variable with a better quality of documentation.

Natarajan and Morse (2009) showed that the notions of defect in services need to be addressed since the customer is often involved in many intangible factors that affect the service experience. They suggested that one way to deal with this increased level of subjectivity is by replacing the human component with information technologies that standardise and automate processes. Consequently, a non-punitive environment encourages staff to report errors and use the documentation to redesign processes for higher reliability. This is a marked contrast to a culture of blame and shame where staff live in fear of punishment for mistakes they must hide. When it comes to documentation, Longenecker and Fink (2001) indicate that organisations that do not document on-going performance measurement and feedback about errors into their management development programs, tend to experience lower than expected performance improvements.

Similarly, Holzmann et al. (2012) assert that organisations use different methods and techniques for debriefing and learning. Some of these methods are based on discussions and interactions (quality of communication) between professionals, while other methods are based on written records and Discussions documentation. involve information simultaneous exchange of between the team members in order to describe the event. understand its circumstances, identify its roots, and agree on correcting. For preventing similar errors in the future, it is important to keep track of the documentation. This requires a wellfunctioning healthcare system along with high-performing individual providers and care teams within that system.

Finally, Wagner et al. (2012) related communication, feedback about incidents and non-punitive response to errors, in which established communication channels for problem solving and quality improvement maintained a positive working relationship. Thus, the following hypotheses to be tested by the conceptual model (Figure 1) are proposed in attempting to answer a question that examines the elements that contribute most to the culture of quality in patient safety in Colombian clinics and hospitals:

Figure 1: Hypothesized structured model



H1. There is a predictive relationship between feedback about errors and safety culture.

H2. There is a predictive relationship between organizational learning and safety culture.

H3. There is a predictive relationship between quality of documentation and safety culture.

Methodology

In order to test the proposed hypotheses in the selected research setting – Colombian health care institutions - a total of 1739 selfadministered paper-based surveys were distributed to a purposively selected sample of healthcare professionals affiliated to 10 different clinics and hospitals in different cities and towns in the North Coast of Colombia. The sample was drawn from medical centers (hospitals& clinics) with at least 100 employees from both privately and publicly operated health institutions in Colombia.

The survey format consisted of a brief demographic section outlining the participant's professional portfolio (medical, nursing, allied health etc), employment (full time, part time, other), work pattern (evening only, rotating shifts), organizational role (executive, middle manager, team leader) number of years of experience in current position, number of years of experience in current profession, duration of employment in the Colombia public health system, English proficiency, age and gender. The questionnaire scales therefore had a total of 35 items. Quality of communication (6), and documentation (5), non-punitive (6). organizational response to errors learning (7), Feedback about errors (5) and safety culture (6) related items were identified from the literature as well as extracted from the Hospital Survey on Culture (HSOPSC). Patient Safety Respondents were asked to rate each item on a 5-point Likert-like scale which consists of these levels: strongly agree =5, agree =4, neutral=3, disagree=2, strongly disagree =1.

Returned surveys were coded and entered into the SPSS statistical software package (version 23 was used) to organize, clean and analyze the data. Data analysis then progressed stages; into two firstly. descriptive data using non-parametric techniques, including the chi-square test for relatedness, was undertaken to determine whether any of the categorical variables were related and provide a profile of the respondents across the hospitals. This included professional portfolio, work pattern, work longevity and language skills. These tests enhance understanding of the examination sample through of the distributions of behavioural and demographic variables. SPSS was also used to test that the reliability of the Cronbach's (1951) Alpha values for the scales (Table 1) were higher than 0.65, which is within the acceptable threshold (Hair et al., 1998).

The dependent variable of this research is safety culture. To explain the variance in the dependent variable, three independent variables will be explored (Figure 1). This research addresses the relative lack of understanding of safety culture in the Colombian healthcare sector by taking factors known to be important in the provision of health care services. This research is an attempt to draw up a more comprehensive view of those factors together and to evaluate their effect on the Safety culture.

Table 1: Scale item Cronbach's alpha

Variable	# of Items	Alpha

Organizational learning	7	0.667
(OI)		
Feedback about errors	5	0.770
(Fae)		
Documentation (Docum)	5	0.657

Amos (version 23) was used to obtain the property of the measures. The average mean values of the statements' ratings were used to build the variables that made up the structural equation model. Independent variables used study include: Organizational in this learning. Documentation and Feedback about errors. The dependent variable is 'Safety Culture'. The fit indices for the scales' regression model as indicated by the CFI, TLI and RMSEA were very good, given the structure of each scale. The standardized loadings and the R-square obtained for each item were examined to further test the reliability of the scale via confirmatory factor analysis. The standardized loading values of most of the scales' items were higher than 0.5. Similarly, R-square values were higher than 0.2, demonstrating high reliability of the scales. With the scales refined and the measurement models well structured, further testing can be done. Structural equation modelling was used to analyse if there is a predictive relationship between one independent variable and a criterion dependent variable. According to Hair et al. (1998) Structural Equation Modelling is a multivariate statistical technique used to relationship examine the between a dependent variable and several predictors. Hair et al. (1998) stated that Structural Equation Modelling analysis provides a means of objectively assessing the magnitude and direction of each predictor's relationship to its dependent variable. Three hypotheses proposed in the literature review section were tested using Structural Equation Modelling which were generated at the p<0.001 levels.

Data Analysis

Data collection took place between February 2016 and September 2016. The characteristics of the respondents showed

that the majority of the respondents were: medical doctors (9%), nurses (57%) allied health professionals (21%), and non-clinical staff (7%). Overall, 88% of the respondents were employed on a full time basis and 71% of them had more than 3 years of work experience. Of 5 maximum points, the overall mean (SD) score is shown in Table 2.

Table 2: Scale Mean Values

Variable	Ν	Mean
Safety Culture (Safecu)	1739	2.78
Organizational learning (Ol)	1739	2.32
Feedback about errors (Fae)	1739	1.85
Documentation (Do)	1739	3.16

Descriptive Results

One of the most interesting findings during this research are related to variables that were not included in the structural model.

Twenty percent of the surveyed workers considered that clinics/hospitals allow that adverse event occur repeatedly. 19 percent of the employees considered that personnel opinions are not listened. 29 percent of health workers argue that the implementation of changes after errors were discovered have not been effective. 27 percent of the sample considered that the procedures and systems are not good enough to prevent medical errors. 55 percent of the workers consider that it is not easy to report what they think about problems in the clinic/hospital. 75 percent of the respondents considered that their opinions are ignored by the clinic/hospital. 52 percent of heatlth workers interviewed considered that their opinions/suggestions are not valued by the clinic/hospital. 34 percent of the surveyed employees think that in order to do the work easier employees ignore the procedures in place. 68 percent of health workers surveyed considered that employees are blamed when a patient is hurt. 52 percent of health workers consider that is treated unfairly when a medical error is discovered. 50 percent of employees reported that they don't feel comfortable reporting any medical errors. In a positive setting 80 percent of the employees

admit that receive feedback when medical errors occur in their unit. 78 percent reported that their workplace pursue continuous improvement. This is mainly due to accreditation processes or independent certification audits. Many challenges still exist in the healthcare system and it requires a great effort to improve the quality of the services provided.

As the main objective of this study is to identify the elements that contribute most to the culture of quality in patient safety in Colombian hospitals, the next step in the data analysis was to perform a confirmatory factor analysis. Confirmatory factor analysis was chosen instead of other classical validation techniques such as exploratory factor analysis, as exploratory factor analysis has a number of significant shortcomings. Among other issues, exploratory factor analysis can produce distorted factor loadings and incorrect conclusions regarding the number of factors, and also, the solution obtained is only one of an infinite number of solutions (Segars and Grover, 1993)

Confirmatory factor analysis was used to study the relationships between the set of observed variables and the set of continuous latent variables. The overall fit of a measurement model is determined by a confirmatory factor analysis. The chi-square goodness-of-fit test shows that the model did fit the data well, X^2 (N = 1379, df = 200) = 583.08, p < .05. The baseline comparisons fit indices of the NFI, RFI, IFI, TLI and CFI exceed 0.90 (see Table 3). This suggests that the hypothesized model fit the observed variance-covariance matrix well relative to null or independence model.

Table 3: Baseline Comparisons	Table 3	Baseline	Comparisons
-------------------------------	---------	----------	-------------

Madal	NFI	RFI	IFI	TLI	CEI
Model	Delta1	rho1	Delta2	rho2	CFI
Default model	0.948	0.934	0.965	0.955	0.965
Saturated model	1		1		1
Independence model	0	0	0	0	0

The estimates were analysed for the measurement model. The unstandardized regression weights were all significant by the critical ratio test (> \pm 1.96, p < .05). The standardized regression weights range from 0.372 to 0.522. These values indicate that the seventeen measurement variables are significantly represented by their respective latent constructs.

The study now turns to examining the hypothesized structural model. The chisquare per degree of freedom value for the model was 2.915, p < .05. The baseline comparisons fit indices of NFI, RFI, IFI, TLI and CFI for the model were above to the suggested cut off value 0.90. The RMSEA is 0.033 which is within the recommended range of acceptability (<0.05 to 0.08). This suggests that the hypothesized model fit the observed variance-covariance matrix reasonably well relative to null or independence model.

Regression weights (Table 4), Standardised regression weights, and Squared Multiple Correlations: Of the coefficients associated with the paths linking the model's exogenous and endogenous variables, all of them are significant by the critical ratio test (\pm 1.96, p < .001). Support was found for the three proposed hypotheses. These significance levels show that there is a highly significant relationship between feedback about errors, organizational learning, quality of documentation and safety culture.

Table 4: Regression Weights

			Estimat e	S.E	C.R.	Р	Label
Sc c	<	Fae	.372	.07 1	5.21 7	** *	par_2 0
Sc c	<	Ol	.460	.04 7	9.68 2	** *	par_2 1
Sc c	<	Do	.522	.14 2	3.67 1	** *	par_2 2

The significance levels support hypotheses 1, which proposed a predictive relationship between feedback about errors and safety culture. This suggests that the greater the feedback about errors in the Colombian hospitals' the greater the improved safety culture at their workplace ($\beta = 0.372$, p < 0.01).

Likewise, support was found for hypotheses 2 ($\beta = 0.46$, P < 0.01), which proposed a relationship predictive between organizational learning and safety culture greater such that the the effective documentation the higher the safety culture at the work place. Support was also found for hypotheses 3, which proposed a predictive relationship between quality of documentation and safety culture. In this case ($\beta = 0.522$, P < 0.01) it can be concluded that the greater the quality of documentation the better the safety culture at the work place.

Conclusions and Policy Implications

Health insurers in Colombia have not yet developed into effective and efficient purchasers of health care services, according to the OECD report. Payments to doctors, clinics and hospitals should increasingly reward health care quality and good outcomes, rather than volumes of health service provided.

The report recommends that Colombia work towards developing a stronger performance and accountability management for health insurers since these organizations are the same ones that provide the service. More demanding performance management is equally needed for clinics hospitals and other health care providers.

Factors such as: the prioritization of new technologies, accessibility to the health system, patient attention, medical knowledge, patient care quality and safety, interpersonal and communication skills amongst others must be fully integrated to current and future safety culture programs to guarantee and improve people's lives.

Health care providers must embrace a more extensive set of health care quality standards that consider national and international accreditation standards. At the same time, it is expected that health care professionals be fully conscious of the aforementioned factors as part of a real improvement journey, and that guidelines for primary care services should be developed. Also, a specialist training curriculum focused on preventing and managing chronic disease should be created for general practitioners.

Steps should also be taken to ensure that health system information is used as effectively as possible. The development of a more sophisticated information system will help Colombia extend its participation in international benchmarking efforts, such as the OECD's *Health Care Quality Indicators*. This will be an important step for continuous improvement in health system quality and efficiency.

In order to identify the factors relating to a more efficient culture of quality in patient safety in Colombian hospitals, a set of variables were conceptualized to construct a model that was tested using descriptive and inferential statistics. A five-point Likert-type scale (Strongly Agree - Strongly Disagree) was used to measure statements associated with the operationalization of the model's variables. The three independent variables tested in this study aimed to gain an insight on the common goals that are fundamental to providing a safer culture of quality in Colombian hospitals that advances higher quality levels in healthcare organisations. The key contribution of this paper is that to improve patient safety culture in the hospitals of Colombia and in other countries it is necessary to document errors as well as positive safety practices and provide feedback, with the objective to prevent clinical and medication errors and to embed patient safety culture at all levels by healthcare professionals, without any fear and deliver high quality of patient safety and satisfaction.

Findings related to hypothesis 1, showed a strong and significant predictive relationship between feedback about errors and safety culture. The strong and significant predictive relationship found between them (β =0.372, p <0.001) demonstrates the importance of a culture of feedback about errors in the communication systems of the healthcare organisations to avoid errors or accidents or procedures of low quality. This supports the findings from Bagnasco et al (2011), who conclude that feedback about errors in organisations will allow these to move towards a patient safety culture, in which damage to patients be reduced.

In relation to hypothesis 2, a significant predictive relationship between organizational learning and safety culture was found ($\beta = 0.46$, P < 0,001). This support Ginsburg et al findings that indicate that formal organizational leadership for patient safety is an important predictor of learning from minor, moderate, and major near-miss events, and major dissemination, commonly observed in a culture of safety. In this case it can be concluded that the more an organization learn the stronger the safety culture of a hospital could be.

In the case of hypothesis 3, a significant predictive relationship between documentation and safety culture was found $(\beta = 0.522, P < 0,001)$. This suggests that the greater the effective documentation the higher the safety culture at the hospitals, which is also supported by Hewitt and Chreim's (2015) study. They found that in tertiary hospitals, where errors were not documented after fixing the problem, safety culture was weak.

The independent variables analysed in this study are suggested to be important drivers of a clear safety culture that promotes high quality standards in healthcare organisations. For organisations in the healthcare sector to create a culture of quality, safety and continuous improvement, they must fashion clear communication channels, and correct feedback, documentation and reporting to all stakeholders involved, after the errors are found. Healthcare organisations are prompted not only to identify errors, but also to acknowledge feedback by reporting and documenting adverse events and errors to learn from and prevent future medical or clinical errors from occurring. This is essential for implementing patient safety culture at hospitals. Hospitals often have information about who caused the error, what happened and why a healthcare provider is generating complaints. However, due to the fear of being defamed and losing business, the healthcare organisations and hospitals tend to ignore such formal complaints of clinical or surgical errors against a physician or a surgeon, and overall dissatisfaction with the healthcare service providers lodged by the patients and their families. An education and training unit for patient safety is essential to develop the culture of patient safety culture and make the staff feel confident in reporting errors (before and after fixing errors/harmful events), without any fear of punishment.

For Colombian hospitals to create a culture of quality, safety and constant enhancement, they need to reinforce a transparent and clear communication policy and correct feedback after errors are discovered. However, they need to adapt a policy of non-punitive response to errors, so that staff are able to learn from their mistakes and prevent similar ones in the future, rather than worrying about the consequences of reporting an error. If staff are concerned that their mistakes will be held against them, which will harm their career advancement, they will not report the error and their mistakes will remain unlearned from. Having a culture of patient safety should involve open discussion and trust at all the levels. Reporting an error without fear should not be considered a punishable offence, but beneficial to the healthcare system as a whole, to learn from it, in order to prevent a repeat of surgical or clinical error in the future.

Government, medical fraternity, medical association and accrediting bodies, medical schools and faculty should work in partnership and consider it imperative to embrace and incorporate in their curriculum a special unit to inculcate the habit of safety and reporting about hospital, patient, clinical and mediation safety culture based on global case studies, its positive effects, and negative impact in terms of patient harm, along with legal and ethical implications.

This empirical research contributes to the safety culture literature in the healthcare sector. It adds value to the industry due to the concern of the Colombian Ministry of Health for promoting the quality of service that its

hospitals can provide. It also adds value to knowledge as a multi-variable model is conceptualized, operationalized and tested with Structural Equation Modelling (SEM) techniques. Generalizations of findings are limited due to the nature of the study specific Colombia. Future research to is recommended through modelling and testing the impact of similar surveys in different areas of the country as well as the design of case studies to further expand the findings of the survey.

References

Aboul-Fotouh, A. M., Ismail N. A., Ez Elarab, H. S., and Wassif, G. O. (2012) 'Assessment of patient safety culture among healthcare providers at a teaching hospital in Cairo, Egypt', *East Mediterrarian Health Journal*, Vol.18, No. 4, pp. 372–7.

Alhashem, A. M., Alquraini, H. and Chowdhury, R. I. (2011) 'Factors influencing patient satisfaction in primary healthcare clinics in Kuwait', *International Journal of Health Care Quality Assurance*, Vol 24, No. 3, pp. 249–62.

Al-Ahmadi, T. A. (2009) 'Measuring Patient Safety Culture in Riyadh's Hospitals: A Comparison between Public and Private Hospitals', *Journal of Egypt Public Health Association*, Vol. 84, No. 5-6, pp. 479–500.

Alahmadi, H. A. (2010) 'Assessment of patient safety culture in Saudi Arabian hospitals', *Quallity and Saf ety in Health Care*, Vol.19, No. 5, pp. 1-5.

Al año, 180.000 personas que son hospitalizadas mueren a causa de errores médicos. Retrieved from:

http://www.elespectador.com/noticias/salud/ al-ano-180000-personas-son-hospitalizadasmueren-causa-articulo-632214, January 24, 2016

Alolayyan, M.N., Ali, K.A.M., and Idris, F. (2013) 'Total quality management and operational flexibility impact on hospitals performance: a structural modelling approach', Int. J. of Productivity and Quality Management, Vol. 11, No. 2, pp. 212–227.

Albejaidi, F. M. (2010) 'Healthcare system in Saudi Arabia: an analysis of structure, total quality management and future challenges', Journal of Alternative Perspectives in the Social Sciences, Vol. 2, No 2, pp. 794–818.

Alhashem, A. M., Alquraini, H. and Chowdhury, R. I. (2011) 'Factors influencing patient satisfaction in primary healthcare clinics in Kuwait', *International Journal of Health Care Quality Assurance*, Vol. 24, No. 3, pp. 249–62. Al-Refaie, A., Jalham, I. and Caleb, M. (2012) 'Factors influencing the repurchase intention and customer satisfaction: a case of Jordanian telecom companies', Int. J. Productivity and Quality Management, Vol. 10, No. 3, pp.374–387.

Ayers, D. J., Menachemi, N., Ramamonjiarivelo, Z., Matthews, M., Brooks, R. G. (2009) 'Adoption of electronic medical records: the role of network effects', *Journal of Product Brand Management*, Vol. 18, No. 2, pp.127–35.

Bagian, J (2012) 'Health care and patient safety: The failure of traditional approaches – how human factors and ergonomics can and MUST help', Human Factors and Ergonomics in Manufacturing & Service Industries, Vol. 22, No. 1, pp. 1-6

Bagnasco,A; Tibaldi,L; Chirone,P; Chiaranda,C; Panzone,M; Tangolo,D; Aleo,G; Lazzarino,L; Loredana, S (2011). Patient safety culture: an Italian experience Blackwell Publishing Ltd, Journal of Clinical Nursing, 20, 1188–1195

Bahrami, M. A., Montazeralfaraj, R., Chalak, M., Dehghani Tafti, A., Ahmadi Tehrani, G. H., and Entezarian Ardakani, S. (2013) 'Patient safety culture challenges: survey result of Iranian educational hospitals', *Middle East Journal of Scientific Research*, Vol. 14, No. 5 pp. 641-649.

Chen, C., Fuang Ng-Hui., and Hui Li, Hung. (2012) 'A multilevel model of patient safety culture: cross-level relationship between organizational culture and patient safety behavior in Taiwan's hospitals'. Int J Health Plann Mgmt Vol. 27, No.1, pp 65–p82

Collazos, C., Bermudez, L; Quintero, A; Quintero, Leon, M; Díaz, M. (2013). Verificación de la lista de chequeo para seguridad en cirugía desde la perspectiva del paciente. *Revista Colombiana de Anestesiología*, 41(2), 109-113. <u>https://dx.doi.org/10.1016/j.rca.2013.0</u> 1.001 (Accessed 21 January 2016)

Edwards, M., " An Organizational Learning Framework for Patient Safety, American

Journal of Medical Quality 1–8 DOI: 10.1177/1062860616632295

El-Jardali, F., Sheikh, F., Garcia, N., Jamal, D. and Abdo, A. (2014) 'Patient safety culture in a large teaching hospital in Riyadh: baseline assessment, comparative analysis and opportunities for improvement', *BMC Health Services Research*, Vol. 14, No. 1, pp.122.

Fracica, P., Lafeer, M., Minnich, M. and Fabius, R. (2006) 'Patient safety checklist: keys to successful implementation', *Physician Executive*, Vol. 32, No. 4, pp. 46– 53.

Gaitán-Duarte, H; Eslava-Schmalbach, J; Rodríguez-Malagon, N; Forero-Supelano, V; Santofimio-Sierra, D; Altahona, H. (2008). Incidencia y Evitabilidad de Eventos Adversos en Pacientes Hospitalizados en tres Instituciones Hospitalarias en Colombia, 2006. *Revista de Salud Pública*, *10*(2), 215-226. Accesed January 21, 2017, from http://www.scielo.org.co/scielo.php?script=s ci_arttext&pid=S0124-00642008000200002&lng=en&tlng=es

Gaviria, A; Medina,C; Mejia,C (2006) 'Evaluating the Impact of Health Care Reform in Colombia: From Theory to Practice, Economic Development Research Center, 2006). Accesed January 21, 2017, from http://www.banrep.gov.co/sites/default/files/ eventos/archivos/d2006-06_0.pdf

Giedion, U; Villar, M; Colombia's Universal Health Insurance System, *Health Affairs* 28, no.3 (2009):853-863, doi: 10.1377/hlthaff.28.3.853

Ginsburg, L; Chuang, Y; Blair Berta, W; Norton,P; Ng, P; Tregunno, D; Richardson, J; (2010). The Relationship between Organizational Leadership for Safety and Learning from Patient Safety Events, Health Research and Educational Trust, Volume 45, Issue 3, pp. 607-632

Giraldo, A., Mothersell, W. M. and Motwani, J. (2015) 'The need for implementing lean in healthcare organisations', Int. J. Productivity and Quality Management, Vol. 16, No. 2, pp.211–230.

Goh, S; Chan, C; Kuziemsky, C (2013). Teamwork, organizational learning, patient safety and job outcomes, International Journal of Health Care Quality Assurance 26(5):420-32

Hamdan, M; Alra'oof Saleem, A (2013). Assessment of patient safety culture in Palestinian public hospital International Journal for Quality in Health Care; Volume 25, Number 2: pp. 167–175

Hair, J. F., Anderson, R. E., Tatham, R. L. and Black, W. C. (1998) 'Multivariate Data Analysis', *International Journal of Pharmaceutics'*, 816 p. [Online] : http://www.pearsonhighered.com/educator/p roduct/Multivariate-Data-

Analysis/9780138132637 (Accessed15 July 2016)

Hewitt, T. A., Chreim, S. (2015) 'Fix and forget or fix and report: a qualitative study of tensions at the front line of incident reporting', *BMJ Qual Saf*, Vol. 24, No. 5, pp. 303-310.

Healy, .K, Hegarty, J., Keating, G., Landers, F., Leopold, S. and, O'Gorman, F. (2008) 'The change experience: how we updated our perioperative nursing documentation', *Journal Perioper Pract*.Vol. 18, No. 4, pp. 163 -167.

Holzmann, V., Mischari, S., Goldberg, S. and Ziv, A. (2012) 'New tools for learning: a case of organizational problem analysis derived from debriefing records in a medical center', *Learning Organisations*, Vol. 19, No. 2, pp. 48-62.

Jones KJ, S.A., Xu L, Sun J, Mueller K., *The AHRQ* hospital survey on patient safety culture: a tool to plan and evaluate patient safety programs. 2008

Khatri, N., Brown, G.D. and Hicks, L.L. (2009), "From a blame culture to a just culture in healthcare", Healthcare Management Review, Vol. 34 No. 4, pp. 312-322

Kossman, S. P. and Scheidenhelm, S. L. (2008) 'Nurses' perceptions of the impact of electronic health records on work and patient outcomes', *Comput Inform Nursing*, Vol. 26, No. 2, pp.69–77.

Longenecker, C. O. and Fink, L. S. (2001) 'Improving management performance in rapidly changing organizations', *Journal of Management Development*', Vol. 20, No. 1, pp.7-18.

Makary, M; Daniel, M. Medical error—the third leading cause of death in the US. *BMJ*(2016); pp 353:i2139 doi: https://doi.org/10.1136/bmj.i2139-Retreived from http://www.bmj.com/content/353/bmj. i2139, Janury 24,2017

Mazzei, A. (2010) 'Promoting active communication behaviours through internal communication', *Corp Commun An International Journal*, Vol.15, No. 3, pp. 221-34.

Moody, R. F., Pesut, D.J., and Harrington, C.F. (2006) 'Creating safety culture on nursing units: Human performance and organizational system factors that make a difference', *Journal of Patient Safety*, Vol. 2, No. 4, pp.198.

Moody, R.F., Pesut, D. J. (2006) 'The motivation to care: application and extension of motivation theory to professional nursing work', *Journal of Health Organisation and Management*, Vol. 20, No.1, pp.15–48.

Murphy, D.M., Shannon, K., Pugliese, G. (2006) 'Patient Safety and the Risk New Challenges and Opportunities', Risk Management Hand book on Health Care Organisation. pp. 1–22.

Natarajan, R. N. and Morse, J. (2009) 'Six Sigma in services – challenges and opportunities', Int. J. Productivity and Quality Management, Vol. 4, Nos. 5/6, pp. 658–675.

Noori, B. (2015) 'The critical success factors for successful lean implementation in hospitals', *Int. J. Productivity and Quality Management*, Vol. 15, No. 1, pp. 108-126. Ocak, S., Köseoglu, M.A, and Bertsch, A. (2015) 'Linkages among organisational culture, knowledge management, and patient safety performance: evidence from a state hospital in a developing country', Int. J. Management and Enterprise Development, Vol. 14, No. 1, pp.11–35.

Penoyer, D., Cortelyou-Ward, H., Noblin, M., Bullard, T., Talbert, S., Wilson, J., et al. (2014) 'Use of Electronic Health Record Documentation by Healthcare Workers in an Acute Care Hospital System', *Journal of Healthcare Management*, Vol. 59, No. 2, pp.130–45.

Pizziferri, L., Kittler, A. F., Volk, L. A., Honour, M. M., Gupta, S., Wang, S, et al. (2005) 'Primary care physician time utilization before and after implementation of an electronic health record: A time-motion study', *Journal Biomed Inform*, Vol. 38, No. 3, pp.176–88.

Schyve, P. (2004) 'An interview with Lucian Leape', *Joint Commission Journal on Quality and Safety*, Vol.30, No 12, pp. 653– 658.

Segars, A. H. and Grover, V. (1993) 'Re-Examining Perceived Ease of Use and Usefulness: A Confirmatory Factor Analysis', *MIS Quarterly*, Vol. 17, No. 4, pp. 517–25.

Soklaridis,S., (2014),"Improving hospital care: are learning organizations the answer?", Journal of Health Organization and Management, Vol. 28 Iss 6 pp. 830 - 838

Sweis, R. J., Al-Mansour, A., Tarawneh, M. and Al-Dweik, G. (2013) 'The impact of total quality management practices on employee empowerment in the healthcare sector in Saudi Arabia: a study of King Khalid Hospital', Int. J. Productivity and Quality Management, Vol. 12, No. 3, pp. 271–286.

Turkmen, E., Baykal, U., Intepeler SS. (2013) 'Nurses' perceptions of and factors promoting patient safety culture in Turkey. *J Nurs Care Qual.*, Vol. 28, No. 4, pp. 360–367.

Twerski, R. A. J. (2007) 'Medical Errors: Focusing More on What and Why, Less on Who', *Journal of Oncology Practice*, Vol. 3, No. 2, pp. 66–70.

Ulrich, B. and Kear, T. (2014) 'Patient Safety and Patient Safety Culture: Foundations of excelent healthcare delivery', *Nephrology Nursing Journal.*, Vol. 41, No. 5, p 447-457.

VanGeest, J.B. and D.S. Cummins, An educational needs assessment for improving patient safety: results of a national study of physicians and nurses., in White Paper Reports. 2003, National Patient Safety Foundation; 2003. White Paper Report 3

Wagner, L. M., McDonald, S. M. and Castle, N.G. (2012) 'Relationship between nursing home safety culture and joint commission accreditation', *The Joint Commision Journal on Quality Patient Safety*, Vol. 38, No. 5, pp. 207–15.

Webster, Paul; "Health in Colombia: A System in Crisis." *CMAJ*: Canadian Medical Association Journal 184.6 (2012): E289–E290. PMC. Web. 26 Jan. 2017.

WHO, World Alliance for Patient Safety. Summary of the evidence on patient safety: *implications for research.* 2008, World Health Organization: Geneva, Switzerland

World Bank; Health expenditure per capita (current US\$); Retrieved from http://data.worldbank.org/indicator/SH.XPD .PCAP), January 26, 2017

Wu, J-H., Shen, W-S., Lin, L-M., Greenes, R. A, and Bates, D. W. (2008) 'Testing the technology acceptance model for evaluating healthcare professionals' intention to use an adverse event reporting system', *International Journal of Quallity Health Care*, Vol. 20, No.2, pp.123–9.

Wong, B.M., Dyal, S., Etchells, E. E., Knowles, S., Gerard, L., Diamantouros, A, et al. (2015) 'Application of a trigger tool in near real time to inform quality improvement activities: a prospective study in a general medicine ward', *BMJ Quality Safety*, Vol.1-24, No. 4, pp. 272–81.

Zuhal, Y. and Sonjul, G. (2015) Determinats of patient safety culture among nurses working at intensive care unit, pakistan Journal of medcal science, Vol.31, No.3, pp. 597-601.

A Capstone Project: "One-System-Network" of an Electronic Health Record Smartphone App

Leugim J. Suriba, BSN, RN, MN Student, SQIL Program, Harvard Medical School Global Education, Philippines

Introduction

An Electronic Health Record (EHR) is an electronic version of a patients medical history, that is maintained by the provider over time, and may include all of the key administrative clinical data relevant to that persons care under a particular provider, including demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports The EHR automates access to information and has the potential to streamline the clinician's workflow. The EHR also has the ability to support other care-related activities directly or indirectly through various interfaces, including evidence-based decision support, quality management, and outcomes reporting.

"One-System-Network" is an electronic health record app that records the entire patient's information same with other electronic health records in the hospital. The difference is, the one-system-network is a mobile app that can be best used in public health setting, anywhere and anytime by any healthcare professionals, that is part of patient's network, like Facebook. The idea came from the difficult experience of my aging parents transferring from one place to another.

1) Major Focus and Minor Focus

Major Focus: Informatics

Minor: Quality of Patient Care and Public Health

2) Problem Statement

"Aging patients transferred residency from Davao City (Southern part) to the Batangas (Northern part) of the Philippines encountered difficulties whenever they visited different hospitals for check-up". In addition to, travelers and foreign workers have problems on their insurances and record filing because of the lack of unified data system of health records.

Since then, only hospitals have the access of the electronic health records. Thus, each hospital has different providers from each other because of privacy and confidentiality of patient's records. Of which, resulted to reassessment of patient coming from a different hospital, same with the clinics and other health facility. The different system provider and the strong adherence on confidentiality and privacy measures to keep the record as the hospital's ownership, including the strict policies of the hospitals affect the fast access of information to deliver immediate, effective and quality of care. The problems identified are the following:

Continuity of Care

In the Philippines, one hospital differs from another in terms of protocols. A patient coming from Hospital-A and decided to transfer treatment facility to Hospital-B will require a new health information, new diagnostic tests, new prescriptions, as most of the hospitals do not accept nor have the access of information from previous hospital the patient was admitted.

Cost-effective to the Patient

Although there are still battles and <u>doubts</u> have been raised about cost saving from

EHRs by researchers at Harvard University, the Wharton School of the University of Pennsylvania, Stanford University, and others.

The patient will benefit on this app on financial matters. Thus, a patient taken a blood test and decided to travel, his/her results can be viewed by the next facility he/she decided to continue his/her care. There will be no more repeat blood test that will add to the cost-expense of the patient. Further, insurance companies will not pay twice for the same test, as most of the hospitals do not honor previous lab results.

Safety of the Patient

A geriatric patient is prone for infection because of skin vulnerability. Thus, decreasing the no. of extraction will decrease the risk of acquiring infection.

Time-consuming

The implementation of EMR can potentially decrease identification time of patients upon hospital admission. A research from the Annals of Internal Medicine showed that since the adoption of EMR a relative decrease in time by 65% has been recorded (from 130 to 46 hours).

Improving the Quality of Data and Coordination of Information

Allergies, previous health history, previous medications and some redundant information that are always asked every hospitalization. Thus, this app stores necessary information to avoid repetitive questions, in case of emergency and instead, fast care response will be administered.

EMR's may eventually help improve care coordination. An article in a trade journal suggests that since anyone using an EMR can view the patient's full chart, it cuts down on guessing histories, seeing multiple specialists, smooths transitions between care settings, and may allow better care in emergency situations.^[35] EHRs may also improve prevention by providing doctors and patients better access to test results, identifying missing patient information, and offering evidence-based recommendations for preventive services.^[36]

Patient as the Rightful Owner

The patient is the rightful owner of his/her patient's record. He/She has the authority to who to share his/her profile and thus, giving him/her independence. The app will improve patient's decision and encourages cooperation of his/her care.

Missed Schedule and Appointments

The app has its notification system that informs the patient and the physician on the next visits and appointments. It will also alert physicians on the red flags of the laboratory results.

Communication and Referral Problems

Distance and unfamiliarity of each health care provider can cause lack of communication between the two providers. The app will link the providers through sharing their possible treatments, suggestions and referrals. The patient and the source healthcare provider will be informed and have the authority if the information is to be shared to another healthcare provider. There is chatbox and referral button to facilitate this process.

3) Researcher (App Developer):

Nurse Researcher: Leugim Suriba Software Engr. Richard Malibiran

Population (Participants):

Physicians

Criteria:

- Out-patient/ Clinic/ Community Health Physician
- Willing to participate in the capstone project
- Have knowledge on smartphone applications

Patients

Criteria:

- The cases of the patient must be limited to Gastronitestinal infection and urinary tract infection
- Must be the patient of the 3 physicians identified

- Must be the patient in Out-patient/ Clinic/ Community Health setting
- Willing to participate in the capstone project
- Have knowledge on smartphone applications

Laboratory Staff

Criteria:

- Must understand the basics of fecalysis and urinalysis
- Must be the same patient as with the physician
- Must be in Out-patient/ Clinic/ Community Health setting
- Willing to participate in the capstone project
- Have knowledge on smartphone applications

Experts

• They are the IT and Healthcare Informatics Professors, Scientist and Computer (Software) Engineers and App Developers

4) Aims

The main aim of this project to develop a "One-System-Network" of an Electronic Health Record App for Smartphone (a prototype) and conduct a trial or pilot study on the effectiveness and functionability of the app.

S- The app will record the following data on the specific section page:

- Patient Assessment & profile
- Physician Notes & Prescription
- Laboratory Results
- There will be a special feature icon and column, for notifications and referral system

M- The app will be evaluated in to three phases, the developers phase, the participants phase and the experts phase. A pilot and trial studies will be conducted on each phase.

A- The project will be participated by the developer, participants and experts for evaluation. The Nurse Researcher will create the pages and the inclusions in the app while

the Software Engineer will design the app and all technical aspects.

R- The app is currently the trend and improves the healthcare system through easy and fast access of patient's information, communication of healthcare providers, provided immediate results, anywhere access and reminders for appointments.

T- The app is prototype is expected to finish on January 2017. The additional inclusions and suggestions will matter on the available financial resources and support funding.

5) Proposed Intervention

Phase 1

a) Creation of the prototype

The prototype will be divided in to 4 sections:

- Patient Assessment & profile
- Physician Notes & Prescription
- Laboratory Results
- Special Feature: Notifications & Referral System

b) Trial Testing of the prototype

The prototype will be tested by the App Developers for proper functioning.

The app will be registered to the Google app store for pilot testing. The App Developers will evaluate the effectiveness of the app.

Phase 2 Pilot Testing

- i. The app will be introduced to the participants (patients, physicians and laboratory staff)
- ii. The participants will be demonstrated on the mechanics and procedure.
- iii. The app will be evaluated by the participants through notes writing.

Phase 3

Experts Suggestions

- i. The app will be introduced to the Health Informatics Experts
- ii. The Experts will be demonstrated on the mechanics and procedure.
- iii. The app will be evaluated by the Experts and write notes for recommendation.

6) Measurements

The app will be evaluated on its effectiveness, functionability, and accessibility and user-friendly. The app developer, participants and the experts will write their suggestions and recommendations in note writing.

7) Challenges

These are the following expected challenges:

a) Budget

The cost of the professional services and the fee for the Google app store to list the app on Google's product list are the basic challenges, likewise, the operational expenses and maintenance of the app. A need for funding and sponsored agencies that will support the project are highly appreciated.

b) Confidentiality of Records

The rightful owner of the patient's record whether in print or electronic is the patient. This has been addressed and resolved while developing this app. The patient has the authority to let the health care provider access his/her data and should be consulted for permission in case of referrer to other healthcare providers, although, there might be security problems that will arise and will be addressed to be resolved by the Experts.

c) Security of Accounts

The security of patient's information is at risk in an online hacking or identity theft. Thus, further development and suggestion from experts are appreciated to counteract these prohibited activities.

8) Sustainability

Phase 3

The app should be developed further. Partial suggestions to sustain the project are the following:

i. Include other notes such as Nurses Notes, Rehabilitation notes etc., likewise more health information should be included

- ii. Improvement of security and access to the information by the use of thumb mark or swiping card similar to credit card for easy access and logging in
- iii. More information to be included such as Family history, more diagnostic results and other pertinent information similar to EHR in the hospital
- iv. Increase the networks of healthcare providers using the app and improves the number of coverage to different health care facilities and hospitals
- v. More patients to be encouraged to use the app
- vi. Any additional suggestions from the participants and experts will improve further development of the app

9) Scalability

The app will be used in a limited no. of participants and looking forward to expand coverage if further improvement achieved.

Likewise an idea of an open-system-network of which a wide no. of participants will use and be informed about the app in a huge network of health services, health care facilities (hospitals, medical centers etc.) will sustain the app.

10) Resources

- Electronic health record. Centers for Medicare & Medicaid Services https://www.cms.gov/Medicare/Ehealth/ EHealthRecords/index.html?redirect=/E healthRecords/. March 2012
- Introduction to Electronic Health Records (EHRs). American Academy of Family Physician. http://www.aafp.org/practicemanagement/health-it/product/intro.html
- Electronic Health Record. Wikipedia. https://en.wikipedia.org/wiki/Electronic _health_record. October 2016.

Knowledge and Awareness about Cervical Cancer Vaccine (HPV) Among Parents in Sharjah

Abstract

Context: Human Papilloma Virus (HPV) infection is the most leading cause of cervical cancer (CC) and other diseases worldwide. Despite several measures taken to reduce the risk of infection with HPV, the most effective method is the HPV vaccine.

Aims: The aim in this study was to assess the knowledge and attitudes of parents in Sharjah towards HPV and whether they would vaccinate their daughters.

Settings and Design: A cross-sectional study of 400 subjects was conducted in public venues in Sharjah.

Methods and Material: Convenient sampling method was used for selection of the sample. A self-administered questionnaire was distributed. Results were compared to those found in similar researches.

Statistical analysis used: Participants' responses were analysed using SPSS 21.

Results: 78.3% of the population had heard of CC, 41.3% of HPV, and 36.5% of the HPV vaccine. Among them, the percentages of the correctly answered knowledge-related questions were found to be 66.2%, 50.9% & 52.1% for CC, HPV & HPV vaccine, respectively. 76.6% of parents were willing to vaccinate their daughters. The percentage increased to 92.9%, had the ministry of health (MOH) recommended the vaccine. Spouse's level of education was found to be significant.

Conclusions: Despite the public's lack of knowledge, the study showed a noticeable increase in parent's willingness to vaccinate their daughters if the government approves the HPV vaccine. Therefore, MOH should work towards approving the HPV vaccine as soon as possible. Moreover, the media should provide more information about HPV and the vaccine so as to increase awareness and willingness of the public to vaccinate their daughters.

Key-words: Human Papilloma Virus (HPV), cervical cancer, vaccine, knowledge, awareness

Key Messages:

It is important to realize the amount of trust UAE people have in the Ministry of Health's advice. This is important as it can help promote awareness about different health issues.

People are willing to listen, they only need guidance.

Introduction

Introduction of vaccines was a point of transition in medicine. They are one of the most effective public health interventions protecting against infectious diseases. Many infections are known to be related to certain types of cancer. Approximately 18% of cancer cases worldwide are attributed to infectious agents, particularly viruses.¹

Cervical cancer (CC) is the abnormal proliferation of malignant cells in the cervix that have the propensity to metastasize. Various HPV strains are known to cause CC. In spite of this, in 2012, CC was the 7th most common cancer worldwide. It was the 4th most common cancer in females causing 7.5% of all female cancer deaths. It is also one of the leading causes of premature deaths in women at reproductive age. The majority of deaths (87%) occur in the less developed regions.²

HPV infection can be present without any detected abnormal cervical changes. This occurs in 11-12% of women worldwide with

the highest rates in Sub Saharan Africa and Eastern Europe. There are many serotypes of HPV. The most common types causing infections are HPV 16 & 18.³ According to the CDC, CC is highly preventable because of available screening tests (Pap smear) and the availability of a vaccine to protect against the HPV infection. When CC is detected early, it can have a good prognosis.⁴

According to the "Human Papillomavirus and Related Diseases Report", every year an estimated 93 new cervical cancer cases are diagnosed and approximately 28 cervical cancer deaths occur in the UAE (estimations for 2012). Cervical cancer ranks as the 3rd cause of female cancers and the 7th cause of female cancer deaths in the UAE.⁵

HPV infection is the most leading cause of CC and other diseases worldwide. Despite several measures taken to reduce the risk of infection with HPV, the most effective method of prevention for women under 26 is the HPV vaccine, while for those above 26, PAP smears are the best choice. This can be explained by the ability of the HPV vaccine to protect women below 26 before they get the HPV infection. While for those above 26, the risk of being already infected with HPV is high, and thus benefits of the vaccine are restricted to the minority of women who have not been infected yet.⁶

The CDC suggests that HPV vaccination should be given for all males and females aged 11 or 12. There are two types of HPV vaccines: the quadrivalent vaccine (HPV 4-Gardasil) which protects against types 6, 11, 16, 18, and the bivalent vaccine (HPV 2-Cervarix) which protects against types 16 and 18 only. The HPV vaccine is given intramuscularly. It consists of three dose series of either type of vaccine given over six months, with a 2 months interval between the doses.⁷

In 2008, Abu Dhabi became the first city in the Middle East to start giving free HPV vaccinations for all grade 11 school girls, both Emiratis and expatriates.⁸ This resulted in a dramatic increase in uptake of the vaccine from less than 60% to more than 95% in 2013.⁹ Since the UAE lacks a national cervical screening program, the Health Authority of Abu Dhabi (HAAD) started in 2013 Abu Dhabi's Cervical Screening Program, the most comprehensive and the first of its kind in the region.⁸ The Ministry of Health (MOH) is yet to impose the HPV vaccine as a compulsory vaccine in the UAE's immunization program.

The aim in this study was to assess the knowledge and attitudes of parents in Sharjah towards HPV and whether they would vaccinate their daughters or not, and if this will have an impact on the MOH's decision to make the vaccine compulsory as part of their vaccination schedule.

Methods

A quantitative, observational, cross-sectional study of 400 randomly selected subjects (parents who have daughters) was conducted in the city of Sharjah in the UAE over a two month period, from February to April 2015. Parents living in Sharjah and available in public places at the time of data collection were included in the study while those working in the medical field and those who do not speak English or Arabic were excluded. The sample was calculated based on 5% marginal error and 50% prevalence. A non-probability convenience sampling method was used in the recruitment of participants.

This study was approved by the Research Ethics Committee of the medical colleges of the University of Sharjah. Participants' consents were obtained. A self-directed questionnaire was developed initially and later modified after feedback from the pilot study. The questionnaire had 32 questions divided 5 sections: and was into demographics, cervical cancer knowledge, HPV knowledge, HPV vaccine knowledge, and people's attitudes. Some of the questions were from previous research articles while others were developed based on hypothetical questions. Questions research varied

between multiple-choice questions, closed and open-ended questions, as well as Likert scale questions. Participants' responses were entered and analyzed using SPSS 21 (Statistical Package for Social Sciences). Frequency was calculated for each variable. Chi square test was used to conduct bivariate analysis. Pie and bar charts were used to present the results which were compared to those found in similar researches.

Results

The demographic data of the sample is shown in Table 1. There were 296 Arab participants who are non-UAE nationals. They were the majority forming 77% of the sample. Only 38 (9.5%) were UAE citizens while the 66 non-Arab participants formed 16.5% of the sample. As shown, the mean age was 40.56 years old with a standard deviation of 10.35. 308 (77%) of the participants and 310 (78.5%) of the spouses had a university degree.

Figure 1 represents participants who heard about CC, HPV and the HPV vaccine. Out of those who heard about the three topics, only 66.2%, 50.9% & 52.1% were considered to be knowledgeable at the end of the study. Those who did not hear about the disease or the vaccine were asked to skip the knowledge questions. Thus, the total knowledge of the sample was only 24%, 21.3% and 19% for CC, HPV and the HPV vaccine respectively.

Table 2 shows participants' sources of knowledge. The TV is the main source of information for CC and HPV vaccine, while knowledge about HPV infection was provided by schools, universities and work.

Figure 2 demonstrates knowledge about CC and HPV that was measured by asking questions about each topic. It can be recognized that knowledge about CC, HPV and the link between the two is poor. 41.8% of population knew that CC can be preventable but only 14.5% of the sample knew that HPV is the main cause of CC.

Discussion

The sample size in this study was 400. 74% of the participants were Arabs, 16.5% non-Arabs and only 9.5% were U.A.E nationals. This is not surprising given the demographic constitution of the society where more than half of the population is expatriate.⁸

Six data collaborators (2 male and 4 female) were involved in data collection. The questionnaires were distributed to parents in public places in Sharjah. Face-to-face interviews were conducted to increase data reliability.

Having male collaborators collecting data proved problematic when approaching parents, especially mothers, since the topic is a relatively sensitive one. This is due to the UAE community being quite conservative.

A large percentage of the Sharjah population had heard of CC, but less than 50% had heard of HPV and its vaccine. Among them, the percentages of the correctly answered knowledge-related questions were found to be on the low side. These results are concordant with those of similar studies conducted worldwide.¹⁰

Our findings also suggest that the public consider the media (TV, internet, advertisements) to be their greatest source of information. This is useful as it can help guide the government to target its efforts in promoting awareness on social media rather than public campaigns.

72.5% of the participating mothers agreed they would take the vaccine. Those who refused to be vaccinated justified their choice by claiming they were too old or had doubts about the vaccine's safety, in terms of potential side effects or long term complications. Similarly, a study in Mali found that 76.6% of the mothers were willing to give the vaccine to their daughters but not themselves.¹¹ The main reasons for this refusal were the side effects of the vaccine and lack of knowledge. The safety of the vaccine has been well-documented by the CDC.¹² Consequently, it is only a matter of raising awareness about it.

The government needs to constantly engage and educate the public. Community-based interventions are vital and must be implemented so as to address concerns about vaccine safety and curb misconceptions the public may have acquired online or from the media. Health care providers also play a vital role in providing scientifically sound information as people will seek their medical advice.¹

A significant correlation was found between the male spouse's education and knowledge about HPV (P value =0.025) and its vaccine (P value = 0.044). This is similar to the findings of a recent study conducted in the Emirate of Abu-Dhabi.⁸ The correlation suggests that husbands can influence their wife/ daughter's decision on whether or not to take the vaccine. Better immunization outcomes may be expected if emerging immunization programs targeted men as well as women.

Despite the public's lack of knowledge about CC, HPV and HPV vaccine, our results showed a noticeable increase of 20% in parent's willingness to vaccinate their daughters had the government approved the HPV vaccine. The results are concordant with the existing literature on HPV vaccine knowledge, which is that while knowledge levels are poor, individuals are still willing to receive vaccination against HPV.¹¹

The increase in the public's willingness to take the vaccine if MOH recommends it is due to "most people in the UAE accept the health care provider's advice knowing that these recommendations are for their sake, contrary to other countries, where the public may question the health care provider's advice." ⁸ This is the most important finding of the study. It demonstrates the urgent need for MOH approval of the HPV vaccine as soon as possible.

The limitation in the study was the convenient sampling method used. This decreased the ability to generalize the results. The link between gender or medical history verses knowledge, awareness and willingness to vaccinate would also be interesting to consider investigating in the future. It would also be interesting to find out the levels of knowledge and willingness to vaccinate daughters in low income uninsured people.

Conclusion

This study showed that the knowledge of CC, HPV and HPV vaccine was lacking. Furthermore, the study showed a noticeable increase in parent's willingness to vaccinate their daughters if the government approves the HPV vaccine. This shows the urgent need for further steps and actions towards raising awareness about the disease.

References

[1] Perlman S, Wamai R, Bain P, Welty T, Welty E, Ogembo J. Knowledge and Awareness of HPV Vaccine and Acceptability to Vaccinate in Sub-Saharan Africa: A Systematic Review. Plos One 2014; 9: 1-14.

[2] GLOBOCAN Cervical Cancer Fact Sheet: Cervical Cancer Estimated Incidence, Mortality and Prevalence Worldwide in 2012. France: IARC; 2012; Available from: http://globocan.iarc.fr/old/FactSheets/cancer s/cervix-new.asp

[3] Forman D, De Martel C, Lacey C, Soerjomataram I, Lortet-Tieulent J, Bruni L, et al. Global Burden of Human Papillomavirus and Related Diseases. Vaccine 2012;30:Suupl 5, F12-F23.

[4] HPV: Questions and Answers. USA: CDC; 2015; Available from: http://www.cdc.gov/hpv/parents/questionsanswers.html

[5] Human Papillomavirus and Related Diseases Report UAE Version. Spain: HPV Centre; 2015 Available from: http://www.hpvcentre.net/statistics/reports/ ARE.pdf

[6] HPV Vaccine Information for Young Women. USA: CDC; 2015 Available from: http://www.cdc.gov/std/hpv/stdfact-hpvvaccine-young-women.htm [7] Immunization Guidelines. Dubai: Dubai Health Authority, Public Health & Safety Department, Health Policy & Strategy Sector; Report No. HPSS/PHSDM001.

[8] Ortashi O, Raheel H, Shalal M, Osman N. Awareness and Knowledge About Human Papillomavirus Infection and Vaccination Among Women in UAE. Asian Pac J Cancer Prev 2013;14:6077-80.

[9] Ortashi O, Raheel H, Khamis J. Acceptability of Human Papillomavirus Vacciation Among Male University Students in the United Arab Emirates. Vaccine 2013;31:5141-4.

[10] Yu Y, Xu M, Sun J, Li R, Wang J, Zhang D, et al. Human Papillomavirus Infection and Vaccination: Awareness and Knowledge of HPV and Acceptability of HPV Vaccine among Mothers of Teenage Daughters in Weihai, Shandong, china. Plos One 2016;11:1-14.

[11] Poole D, Tracy J, Levitz L, Rochas M, Sangare K, Yekta S, et al. A Cross-Sectional Study to Assess HPV Knowledge and HPV Vaccine Acceptability in Mali. Plos One 2013;8:1-7.

[12] Slade B, Leidel L, Vellozzi C, Woo EJ, Hua W, Sutherland A, et al. Postlicensure Safety Surveillance For quadrivalent Human Papillomavirus Recombinant Vaccine. JAMA 2009;302:750.

Tables:

Demographics	UAE		Arabs (Non-UAE nationals)		Non	–Arabs	T	otal
Age	Ν	%	Ν	%	Ν	%	Ν	%
<36	11	28.9	104	53.1	29	43.9	144	36
36-50	18	47.4	137	46.3	31	47	186	46.5
>50	9	23.7	55	18.6	6	9.1	70	17.5
Mean + SD	42.71 +	-/- 9.218	40.95 +/- 10.571		37.54 -	⊦/- 9.472	40.56 +/- 10.352	
Education	Ν	%	Ν	%	Ν	%	Ν	%
Below university	10	26	73	42.7	9	13.6	92	23
University	28	73.7	223	75.3	57	86.4	308	77
Spouse education	Ν	%	Ν	%	Ν	%	Ν	%
Below university	16	42.1	60	20.3	9	14.8	85	21.5
University	22	57.9	236	79.7	52	85.2	310	78.5

Table 1: Demographic Characteristics of Study Participants

Table 2: Sources of Obtaining Knowledge among the Participants

		UAE		Ara	Arab (Non UAE		Non-Arab	Total
		N	%	N	nationals %	N	%	%
	TV	13	34.2	135	53.6	32	54.2	51.6
	News	10	26.3	78	31	28	47.5	33.2
	Radio	1	2.6	26	10.3	15	25.4	12
Knowledge	Internet	8	21.1	75	29.8	28	47.5	31.8
of CC	School\university\ work	7	18.4	66	26.2	25	42.4	28.1
	Someone	6	15.8	53	21	12	20.3	20.3
	Others	12	31.6	26	10.3	10	16.9	30.8
Knowledge of HPV	TV	3	15.8	41	36.6	13	40.6	35
	News	3	15.8	27	24.1	7	21.9	22.7
	Radio	0	0	8	7.1	3	9.4	6.7
	Internet	4	21.1	34	30.4	12	37.5	30.7
	School\university\ work	11	57.9	33	29.5	14	43.8	35.6
	Someone	3	15.8	17	15.2	8	25	17.2
	Others	1	5.3	6	5.4	3	9.4	6.1
	TV	3	25	38	35.8	9	33.3	34.5
	News	3	25	20	18.9	11	40.7	23.4
Knowledge	Radio	1	8.3	3	2.8	4	14.8	5.5
of HPV	Internet	2	16.7	25	23.6	11	40.7	26.2
vaccine	$School \ work \ work$	2	16.7	27	25.5	12	44.4	28.3
	Someone	4	33.3	18	17	5	18.5	18.6
	Others	3	25	15	14.2	4	15.8	15.3

Figures:



Figure 1: Percentage of people who heard about CC, HPV and HPV vaccine



Figure 2: Knowledge about CC & HPV



Figure 3: Knowledge about HPV vaccine



Figure 4: Giving daughter vaccine if MOH recommends it

Health Literacy among UAE Adolescents Using the NVS Instrument

Niyi Awofeso, Ahmad Al Zarooni, and Zahour Al Haj Rabih Hamdan Bin Mohammed Smart University, Dubai, United Arab Emirates

Moyosola Bamidele John Snow Research & Training Institute (JSI), Abuja, Nigeria

Abstract

Assuring high quality health literacy for adolescents is important in UAE to facilitate government's Vision 2021 objectives of superior intellectual attainment of students as well as to reduce very high prevalence of adolescent obesity and other behavioural and dietary risk factors for health. In mid-2016, we applied the validated Nestle New Vital Sign Health Literacy instrument to survey 440 Emirati nationals and expatriate high school pupils in grades 7 to 12 with mean age of 14 years in Dubai, UAE. Results indicate that mean literacy score is 2.7/6, and that 38.64% of respondents were possibly literate, while 33.41% were highly literate. Emirati females demonstrated higher health literacy compared with males (3.26, 95% C.I. 2.94 – 3.57 Vs 2.67, CI: 3.30 - 3.04). Non-Emirati Male (2.73, 95% CI: 2.43 - 3.02) demonstrated higher health literacy compared with Emirati Male. In contrast. Emirati female demonstrated higher health literacy compared with Non-*Emirati Female* (2.36, 95% CI: 2.07 – 2.65). There was no significant difference in health literacy scores relative to school grade (p > p)0.05). Our findings indicate a low percentage of highly health literate UAE adolescents, highlighting the need to improve health literacy training among UAE adolescents, and especially among Emirati males.

Key words: Health literacy; UAE; Emirati and non-Emirati adolescents; gender

Introduction

Developing a structured approach to enable adolescents acquire a high level of health literacy will facilitate acquisition of accurate health information and enhance appropriate interactions with the health system, thus increasing the likelihood of optimal health outcomes later in life. This is particularly important in relation to adolescents with chronic illnesses such as asthma and diabetes, who require more frequent contact with the health system and to effectively manage their disease (Valerio et al, 2016). Education and health operate in a virtuous cycle – individuals with quality education are less likely to develop adverse health outcomes, while individuals who minimize adverse impacts of behavioural and dietary risks to their health are more likely to achieve high educational outcomes (Morton et al, 2016; Basch, 2010).

Both health and literacy are critical resources for everyday living. Health literacy requires basic literacy and a grasp of health-related vocabulary, in addition to developing competencies necessary for finding, evaluating and integrating health information from a variety of contexts. Nutbean (2000) identified three levels of health literacy; Functional: basic skills in reading and writing necessary for effective functioning in a health context; Interactive: more advanced cognitive literacy and social skills that enable active participation in health care; and Critical: the ability to critically analyze and use information to participate in actions that overcome structural barriers to health. Sorensen et al (2012) suggested that the core role of health literacy is to equip individuals with the ability to access, understand,
appraise, and apply health information to make decisions in everyday life in disease prevention, healthcare access, and health promotion.

Currently, several useful tools exist for measuring health literacy among adolescents (Ghanbari et al, 2016; Altin et al, 2014). A particularly efficient and validated measure of health literacy among adolescents is the Newest Vital Sign (NVS), a nutrition label that is accompanied by 6 questions and requires 3 minutes for administration. It is reliable (Cronbach $\alpha > 0.76$ for English version) and correlates with the Test of Functional Health Literacy in Adults. Patients with more than 4 correct responses are unlikely to have low literacy, whereas fewer than 4 correct answers indicate the possibility of limited literacy (Weiss et al, 2005). The NVS enhances comprehensiveness of health literacy by assessing reading, interpretation, and numeracy (Hoffman et al, 2015).

UAE's Vision 2021 includes 10 health indicators, the first five of which require above average health literacy to efficiently achieve expected target. (UAE Vision 2021, There are currently no published 2014). studies on the level of health literacy in UAE. However, basic illiteracy rate dropped significantly from 16% in 1995 to 7.3% in 2015. With UAE's epidemiologic and nutrition transitions, which has resulted in high prevalence of diabetes, obesity, and complications cerebrovascular disease occurring on average 15 years earlier compared with trends in European nations, the need to assess and where appropriate, scale up health literacy rate of adolescents and adults is self- evident (DeWalt and Hink, 2009; AlBlooshi et al, 2016). High levels of health literacy are strongly correlated with prevention and self-management of noncommunicable diseases (Poureslam et al, 2016). Especially among adolescents, health literacy interventions constitute an evidencebased approach for health promotion and reduction of non-communicable disease risks in adulthood (Hanson et al, 2012). In this study we examined health literacy among high school students in Dubai, UAE.

Materials and Methods

A total of 440 high school students (227 males and 213 females) in grades 7 - 12 (i.e. ages 12 - 17) were recruited from Dubai schools for this study in mid-2016. The selection of the schools was carefully made to be representative of Emirati citizens and non-Emiratis in UAE. Approval was obtained from the school authorities, and oral consent was obtained from participating HBMSU Institutional Review students. Board involvement in this study was not required as the study was low risk and all data were de-identified. Respondents' confidentiality was preserved throughout the study. The study was designed to accept or reject the following research hypotheses:

- a) Over 80% of study participants will be at least possibly literate, and over 50% will be highly literate.
- b) Emirati males will demonstrate significantly higher health literacy compared with Emirati females.
- c) Emirati males will demonstrate significantly higher health literacy compared with non-Emirati males.
- d) Emirati females will demonstrate significantly higher health literacy compared with non-Emirati females.
- e) Health literacy will be significantly higher in proportion to years of education (e.g. scores for students in grade 12 will be higher than for grade 11, which will in turn be higher for grade 10, and so on.

The Newest Vital Sign Health literacy assessment tool (Pfizer, 2011) was utilized for this study. Participating learners in each class took time off regular school activities to complete the survey at the same time over 6 minutes. Data on citizenship, class grade and gender were collected. The data were analysed on STATA© version 12 using descriptive analysis(frequency) and twosample t test with equal variances to test the study hypothesis.

Results

From the study, 54% of the study participants were non-emirate, 46% emirate while 52% and 48% were male and female respectively. The mean average of the participant was 14. The first hypothesis is rejected as only 72% of respondents were at least possibly literate, and only 33.4% were highly literate (Table 1).

Table 1: Scores of 440 participating UAEadolescents in the Newest Vital Sign healthliteracy survey

Score	Freq.	Percent	Cum.
0 1 2 3	41 82 78 92	9.32 18.64 17.73 20.01	9.32 27.95 45.68
3 4 5 6	92 61 67 19	13.86 15.23 4.32	80.45 95.68 100.00
Total	440	100.00	

Data on the second, third and fourth hypotheses are shown in Table 2.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
E-Mal E-Femal	101 100	2.673267 3.26	.1856799 .1573903	1.86606 1.573903	2.304884 2.947703	3.041651 3.572297
combined	201	2.965174	.1232596	1.747507	2.722119	3.208229
*diff		5867327	.243616		-1.067133	1063326
*significa	ant at P<0	.05				
Non-EmirM E- Mal	126 101	2.730159 2.673267	.1471044 .1856799	1.651243 1.86606	2.439021 2.304884	3.021297 3.041651
combined	227	2.704846	.115908	1.746329	2.476447	2.933244
**dif:	+ f	.0568914	.2337216		4036719	.5174547
**insigni.	ficant at .	P>0.05				
Non-EmirF E- Femal	113 100	2.362832 3.26	.1455525 .1573903	1.547244 1.573903	2.074438 2.947703	2.651225 3.572297
combined	213	2.784038	.1109699	1.619553	2.565292	3.002783
*diff		8971681	.2141519		-1.31932	4750167

Tuble 2. Mean comparative scores bused on nationality and genaci	Table 2: Mean	comparative scores	based on	nationality a	and gender
--	---------------	--------------------	----------	---------------	------------

*significant at P<0.05

E-Mal = Emirati male participants; E-Femal = Emirati female participants; Non-EmirM - = Non-Emirati male participants; Non-EmirF = Non-Emirati female participants.

The second hypothesis is rejected as Emirati Female participants (p < 0.05; mean value 3.26, CI: 2.94 – 3.57) demonstrated higher health literacy compared with Male Emirati participants (mean value 2.67, CI: 2.30 –

3.04). The third hypothesis is rejected as non-Emirati male participants demonstrated higher health literacy scores compared with Emirati male participants, although the difference was not significant. Based on the mean value, the result shows that Non-Emirati Male participants (p = 0.81; mean value 2.73, CI: 2.43 - 3.02) demonstrated higher health literacy compared with Emirati Male (2.67, CI: 2.30 – 3.04). The fourth hypothesis is accepted as Emirati female participants demonstrated significantly higher average health literacy scores compared with non-Emirati female participants. Based on the mean value, the result shows that Emirate Female (P < 0.05; 3.26, CI: 2.94 – 3.57) demonstrated higher health literacy compared with Non-Emirati Female (2.36, CI: 2.07 - 2.65). The fifth hypothesis is rejected as there is no observable linear relationship between school grade and NVS test scores among participating students. For example, a third of participants scored 1-2/6, another third 3-4/6 and the last third 5-6/6 in grade 12, while in grade seven, the corresponding scores were 21% for 1-2/6, 57% for 3-4/6 and 21% for 5-6/6.

Discussion

To the best of our knowledge, ours is the first study to systematically examine health literacy among adolescents in the Middle East and North Africa region. The survey participants study in schools where English and Arabic were the languages of instruction, and any difficulty in understanding the survey questionnaire was clarified by two of the authors (ZA & AA) who personally administered the survey. As health literacy skills are best developed early in life, intersectoral collaboration between the education and health sectors is vital if the risks of low health literacy are to be minimized. One such collaboration is the health promoting schools' concept, which entails incorporating a structured curriculum in health studies as part of the school curriculum (Sharma and Abdou, 2009). Use of the NVS survey instrument (translated into respective languages) for measuring health literacy among adults in European nations showed that 47% of the population were at risk of low health literacy, with mean health literacy scores varying widely, from 26/6 in Spain to 4.5/6 in the Netherlands (HLS-EU Consortium, 2012). The average score of in this survey is particularly 2.7/6disappointing as adolescent students are not normally included in the category of disadvantaged learners.

The significantly higher NVS health literacy test scores among Emirati females compared with Emirati males as well as non-Emirati females illustrates the effectiveness of UAE's gender equality strategies in the past two decades which has defied modest projections on female literacy and facilitated the emergence of female Emiratis who not only outperform their male fellow citizens educationally but also outperform females from other Middle East and North African nations where cultural norms still put females at a disadvantage vis-à-vis access to quality education. (Kanj and Mitic, 2009). As the UAE and other Gulf Cooperation Council nations' health systems progresses into the digital age, the need for highly health literate citizens cannot be over-emphasized if the returns on impressive investments in health are to be realized.

References

AlBlooshi A, Shaban S, AlThunaiji M. (2016). Increasing obesity rates in school children in United Arab Emirates. Obesity Science and Practice, 2: 2. doi: 10.1002/osp4.37.

Altin SV, Finke I, Kautz-Freimuth S, et al. (2014). The evolution of health literacy assessment tools: a systematic review. BMC Public Health201414:1207. DOI: 10.1186/1471-2458-14-1207.

Basch CE. (2010). Healthier students are better learners: a missing link in efforts to close the achievement gap.

New York: New York. Columbia University; 2010. http://

http://www.equitycampaign.org/i/a/docume nt/12557_EquityMattersVol6_Web0308201 0.pdf. Accessed October 21, 2016.

DeWalt D, Hink A. (2009). Health literacy and child health outcomes: a systematic review of the literature. Pediatrics, 124, S265-S274; DOI: 10.1542/peds.2009-1162B.

Ghanbari S, Ramezankhani A, Montazeri A, Mehrabi Y. (2016). Health Literacy Measure for Adolescents (HELMA): Development and Psychometric Properties. PLoS ONE 11(2): e0149202. doi: 10.1371/journal.pone.0149202

Hanson MA, Gluckman PD, Ma RCW, Matzen P, Biesma RG. (2012). Early life opportunities for prevention of diabetes in low and middle income countries. BMC Public Health, 12:1025. doi: 10.1186/1471-2458-12-1025.

HLS-EU Consortium. (2012). Comparative report on health literacy in eight EU member states. Maastricht, The Netherlands: European Health Literacy Survey. URL: http://healthliteracy.trinityseven.biz/wpcontent/uploads/2012/09/HLS-

<u>EU_report_Final_April_2012.pdf</u> Accessed 23 October 2016.

Hoffman S, Marsiglia FF, Lambert MC, Porta M (2015) A Psychometric Assessment of the Newest Vital Sign among Youth in Guatemala City. Journal of Child and Adolescent Behavior 3:190. doi:10.4172/2375-4494.1000190.

Kanj M, Mitic W. (2009). Discussion document: "Promoting Health and Development: Closing the Implementation Gap", 7th Global Conference on Health Promotion, Nairobi, Kenya. URL: <u>http://www.who.int/healthpromotion/confer</u> <u>ences/7gchp/Track1_Inner.pdf</u> Morton RL, Schlackow I, Staplin N. (2016). Impact of educational attainment on health outcomes in moderate to severe CKD. American Journal of Kidney Diseases ,67, 31 -39.

Nutbeam D. (2000). Health literacy as a public health goal: a challenge for contemporary health education and communication strategies in the 21st century. Health Promotion International, 15, 259-267.

Pfizer (2011). The Newest Vital Sign. URL: https://www.pfizer.com/files/health/nvs_flip book_english_final.pdf Accessed 21 October 2016.

Poureslami I, Nimmon L, Rootman I, and Mark J. Fitzgerald MJ. (2016). Health literacy and chronic disease management: drawing from expert knowledge to set an agenda. Health Promotion International. doi:10.1093/heapro/daw003

Shama ME, Abdou SS. (2009). Evaluating the impact of Health Promoting School initiative on dietary habits and BMI of students in Oman. The Journal of the Egyptian Public Health Association, 84, 119-123.

Sørensen K, Van den Broucke S, Fullam J, et al. (2012). Health literacy and public health: a systematic review and integration of definitions and models. BMC Public Health, 12, 80–92. doi: 10.1186/1471-2458-12-80.

StataCorp. 2011. *Stata Statistical Software: Release 12.* College Station, TX: StataCorp LP.

UAE Vision 2021 (2014). National key performance indicators. Abu Dhabi, UAE Government. URL:

https://www.vision2021.ae/en/nationalpriority-areas/national-key-performanceindicators Accessed 20 October 2016.

Valerio MA, Peterson EL, Wittich AR, Joseph CL. (2016). Journal of Asthma, 53, 1041-1047. doi: 10.1080/02770903.2016.1175473.

Weiss BD, Mays MZ, Martz W, et al. (2005). Quick assessment of literacy in primary care: the Newest Vital Sign. Annals of Family Medicine 3, 514–522.

Perceptions and Motivations of Volunteers in the United Arab Emirates – Health Services' Implications

Niyi Awofeso and Mohammed Guleid Hamdan Bin Mohammed Smart University, Dubai, United Arab Emirates

Moyosola Bamidele John Snow Research & Training Institute (JSI), Abuja, Nigeria

Abstract

Volunteering is normally undertaken to be of benefit to the community and the volunteer, of the volunteer's own free will and without coercion and for no financial payment. The UAE has a strong tradition of volunteering nationally and internationally, with, for example, more than 6,000 volunteers collecting about 20 tonnes of waste during the 15th cycle of the Emirates Environmental Group's annual Clean Up UAE campaign in December 2016. There are different perspectives about what volunteering means, and some activities such as direct family responsibilities and foster care are normally excluded due to the family relationship, but such activities are open to individual interpretation. Motivations for volunteering vary from personal to societal. Societal motivations are usually altruistic in nature, directed towards the "greater good" e.g. preserving and of communities, improving wildlife habitats. Personal motivations include career benefits such as networking, feelings of satisfaction and happiness gained from helping others, opportunity to contribute to a cause one is passionate about and travel opportunities.

This study seeks to determine the perceptions of a sample of volunteer stakeholders in UAE about what the concept of volunteering means, as well as their motivations. Using a structured and customized English/Arabic questionnaire, 103 stakeholders were interviewed – student volunteers, internal staff and volunteers of Emirates Red Crescent, staff and volunteers of Dubai Cares. About 75% of respondents were aged

18 - 35 years, and 68% were female. Approximately 52% of respondents volunteered for more than 50 hours annually. Participants had varying definitions and motivations for volunteering. Data analysis revealed that motivations for volunteering were not significantly influenced by age or gender, and that Emiratis are significantly more likely to volunteer compared with non-Emiratis. Participants who were affiliated with University establishments were more likely to volunteer than workers affiliated with government public service (P-value =0.002). Managers of organizations that employ volunteers appear to be aware of the need to motivate volunteers and to allocate a significant part of their workday to volunteer issues. There is ample room to promote volunteering as a pathway for community participation in health services in UAE. If health sector policy makers are aware of the perceptions and motivations of volunteers. they can structure volunteer programs to better align the interests of volunteers with those of health systems.

Keywords: Volunteering, UAE, Motivations, Emiratis, Non-Emiratis, Health services

Introduction – Concept of Volunteering

Formal volunteering is an activity which takes place through partnership with government or not-for-profit projects to be of benefit to the community and volunteer, of the volunteers' free will and without coercion, in which monetary reward is not the principal motivating factor, and in designated volunteer positions (European

Youth Forum, 2012). Volunteering is a personal or national value comprising many principles, such as; Volunteering is a vehicle for individuals or groups to address human, and social environmental needs: Volunteering respects the rights, dignity and culture of others; and Volunteering promotes human rights and equality (Volunteering Australia, 2009). A more comprehensive definition of volunteerism describes the term as voluntary, ongoing, planned, helping behavior that increases the well-being of strangers, offers no monetary compensation, and typically occurs within an organizational context (Finkelstien, 2009). Central to this definition are six elements: voluntary action, compensation, little to no longevity, non-obligation. planfulness. and organizational context.

At the local level such as in village development committees, volunteering provides opportunities for dialogue between governments, organizations and grassroots community members as well as their representatives. Such contexts may also empower volunteers to shape policy development and implementation. At the national level. governments often governments invite volunteers to work with them on issues such as increasing transparency, monitoring service provision, setting up volunteer agencies and working closely with formal volunteers. Where governments have put in place structures to enhance volunteer engagement, they have been able them to systematically leverage the power of volunteerism and create scope for volunteers to seize the initiative in areas important to national development such as refugee health and girl child education and global health. Volunteers using diverse strategies that can engage back and forth among local grassroots constituents, national policy-making fora and global fora are effectively promoting multiple voices and increasing participation in global debates (UNDP, 2015).

Although motivations for volunteering vary widely, volunteers' experiences that are more

closely connected to their motivations to give time may improve volunteer recruitment and retention (Walford, Cox & Culp, 2001). The United States has a long history of volunteerism and reliable documentation of its impacts on civic life. In 2015, 62.6 million volunteers provided 7.8 billion hours of volunteer services, valued at 184 billion dollars - \$23.56 per hour (Corporation for National and Community Service, 2016). Motivations for youth volunteers in the United States include: Values (altruism, humanitarian concern for others, doing something meaningful); Understanding (opportunity to exercise knowledge and sense of being important skills. to organization); Social networking (being with or making friends): Career (career-related benefits or skills, challenging work, responsibility); Protective (volunteering to reduce negative feelings, shifting focus from personal problems, reducing guilt over personal privilege); and Enhancement satisfaction from personal growth and selfesteem, creates positive mood.

In the Middle East and North Africa (MENA) region, there is little evidence of youth volunteering being motivated by a desire to acquire work-related skills to facilitate transitioning to the formal work sector. Growth of formal volunteerism is hindered by weak institutional framework, high youth unemployment, sparse youth role models for volunteering, conflict and insecurity. cultural norms which inadvertently exclude female youth in volunteering activities, as well as negative perceptions and weak capacity of civil society organizations. Tunisia is currently the only country in the MENA region with volunteerism legislation, but the UAE government has signaled its intention to implement a volunteerism legislation in 2017. So far, the opportunities provided by volunteerism socio-economic in development and participatory governance have been largely missed in the MENA region.

Similarly, perceptions of the meaning of volunteerism vary widely. Craan et al (1996) suggests that public perception of the term volunteer is the outcome of people's conception of the net-cost of any volunteer situation, which they defined as total cost minus total benefits to the volunteer. Accordingly, the public can view two people performing the same task that equally benefits society and designate the individual who accrues more net-costs as being more of a volunteer. They described the costs of volunteering as including items such as the time spent volunteering, effort, and the income and social pleasures foregone. Benefits to the volunteer go beyond simple monetary remuneration (although in most cases we expect little or no monetary remuneration) and include items such as improvement in social status and social opportunities (reputation), enhancement in future earning capability (wealth), social interaction and leisure activity, a sense of satisfaction from working for a cause one supports and a good feeling about oneself (warm glow).

In the MENA region, volunteering of often associated with religious faith and the concept of charity. In Islam, volunteerism is a very broad concept that encompasses whatever one does for the benefit of others for the sake of Allah. The Arabic concept for volunteerism is al-Tatawwu', which etymologically is derived from tawa'a, an Arabic verb that conveys the meaning of performing an action willingly. The volunteers are called *al-Mutawwi'ah* (Quran 9:79). Volunteerism is a beautiful loan to Allah to which He promises a big reward (Quran 73:20). The two pillars of Islam; namely, establishment of salat (regular Prayer) and giving *zakat* (regular Charity), are a prerequisite for one to spend time and money (other than *zakat*) to help others. The ultimate motive of a Muslim volunteer is not to earn fame, respect or reward from people but to receive Allah's Rahmah (mercy). A core principle of volunteerism in Islam is that volunteer a is required to avoid discrimination while rendering voluntary services (Sulaiman, 2011).

The meaning of the term volunteerism also varies across countries in the MENA region. In Egypt, volunteerism is commonly viewed as synonym for voluntary military service or In Morocco, volunteering is donations. commonly linked to the French benevolat. which refers to ancestral forms of solidarity communitarianism. In UAE. and volunteering is often used synonymously with charity. However, with charity one gives in cash or in material assets, whereas volunteers usually give their time as they devote themselves to specified nonremunerative activities. In Australian and many European nations, volunteerism is currently being entangled with other kinds of engagement such as work experience and placements, educational as well as work mandatory schemes which are conditional for receipt of welfare benefits -"work for the dole". "Any kind of forced relationship that is labelled as volunteering undermines the very essence of what volunteering means to the individual. And it distorts the public's perception of donating time. Perhaps even more significantly, it also undermines the work of managers of volunteers tasked with leading and motivating people to get involved, and the potential impact that such involvement can make within communities." (Jones, 2013).

Volunteering in UAE

Volunteering is integral to the National values and culture of UAE. Inspired by the vision of UAE's first President, the late Sheikh Zayed Bin Sultan Al Nahyan, Fazaa values is the initiative of providing help and assistance to others. Emirati people have always striven to offer help to others in times of difficulty and prosperity to strengthen the social ties and share life events with others. The person undertaking Fazaa is associated with the following attributes: altruism; generosity; courage, and; philanthropy (ACTVET, 2014). Where a culture of volunteerism exists and flourishes,

volunteerism law and policy initiatives can find rapid success as they are taken up by preexisting volunteer constituencies. UAE's Federal law 9 of 2004 relates to volunteering in the civil defense. This law stipulates the eligibility and functions of; "Every civilian who participates willingly in Civil Defense works in time of peace, war, disasters or contingencies" (UAE Federal Law 9, 2004). In 2017, the UAE government has designated 2017 the Year of Giving, and committed itself to promulgating a law on charity and volunteering before December 2017. While the UAE currently has more than 200,000 registered volunteers, the proposed law aims to motivate more residents and citizens to volunteer, and establish a regulatory process that can monitor the number of hours volunteered by individuals. One of the objectives of the proposed law is to provide volunteers with incentives and a comprehensive framework for volunteering to document and reward their initiatives and efforts (Khamis & Achkhanian, 2017).

The International Federation of Red Cross and Red Crescent Societies (IFRC) is the world's largest humanitarian network that reaches 150 million people in 190 National Societies through the work of over 17 million The Emirates Red Crescent volunteers. (UAE) was officially launched on the 31st of January, 1983. It was internationally attested as member number 139 in the International Federation of Red Cross and Red Crescent Societies on the 27th of August, 1986. It has branches in all Emirates and about 2000 registered active volunteers. Emirates Red Crescent is focused on volunteering activities in the field related to: first-aid and traffic safety programs, training and rehabilitation for the handicapped, assistance for orphans and vulnerable populations, psychological support programs for sick and elders, addiction prevention programs, environment safety and overseas aid in areas of health and community welfare. Prospective Emirates Red Crescent volunteers are required to be at least 18 years old, literate, a person of good character and reputation, holding license from Ministry of Health if they are volunteering for medical activities, and matching the requirements of Emirates Red Crescent (ERC, 2014).

The Emirates Environmental Group (EEG) is a non-governmental professional working group founded in 1991 in Dubai, UAE. EEG is composed of corporate members, federal and local government agencies, as well as students, individuals and families. With more than 2,000 volunteers from across UAE, EEG considered as one of the most active environmental NGO's in the region. The EEG's Clean Up the UAE campaign is the biggest volunteer waste collection initiative in UAE. In 2016, UAE 125,536 residents collected 1.5 million kilograms of waste, most of which are sent to recycling plants. Since 2001, EEG has collected 14.7 million kilograms of recyclable paper waste, equivalent to saving 279,000 trees (EEG, 2016).

The Dubai Health Authority's (DHA) volunteer program document enables users to sign up for volunteer activities at all DHA facilities with a single sign up (DHA, 2016). The most well-established of DHA volunteer programs is the Rashid Hospital volunteer program, which offers volunteer opportunities to enhance patient satisfaction while producing a well-deserved feeling of personal fulfillment for the volunteer. Volunteer activities at Rashid hospital include: greeting visitors and helping them find their destinations, being а compassionate voice on the phone, and providing clerical support, such as filing of While performing such medical records. valued services, volunteers make new friends, learn new skills, and derive personal satisfaction from helping others (Rashid Hospital, 2017).

Volunteering in the Healthcare Sector

In the UAE, about 60% of the estimated 200,000 current volunteers are affiliated with the Emirates Environmental Group. The proportion of UAE volunteers affiliated with

the healthcare sector is estimated at between 2% and 5%, with the majority (about 2000) of health sector related volunteers working with the UAE Red Crescent Society. In contrast, between 18% and 20% of volunteers in the United States are affiliated with the health sector. In England, about 3 million people volunteer in healthcare and social services sector (equivalent to the total paid workforce in the sector), with 25% volunteering at least once a month. The scope and depth of volunteering is superior in the UK and USA compared with the USA in part because of strong governmental and institutional support. In the UK, for example, the government expended over 40 million pounds between 2011 and 2013 to support research activities by creating greater incentives. and removing barrier. to volunteer. Volunteers commonly assist in the health sector by:

- improving patient experience in hospitals and elsewhere
- building a closer relationship between services and communities
- tackling health inequalities and promoting health in hard-to-reach groups
- supporting integrated care for people with multiple needs (The Kings Fund, 2013).

In community and public health settings, provide social support volunteers for vulnerable groups; signposting and improving access to services; teaching and training; advocacy interpreting; and providing wellbeing activities in the community; coaching patients through lifestyle changes; fundraising. In acute hospital settings, volunteers assisting with meal times; buddying; delivering supplies to frontline staff; collecting patient feedback; ambulance 'first responders'; plain language volunteers (to edit written materials); clerical support; welcoming and guiding around the hospital. In home care, volunteers assist with visiting and befriending older people outside care homes to reduce isolation; provide home escorts for vulnerable patients; carer support services.

Although volunteers normally complement the work of paid professionals, there is a perception that they may end up substituting the work of the paid workforce, thereby encouraging cuts in staff on the payroll. Related to this issue is the tendency for volunteers to stimulate deprofessionalization of the health workforce. For example, there is increasing evidence on the effectiveness of peer support in mental health, long-term conditions such as diabetes (Fisher et al, 2012) and for promoting healthy behaviours (Phillips, 2006).

Volunteering in the health sector constitutes an enormous reservoir of skills, energy and knowledge which local can assist governments in carrying out more targeted, efficient, participatory and transparent public programmes and policies. A conceptual framework for volunteering in the health sector needs to align recruitment, training and motivations of volunteers with the objectives of volunteer recruitment organizations and the requirements of populations in need of volunteer services, and to evaluate the extent to which stakeholders' needs are met (Figure 2).

As shown in Figure 1, health services managers have significant influence over volunteer experience at the recruitment, training and actual volunteer work engagement points. The framework highlights the need for an understanding of volunteer motivation and how it affects each of the three engagement points. A major challenge for health services volunteer coordinators is to address problems at engagement points (indicated by dashed lines) where a volunteer might cease their involvement due to unsatisfactory outcomes for the volunteer, the agency, or populations who require volunteer services.



Figure 1: Conceptual Framework for volunteering in the health sector (Adapted from Cuthill and Warburton, 2005).

In the health care sector, providers and employers should see the creation of volunteering opportunities as an essential part of their relationship with the local community, as well as being a means of improving patient or service user experience. The focus should be on quality benefits rather than cost reduction, and inevitable sensitivities around job substitution will need to be dealt with head on. This study examines the motivations and perceptions of a sample of volunteers in UAE, and explores opportunities to volunteering activities in the UAE health sector for the benefit of volunteers, patients and health care organizations.

Materials and Methods

This study was conducted between October and December 2016. Arabic and English versions of a questionnaire were developed to determine the motivations and perceptions of volunteers, as well as perceptions and structural frameworks under which coordinators of volunteer activities in UAE operate. The survey instrument was distributed via email to the following organizations to which UAE volunteers are affiliated (Figure 2):

Universities	Government Org	Others
Abu Dhabi University	Dubai driving school	• ADNOC
• Ajman university	Dubai Customs	<u>Dubai Cares*</u>
• Al falah university	Dubai police	Al mazoon school
• College of Islamic and	Emirates Identity Authority	• Al rwade school
Arabic Studies	Emirates Post	• <u>Al Qamma volunteering team</u>
• Emirates university	• General Directorate of Residency	Armor Lubricants
 Dubai women's college 	and Foreigners Affairs in Dubai	 Al sharaf group
• HBMSU	Islamic Affairs	 Assad Sha'ab volunteering team
• Higher Colleges of	Ministry of Culture	• Bal Hassa
Technology Shj & Dubai	Ministry of health	• Fakher AlWatan Events Organizing
 Petroleum institute 	 Ministry of education 	• MLG
 Sharjah university 	Sharjah International Airport	 Royal Hospital Sharjah
• Zayed university	The Government of Fujairah	• Takatof Emirates foundation
	• Ministry of interior	• Terra casa
	• Western Region Police (West part	• Strata company
	of UAE)	• HCT
	UAE ID ASSOSIATION	 Consultative Center for Studies
	• University dental hospital in	The National Council
	Sharjah	• Systems center
	• Department of Culture and	Vina Contracting
	Information and the Sharjah	• <u>Red crescent</u>
	Institute of Heritage	 <u>Happiness program</u>
	• SHJ police	Red crescent medical center

*Underlined volunteer entities indicate volunteer programs or organizations that actively recruit volunteers. Figure 2: Organizations from which responses by volunteers and coordinators of volunteer programs in

UAE. Names of organizations that actively recruit volunteers are underlined.

The questionnaire content is accessible via: https://drive.google.com/drive/folders/0B92

hioMfbkKSazlBTGxGSy1iSHM. The survey instrument is sectioned into three parts. The first part relates to demographic attributes of respondents. The second part explores motivations and perceptions of respondents towards volunteering. The third part is designed to receive responses related to volunteering-related operational issues that coordinators and managers of volunteer programs experience. As at the time of data analysis, a total of 103 responses were received. A purposive sampling approach was utilized. The quantitative aspects of the study sought to address the following questions:

- Are there significant differences in how males and females, or different nationalities in our study participants, perceive the concept of Volunteering?
- Are motivations for volunteering influenced by occupational affiliations?
- Are motivations for volunteering influenced by age?
- Are motivations for volunteering influenced by gender?
- Are Emiratis more likely to allocate more time to volunteering compared with non-Emiratis?

The quantitative analysis was performed on STATA 12 using frequency analysis and chisquare to test in relation to the predictors and independent variables having that the variables are at nominal scale. The research questions were tested at 0.05 level of significant. Ethics application processes were waived as the study was deemed as having insignificant ethical risk to participants.

Additional questions were used to explore the following aspects among a sub-set of 32 coordinators and managers of volunteer recruitment and placement services:

- Criteria for allocating volunteers to volunteer projects
- Organizational strategies designed to motivate volunteers

Results

The demographic variables of the 103 survey respondents are shown below:

Table 1: Demographic Variables

Age	Freq.	Percent	Cum.
<18years	7	6.80	6.80
18-25years	42	40.78	47.57
26-30years	17	16.50	64.08
30-36years	18	17.48	81.55
36-39years	3	2.91	84.47
>40years	16	15.53	100.00
Total	103	100.00	

Gender	Freq.	Percent	Cum.
Male	33	32.04	32.04
Female	70	67.96	100.00
Total	103	100.00	

Time allocated to Volunteering

	Freq.	Percent	Cum.
< 9hours	10	9.71	9.71
9-15hours	10	9.71	19.42
15-30hours	11	10.68	30.10
30-50hours	18	17.48	47.57
>50hours	54	52.43	100.00
Total	103	100.00	

In line with international trends, volunteers aged 18 - 36 years constitute the majority (85%) of respondents. Over two thirds were female, and the majority devoted over 50 hours to volunteering activities every year.

 Table 2: Respondents perceptions on the meaning of "volunteering":

Meaning of	Freq.	Percent	Cum.
volunteering			
Helping the one who	18	17.48	17.48
seek help			
Giving money to charity	1	0.97	18.45
Doing any task without	48	46.60	65.05
getting paid or			
Type of fun activity that	22	21.36	86.41
you like spend			
Working in civil defense	2	1.94	88.35
or other govt.			
Other descriptions	12	11.65	100.00
Total	103	100.00	

All but one of the respondents appropriately differentiated between volunteering and charity. The non-remunerative nature of volunteering featured prominently in the way the majority of respondents perceived volunteering. Also emphasized is the notion that a volunteer activity must be of interest to volunteers. Males and females perceived the meaning of volunteering differently [Pearson chi2(5) = 8.7117 Pr = 0.121].

Motivations	Freq.	Percent	Cum.
Pursue the goal of	5	4.85	4.85
your religion			
Family tradition	1	0.97	5.83
To assist less	25	24.27	30.10
privileged people and			
co			
Getting experience or	17	16.50	46.60
achieve something			
To exchange it with	2	1.94	48.54
benefits I future			
To have fun or feel	20	19.42	67.96
happy			
to enhance self-	23	22.33	90.29
esteem and be			
socialize			
Others	10	9.71	100.00
Total	103	100.00	

 Table 3: Motivational factors related to volunteering among participants

Most of the motivational factors for survey respondents (60/103) were volunteer-centred – gaining field/work experience; having fun; enhancing self-esteem and socializing. However, the single most commonly reported reason for volunteering is to assist less privileged and vulnerable individuals and communities. Interestingly, religious considerations and family tradition for volunteering were insignificant motivators among participants.

The data on the relationships between the different age brackets and motivational factors for volunteering are shown in Table 4. Motivations for volunteering among study participants were significantly influenced by age (Chi –square = 49.7801, P-value = 0.05), although the motivation level is significantly different by age level, with respondents between the ages of 18-25 years are more motivated while ages 36-39 years were less motivated.

The data in Table 5 shows that motivations for volunteering were not significantly influenced by age (P-value = 0.511), although females were more likely to volunteer than males.

Table 6 shows the association between time devoted to volunteering among Emiratis and non-Emiratis. The data in Table 6 shows that Emiratis allocated significantly more time to volunteering compared with non-Emiratis.

					Motivatio	n			
Age	Pursue	Family	То	Getting	То	То	to	Others	Total
	th	tr	assist	e	exchan	have f	enhanc		
<18years	0	1	0	1	0	1	1	3	7
	0.00	14.29	0.00	14.29	0.00	14.29	14.29	42.86	100.00
18-25years	0	0	9	10	1	10	9	3	42
	0.00	0.00	21.43	23.81	2.38	23.81	21.43	7.14	100.0
26-30years	2	0	3	4	0	2	5	1	17
	11.76	0.00	17.65	23.53	0.00	11.76	29.41	5.88	100.0
30-36years	2	0	6	1	1	2	4	2	18
	11.11	0.00	33.33	5.56	5.56	11.11	22.22	11.11	100.00
36-39years	0	0	3	0	0	0	0	0	3
	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	100.00
>40years	1	0	4	1	0	5	4	1	16
	6.25	0.00	25.00	6.25	0.00	31.25	25.00	6.25	100.00
Total	5	1	25	17	2	20	23	10	103
	4.85	0.97	24.27	16.50	1.94	19.42	22.33	9.71	100.00

Table 4: Correlations of motivations for volunteering with age brackets

Pearson chi2(35) = 49.7801 Pr = 0.050

	Motivation								
Gender	Pursue	Family	То	Getting	То	То	to	Others	Total
	th	tr	assist	e	exchan	have f	enhanc		
Male	3	1	8	4	0	7	8	2	33
	9.09	3.09	24.24	12.12	0.00	21.21	24.24	6.06	100.00
Female	2	0	17	13	2	13	15	8	70
	2.86	0.00	24.29	18.57	2.86	18.57	21.43	11.43	100.00
Total	5	1	25	17	2	20	23	10	103
	4.85	0.97	24.27	16.50	1.94	19.42	22.33	9.71	100.00

 Table 5: Details data on the relationships between motivations for volunteering and gender among the study sample

Pearson chi2(7) = 6.2504 Pr = 0.511

Fable 6:	Time devoted	to volunteering	bv Emiratis	and non-Emiratis
	I mie actorea	to volumeeting	by Limit acts	and non Linnaus

Nationality	Time devoted to volunteering					
	< 9hours	9-15hours	15-30hour	30-50hour	>50hours	
UAE	9	7	7	14	26	63
	14.29	11.11	11.11	22.22	41.27	100.00
Others	10	10	11	18	54	40
	2.50	7.50	10.68	17.48	52.43	100.00
Total	10	10	11	18	54	103
	9.71	9.71	10.68	17.48	52.43	100.00

Pearson chi2(4) = 9.8006 Pr = 0.044

We collapsed occupational affiliations of volunteers into two groups - those who work in universities and those who work in government agencies. Only 53 of the 103 respondents were in regular employment. The rest were either university students (43) or unemployed (7). Among the employed participants, university workplace affiliation had a significant influence in participants' participant motivation level participants who affiliated with University were establishments were more likely to volunteer than workers affiliated with government public service (P-value =0.002). There was significant relationship between no occupation affiliation and time allocated to volunteering, although respondents with University affiliation tended to allocate more time to volunteering.

Of the 32 survey respondents with varying levels of involvement in recruitment and placement of volunteers, the two most important criteria for placement of volunteers are according to the skillset and according to the requirements of individuals and communities who require volunteer services. Managers of UAE volunteer recruitment and placement organizations motivate volunteers to enroll and actively participate through: (a) providing volunteers with interesting and challenging responsibilities, and providing appropriate training for such missions; (b) public recognition that enhances their esteem within the community. About 70% of respondents devote at least 50% of their work time to volunteer-related activities. Over 90% of managers of volunteer recruiting and placement organizations strongly agreed or agreed that; establishing a culture that engages volunteers will enhance their performance. Culture engagement of volunteers was explained as, making clear goals that the volunteer can understand and act on, that volunteer can get the chance to give opinion and get respected for it, and also give the volunteer respect and make them feel appreciated by the organization, and support the volunteers to optimise their performance through moral, financial or infrastructural support.

Discussion

To the best of our knowledge, this is the first study to study the motivations and perceptions of volunteers in UAE. The predominantly youthful female and demographic of volunteers suggests opportunities to analyse volunteer activities in the health sector that will be of interest to volunteers, and to provide the right incentives in order to attract more volunteers to health sector activities. The online single sign-on volunteer web site of Dubai Health Authority needs to be supplemented with regularly updated lists of volunteer activities at DHA facilities, similar to what obtains in health care organizations such as Mayo Clinic (2017). It may be necessary to adopt a consensus definition of volunteering which highlights its benefits to the volunteers as well as the individuals and communities who require volunteer services. Health sector volunteering is still evolving in UAE. It requires careful nurturing to optimise its currently unrealized potential as a significant contributor to the health system development of UAE.

University students appear to be selfmotivated to participate in volunteering activities. This observation provides opportunities for health sector volunteer programs to recruit suitable individuals, given that fairly high levels of literacy are required even for relatively basic tasks. A recent survey research on the motivators for United States health science and medical student volunteers indicated that they were motivated by tasks related to their university education that an inherent desire for volunteer work (Rovers et al, 2016). Aligning the personal goals of medical, public health and health science volunteers with health care organizations' objectives and volunteer organizers' practices is a feasible task (Rozier, Lasker and Compton, 2017). In Dubai Emirate, Volunteering hours between January and Seprtember 2016 exceeded 60,000 hours, which is double the 30,000 volunteering hours in the Emirate for the whole of 2015. According to Dubai's Community Development Authority (CDA) the January-September 2016 volunteering hours by 5000 registered volunteers (of

References

which 2000 are active) translates to a saving of AED 4.9 million. The CDA is currently advocating for health care professionals to join the 34 volunteer doctors and nurses currently registered with the agency (De Leon, 2016).

A noteworthy limitation of this study is that the sampling is non-probabilistic. In line with purposive sampling techniques, we approached organizations we know are associated with volunteer activities and requested volunteers to participate in our online survey. Consequently, there may be bias in our survey sample. some Nevertheless, we believe that the voluntary, non-compensatory, and anonymous approach for our study may lessen the bias.

Conclusion

Health sector volunteering is currently underdeveloped in UAE, both in terms of the number of volunteers and the activities in the health sector open for participation by Volunteering needs to be volunteers. perceived as a high-value activity in health care, and volunteers as an important part of the health workforce. Consequently, stakeholder health sector managers should take a much more strategic approach, with a clear vision of how volunteers will help meet organisational objectives and benefit patients and the local community. Volunteering should be used as a means of improving quality rather than reducing short-term costs. The management of volunteering and supporting infrastructure should be adequately resourced. It is important to maintain the boundaries between professional and volunteer roles, with volunteer work defined as complementing rather than replacing paid work.

Acknowledgment

We appreciate the helpful critique of Prof. Hamdy Abdelaziz of the HBMSU School of e-Education on an earlier draft of this manuscript. Abu Dhabi Centre for Technical and Vocational Education and Training. Volunteer & Community Service Program, Handbook 2014. URL: <u>http://www.actvet.ac.ae/files/Fazaa_Handbo</u> <u>ok2014_En.pdf</u> Accessed 6 February 2017.

Corporation for National and Community Service. (2016). Volunteering and Civic Life in America – 2015. URL: https://www.nationalservice.gov/vcla/resear ch Accessed 5 February 2017.

Cnaan RA, Handy F, & Wadsworth M. (1996). Defining who is a volunteer: Conceptual and empirical considerations, Nonprofit and Voluntary Sector Quarterly, 25, 364-383.

Cuthill M and Warburton J. (2005). A conceptual framework for volunteer management in local government. Urban Policy and Research, 23, 109 – 122.

De Leon J. (2016). Professionals wanted to serve community. Gulf News, November 18, 2016. URL: http://gulfnews.com/news/uae/society/profe ssionals-wanted-to-serve-community-1.1931542 Accessed 15 February 2017.

Dubai Health Authority. (2016). Volunteer Program. Dubai. URL: https://www.dha.gov.ae/en/Documents/ESer vicesFiles/VolunteeringProgram UserManu al_V1.pdf Accessed 6 February 2017.

Emirates Environmental Group. (2017). EEG reflects Year of Giving aims. Gulf News, 6 February 2017. URL: <u>http://gulfnews.com/news/uae/environment/</u> <u>eeg-reflects-year-of-giving-aims-1.1973270</u>

Emirates Red Crescent. Emirates Red Crescent Programs and Activities. (2014). Dubai, RCA. URL: <u>http://www.rcuae.ae/RCBrochure.pdf</u> Accessed 6 February 2017.

European Youth Forum. (2012). European Charter on the rights and responsibilities of volunteers. European Commission, Belgium. URL: http://ec.europa.eu/citizenship/pdf/volunteer ing charter en.pdf Accessed 5 February 2017.

European Youth Forum. (2012). European Charter on the rights and responsibilities of volunteers. European Commission, Belgium. URL: <u>http://ec.europa.eu/citizenship/pdf/volunteer</u> <u>ing_charter_en.pdf</u> Accessed 5 February 2017.

Fisher E, Boothroyd R, Coufal M, et al. (2012). Peer support for self-management of diabetes improved outcomes in international settings. Health Affairs, 31, 130-139.

Francis JE. (2011). The functions and norms that drive university student volunteering. International Journal of Nonprofit and Voluntary Sector Marketing, 16(1), 1–12. URL: <u>http://doi.org/10.1002/nvsm.390</u> Accessed 5 February 2017.

Finkelstien, MA. (2009). Intrinsic vs. extrinsic motivational orientations and the volunteer process. Personality and Individual Differences, 46, 653-658.

Jones S. We need a clear distinction between volunteering and Help to Work scheme. The Guardian, 15 October 2013. URL: <u>https://www.theguardian.com/voluntary-</u> <u>sector-network/2013/oct/15/volunteering-</u> <u>distinction-help-to-work</u> Accessed 10 February 2017.

Khamis J and Achkhanian M. (2017). Laws to govern charity, volunteering soon. Gulf News, 22 January 2017. URL: http://gulfnews.com/news/uae/year-

giving/laws-to-govern-charity-volunteeringsoon-1.1971837. Accessed 6 February 2017.

Mayo Clinic. (2017). Volunteering at Mayo Clinic in Florida. URL: <u>http://www.mayoclinic.org/about-mayo-</u> <u>clinic/volunteers/florida/service-areas</u> Accessed 9 February 2017.

Phipps B. (2006). Peer support for breastfeeding in the UK. The British Journal of General Practice, 56(524), 166–167.

Rashid Hospital. (2017). Volunteering program. Dubai, DHA. URL:

https://www.dha.gov.ae/en/RashidHospital/ Pages/VolunteeringProgram.aspx Accessed 6 February 2017.

RoversJ, Japs K, Truong E, & Shah Y. (2016). Motivations, barriers and ethical understandings of healthcare student volunteers on a medical service trip: a mixed methods study. BMC Medical Education, 16, 94. DOI: <u>http://doi.org/10.1186/s12909-016-0618-0</u> Accessed 4 February 2017.

Rozier MD, Lasker JN, Compton B. (2017). Short-term volunteer health trips: aligning host community preferences and organizer practices. Global Health Action. Volume 10, Issue 1. DOI: http://dx.doi.org/10.1080/16549716.2017.12 67957 Accessed 14 February 2017.

StataCorp. 2011. Stata Statistical Software: Release 12. College Station, TX: StataCorp LP.

Sulaiman KU. (2011). Volunteerism from Islamic perspective. International Conference on Humanities 2011. URL: <u>http://irep.iium.edu.my/6624/2/Kabuye_Uth</u> <u>man_Sulaiman.pdf</u> Accessed 5 February 2017. The Kings Fund. (2013). Volunteering in health and care: securing a sustainable future. London, The King's Fund.

United Arab Emirates. (2004). UAE Federal Law 9, 2004 concerning volunteering In the civil defense. Abu Dhabi, UAE Government. URL: http://www.sohbetna.com/business/uaelaw/f ederallawno9concerningvolunteeringintheci vildefense/

United Nations Development Programme. (2015). State of the World's Volunteerism Report, 2015. Denmark, UNDP. URL: <u>http://www.volunteeractioncounts.org/SWV</u> <u>R2015-frame/21337%20-</u> <u>%20SWVR%20report%20-</u> <u>%20ENGLISH%20-%20web%201.pdf</u> Accessed 5 February 2017.

Volunteering Australia. (2009). Definitions and Principles of Volunteering. Melbourne. URL: <u>https://volunteeringaustralia.org/wpcontent/uploads/Def_and_Princ_English.pdf</u> Accessed 6 February 2017.

Wolford J, Cox K, & Culp K. (2001). Effective motivators for master volunteer program development. Journal of Extension, 39(2), 1–8.

The Efficacy of Eaulier Rehabilitation Therapies in 44 Patients with Parkinson's Disease

ZHANG Jun Eaulier (Dalian) Hospital

Abstract

Aim: To observe the efficacy of Eaulier rehabilitation therapies in treating Parkinson's disease.

Methods: From September 2013 to December 2015, 44 patients with primary Parkinson's disease were treated with Eaulier rehabilitation therapies. The changes in the patients' symptoms and signs, including resting tremor, stiffness, bradvkinesia, postural and gait abnormalities, facial expressions, fine hand insomnia. well movements. as as constipation, were observed, and efficacy of the therapies was evaluated based on the symptoms, signs and Webster ratings. Data statistically processed. obtained were Measurement data was analyzed with t-test and enumeration data with x^2 -test. If p <0.05, there are significant differences.

Results: After treatment, the patients' symptoms and signs, including resting tremor, stiffness, bradykinesia, postural and gait abnormalities, dull facial expressions, inflexible fine hand movements, insomnia, as well as constipation, have all shown rather remarkable improvement. Their ADL levels have increased significantly, standing at 71.76±8.13 before and 90.97±9.57 after treatment (p < 0.01). Mini-Mental State Examination (MMSE) results were 26.84±2.22 before and 27.66±1.23 after treatment (p < 0.05). Webster's evaluation results were 13.85±4.76 before and 7.89 ± 2.31 after treatment (p < 0.01). Hamilton Anxiety Rating Scale was 51.99±7.37 before and 50.75 ± 7.68 after treatment (p>0.05). Symptoms and signs such as dull facial expressions, inflexible fine hand movements, insomnia and constipation have all shown

rather remarkable improvement.

Conclusion: Eaulier rehabilitation therapies have good efficacy in treating Parkinson's disease. They don't cause any side effects, are simple to administer, and are worth promoting.

Keywords: Eaulier, rehabilitation, rehabilitation hospital, Parkinson's disease, micro-current, low- and intermediatefrequency current

Parkinson's disease (PD) is a common, chronic, slowly progressing and insidious degenerative disease of the nervous system. It usually occurs among the middle-aged and the elderly, especially those aged above 65. The prevalence rate of PD in people aged above 65 is 1.7%. PD is also the fourth most common neurodegenerative disease among the elderly, leading to symptoms such as resting tremor, stiffness, bradykinesia, as well as postural and gait abnormalities. The disease progresses gradually, seriously affecting the quality of life of the patients and bringing about a heavy burden to their families and society. Currently, there are no significantly effective therapies for PD. Levodopa, Sifrol, Artane and Amantadine are usually used to treat the disease, but their effectiveness is uneven. Moreover, they become less effective after long-term usage and may cause motor fluctuations, abnormal actions, illusion, schizophrenia and other serious side effects. The Eaulier rehabilitation therapies we have used to treat 44 PD patients have led to rather significant improvements. The treatment results are reported below.

1. Data & Methods

1.1. General Data

All the PD patients selected for this study suffered from primary PD, and stayed in this hospital between September 2013 and December 2015. Of the 44 cases, 28 were male and 16 were female. Their age ranged from 53 to 85, with the average age being 67.18 ± 9.39 . They had suffered from PD for periods of 3 months to 13 years, on average 6.5 years ± 0.25 . They were classified according to the Hochn _Yahr staging scale as follows: two patients in Stage 1, four in Stage 1.5, twelve in Stage 2, five in Stage 2.5, sixteen in Stage 3, two in Stage 4 and three in Stage 5. Thirty-five of the cases had been taking drugs to treat their diseases. Some had seen drug effectiveness drop while others had suffered from such serious side effects as motor fluctuations, abnormal actions. illusion, schizophrenia, etc. The rules for inclusion and exclusion of the cases for the study were as follows: all the 44 cases were primary PD patients, in accordance with the "Standards for the Diagnosis and Identification of PD and Parkinson's syndrome" released at a national seminar on extrapyramidal system diseases in 1984. Excluded from the study were patients with secondary PD, patients with Parkinsonismplus syndromes, postoperative PD patients, patients with grave heart, brain, kidney and mental diseases, pregnant women and those allergic to electrical stimulus.

1.2. Treatment

Eaulier rehabilitation therapies were adopted, including 1. Treatment from head to feet: 20min, 3 times/d; 2. Patch treatment: patches were fixed at acupuncture points including Taichong (Liv3), Bailao (GV 14), Tianzhu (BL10), Shenshu (BL 23), Dazhui (GV 14) + Mingmen (GV 4), Sanyinjiao (SP 6), Taixi (K 3), Zusanli (ST 36), Qihai (CV6), Guanyuan (CV 4), etc., 20min, 3 times/d, working on one group of acupuncture points at a time; 3. After seven days, brain cell activation therapy was carried out, 1-3 times/week; 4. Based on the extent of dysfunction of the patients' trunk, limb and speech, PT (exercise therapy), OT (occupational therapy) or ST (speech therapy) was carried out, 1 time/day. Thirty days of the aforementioned treatment was considered as one course of treatment. Generally, a patient would be given one to three such courses on a continuous basis.

1.3. Efficacy Evaluation

Efficacy was evaluated based on changes in the patients' symptoms and signs and according to the Webster rating scale.

Clinical control: Patients' symptoms and signs disappeared and the Webster efficacy index was > 75%:

Very effective: Patients' symptoms and signs showed significant improvement and the Webster efficacy index was between 50% and 75%;

Effective: Patients' symptoms and signs showed improvement and the Webster efficacy index stood between 30% and 50%;

Ineffective: Patients' symptoms and signs showed no change and the Webster efficacy index was < 30%.

The Webster efficacy index was calculated as follows: Webster rating before treatment - Webster rating after treatment / Webster rating before treatment x 100%.

Standards for the evaluation of other symptoms and signs were as follows:

Evaluation of:

Tremor: Mild: Tremor amplitude < 2.5cm; moderate: Tremor amplitude < 10cm; serious: Tremor amplitude > 10cm.

Muscle stiffness: Mild: neck and shoulder rigidity and positive irritation/ positive excitation?; moderate: moderate neck and shoulder rigidity when not on medication; serious: moderate neck and shoulder rigidity even with medication.

Posture and gait: Mild: Spine becoming rigid with head flexed forward 12cm; moderate: Spine becoming rigid with head flexed forward 15cm; serious: head flexed forward >15cm and beginning flexion of knees. Insomnia: Mild: 4-6 of sleep; moderate: 2-4 hours of sleep; serious: 1-2 hours of sleep.

Facial expressions: Mild: Slightly immobile facial expressions; moderate: Moderately immobile facial expressions and mild drooling; serious: Severely immobile facial expressions and severe drooling.

Hand movements: Mild: Slowing of fine movements and beginning difficulty with handwriting and button fastening; moderate: Moderate slowing of hand movements and obvious impairment of handwriting; serious: Moderate slowing of hand movements and unable to write or fasten buttons.

1.4. Statistical Methods

Data obtained were statistically processed. Measurement data was analyzed with t-test and enumeration data with x^2 -test. If p < 0.05, there were significant differences.

2. Efficacy

2.1. Symptom Alleviation

Changes among two groups of patients in the following symptoms: resting tremor, muscle stiffness, posture and gait, bradykinesia, insomnia, constipation, lower extremity edema, facial expressions, drooling, fatigue, handwriting, as well as being able to turn over.

As shown in Table 1, after treatment with Eaulier rehabilitation therapies, the patients' symptoms and signs including resting tremor, muscle stiffness, postural and gait abnormalities and bradykinesia have improved significantly As shown in Table 2, after treatment with Eaulier rehabilitation therapies, the patients' symptoms and signs including insomnia, constipation, lower extremity edema and dull facial expressions have improved significantly.

As shown in Table 3, after treatment with Eaulier rehabilitation therapies, the patients' drooling and fatigue have been alleviated, their handwriting has improved and drug use has decreased.

2.2. Changes in the objective indexes, including muscle tension, ADL, MMSE, Hoffer walking ability classification and Webster scale, among the 44 patients

As shown in Table 4, after treatment with Eaulier rehabilitation therapies, the muscle tension, ADL, MMSE and Hoffer walking ability among the 44 patients have all improved in varying degrees.

As shown in Table 5, after treatment with Eaulier rehabilitation therapies, the grading of the patients according to the Hochn _Yahr staging scale, the Webster scale and the Hamilton anxiety rating scale has risen or improved in varying degrees.

As shown in Table 6, after treatment with Eaulier rehabilitation therapies, 37 cases have benefited from varying degrees of improvement in their symptoms and signs, and their Webster scores have increased. The clinical treatment has rather beneficial results, with an overall effectiveness rate reaching 84.09%.

Table 1: Changes in resting tremor, muscle stiffness, posture and gait, and bradykinesia among the 44patients

Resting tremor Muscle stiffness Postural and gait abnormalities Bradykinesia
None observed Mild Moderate Serious None observed Mild Moderate Serious None observed Mild
Moderate Serious None observed Mild Moderate Serious
治疗前 8 8 11 17 4 16 17 7 6 6 23 9 1 8 24 11
Before treatment
治疗后 19 14 9 2 20 21 3 22 17 5 22 19 3
After treatment
Table 2: Changes in insomnia, constination, lower extremity edema and facial expressions among the 44

patients

失眠	便秘	下肢浮肿	面容(面具脸)
Insomnia	Constipation	Lower extrem	ity edema Face (mask-like face)
未见 轻度 中周	度重度 未见轻	度 中度 重度	未见 轻度 中度 重度 未见 轻度 中度 重度
None observed Mil	d Moderate Seri	ous None observe	ed Mild Moderate Serious None observed Mild Moderate
Serious None obser	rved Mild Mode	rate Serious	
治疗前 20 7 10	7 26 3 8 7	21 7 11 5	18 11 12 3
Before treatment			
治疗后 29 14 1	31 10 2 1	43 1	23 19 2
After treatment			

Table 3 Changes in drooling, fatigue, handwriting and drug use among the 44 patients

流涎 疲劳	手动	作(不灵活)	用药	
Drooling Fatigue	Hand mover	ments (inflexible)) Drug use	
未见 轻度 中度 🕯	重度 未见 轻度,	中度 重度 うまう オンション オンション オンション もうちょう オンション しんしょう オンション しんしょう しんしょう オンション しんしょう オンション すいしんしょう しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう オンション しんしょう オンション しんしょう しんしょう しんしょう オンション しんしょう オンション しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう オンション しんしょう オンション しんしょう オンション しんしょう オンション しんしょう オンション しんしょう しんしょう オンション しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう オンション オンション しんしょう オンション しんしょう オンション しんしょう しんしょう しんしょう オンション しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう しんしょう オンション しんしょう しょう しんしょう しんしょ しょう しょ しょう しょう しょ	ミ见 轻度 中周	度 重度 未用 少量 中度 大量
None observed Mild	Moderate Serious	s None observe	d Mild Mod	lerate Serious None observed Mild
Moderate Serious Nor	ne observed Mild	Moderate Serie	ous	
治疗前 19 18 5 2	9 9 19 7	3 9 22 10	3 18 20	3
Before treatment				
治疗后 40 4 2	22 18 4 2	21 14 9 9	28 7	
After treatment				

Table 4: Changes in muscle tension, ADL, MMSE and Hoffer walking ability among the 44 patients

肌张力	日常生活活动	(ADL)	精神状态简	易量表	(MMS	5 E)	Hoffer步行能力分级
Muscle tension	ADL	MN	ISE Hoffer	r walking	ability	classific	ation
0级1级2级3级4级5级			I	级Ⅱ级	Ⅲ级	IV	
Level 0 Level 1 Level 2 Level 3 Level 4			evel 5		Le	vel I Lev	vel II Level III Level IV
治疗前419174	71.16±8.	13	26.84±2.22	6	12 12	14	
Before treatment							
治疗后 22 17 5	90.97±9.5	57	27.66±1.23	1	4 13	26	
After treatment							
T 值	5.26	3.48					
T value							
P 值	p<0.01	p<0.05					
P value							

Table 5 Changes in Hochn _Yahr staging, Webster scale and Hamilton anxiety rating scale among the 44patients

Hochn Yahr staging Webster scale Hamilton anxiety rating scale
0级1级1.5级2级2.5级3级4级5级
Stage 0 Stage 1 Stage 1.5 Stage 2 Stage 2.5 Stage 3 Stage 4 Stage 5
治疗前 2 8 10 5 14 2 3 13.85±4.76 51.99±7.37
Before treatment
治疗后 6 29 6 3 7.89 ±2.31 50.76±7.68
After treatment
T值 8.94 1.79
T value
P 值 p<0.01 p>0.05
P value

 Table 6: Evaluation of the Overall Clinical Efficacy of the Eaulier rehabilitation therapies among the44 patients

Patient number Basically cured Very effective Effective Ineffective Very effective rate (%) Overall effective rate (%)

2.3. Safety Observation

Three patients suffered from adverse reactions during the course of treatment, with one case of dizziness, one case of palpitation and one case of insomnia. These cases were not separately dealt with. However, their adverse reactions disappeared after the continuation of treatment.

3. Discussions

PD is a common chronic nervous system disease that usually occurs among the middle-aged and the elderly, especially among the age group above 65, where the prevalence rate of PD is as high as 1.7%. PD is also the fourth most common neurodegenerative disease among the elderly. The major symptoms are resting tremor, stiffness, bradykinesia, as well as postural and gait abnormalities. The disease on insidiously and progresses comes gradually, usually becoming more and more severe and seriously affecting the quality of life of the patients, bringing about a heavy burden to their families and society. The treatment of PD has always been widely recognized in the world's medical circle as a difficult problem, and currently, there is no significantly effective cure for the disease. Ldopa and dopamine receptor agonist are usually used in clinical treatment of PD, but their effectiveness is uneven. Moreover, these drugs become less effective after longterm use and may bring about grave side effects such as motor fluctuations, abnormal actions, illusion and schizophrenia.

Using Eaulier rehabilitation therapies, we have achieved relatively significant efficacy in the treatment of PD. After one to three courses of treatment, the clinical symptoms and signs of 44 PD patients -- including resting tremor, muscle stiffness, postural and gait abnormalities, bradykinesia, insomnia, constipation, lower extremity edema, dull facial expressions, drooling, fatigue and micrographia – were all significantly alleviated. In addition, the patients' muscle tension, ADL, MMSE, Hoffer walking ability classification and Webster score have also improved. The results of this study showed that Eaulier rehabilitation therapies are relatively efficacious in treating PD patients, and are worth promoting.

The Eaulier systemic current therapy is a new kind of electrotherapy that applies weak lowand intermediate-frequency current to the human body to help prevent and cure diseases. It integrates the functions of health preservation, disease prevention and treatment. This new micro current therapy has been jointly developed by Japanese and Chinese scientific teams after many years of research, using brand new science and technologies and unique medical design. It is a perfect integration of modern Western electrotherapy and traditional Chinese acupuncture therapy. By transmitting a special form of electric current through various reflex zones in the central nervous system including the sole, the palm and the head, through the projection zones of the central nervous system in the head, and through special acupuncture points, the therapy provides supplementary bioelectric energy to human tissues. This process helps to revitalize the human body, decelerate aging, relieve various pains, and significantly improve the functions of major organs such as the heart and the brain. It gives full play to self-healing abilities, promotes recovery from various kinds of diseases, and cures some diseases believed to be incurable by the medical industry, such as PD, stroke sequelae, dementia, depression and other chronic diseases. It is widely used in the treatment of cardiovascular diseases, nervous system diseases, bone and joint diseases, as well as digestive, respiratory, endocrine and other systemic diseases.

It is widely known that the some function control areas of the central nervous systems of the brain and the spinal cord, such as those for the nerve, digestive, circulatory and endocrine systems, have corresponding reflex and projection areas at the sole, the hand and the head. In the course of Eaulier systemic current therapy, Eaulier electrical currents stimulate these reflex and projection areas and through conditioned reflex adjust the functions of the central and autonomic nervous systems to boost the electrical activities of the brain cells. The resonance induces the emergence and increase of rhythmic brain waves, decreases abnormal brain waves and activates inhibited brain cells to promote the orderly electrical This helps the activities of the brain. confused central nervous system to adjust and revive, thereby working on the various nerve centers of the brain and affecting the functions of various systems including the body's nerves, metabolism, circulation. respiration, digestion, endocrine and systems.

In the course of the Eaulier systemic current therapy, brain tissues also release kinin, bradykinin, acetylcholine, serotonin and neurotransmitter mediators other and vasoactive substances, causing a series of reactions. For example, the Eaulier electrical currents stimulate brain substantia nigra, striatum and globus pallidus, releasing an increased level of dopamine, serotonin and neurotransmitter. This helps to alleviate the symptoms that affect most PD patients, such as hand and foot tremor, stiffness and lack of thereby facilitating movement, their activities and improving the mental state of the patients. The Eaulier electric current can expand blood vessels in the brain, promote collateral circulation, relieve the hypoxia state of the brain tissues, improve blood supply and accelerate the repair of damaged brain cells.

The human hand is where the meridians of the hand, *three yin* and *three yang*, intersect,

while the foot is where the meridians of the foot, three vin and three vang, intersect. In addition, the eight channels of Ren. Du. Chong, Dai, Yanggiao, Yingiao, Yangwei and Yinwei, the branches of the twelve meridians, the muscle along the twelve regular meridians, and the twelve cortexes also connect with the aforementioned twelve channels. They are distributed throughout the body and form a huge network of meridians (jingluo). Meridians are the channels for the distribution of vitality (qi) and blood in human bodies. They are part of the internal organs, run all over the body, and adjust the functions of all the organs. The Eaulier treatment of the entire body runs the Eaulier current through the hand and the foot, stimulating particular acupuncture points in the hand and foot, opening up the channels to facilitate the distribution of vitality and blood circulation, and enhancing the functions of the organs. Treatment with the Eaulier patch and the activation of brain cells also work through the operation of the Eaulier electric current various meridians on and acupuncture points, opening up the channels and facilitating the distribution of vitality and blood circulation, enhancing the functions of the organs to help prevent disease and strengthen the body.

In summary, the Eaulier electrical current can expand blood vessels in the brain, promote collateral circulation, increase the supply of oxygen and blood to the brain tissues, activate enzymes, facilitate neurotransmitter release, accelerate the metabolism of the brain tissues and the repair of damaged cells, and improve the functions of the central and autonomic nervous systems. It also boosts the bioelectric activity of the brain cells, and through resonance, induces rhythmic brain waves and decreases abnormal brain waves, activating inhibited brain cells to promote the orderly activities of the brain cells so that the disorderly functions of the brain and the nervous system can be adjusted and revived.

- 1、陈景藻·现代物理治疗学·北京:人 民军医出版社·2001年。
- 1. CHEN Jingzao. Modern Physical Therapy. Beijing: People's Military Medical Press, 2001 (in Chinese)
- 2、乔志恒·新编物理治疗学·北京:华 夏出版社·1993年。
- 2. QIAO Zhiheng. New Physical Therapy. Beijing: Huaxia Publishing House, 1993 (in Chinese)
- 3、卓大宏·中国康复医学·北京:华夏

出版社·1990年。

- ZHUO Dahong. Rehabilitation Medicine in China. Beijing: Huaxia Publishing House, 1990 (in Chinese)
- 4、张福金·帕金森病患者的物理治 疗·国外医学—物理医学与康复分 册, 1990,4,174.
- ZHANG Fujin. Physical Therapy for Patients with Parkinson's Disease. Foreign Medical Sciences (Physical Medical and Rehabilitation), 1990, 4:174 (in Chinese)

The Fiction of TQM Implementation in Healthcare Organizations

Uche Nwabueze Texas A&M University at Galveston, Texas USA

Abstract

TQM is being implemented in a vacuum, for example in a piecemeal fashion due to the fact that managerially, many hospital systems lack the time required for detailed planning and execution, thus quality management is seen as a political game rather than an integrated approach to improving the quality of patient care.

Evidence from a structured interview of twenty quality managers suggests the lack of managerial understanding of the holistic nature of TQM. There seems to be broad confusion as to what constitutes the key requirements of TQM. Many hospitals focus on the quality assurance requirements of standard setting and monitoring and then think that by so doing they are implementing TQM. However, what these hospitals are actually doing is installing methods to inspect and correct medical performance rather than embarking upon an organization-wide drive to improve quality of care and caring for patients.

The paper presents a model for the time constrained manager; a model that offers an understanding of the essential requirements for the success of TQM in healthcare organizations.

Introduction

It is in pursuit of making TQM philosophy manifest, in making it operational and strategically useful in modernizing the delivery of care that practicing managers need a definitive model for guidance. To date, there are remarkably few, if any, empirical attempts made to offer an holistic implementation model of TQM in healthcare organizations; a model that would help improve the quality of care and caring, but more importantly, make healthcare affordable to the consumer –the patient.

The paucity of such models has meant that managers directed only by the generalized prescriptions of the work of Deming, Juran, Crosby, and a few business consultants have adopted their own individual approaches to the implementation of TQM. Whilst such personalized models have the merit of affording recognition to those unique characteristics which all organizations possess, and which provide each with its own particular culture, they have the demerit of failing to ensure continuity of implementation with successive quality managers adding their own preferred definitions and approaches to what should be a comprehensive, coherent and sustained drive for enhanced quality throughout the organization. The obvious consequence is a loss of direction and momentum and ultimately, the lack of constancy of purpose. In addition, the continued use of TQM models based on subjective, and by definition, the idiosyncratic experiences of managers who have a poor understanding of the theoretical underpinnings or might one add, the tenets of TQM has invariably given rise to a fragmented internal work culture incapable of dealing with process and systems re-alignment with strategy and structure of the organization.

For example, claims are often made that if an organization steadily improves quality, consumer satisfaction will increase and everything else will take care of itself. This assertion has given rise to the situation where organizations concentrate on process improvement efforts that over treat symptoms and ignore root problems in inputs, throughput and delivery of medical services (Eskildson, 1994). The superficial understanding of what is important to the consumer of healthcare services has also led to the adoption of standard setting and monitoring, what the author would call "professional medical care" -the lack of balance between a patient informed and doctor acceptable levels of performance. Despite the fact that the TQM literature emphasizes the need to improve patient valued outcomes, a large number of hospital systems focus instead on creating a quality management culture through organizationwide training, self-managing teams, vision and value statements. The result is a state of confusion, long implementation time frames, frustration, resistance, and the abandonment of the program ultimately follows.

The findings of this paper are that the failure of TQM in hospital systems is down to cultural, behavioral and strategic challenges. When change of how the organization delivers care occurs, work relationships may become strained, ambiguous and new work conditions and demands not clearly longstanding articulated. Furthermore, behavioral issues as it relates to employee attitudes as informed by lack of job satisfaction and negative emotions impact relationships between management, clinical and non-clinical staff. Strategically, due to the lack of a clan culture that is required to commit hearts and souls to aspiration to "patients we believe", TQM is cornered to the mysterious graveyard of panacea that never quite delivered the goods.

Quality Gaps in Hospital Systems

Parasuraman etal (1985) and Speller (1993) identified seven gaps in their service quality model and the contention was the suggestion that if these gaps existed in the quality program of an organization, that organization is failing in the delivery of quality services to its customers. It is in this way that the paper utilized a questionnaire based on the Parasuraman etal (1985) model to identify service gaps in 20 hospital systems in Texas, USA. Twenty quality managers were asked to rate their organization on each of the seven gaps by circling a code of 3, 2, or 1 in which 3 stands for high ranking ("we are good at this; I'm confident of our skills here"); 2 for medium score ("we are spotty here; we could use improvement or more experience"); and 1 for low score ("we have problems with this; this is new to our organization).

What the analysis of the twenty returned questionnaires revealed was that medical services provided at the all the hospitals fell short of patient expectations and that the hospitals were stumbling in the dark with regard to the successful implementation of quality management. This is not surprising given that the respondents noted that they need help with external communication with their patients and that internal communication within and between work teams was a problem. This has resulted in disillusionment among staff whereby some groups feel outdone by others, and with managers and supervisors failing to listen to neither voice nor notice the visibly frustration of nurses.

Zemke and Schaaf (1989) notes that "the success of an organization depends on how you treat, relate to, engage, motivate and reward your contact employees who deal directly with customers" (Zemke and Schaaf, 1989). Furthermore, it was ascertained through face-to-face interviews with the twenty quality managers that these factors were also pertinent to the difficulties encountered through implementation:

- 1. Top management lacked understanding of patient's expectation of service, which showed poor management perception (Gap 1)
- 2. Systemic failure in translating knowledge of patients' expectations into service quality specifications, service standards and patient informed guidelines (Gap 2)

- 3. Structurally, the delivery of services failed to adhere to set quality guidelines (Gap 3)
- 4. Process alignment –failure to map the cycle of patients throughput (Gap 4)
- 5. Perception is the reality of most people and staff felt like pawns of faith (Gap 7)

It can therefore be argued that what is required to successfully implement quality management in healthcare organizations is a comprehensive model if TQM is to avoid the fate of previous management systems that promised revolution and true reform and failed. A process led strategy will have the advantage of enabling hospitals to focus on its main purpose: arranging care, delivering care, and managing care. Part of the problem across many hospitals in the United States is that medical care and caring processes are too task-oriented and impersonal.

For example, one worker takes the patient's registration information, another staff takes vital signs, and yet another staff moves the process forward. This represents the antithesis of efficiency and effectiveness of work performance. A process-led model will reorganize and reorient work activities so that when a staff member is arranging care for a patient, he or she follows the patient all the way through the provision of care, thus ensuring that there is no loss of communication, no missed opportunities and that the entire system works much more efficiently to the patient's advantage.

The Proposed TQM Model for Healthcare Organizations

Unlike most TQM models that focus primarily on increasing customer satisfaction with the so called implicit assumption that it will improve organizational performance, a process focused, a process aligned with personnel agility built in would drive increased dedication on the quality of care, quality of caring, and effective medical outcomes. Quality should never be seen as a political game rather, it must be an integrated approach to improving the quality of care.

The Essential Elements of the Model Include

Top management must demonstrate its commitment and leadership to the TQM effort by becoming process champions. This would require the development of a vision for the organization, identification of organizational values and beliefs, and the development of learning and patient focused culture. The signals senior management sends with its daily behavior, actions and decisions will share the attitude and behavior of staff members. The implementation of management in a healthcare quality environment is not nembutsu -repeating prayers to obtain salvation. In Japan, examples of successful implementation of TQM are led by top management who acknowledge the importance of quality control and then implement it by leading from the front line. Management must show, engage, inspire and led the way. Management must be seen by all employees to reach and scream from the mountain top about the virtues of TQM and its focus on delighting the customer.

If TQM is introduced with a focus on process identification, process streamlining, process improvement, and process optimization then it is reasonable to expect benefits to be delivered over a period of three years. Therefore, organizations should tackle the obstacles to process discipline through training, education, communication, participation and facilitation. These must be supported by a slow, planned, purposeful approach that engages top management and capitalizes upon bottom-up involvement.

Based on what the author of the paper calls the SMEP, which means the Single Minute Exchange of Patients, a typical hospital must fast track patients through the system by reducing service lead times and also by employing the S:P ratio to better route patients to various medical cells. S –the total throughput time, the time it takes to arrange, deliver, and manage medical care. P –the clinically determined patient waiting time; the time between diagnosis and receiving treatment

- If S>P=refer to medical cell
- If S<P=refer to focused hospital
- If S=P=use CA/PA

Conclusion

Overall, the paper would surmise that quality management implementation in healthcare requires:

No waste of movement -trading fat for muscle

Modifying and simplifying work processes

Process refinements –use of appropriate medical technology

Quality improvement –the utilization of the right people

However, the first reaction in a situation of disarray that is the fictional implementation of quality management in hospital systems is always to reach out for the short-term measure of 'patching' and 'spot-welding' here, there, and yonder. TQM is only possible when there is dramatic change in structure, organization, and management; and succeeds when the entire organization participates.

References

Eskildson, L (1994) Improving the odds of TQM Success, Quality Progress, April

Parasuraman, A., Zeithaml, I and Barry, L (1985) A conceptual model of service quality and its implications for future research, Jornal of Marketing, Vol.49

Speller, M and Ghobadian, A (1993) Change for the Public Sector, Managing Service Quality, September, pp.29-34

Zemke, R and Schaaf, D (1989) The Service Edge, Penguin Books

A Customized Change Management Process System in the Health Care Industry

Abdul Qureshi Cleveland Clinic Abu Dhabi, Al Maryah Island, Abu Dhabi, UAE

Abstract

Electronic Medical Record (EMR) systems have grown in complexity over the last few years in their breadth and scope. Meanwhile the change management process software that manages such software migrations across various environments have not been able to keep pace with the rapid developments. This paper provides a new framework (CMS) Change Management System, by which a new customized solution is developed that is robust, scalable, and takes into account of the complexity and relationships between the various software artifacts of the EMR systems and sub systems.

Index Terms—Change management system, EMR, SCM (Software Configuration Management), Change Control Process, Change Request Management (CRM).

Introduction and Problem Description

Electronic Medical Record (EMR) systems have been growing in complexity since they were first envisioned in the 1970's as very basic patient chart and diagnosis tools to fully integrated toolsets with multiple vendors competing in various environments either in the ERP, Client Server or Cloud based EMR's. Such EMR Systems generally go through a change management process by which various phases of development are managed, by which the initial change is done in a development or proof of concept environment and then such changes are moved to a test environment to test the same by various teams and also integrated with other modules or applications and after such approvals are taken and the change is successfully tested in all the previous environments, then the changes are moved to the production environment in a scheduled release management window. This process is managed by using various toolsets and the range includes from as basic as Microsoft word or excel documents, home grown developed models using client server technologies such as Microsoft Access, Share Point, Java, .NET to enterprise change management systems such as Tivoli etc. What has been observed is the fact that while the EMR systems have matured and gotten complementary complex. the change management systems have not been able to keep the pace with the growing complexity and breadth of such systems. However such complexity in the system has not also translated into an effective, robust, scalable comprehensive SCM (Software and Configuration Management) tools or the change management system. Most of the healthcare organizations are still using non standardized toolsets, with varying degree of complexity, which do not offer the complete breadth of information that is required and is needed to change, track, migrate and have an effective knowledge based system based on the changes that have been moved to the various environments.

When such tools are developed in-house, there is some effort to customize the solution but when the incorrect tool is used for such comprehensive solutions like Microsoft access, Word or excel, it is very difficult to create a comprehensive solution that includes the traceability and complex relationships between artifacts built into the software tool itself. The mature tools like Rational, Tivoli do come with such functionality but on many occasions such efforts is not used as too much work is seem as exhaustive and efforts are not customized enough and many complex relationships between the software artifacts are left unaddressed. However such tools also have some limitations as the EMR software itself have gotten very complex with various database architectures ranging from cloud, hierarchical, client server, and No SQL databases as well and not all of the requirements especially complex build and relationship requirements could be built into such tools.

Even when such relationships can be collected using complex relationships, such are based and are stored in an SQL based methods where data is stored and is used using various SOL based queries either in open or using user interface command that use backend objects. An alternative to such limitation could be а utilization of Visualization tools which do not have the traditional limitations of SOL based queries which do not allow drilling, exploring browsing and filtering of data and complex relationships between various artifacts and the relationships between them. Even though such traditional tools can create reports and some of them quite complex, these do not offer the simplicity or the essential benefits of visualization that has to offer.

The pace of the communication matters while we are making the changes and migrating these across various systems in the organization it is critical that feedback loops are operational and communication is free flowing so that all affected teams can know of the proposed changes that are flowing across the system and provide their feedback as needed. Any party can raise objection and can withhold their approval based on the proposed function being employed. This should be immediate and communicated well in advance. The evidence shows that here we have various mechanisms by which such communication is distributed. These could be just ad hoc meetings or ad hoc emails beings sent to communicate to the affected groups and teams to review and approve their changes, if they are affected by them. These also have been shown to include default emails going out from change management systems to all the parties involved in the organization that which changes are being migrated. It is rarely the case that such communications and the feedback loops associated with such communication are tied to the complex relationships in the system or the relationships between the various software artifacts. Hence the integration of this communication system with the feedback loops and how these are communicated becomes of critical importance. As without such kind of feedback loops we will be over communicating and also such information would be more generic in nature if the complex relationships are not built into the system itself.

Literature Review

Mohan, Xu, and Ramesh (2008) cited the importance of traceability and why is it so crucial to integrate the same with the software configuration management and how the overall change control process is enhanced as well. By traceability they mean how it is used to maintain the links between the various software artifacts so that it ensures the design and implementation satisfy the requirements. Hence this way such traceability can be used to document complex dependencies between various artifacts being used and how changing one artifact affects other artifacts.

Eick, Graves, Karr, Mockus, and Schuster (2002), explored the idea of visualization of software changes and stated that why it is very difficult for the existing toolsets to get meaningful data out of the traditional reporting or change management tools and give the information to the users. They stated the inherent limitations with the SQL based tools and what advantages a visualization library can have on creating multiple views show us the relationships and and complexities that were hidden before while using the legacy SQL based tool sets. Hence change either а is additive (new functionality). corrective(fixes) or reengineering based (improvements), one can create various visualizations to show the reports which were cancelled, deferred, not changed and also can create visualizations based on severity of the changes and by the users based on drill down features to name a few. This gives added knowledge and

information to manage risks and results in effective change management process.

Gene Forte (1997) explained in detail the challenge in the delicate balancing act between change and order. The author emphasized the importance of the pace of the communication and how the complexity of the relationships between the software artifacts and the impacts of the change, would lead us to an effective feedback loop based change management system, in which all affected parties are communicated to in an efficient manner when changes are moving across environments and which changes will affect which specific teams. What authors concluded in their paper was this that, there must be an integrated change management system that should include defect tracking, full featured configuration management, build automation, impact analysis and release management. Such changes should be managed by a central Change Czar and there must be scheduled release windows when changes should go into the environments and when such change is migrated, then all affected parties based on impacts and relationships between artifacts should be communicated with and kept on the same page. It is critical that such feedback should occur early in the process so any failures could be adequately re-tested through regression tests, smoke tests and integration tests so that high level of stability can be maintained in the software architecture.

Islam and Bordelon (2003)Munirul articulated that the currently used in the software configuration and change management have limitations and constraints that reduce the speed of the development and lower the quality of the final product. Many have problems in supporting dependencies between the objects which are dependent or cannot integrate third party impacts. Most do not integrate the configuration and change management as are not integrated systems.

Suggestion/Tentative Design

The suggested implementation architecture of the Change Management system (CMS) will

be developed in a fourth generation language such as .NET, as shown below in Figure 1. These all objects will be tracked in a SQL The customized system server database. reads the data from the SQL server database and displays the information in the user interface. Operations on the objects will be performed using the graphical user interface that will be developed using C#. In the internet the application runs using ASP.net using IIS web server to access SOL Server database. The nightly batch job runs from the ETL tool that exports the meta-data and change control process relevant data to the SQL server daily so that all the software artifacts and its underlying tables and data are up to date in the system.



Figure1: High Level CMS Implementation architecture

The importance of the nightly batch job via ETL is of critical importance as it downloads the meta-data relating to the various database objects and software artifacts that interact with each other and can have dependency between each other. Depending on the fact that a user selects some object, it could trigger dependency or information checks or approvals from other teams. Hence this dynamic nature of the user interface that is triggered when the user selects a new item to move through the change request through various environments will inform the correct people that are impacted. The process model of how a change flows through in the CMS system is shown as below in Figure 2.



Figure 2. High	Level	process model for	the change	request flow	in the	CMS system
rigui e 2. iligii	LEVEL	process model for	the change	request now	in the	CIVID System

The roles in CMS system are listed as below in Table 1

ROLES IN CMS SYSTEM

Role	Description	Create/Update	Delete
Change Administrator	The person who manages the change control process and authorizes the changes as approved after all application teams have reviewed the changes	Х	Х
Development Team Member	The application teams who will be building artifacts into the system and will be approving their teams affected impacted items	Х	N/A (though can back out change)
Managers	These are application managers who will oversee the work of the development team members and have view access to the changes	View access	View access

The affected applications in the CMS system and their sub applications are listed in Table II below

AFFECTED APPLICATIONS

Teams	Team Members	
Revenue	These teams would include Health Information Management team(HIM), Billing	
Cycle	Team, Contact Center/Registration Team, Admission Discharge Transfer Team	
Clinical	These would include all the clinical application teams such as Ambulatory, Inpatient,	
Team	Surgery, Hospital Outpatient, Dentistry	
Technic al Team	These teams would include Technical, Integration and DBA teams and 3 rd part affected teams are managed through the Integration team	

Table III. Database Impacts Check Dependency Model

DATABASE IMPACTS CHECK DEPENDENCY

Team area	Database objects/artifacts	Owning team	Affected/Subscribed teams
Revenue Cycle	Patient Database	Registration	Admission, HIM, Billing, Outpatient, Inpatient
Clinical Team	Diagnosis	Inpatient/Outpatient	HIM, Billing
Technical Team	Interface tables	Integration	HIM Billing 3rd Party Integration team vendors

*An example of a sub set model, actual database meta-data will be exported using ETL from production EMR system

The dependency checks will work as follows, by which the database objects and software artifacts will be divided into each application team and any team can also subscribe to such objects as well to be notified of as well.

There have been various problems that have been identified by the literature review and we feel that many of these could be resolved by using our approach for a customized change management system that incorporates various integration of software artifacts and their Meta data.

These dependency checks will solve the problem of the traceability issue that has been

identified by various researches, as this will show the dependencies between various software artifacts and this will show the impacts between various database tables as well. This will ensure that correct teams are identified when some changes are moving via change management across the various environments and will ensure that the systems is in sync across all the environments as well as impacts to all teams have been adequately addressed as well.

The front end that will be developed using any fourth generation language we will also ensure that we will utilize some visualization tool like node.js or some similar tool to show such dependencies between various software artifacts to show the dependencies between various software artifacts and this will show the visual picture of the various impacts and dependencies, so that end users can know in one glance that where the change will have impacts.

The suggested approach will be an integrated change management system that will include reports that will show the defects being raised, adequate support for configuration management, automated emails and other automated tasks via various trigger and workflow mechanisms that will help in the release management of the changes on a weekly basis across environments.

In table III we also mentioned that the Interface tables will include the third party impacts as well, this will also ensure that the problem associated with the third party impacts and Master data management (MDM) issues related to the database items that span across various software artifacts are addressed as well. Hence when some of the third party master data management items are changed the ETL job will download such items and keep the various dependency tables in sync.

Hence based on the literature review we have demonstrated problem relevance that there is

a need for a robust change management system that is dynamic and checks for the meta- data and dependencies between database objects and artifacts.

Research rigor is also applied her as we have demonstrated that we have used the existing research in this area and applied it a specific area i.e. healthcare applications.

Design as a search process is established as we have detailed the process flows that will be undertaken and how the workflow for the change request will flow through the change management system.

Design as an artifact is clearly established as well with the development of the instantiation of a system as CMS that will be based on the dynamic nature of the model of data items and dependency between these.

Research contributions are the design artifacts i.e. the instantiation and the data model that checks for the dependency between the database objects and artifacts to check the impacts that any change has over other application objects and artifacts.

Research communication is adequately provided by the process workflows and based on the dependency checks, application teams and the managers would be notified if they have subscribed to the affected database object or software artifact.

Evaluation

This system will be evaluated in several important ways:-

First the system will be compared against the existing change management systems in the industry.

Secondly the system will be evaluated using internal benchmarks and how the process is progressing and have we experienced any improvements over the previous system in efficiency and effectiveness yardsticks.

References

Kannan Mohan, Peng Xu, and Balasubramaniam Ramesh, Improving the Change Management Process, Communications of the ACM, May 2008/Vol. 51. No 5, pp. 59-64

Stephen G. Eick, Todd L. Graves, Alan F. Karr, Audris Mockus, Paul Schuster, Visualizing Software Changes, IEEE Transactions, on Software Engineering, Vol. 28, No 4, April 2002, pp396-412.

Gene Forte, INTEL, IEEE, Managing Change for Rapid Development, Roger Pressman and Associates, March/ April 1997. 0740-7459 pp. 120-122.

Munirul Islam and Eugene P. Bordelon, CCMS A Geographically Distributed Concurrent Change and Configuration Management System, Bell Labs Technical Journal 8(3), 111-133 (2003)

Lars Mathiasson, Ivan Aaen, Ojelanki Ngwenyama, Managing Change in Software Process, IEEE Software 2005 pp. 84-91s.

Hevner Alan R., March Salvator T, Park Jinsoo, Design Science in Information System Research. MIS Quarterly March 2005 pp. 75-106.

A Survey of Energy Drink Consumption and Negative Health Effects: A Random Sample of Emirati Higher Education Students

Sarah Sanad & Matthew A. Robby Hamdan Bin Mohammed Smart University

Abstract

Objective: The objective of the study is to determine the preferences, frequency, and negative health effects of energy drinks consumption by a random sample of Emirati university students.

Methods: A cross sectional study was carried out among university campuses in Abu Dhabi, Al Ain, Sharjah and Dubai. Out of 1,100 randomly selected students, 522 students completed the online survey. Data analysis was performed using SPSS software. Descriptive analysis was performed using frequencies, graphs, chisquared, t-tests, and Spearman correlations.

Results: The survey was completed by 70% females. 71% were in their second year of academic studies. The most consumed energy drinks by the population was Red Bull (57%), Ornamin-C (10.4%), Power-horse (9.5%), and 5 other brands (23.1%). About 17% were found to be consuming 1 to 3 + cans per day. The reasons for consumption included: 40% enjoy taste, 28% for obtaining energy when tired, 13% to help studying. A greater proportion of males were found to drink more energy drinks and be more at risk for negative health impacts. Students drinking 1 to $3 + a \, day \, 1$ had lower GPAs than "low to no" energy drink users. Those with "low to no" energy drink usage self-reported better overall health. Drinking 1 to 3+ cans a day was statistically significant and correlated with nervousness, increased blood pressure, *heart palpitations*, headaches. blurred vision, increased feelings of thirst, and experiencing difficulties sleeping.

Conclusions: Energy drink consumption is a widespread occurrence and a popular and increasing trend among young adults and university students. Self-reported negative health effects and lower GPA were associated more frequent consumptions of energy drinks. Universities and public health agencies can help by reviewing policies, educational campaigns, and the risks in the population of students and offer support and intervention programs to promote healthy lifestyles, ameliorate risks in the population, and provide services as needed to address negative health impacts and addiction from energy drinks to improve health and wellbeing of students.

Keywords: Energy drinks, university students, energy drinks effects, energy drinks motives

Introduction

Consumption of energy drinks is a global phenomenon, has spread to 140 countries, and sales and market share of the beverage industry has been increasing exponentially since the late 1990s (Pettit & DeBarr, 2011). It is a multi-billion dollar industry consisting of a plethora of different types of energy drink brands available for consumers. The marketing of these energy drinks uses themes of an active lifestyle and claims of increased energy and performance and this is targeted at teenagers and young adults (Reissig, Strain, & Griffiths, 2009). Energy drink consumption is popular and occurring in large proportions of minors, young adults, and university students (Malinauskas, et al., 2007; Musaiger & Zagzoog, 2014).

For example, relying on a European Food Safety study in 2011, Visram et al. (2016) reported that about 70% of minors 10 to 18 years old and 30% of adults were consumers of energy drinks in the 16 European countries studied. In a university study conducted in the USA, at least half of the college students were found to consume energy drinks monthly (Malinauskas, et al., 2007). In the Western province of Saudi Arabia, 55% of secondary school girls were found to drink energy drinks, according to Aluqmany, Mansoor, and Saad, et al. (2013). Whereas, Alsunni and Badar (2011) found that 54% of college males in the Eastern province of Saudi Arabia were regular consumers of energy drinks. From a study conducted at a university in the UAE, Faris, et al., (2016) found that 41% of university students were regular users of energy drinks. Among a sample of 125 medical students in the UAE, Jacob et al. (2013) found that 92% drank energy drinks. The prevalence of energy drink consumption is clearly large and widespread among minors and young adults, although the extent of consumption varies by region, country, and factors like age, gender, and the populations studied.

A formal review of the literature finds limited information about research performed and published in peer-reviewed sources globally about energy drink use and impacts on the health of young adults and college students (Malinauskas et al., 2007; Attila & Cakir, 2011). A small number of studies have been performed in the Gulf Cooperation Council (GCC) states. according to Alhyas, El Kashef, and AlGhafer (2015). Most energy drink research in the GCC has occurred in Saudia Arabi as studies identified in the literature 8 (Kabbash, 2006; Alsunni & Badar, 2011; Al-Hazza et al., 2011; Aluqmany et al., 2013; Bawazeer & AlSobahi, 2013; Musaiger & Zagzoog, 2014; Ibrahim et al., 2014; Faris, at el., 2015). One study was found in the Sultanate of Oman (Kilani et al., 2013). Two research studies were performed and published about energy drink consumption patterns in the United Arab Emirates (UAE) university students among (Jacob, Tambawel, Trooshi, & Alkhoury, 2013; and Faris et al., 2016). Nevertheless, no published studies have been identified that have primarily focused on Emirati students as the sample in higher education to understand their consumption behaviors and self-reported impacts from energy drinks.

Out of concern for health and safety, public information about the potential harmful effects of energy drinks appeared in about three-dozen regional newspapers over the course of the last 5 years. Public health information campaigns have been performed in the UAE out of concerns for the health and safety of at risk populations. In fact, because of health concerns, energy drink warnings have been issued and posted in the UAE for minors, pregnant women, people with allergies, persons with heart disease, and athletes. Emirates Authority for Standardization Metrology requires important standards for product display and labelling requirements for energy drinks for the protection of consumers. At the same time, the UAE Ministry of Health is promoting research and innovation on public health issues of concern and that includes use and impact of energy drinks.

Currently, markets and convenience stores found selling energy drinks to anyone 18 years of age or less will be fined 100,000 dirhams, so the UAE is committed to protecting the health of young people. Zriqat (2015) reported that the mixing of energy drinks with other drinks in restaurants has in fact been banned for safety reasons in the Sharjah Emirate. Masudi (2014) reported that authorities are reviewing the research evidence and considering increasing the prohibition of sales of energy drinks to anyone less than 20 years old in the Emirates. As energy drinks are viewed as part of an unhealthy lifestyle like smoking and over indulgence, a number of newspaper articles reported on the considerations occurring by the GCC states for probably imposing a 100% tax on harmful products such as energy drinks.

The problem has to do with energy drinks containing powerful herbal ingredients which act as stimulants, potentially large doses of caffeine, and other substances that can negatively impact health and well-being but have not been adequately researched and
tested for safety. The lack of consumer and scientific knowledge about the impact on health from the mixture of ingredients in certain energy drinks has been raised as a serious issue (Pettit & DeBarr, 2011). Research by Bigard (2010), Zeidan-Chulia et al. (2013), and Joao (2014) mention a range of substances which raise concerns about health and safety for consumers, and they include: (a) herbal ingredients like ginseng, guarana, cordyceps, ginkgo biloba, milk thistle, and Echinacea; (b) amino acids, such as L-Taurine, L-Theanine, and L-Carnitine; (c) large doses of b vitamins (e.g., b3, b6, and b8); and (d) artificial sweeteners as well as large amounts of unhealthy sugar derived primarily from corn syrup. The combination of ingredients in energy drinks have not been studied over time to determine the extent of risk for disease or harm for consumers based on consumption patterns and under various circumstances as well as patients with different health conditions.

Heavy consumption as well as prolonged use of energy drinks has not been effectively researched to understand the potential toxicity levels and contraindications of substances with other consumer beverages, products, and including medication. It is unclear what kind of impact on physical and psychological health and well-being certain brands of energy drinks can have with heavy and prolonged consumption use for consumers with different characteristics. Gunja and Brown (2012) emphasized serious concern for consumers not knowing the potential risks to health with using energy containing ginseng and drinks other stimulants with prescription medications, smoking, intoxicants, and other products.

With regards to caffeine, the concentration of ingredients will vary by the energy drink brand sold. The amount of caffeine in typical energy drinks ranges from the equivalent to an 8 ounce cup of brewed coffee or a 1 once expresso drink up to a concentrated mega dose of 500mgs of caffeine per drink or higher; that is, considering that some of the plant extracts are stimulants and may not be part of the estimates of the caffeine dosage on the product label (Reissig, C.J., Strain, E.C., & Griffiths, R.R., 2009; Attila & Cakir, 2011). A problem has been reported with respect to energy drinks containing herbal stimulants that in combination with other ingredients can have a powerful impact on the body. In fact, the herbal stimulant known as "Guarana" and others were reported as being a source of caffeine not always included in the caffeine count on energy drink labels resulting in higher dosages of caffeine than reported (Gunja & Brown, 2012).

Caffeine is a diuretic and stimulant and in large concentrations in certain energy drinks this can place a person engaged in moderate activity at risk for experiencing dehydration other negative health symptoms and (Astorino, T.A., & Robertson, D.W., 2010; Attila & Cakir, 2011). Diuresis and dehydration can potentiate a severe danger for some during the summer months in the Middle East region when temperatures reach 49 Celsius or 120 Fahrenheit and include significant humidity and a high heat index. drinks The consumption of energy concentrated with high doses of caffeine and other stimulants under the conditions of hot temperatures can likely offer severe risk for dehvdration and negative health consequences. As the number of tourists to the region significantly increases, the summer months will undoubtedly produce more heat exhaustion and heat stroke cases among tourists from societies with a lifestyle that involves consuming large quantities of energy drinks. Public health information campaigns and health services can help to ameliorate these risks.

Bawazeer and AlSobahi (2013) highlighted the potential issues associated with high caffeine consumption in energy drinks and herbal stimulants, such as increased blood pressure, dehydration, and symptoms of type 2 diabetes; as well as a range of symptoms (e.g., nervousness, anxiety, increased heart rate, and abdominal pain) related to withdrawals because of addiction. Arria and O'Brien (2011) reported that energy drinks can in fact disrupt sleep, elevate blood sugar and blood pressure, and produce digestive disorders. Higgins and Ortiz (2014) reported on use of energy drinks and experiencing negative symptoms and impacts to the nervous system, digestive system, and circulatory system. Therefore, need exists for research studies to be conducted to better delineate and understand the potential risks and impact on short-term and long-term physical and mental health associated with (a) the ingredients of energy drinks (e.g., high caffeine, herbal stimulants, amino acids, b-vitamins, and high sugar content or artificial sweeteners) and (b) the use of energy drinks among populations with different characteristics, health conditions and risk factors, brand usage, consumption practices, and consumption circumstances.

Importance

Evaluating the use of energy drinks and their self-reported impacts on health among Emirati university students contributes to the research literature and understanding for the local context and gives insights into the energy drink consumption patterns among this unique population. This information can help to inform institutional and public health planning and designing innovative initiatives for ameliorating risks; at the same time, will contribute to increasing the body of knowledge to advance research in the GCC region. Findings may be helpful to inform planning, policies, decisions, and practices in agencies and institutions, among researchers and clinicians, and for individuals and families. This study is part of a larger effort to enhance understanding and the quality and relevance of health information and services provided to students attending the university to enhance their lifestyle choices and healthy development and well-being.

This applied research study used an online survey and descriptive and inferential statistics to examine energy drink consumption patterns among a random sample of Emirati male and female university students among 4 university campuses in the UAE. The research investigates and enhances understanding for the following: (a) the type and quantity of energy drinks consumed and how it varies by student characteristics, (b) the rationale or perceived benefits with drinking energy drinks, and (c) the extent that symptoms or ill health effects are reported with heavy consumption for certain students.

Methodology

The applied research study was conducted in Spring-2016. It utilized a cross-sectional design and administered an electronic survey to a random sample of 1,100 Emirati males and females who were attending university among 4 campuses, each located in different regions in the UAE; that is, the samples came from the Emirates of Al Ain, Abu Dhabi, Dubai, and Sharjah. The study helps to illuminate the monthly to daily amount and type of energy drinks consumed within the sample, the various reason for consumption, and the extent that any symptoms or adverse health impacts are self-reported associated with energy drink consumption.

The total population of Emirati students attending among the 4 campuses in program years 1 and 2 were 3,300. So one-third of these were randomly selected. From 1,100 surveys administered, 522 were completed yielding a +/- 3.1% margin of error based on the 95% level of confidence. From these surveys, about 15% reported never using energy drinks; therefore, detailed survey responses were obtained and reported for 444 participants who reported certain levels of consumption of energy drinks.

The Energy Drink Survey was designed and pilot-tested based on review of the literature, yielding suggestions from items asked in other contexts. These sources included items about prevalence of energy drink use and type of energy drink use, and self-reported impacts on health. Additionally, small focus groups consisting of 5 teachers and 10 students gave feedback on the face validity, content validity, and relevance of items. Feedback was also obtained for how well directions, items, and response option were understood. Items were identified as most relevant for the information needs for the project to have practical benefit to the higher education institution and to inform new knowledge by addressing key questions and objectives for the research.

From feedback, some modifications to survey questions were made and the 14 item questionnaire was developed. Excluded from the survey were questions about coffee or tea because their use is so prevalent and the focus of the research was specifically on energy drinks found in local stores with high levels of caffeine, sugar, and herbal ingredients which may act as a stimulants upon the body and produce various symptoms under certain conditions of use and based on health and other factors.

The Survey-gizmo online software was used to administer the Energy Drink Survey. The survey was voluntary, no names were reported with results, and findings were only reported in group form within the institution. The study received ethical clearance and approval from the Ethics Committee of the institution. A file of student data (e.g., demographics, campus, program year, and cumulative GPA) were loaded into the survey software so responses would be connected with these grouping data. Survey results were downloaded to SPSS 22.0. All data were formatted and coded and descriptive data were generated to review accuracy, counts, proportions, distributions, and to check statistical assumptions. Statistical results were derived from use of frequencies, graphs, cross-tabulation tables, chi-square, t-tests. and Spearman correlations.

Hypotheses organized the data collection and analysis. The study assumed the null hypotheses that no statistically significant differences (at or below the alpha level of .05) would be found: (a) by gender and level of energy drink consumption; (b) between students who did and did not consume daily energy drinks and their college GPA and self-reported health; and (d) between students with or without daily energy drink consumption and experiencing any of the following: nervousness, anxiety, increased blood pressure, heart palpitations, excessive thirst, headaches, blurred vision, fatigue, and/or difficulty sleeping.

Results

Out of 522 study participants completing the Energy Drink Survey, as reported in Table 1, 365 or around two-thirds of these Emirati higher education students were female, 347 or 66.5% were 18 to 20 years of age, 376 or 71% were in year two of the their academic program leading to a 4-year degree, and 352 or 67.7% were in "good to excellent" self-reported overall health.

 Table 1: Participant Characteristics (n = 522)

Variable	No.	%
Male	157	30.1
Female	365	69.9
Age 18 to 20	347	66.5
Age 21 to 22	128	24.5
Age 23+	47	09.0
Year 1 in Program	146	28.0
Year 2 in Program	376	71.0
Al Ain	84	16.1
Abu Dhabi	183	35.1
Dubai	150	28.7
Sharjah	105	20.1
Poor to Very Poor Health	41	07.9
Average Health	127	24.4
Good to Excellent Health	352	67.7

Whereas, 127 or 24.4% reported being in average health and 41 or 7.9% reported being in "poor to very poor" health. In terms of Emirates where they attended the university, one-fifth or 105 were from Sharjah, about one-third or 150 were from Dubai, and 183 or 35.1% were from Abu Dhabi and 84 or 16.1% were from the Al Ain Emirate.

The study reveals in Table 2 that out of 522 students, 78 students or 14.9% never drank energy drinks, so 444 or 85.1% drank energy drinks and their consumption patterns varied. The highest percent was 30.2% for 158 students who drank energy drinks 1–2 days per month. Whereas, 129 or 24.7% drank energy drinks 1 to 2 times a week, 69 or 13.2% drank them 3 to 4 times a week, and 88 or 16.8% drank energy drinks one or more times per day. Examining only the 444 who reported consuming energy drinks, results indicate that 19.8% drank 1 to 3+ energy drinks a day.

Table 2: How	Often	Consumed ((n =	522)
--------------	-------	------------	--------------	------

Variable	No.	%
Never	78	14.9
1 to 2 times a month	158	30.2
1 to 2 times a week	129	24.7
3 to 4 times a week	69	13.2
Once a day	30	05.7
2 energy drinks a day	20	03.8
3 or more drinks a day	38	07.2

Cross-tabulation tables, chi-square, and phi statistics summarized in Table 3 reveal statistically significant differences for consuming 1 to 3+ energy drinks a day based on gender, year in college, and age. Thus "slightly" greater proportions of males vs. females overall consumed 1 to 3+ energy drinks a day, $X^2(1, N = 444) = 43.5, p = .000,$ phi = -.331; "slightly" greater proportions of males in university year 2 consumed 1 to 3+ energy drinks a day, $X^{2}(1, N = 337) = 20.7$, p = .000, phi = -.248; and "slightly" greater proportions of males from age 18 to 20 consumed 1 to 3+ energy drinks a day, $X^2(1,$ N = 302) = 19.2, p = .000, phi = -.252; "slightly" greater proportions of age 21 to 22 males consumed 1 to 3+ energy drinks a day, $X^{2}(1, N = 109) = 12.6, p = .000, phi = -.340.$ Whereas, "moderately" greater proportions of males drank 1 to 3+ energy drinks a day in college year 1, X^2 (1, N = 107) = 25.6, p = .000, phi = -.490; and consumption was "moderately" higher for male students at or above age 23, $X^2(1, N = 33) = 8.3$, p = .006, phi = -.504.

Table 3: Drinks 1 or More a Day

Variable	No.	%	X ²	p	phi
Overall					
Males	54	38.0			
Females	34	11.3	43.5	.000	-
					.313
Gender and Year 1					
Males (yes)	29	78.4			
Females (yes)	19	27.1	25.6	.000	-
					.490
Gender and Year 2	, ,				
Males (yes)	25	23.8			
Females (yes)	15	06.5	20.7	.000	-
					.248
Age 18 to 20					
18 to 20 Males	26	31.3			
18 to 20 Females	23	10.5	19.2	.000	-
					.252
Age 21 to 22					
21 to 22 Males	18	40.0			
21 to 22 Females	07	10.9	12.6	.001	-
					.340
Age 23+					
23+ Males	10	71.4			
23+ Females	04	21.1	8.3	.006	-
					.504

Note. Stat. Sig. if p < .05; $X^2 =$ value of chi-square; Phi = Phi Value.

Students were asked for their primary reasons for using energy drinks. Results in Figure 1 indicated that 39.9% enjoyed the taste and 27.7% said it gave them energy when tired. Also, 13.1% reported it helped them study, 11.9% said it makes them feel better, and a further 7.5% reported that energy drinks helped them during exercise, working, and driving.

Further analysis revealed that large proportions of low energy drink users used did so to make them feel better (85%) and because they liked the taste (70%). Whereas, the 123 students who reported drinking energy drinks because it gave them energy when tired, 48 or 39% of these students reported drinking energy drinks from at least 3 times a week up to 3 or more times a day. So needing energy drinks when tired was a reason associated with students with the highest quantity levels of energy drink consumption.



Figure 2 displays the number and proportion of students reporting a specific energy drink brand preference. Red Bull was reported by 253 students or 57% as their most preferred energy drink. Ornamin-C was reported by 46 students or 10.4%, Power Horse was reported by 42 students or 9.5%, and Burn was reported by 34 students or 7.7%. A further 15.4% reported preferring Jolt (4.7%), Monster (4.5%), Gold Dubai (3.6%), and Rock Star (2.6%).

The independent sample t-tests compared mean cumulative GPA in university and level of consumption. Findings in Table 4 indicate that those consuming 1 to 3+ energy drinks a day have a lower GPA than students that consumed less to none, and this result is statistically significant, t (1, 444) = 2.99, p = Nevertheless. statistically .003. no significant GPA differences were found for high levels of energy drink consumption with 1 to 3 + a day by gender, t (1, 86) = -.961, p = .339; and year in college, t(1, 86) = .295, p =.768. So those with higher overall energy drink consumption levels, regardless of gender and amount of time attending the university, have lower GPAs than students with "no to low" energy drink use.



1+ a Day	88	2.97	.476		
Low to	356	3.14	.454	2.99	.003**
None					
1+ a Day	54	2.94	.468		
(Males)				-	220
1+ a Day	34	3.03	.432	.961	.559
(Females)					
1+ a Day	48	2.99	.449		
(Year 1)				205	769
1+ a Day	40	2.96	.467	.293	./08
(Year 2)					

Note. *p < .05, **p < .01, ***p<.001.

Consumption and Health

Self-reported health was examined with a 5 point scale (0=Very Poor, 1=Poor, 2=Average, 3=Good, and 4=Excellent). To facilitate chi-squared analysis, the scale was recoded, as follows: 0=Very Poor + Poor + Average and 1=Good to Excellent. For male

students with "low to no" energy drink use, 83% reported "good to excellent" health, but males who drank 1 to 3+ energy drinks a day. 40.7% reported "good to excellent" health. This result was statistically significant, $X^2(1,$ N = 142 = 26.9, p = .000, phi = -.435, revealing a "slight to moderate" lower quality of health for males with higher consumption energy drink patterns. Statistically significant proportional differences were also found for female students, X^2 (1, N = 302) = 23.9, p = .000, phi = -.282; and for students overall, X^2 (1, N = 444) = 41.0, p = .000, phi = -.304. So lower quality of self-reported health is reported by "slightly" more females and "slight-tomoderately" more males who drank 1 to 3+ energy drinks a day.

....

Table 5:	Level of	Consumption	by	Overall Health

. . .

Variable	Low to No Use	1 to 3+ a Day	Total	X ²	p	phi
Males						
Very Poor	n=15	n=32	n=47			
to Avg.	17.0%	59.3%	33.1%			
Good to Evallant	n=73	N=22	n=95	26.9	.000	435
Good to Excellent	83.0%	40.7%	66.9%			
Female						
Very Poor	n=89	n=26	n=115			
to Avg.	33.2%	76.5%	38.1%			
Good to Evallant	n=179	N=08	n=187	23.9	.000	282
GOOD TO EXCELLENT	66.8%	23.5%	61.9%			
Overall						
Very Poor	n=104	n=58	n=162			
to Avg.	29.2%	65.9%	36.5%			
Good to Evallant	n=252	N=30	n=282	41.0	.000	304
Good to Excellent	70.8%	34.1%	63.5%			

Note. Stat. Sig. if p < .05; $X^2 = value of chi-square; Phi = Phi Value.$

Adverse Health Impacts

Spearman correlations were examined to determine if drinking 1 to 3+ energy drinks a day is linked with certain types of negative health impacts or symptoms directly related to energy drink consumption. The following are the statistically significant correlations identified. Table 6 results indicate that college students that drank 1 to 3+ energy drinks a day were more likely to have a "slightly" lower overall health self-rating (p = .000, r = -.304) and "slightly" more likely to experience nervousness, (p = .005, r = .132). Students that experienced nervousness also had statistically significant correlations with increased blood pressure (p = .000, r = .258) and heart palpitations (p = .000, r = .234).

Varia	ıble	Drinks 1 to 3+ a day	Health Rating	Feeling Nervous	Up Blood Pressure	Heart Palp.
Drinks 1 to 3+ a	Correlation	1.000	304**	132**	.044	.038
day.	Sig.		.000	.005	.354	.428
Health	Correlation	304**	1.000	.115*	028	056
Rating	Sig.	.000		.015	.553	.240
	Correlation	.132**	.115*	1.000	.258**	.234**
Feeling Nervous	Sig.	.005	.015		.000	.000
Up Blood	Correlation	.044	028	.258**	1.000	.419**
Pressure	Sig.	.354	.553	.000		.000
Heart	Correlation	.038	056	.234**	.419**	1.000
Palp.	Sig.	.428	.240	.000	.000	

Table 6: Spearman Correlations (N=444)

Note. *p < .05, **p < .01, ***p<.001.

Table 7 summarizes additional statistically significant correlations. Findings indicate that students that drank 1 to 3+ energy drinks a day were more likely to experience headaches (p = .000, r = .172), blurred vision (p = .000, r = .282), increased feelings of thirst (p = .000, r = .225), and experience

difficulties sleeping (p = .000, r = .308). Experiencing energy drink induced headaches was "moderately" correlated with experiencing blurred vision (p = .000, r = .518) and sleeping difficulties (p = .000, r = .422).

Table 7: Spearma	n Correlations	(N=444)
------------------	----------------	---------

Var	iable	Drinks 1 to 3+ a day.	Headache	Blurred Vision.	Feeling Thirsty.	Tired Later.	Difficulty Sleeping.
Drinks 1 to	Correlation	1.000	.172**	$.282^{**}$.225**	032	.308**
3+ a day.	Sig.		.000	.000	.000	.497	.000
Haadaaha	Correlation	.172**	1.000	.518**	.297**	.309**	.422**
Headache	Sig.	.000		.000	.000	.000	.000
Blurred	Correlation	.282**	.518**	1.000	.390**	.236**	.461**
Vision.	Sig.	.000	.000		.000	.000	.000
Feeling	Correlation	.225**	.297**	.390**	1.000	.293**	.441**
Thirsty.	Sig.	.000	.000	.000		.000	.000
Tired	Correlation	032	.309**	.236**	.293**	1.000	.376**
Later.	Sig.	.497	.000	.000	.000		.000
Difficulty	Correlation	.308**	.422**	.461**	.441**	.376**	1.000
Sleeping.	Sig.	.000	.000	.000	.000	.000	

Note. *p < .05, **p < .01, ***p<.001.

Figure 3 summarizes the proportion of the college students who are most impacted and at risk and who self-reported experiencing adverse health symptoms from drinking 1 to 3+ energy drinks a day. Difficulty sleeping, experiencing thirst, headaches, and blurred vision are the problems reported by a large proportion of the 88 students identified with high daily energy drink consumption. Many of the self-reported symptoms from drinking

energy drinks were correlated with each other. Correlation results can help to provide a general explanation but are subject to lack of precision because of confounding variables and study design limits. So caution is suggested when drawing conclusions from the results as correlation may not fully explain causation of the negative health impacts.



Discussion & Conclusions

Energy drink consumption patterns have been examined using a cross-sectional design, Energy Drink Survey, and a random sample of Emirati university students. The research findings provide insight into energy drink consumption patterns. Based on limitations of the research design and sampling, which is context dependent and relevant for the local communities and the higher education campuses involved -results will not represent all university students in the UAE and will not be representative of all Emirati students in higher education. While a random sample was used, findings probably only apply with caution to the Emirati populations attending higher education campuses the that participated in the research. There were consumption level differences found between the different emirates where the samples were drawn for this study, but due to uneven sample sizes and sampling error, findings were not reported to support location specific conclusions.

Similar to other studies published in the GCC region, the research has found that 85.1% of the sample has reported consuming energy drinks, and a greater proportion of male students than female students are consumers

of these drinks. In fact, a greater proportion of males were found with the highest levels of consumption based on key characteristics examined and available (e.g., overall, age, gender, and academic year). "Moderately" greater proportions of males vs. females had high energy drink consumption patterns in their first year at the university and among males age 23 and above. About 34% of the males have been identified as being most at risk for the potential harm from these drinks due to consuming from 1 to 3+ cans a day of energy drinks. Red Bull was most frequently consumed by the sample of Emirati students as well as Ornamin-C and the energy drink called Power Horse. The brands most used may be related to those sold in the convenience stores, markets, and petrol stations near the campuses involved in this research and may not represent the type of energy drinks used in high proportion nationally or in the GCC states.

It is a serious concern for the health and safety of the most at risk students who engaged in daily energy drink usage when two-thirds of these reported difficulties sleeping, more than one-third experienced dehydration, thirst and headaches, one-third had blurred vision, and one-fifth reported feelings of increased blood pressure, heart palpitations, as well as post-consumption fatigue. These symptoms are often reported in the literature linked with excessive ingestion of caffeine and herbal products that have a stimulant impact on the body. Therefore, findings suggest that university students and young adults should not consume energy drinks on a daily basis and they need to be careful about excessive use and long-term use because of the negative side effects that have been reported by a significant proportion of the sample of Emirati students in this study.

The conclusions are preliminary because a cross-sectional design was used based on the practical circumstances of the research and ethics approval granted. While careful data collection, coding, processing, and analysis occurred, this was not a rigorous enough design so there was not enough complexity and variables built into it which could be used for control to better isolate the effects of energy consumption and to draw stronger conclusions. Use of correlations helped our understanding and explanation about the self-reported symptoms associated with various levels of consumption, but these are obviously not causal data.

There are likely factors not examined in our research that could help if addressed in a future study to provide stronger evidence of the impact of energy drink ingredients on young adults. Researchers always have to be concerned with antecedent, intervening, mediating, and moderating variables that can errors in drawing produce accurate conclusions. So we hereby exercise caution and suggest that these descriptive results are preliminary and should not be viewed as causal. We recommend more future studies be conducted to build the body of literature about energy drink consumption patterns in the region and for UAE populations. We recommend in general that more safety, risk, efficacy, and impact studies should be conducted using quasi-experimental and experimental designs and application of evidence standards to help better understand the physical health impacts that energy drink substances of concern can have on physical and mental health and specific diseases based on dosages and over time. Besides randomized control trials and scientific experiments, case control and cohort studies could be useful if key data are collected over time to facilitate the research.

The GCC region suffers from a high prevalence of obesity, diabetes, and cardiovascular disease so these are significant areas of concern that should be considered. The fact that a large proportion of the students with the greatest use of energy drinks experience thirst, concern exists that students are consuming excessive sugar and carbohydrates which contributes to diabetes. Also the excessive thirst may mean that they are in a dehydrated condition from the heavy doses of caffeine and herbal stimulants. Coupled with the fact that the weather is very hot at times in the region, this places them at risk for health hazards from heat stroke, heat exhaustion, fatigue, as well as kidney, digestive, and cardio-vascular issues.

Students should be educated about the science and be guarded against the temptations of consuming energy drinks to enhance their perceived performance in university studies. Our findings suggest student GPAs are lower for those that regularly consume energy drinks. It is a challenge to positively influence young people and adults to make healthy lifestyle choices regarding consumption of energy drinks as they are heavily marketed, popular among peers, and have been incorporated into the lifestyles of many university students. Energy drinks are marketed as positive stimulants for the body and boosters for energy.

Nevertheless, the consequences of consumption are not well researched and reported on to make a rational decision. Teenagers and young adults should be presented with facts and public health information to enhance knowledge and awareness to be able to make rational choices for a healthy lifestyle and life. Emphasizing through education and public information campaign messages about healthy nutrition, regular exercise, and healthy lifestyle choices to maintain vitality and energy levels should be strongly supported.

The reality of the potential harm that could be caused by these drinks, as reported in the peer-reviewed literature and the adverse health symptoms associated with daily use found in this study, should cause students and the public to exercise greater caution when considering consuming energy drinks and to try and make healthy lifestyle choices to minimize their risks and to maximize health and well-being. Concern has been expressed about the increased risk for developing tolerance and addiction related to high doses of caffeine including herbal ingredients within energy drink products. The stimulant impact on the body may produce physical and psychological tolerance and addiction for some students.

Energy drink contents have not been adequately tested by many food and drug administrations throughout most of countries where energy drinks are sold. The safety and risks have not been well researched related to doses of herbal stimulants mixed with caffeine, sweeteners, amino acids, and bvitamins, and the contraindications with medications, other products, and long-term use on health and association with disease. It is unclear how energy drink products may influence young adults differently based on whether they are more sensitive to caffeine and other ingredients found in typical energy drinks in the region. A genetic predisposition may exist for enhancing risk of harm for some young adults. This has not been addressed in the literature and with testing and health research.

We recommend all universities examine their policies to ensure that drinks are not sold by private vendors on campus or near campuses to young people in violation of the law. It is a good idea to understand what energy drinks are available for young adult university students and what proportion of students are regular users of these beverages to try and better understand the factors that may be impacting on the health and safety of the student population. Public health agencies as well as higher education institutions should think about collaborating and identifying high risk populations and providing medical support and intervention assistance as needed to help ameliorate the risks and to deal with physical and psychological addiction to energy drinks that impact on behavior, their performance, how students are feeling, and the quality of their health.

References

Al-Hazza, H., Abahussain, N., Al-Sobayel, H., Qahwaji, D., & Musaiger, A. (2011). Physical activity, sedentary behaviors and dietary habits among Saudi adolescents gender and relative to age, region. Journal **Behavioral** International of Nutrition and Physical Activity, 8: 140. https://www.ncbi.nlm.nih.gov/pmc/articles/ PMC3339333/

Alhyas, L., El Kashef, A., & AlGhafer, H. (2015). Energy drinks in the Gulf Cooperation Council states: A review. Journal of Royal Society of Medicine Open, 0(0): 1-12.

Alsunni, A. & Badar, A. (2011). Energy consumption pattern, perceived benefits and associated adverse effects amongst students of University of Dammam, Saudi Arabia. *Journal if Ayub Medical College, Abbottabad*, 23: 3–9.

Aluqmany, R., Mansoor, R., Saad, U., Abdullah, R., & Ahmad, A. (2013). Consumption of energy drinks among female secondary school students, Kingdom of Saudi Arabia, *Journal of Taibah University Medical Science*, 8: 60–65.

Arria, A.M., & O'Brien, M.C. (2011). The high risk of energy drinks. *Journal of American Medical Association*, 305(6): 600-601.

Astorino, T.A., & Robertson, D.W. (2010). Efficacy of acute caffeine ingestion for short term high-intensity exercise performance: A systematic review. *Journal of Strength Conditioning and Research*, 24: 257-265.

Attila, S.P., & Cakir, B. (2011). Energydrink consumption in college students and associated factors. *Nutrition*, 27: 316-322.

Bawazeer, N.A., & AlSobahi, N.A. (2013). Prevalence and Side Effects of Energy Drink Consumption among Medical Students at Umm Al-Qura University, Saudi Arabia. *International Journal of Medical Students*, *1*(3), 104-108. Bigard, A.X. (2010). Energy drinking hazards among young people risks of energy drinks in Youths. *Archives de Pediatrie*, *17* (1), 1625-1631.

Clauson, K.A., Shields, K.M., McQueen, C.E., Persad, N. (2008). Safety issues associated with commercially available energy drinks. *Pharmacy Today*, *14*(5), 52-64.

Deliens, T., Clarys, P., De Bourdeaudhuij, I., & Deforche, B. (2015). Correlates of university students' soft and energy drink consumption according to gender and residency. *Nutrients*, 7: 6550-6566.

Faris, M.A., Epuru, S., Al-Shimmari, S., & Al-Shimmari, E. (2015). Alarming high levels of energy drinks consumption among school children in Hail, Northern of Saudi Arabia. International Journal of Child Health and Nutrition, 4, 1-13.

Faris, A.-I. E., Jahrami, H., Al-Hilali, M. M., Chehyber, N. J., Ali, S. O., Shahda, S. D. & Obaid, R. S. (2016). Energy drink consumption is associated with reduced sleep quality among college students: A crosssectional study. *Nutrition & Dietetics*. doi: 10.1111/1747-0080.12289.

Gunja, N., & Brown, J. A. (2012). Energy drinks: Health risks and toxicity. *Medical Journal of Australia*, *196* (1): 46-49.

Higgins, J.P., & Ortiz, B.L. (2014). Energy Drink Ingredients and their Effect onEndothelial Function: A Review. *International Journal of Clinical Cardiology*, 1: 1-6.

Jacob, S., Tambawel, J., Trooshi, F.M., & Alkhoury, Y. (2013). Consumption pattern of nutritional health drinks and energy drinks among university students in Ajman, UAE. *Gulf Medical Journal*, 2(1): 22-26.

Joao, B.J., Whiting, S.H., Encarnacao, R., Norberg, S., Jones, R., Reinap, M., & Jewell, J. (2014). Energy drink consumption in Europe: A review of the risks, adverse health effects, and policy options to respond. *Frontiers in Public Health*, 2(134), 1-5. Kabbash, A. (2006). Drug and substance abuse among medical students. Department of Family and Community Medicine: King Saud University.

Kilani, H., Al-Hazzaa, H., Waly, M., & Musaiger, A. (2013). Diet, physical activity and sleep duration Among Omani adolescents. *Sultan Qaboos University Medical Journal*, *13*: 510–519.

Ibrahim, N., Iftikhar, R., Murad, M., Fida, H., & Abalkaeil, B. (2014). Energy drinks consumption amongst medical students and interns from three colleges in Jeddah, Saudi Arabia. *Journal of Food Nutrition Research*, 1: 174–179.

Malinauskas, B.M., Aeby, V.G., Overton, R.F., Carpenter-Aeby, T., & Barber-Heidal, K. (2007). A survey of energy drink consumption patterns among college students.*Nutrition Journal*, 6: 35.

Masudi, F. (2014). Energy drink age limit under review. Gulf News, September 11, 2014. Retrieved November 22, 2016 from: <u>http://gulfnews.com/news/uae/general/energ</u> <u>y-drink-age-limit-under-review-1.1384054</u>

Musaiger, A.O., & Zagzoog, N. (2014). Knowledge, attitudes and practices toward energy drinks among adolescents in Saudi Arabia. *Global Journal of Health Science*, 6(2): 42-46.

Nordt, S.P., Vilke, G.M., Clark, R.F., Cantrell, F.L., Chan, T.C., Galinato, M., Nguyen, V., & Castillo, E.M. (2012). Energy drink use and adverse effects among emergency departmentpatients. *Journal of Community Health*, 37(5): 976-981. Pettit, M.L., & DeBarr, K.A. (2011). Perceived stress, energy drink consumption, and academic performance among college students. *Journal of American College Health*, 59(5), 335-341.

Reissig, C.J., Strain, E.C., & Griffiths, R.R. (2009). Caffeinated energy drinks – A growing problem. *Drug Alcohol Dependency*, 99: 1-10.

Visram, S., Cheetham, M., Riby, D.M., Crossley, S., & Lake, A.A. (2016). Consumption of energy drinks by children and young people: a rapid review examining evidence of physical effects and consumer attitudes. *BMJ Open*, 1-23. Retrieved from: <u>http://bmjopen.bmj.com/content/bmjopen/6/</u> 10/e010380.full.pdf

Zeidan-Chulia, F., Gelain, D.P., Kolling, E.D., Rybarczyk-Filho, J.L., Ambrosi, P., Resende, T, S., et al. (2013). Major components of energy drinks (caffeine, taurine, and guarana) exert cytotoxic effect on human neuronal SH-SY5Y cells by decreasing reactive species oxygen production. Oxidative Medicine Cellular Longevity Journal, Article ID 791795, 22 pages. Retrieved from: http://dx.doi.org/10.1155/2013/791795

Zriqat, T. (2015). Sharjah's ban on energy drinks welcomed by parents and doctors. The UAE National, August 13, 2105. Retrieved November 22, 2016 from: http://www.thenational.ae/uae/sharjahs-banon-energy-drinks-welcomed-by-parentsand-doctors

Supporting Healthcare Management through Mobile Technologies: BH Hospitals' Android Application

Humam Elagha, Hanan Bamasood, and Nayla Albinali Royal University for Women, Kingdom of Bahrain

Abstract

Mobile applications have changed the way people live, work, play and communicate. In the same way, they are transforming healthcare. Healthcare access, affordability, and quality are problems all around the world. Large numbers of individuals do not receive the quality care that they need. Mobile technology offers ways to help with these challenges. Mobile applications and related technologies promise to alter the way that healthcare is delivered, to empower patients to take responsibility for their health, to make the delivery of healthcare more efficient, and to potentially lower costs and improve outcomes.

In this paper, the main goal is to develop a mobile application with several features that provides useful contents and information about Bahrain private hospitals. Many people nowadays require getting their information fast and in a simple way. The app provides information about different *hospitals* in Bahrain with detailed information about each hospital with its contact information and enables users to book an appointment for a selected hospital of their choice. The need to cope and keep up with new upcoming technologies and the responses gathered about the idea is what inspired the creation of such mobile application. The proposed Android-based mobile application allows both the patient and the medical practitioners to manage appointments and make use of the electronic messaging facility to send reminders when the appointed time is approaching in realtime.

This paper also examines how mobile applications and technologies are

transforming healthcare, and looks at the effects mobile and related technologies will have on patients, IT, developers, providers, and payers. The finding of this paper shows that healthcare mobile applications will make healthcare more efficient and effective, bringing dramatic benefits to providers and payers alike. In addition, mobile Health offers tremendous opportunities for developers who can reap significant revenue by providing timely, useful apps powered by reliable and proven content.

Healthcare's mobile future has significant implications for IT departments and developers. For the IT departments within healthcare organizations, it means incorporating new types of technologies and ways of remotely accessing information. More IT departments will also need to hire people with mobile expertise, a skill set in high demand. Mobile requires IT departments to think differently than they have in the past. Typically, IT departments have tried to limit the types of computers and devices in use in order to simplify support and maintenance.

For developers there are opportunities beyond consumer app development, such as custom programming work and integration work for payers, hospitals and healthcare facilities. and medical professionals. Providers use mobile technology for three reasons: it can improve outcomes, reduce costs, and improve efficiency. An article in the American Medical Association notes that technologies mobile have "caused physicians to view health IT adoption as something they want to do, as opposed to something they are being forced to do."

Payers are investing in the underlying mobile computing infrastructure, such as updating IT systems to enable mobile access. providing cloud-based services and investing in analytics software that can identify plan members who will most benefit from outreach via mobile methods such as text messages and email. Mobile applications and related technologies hold great promise for patients, helping them adhere to medication regimens, manage their conditions, control healthcare costs, access medical information, connect with physicians. pharmacists, and other healthcare professionals, and generally lead healthier lives.

Keywords: Healthcare, Mobile Technology, Hospitals, Requirements, Application

1. Introduction

Hospitals are an essential part of our lives, providing best medical facilities to people suffering from various ailments. With the number of increasing the country's population it is hard to manage a large number of people who are pouring in into the front desk, or reception of the hospitals which will make the waiting process longer to people, which will cause extra effort to pull on the employee's side and the hospitals will need to hire more people and build more desks to help people with their needs which will increase the costs for them. Also it's really time consuming to find out about different hospitals, you either have to call them separately or visit their websites. That is where the idea of a mobile application for hospitals came to point.

1.1. Research Aims

The main aim of our project is to develop a mobile based application which will help the people to get a view of current working hospitals in Bahrain and know their details. Also get a chance to search through the hospitals that are specialized in certain areas or specialized in all areas, and as well as the chance to book an appointment in whatever hospital they choose in order to provide comfort and a quicker process to the user.

1.2. Research Objectives

In this project we want to build a mobile application that will provide easiness on the user to search for a list of hospitals, their information and what services they offer and the prices (for private hospitals) for their services as well as where are they located and etc. It is designed to achieve the following objectives:

- Taking advantage of the importance of smartphones and develop an Application with Android that is capable to meet today's life.
- To provide details and information about the hospitals and their ranking.
- Users can do their appointment booking in the middle of doing other tasks.
- Less time and effort while finding about different hospitals.
- Making the Booking appointment easier and convenient.
- Provide a very user-friendly interface, which will attract the users to use the application.

1.3. Problem Statement

There are plenty of hospitals out there, which might confuse the user and make him think about which hospital should he goes to for treatment and what hospital is specialized in the area that he is looking for. Also there are residents who are non-Bahrainis or even tourists that might need medical attention and have no idea where to go to provide medical care for them. As well as the increasing number of the population, hospitals are very crowded with people waiting in line to book an appointment, which is a lengthy process that takes time for people to wait for, which also in this case raises the amount of hours of work and effort for the registrar or receptionist to serve all those people. Furthermore, it's really time consuming to look up on different hospitals, you either have to call them separately or visit their websites to know about the specialists they have or further details.

1.4. Suggested Solution

Mostly, the Users have to look or search for different hospitals and what they offer, also they have to come to the hospital in order to book an appointment or wait in a queue of people, while the staffs are handling other patients' calls which might take time. So in order to solve this problem we have come up with a solution which is a mobile application that includes private hospitals. The mobile application enables the users to search for different hospitals that are categorized in a manner that is easy to look for. Also it enables the users to book an appointment from the comfort of their homes or anywhere because of the portability of the application.

1.5. Significance

Today, modern technology keeps changing from time to time such as software, system web applications. programs, mobile applications and so many other possibilities. But research has proved that users who use their mobile phones today are spending 86% of their time while using their mobile phones on mobile applications, which indicates that users prefer mobile apps over common websites. Searching and booking appointments in hospitals is quite important since years ago. Therefore, we came up with this idea to be implemented into a mobile app, which is considered unique and the first of its kind in Kingdom of Bahrain. With this app, users can easily search for local private hospitals, book and manage appointments anywhere at any time (Cristina, 2015).

2. Background

2.1. Literature Review

The customers today are always on the they're mobile move and using platforms application to achieve multiple activities or purposes. Whether they use phones, tablets or other mobile devices they have all the information that they need. That's why mobile apps important SO much in today's are market. Bahrain Hospitals App is the first app of its kind to be implemented

Kingdom of Bahrain and nearby in countries. Throughout our research we found several articles that have been done on this idea particularly, and what do they hope to find in these kinds of applications which will increase our understanding of the subject and our knowledge and guide us with the implementation of the mobile application.

2.2. Similar Applications

BH Because Hospitals mobile application is a new idea that hasn't been implemented region and nationwide, there aren't any exact similar mobile applications that have features since there the same are additional features. Therefore. listed below are some mobile applications help people that can to have an overview of the services that a certain hospital or clinic offers to its patients:

• Gibson **Hospital:** Gibson Area Hospital and Health Services of Gibson City, is a mobile application which is based in Illinois, Northern America which is used as an information resource to find and get GPS directions to local clinics. search physicians, preregister for the emergency room and other services (Gibson Hospital App, 2014).



Figure 2: Gibson Hospitals

• *Limitation:* doesn't include any other hospital outside of the area, you can't book appointments, rank hospitals or write a review.

- My Clinic: is a mobile application for a specific clinic that is offered to its users and visitors and it includes the following features:
 - 1. Request Appointment.
 - 2. Share clinic contacts to friends.
 - 3. Get Directions between patients to the clinic.
 - 4. Manage the appointments and messages.
 - 5. One touch call, e-mail and message as well (Technologies, 2013).
- *Limitation:* created for one clinic only, doesn't include a search, you can't rank the clinic or write a review.



Figure 3: My Clinic

- Mv Dental **Clinic:** this mobile application helps dentists manage their patients and clinic. Dentists can keep a database of their patient records. These include personal charts. information, dental dental notes and appointments. Dentists can also call or send SMS directly from the contact number of the patient.
- Limitations: created for one clinic that is specialized in dental services only, doesn't include a search, you can't rank the clinic or write a review.



Figure 4: My Dental Clinic

- My Face Clinic: this app is based in Erina, New South Wales, Australia, it provides to its patients and customer's exclusive offers and promotions for its services, while offering extremely an comprehensive information source with complete social media integration.
- Limitations: created for one clinic that is specialized in cosmetology only, you can't book appointments, or rank, or write a review of the clinic.



Figure 5: My Face Clinic

Hospitals: Artemis Artemis Health Personal Record (PHR) mobile app is a comprehensive personal health record solution Artemis Hospitals offered by Gurgaon. The user can access a range of services online through the app, like having access to the entire family medical records and visit the history, browse Doctors, check appointment availability and book appointment and other an manv features (Artemis Hospitals) (Artemis, 2016).

• *Limitations:* created for one hospital only, you can't rank the clinic or write a review.



Figure 6: Artemis Hospitals

2.3. Online Appointment System for Hospitals

Online health care services are expanding due to the popularization of the internet and smart phones. In Canada and England, online health care appointment systems are introduced and used to help the patients and such systems are gradually growing. The online hospital appointment system has the advantage of conveniently making appointments anywhere and at any time, which can be outside the times when hospitals are open for treatment. There are many related papers that were analyzed to realize the impact of such system on hospitals and patients.

Among 18 papers, 16 papers reported that the online appointment system improves the satisfaction for the patients and increases the efficiency of work and gain more profits for the hospital. The result of literature research revealed that the online appointment system allows the patients to book appointments during non-work hours of the hospital (Kim, 2016).

2.4. Online Booking Appointments in Bahrain

There are several hospitals in Bahrain that have online booking appointments in their websites to provide easiness and comfort to their users. The Ministry of Health has established eHealth service which is provided for the Citizens and Residents. It allows them to book their medical appointments electronically with General Clinics under the Ministry of Health. This service will also allow the users to cancel or reschedule their well appointments as as to view appointments in medical all Ministry Health Institutions. Since this service is at the trail period, it will be available to the users that belong to the Health Centers within Muharraq Governorate only (Health, 2016).

Kingdom of Bahrain Ministry of Health	e-Services				in pl
e-Services Authentic	ation				
	Hene, errer som teformat	THE REAL PROPERTY OF	e service.		
	Persona Number 4 (199 Econy data 4 Basis Number 4	24	< ten	2 100	
	land, republic the first segment	3	Ans Gros		

Figure 7: Ministry of Health e-Service

•

King Hamad University Hospital: (KHUH) was established in 2010 and it was joined to the Bahrain Defense Force. The Hospital offers its services to all citizens. (KHUH) provides medical services using the best administrative and therapeutic practices and academic and research services using independent budget that is attached to the Bahrain Defense Force's budget. At the King Hamad University Hospital - Private Practice has an online booking appointment through their website. Where the users can book an appointment in the specialty they want and view few details about them (Hospital, 2014).

121		
August Control of	Farmer 1	10012-001
		(replaced)
	T the second sec	A REPORT OF TAXABLE
last -	(here we have a second	- dinali
		- And And The Association
-	Terration (1.4)	- Barristall
	0.000-0	- send a
(a president
		20.000.00
		C. I. Lorenza
		- 34hil 1
		a limited a

Figure 8: King Hamad University Hospital Online Appointment

International Hospital of Bahrain: is the first private medical center in kingdom of Bahrain. It's started from a small private clinic which was found by Dr. Faysal Saeed Zeerah, to become later a major community hospital over the past 35 years. It is committed to the service of the Community and is thankful to have the support since its establishment in 1978. The Hospital appreciates itself in its hundreds of well- skilled and trained physicians from different nationalities. covering most of the major specialties. The Hospital has an online booking appointment through their website. Where the users can book an appointment with the clinic, choose their desired doctors and view few details about them (Bahrain, 2016).

Nelth are manifetery			
APPENDING NT DETAIL	1.5		
* Patient Name	11		1
" Home thankers	0	11	
PEN			
Prefacead Date	0	Professed Time	Seators*
(Jane Doctor	Entering: 5.814	60996 243	
VERIFICATION CODE	1		
Passie type if a chile if	to -m it appearts in	where ever of most	

Figure 9: International Hospital of Bahrain Online Appointment

• Bahrain Defense Force Royal Medical Service: One of Bahrain's most recognized hospitals is the Royal Medical Services. It has maintained this status for the past 45 years due to a high quality healthcare. The Royal Medical Services is well-known for its Private practice which delivers the patient with the best medical expertise. The hospital has an online Appointment system through their website which provides comfort and easiness to their patients (bdfmedical, 2017).





Figure 10: The Royal Medical Services Online Appointment System

3. Methodology

3.1. Research Methodology

There are many software development approaches and methodologies that can be used for developing a mobile application. For this project the most suitable approach to be used is Extreme programming (XP), which comes under agile methodology. It is considered to be one of the most flexible approaches that reduce costs and it saves time.

3.2. Agile Methodology

The software process model approach that is used in this project is the Agile Method. As recognized, rapid development and delivery is now often the most important requirement for software systems. That is why this method was chosen because it focuses on the code rather than the design, it is based on an iterative approach to the software development and it is intended to deliver working software quickly and meet with the constant changing requirements.



Figure 11: Agile Approach

The aim of agile method is to reduce overheads in the software process, for example by limiting documentation, and to be able to respond quickly to changing requirements without excessive rework. During the implementation of this app one might face new requirements or need to apply new updates, tools or reprograming to this app, considering the complexity of the app, that will require or might come up with constant changes from time to time. That's why this approach is important during the implementation and development of this mobile application (summervilla, 2016).

3.3. Extreme Programming

Extreme Programming is very successful because it depends highly on customer satisfaction and it delivers the software you need as your customer needs it. Extreme Programming helps the developers to confidently respond to any changes in the customer requirements, even if it was at the of the implementation. Also, end it underlines teamwork, whereas customers, managers and developers are all equivalent partners in a collaborative team. Extreme Programming implements an effective and simple environment that enables teams to become highly productive. It improves a software project in five essential ways that are: communication, simplicity, feedback, respect, and courage (Wells, 2013).

4. Analysis and Design

4.1. Requirement Determination

Taking Agile Model and XP process as our approach to guide us through each and every phase, we performed the following procedures:

First we decided to know about people's thoughts around the application if the idea was accepted and encouraged, thus we distributed a survey using Google Forms to several amount of people and recorded their responses to gather people's opinions, suggestions and requirements about the project's idea. After analyzing the answers and diagrams, we have discovered that a lot

of people liked the idea a lot and thought it was unique and very helpful (The survey with the results and charts is attached in the Appendix chapter). So based on this feedback we went with the next step which is interviewing.

First order of business, we have gathered enough information and conducted an interview with multiple private hospitals such as International Medical City or (IMC), Al-Rayan Private Hospital, and Al-Hilal Private Hospital. In addition, we collected some document brochures that included the list of services, offers, a list of their departments or clinics as well as a list of their doctors and so on.

During the interview we got the impression of acceptance and the interviewees were praising us for the idea. In each and every hospital, we asked them a lot of questions regarding the application. We found the interviews very helpful and insightful and got exactly what we need to start with our project. And to support the content of the project report and application we gathered brochures and information as well, to help us with the document analysis and get a hold of tangible material to make use of in this project in order to have a solid reference of the requirements needed to implement this application.

4.2. Surveys

The Second method that we used to gather the requirements is a survey. And in order to conduct this survey, we used Google forms to do so. In the survey we included the most appropriate important and fields and questions enabled us to collect exactly what we need from the users and view their preferences about the application features for example and other questions as well. After distributing this survey we gathered around 100 responses from all ages approximately. Around 97.4% percent of the users agreed strongly that this idea is beneficial to society, and that it'll be a lot easier to book appointments online without going through trouble with the traditional way. In addition, around 95% of users chose the "book

appointment" feature in the app which took the first place in their preferences along with other features as well. (The Survey analysis with the results and charts are attached in the Appendix).

4.3. System Requirements

4.3.1. Functional Requirements

Functional requirements are statements of services the system should provide, that tells us how the system should behave in particular situations and how to react to particular inputs. It specifies the software functionality that the developers must build into the product to enable users to accomplish their tasks (summervilla, 2016).

The system will consist of four actors, General Admin, Specific Admin, Users and Guests.

- **General Admin**:
 - The General Admin shall login in order to manage the app including the design.
 - The system should allow the admin to view, edit or delete any Users from the App.
 - The Admin should be able to update the list of hospitals quickly.
 - The system should allow the admin to add new hospitals in the app, as well as updating and deleting them.
 - The system should allow the admin to view the users that have booked an appointment.

Specific Admin:

- The specific admin shall login in order to **only** manage his hospital section.
- The specific admin should be able to update the information quickly.
- The system should allow the specific admin to update, delete, or add new information in any section.
- The system should allow the specific admin to **only** view the users that have booked appointments in his hospital with their information.

- ➤ Users:
 - Users should sign in to access all of the application features.
 - Users should be able to create an account.
 - The system shall allow the Users to view details of a particular hospital.
 - Users should be able to search for different hospitals.
 - Users should be able to book an appointment.
 - The system shall confirm the appointment by sending an email.
 - The system should be able to remind the Users of their booked appointment.
 - Users should be able to write a review.
 - Users will sign out from the account when sign out button is pressed.
- ➤ Guests:
 - The system shall allow the Guests to view the list of hospitals.
 - Guests should be able to search for different hospitals.
 - Guests can't book appointments until they Sign up.
 - Guests can't write reviews until they Sign up.

4.3.2.Non- Functional Requirements

Non-functional requirements may define constraints on the system implementation such as the capabilities of I/O devices or the data representations used in interfaces with other systems, and it can specify or constrain characteristics of the system as a whole (summervilla, 2016).

- The system should always be available to access for all who are using Android platform at 24 hours, 7 days a week.
- The system must provide a username and password to prevent the system from unauthorized access.
- The system must provide a high performance, strong and secure group communication service; applying

different protection methodology can achieve this.

- The system must be flexible and easy to update, maintainable, and features are able to be developed.
- The user interface system should be user friendly, easy to use, perform high quality functions with a unified design.
- The system must ask the admin to login in for any changes in order to ensure authorization and authentication of the admin.

4.4. Application's Structure Diagram

The Structure diagram of the application will explain how the app will work and as it shown in the figure, our system consists of two main sections:

- Admin interface (Content Management System "CMS"): consists of a web page that will be used by the General and Specific Admin only. General Admin has the authentication to login and access to add, edit, update, and delete the list of the hospitals. Specific Admin has the authentication to login and access to add, edit, update, and delete contents of his hospital only.
- Client interface: it is an android mobilebased application that will be used by Users and Guests of the application.



Figure 12: General Structure for the Project

5. Detailed System Design

5.1. Application's Name and Logo

BH Hospitals is the title of our application, which indicates to the user about the concept

of the application and its capabilities such as searching for hospitals and booking appointments. We have designed the logo accordingly based on the users' choice; we demonstrated few logo designs and all of them chose this logo. The main theme color of our mobile application is purple, which we were inspired by King Hamad Hospital, and also based on users' opinions that we gathered via social media. Moreover, we have chosen the (Heart with a beat) logo design that reflects healthcare and people's well-being, which is related to the application.



Figure 13: Application Logo

5.2. Application's Splash Screen

When the users access the application, a splash screen will automatically appear (as displayed in the figure) for few seconds until the content of the application is fully loaded. The splash screen contains the BH Hospitals logo and the loading icon, which indicates that the application is in process of opening.



Figure 14: Splash Screen

5.3. Application's Home Page

After the splash screen disappears the user will be directed to this page which is the "home page" As shown in the figure. The home page consists of three main parts which are:

1. **Menu in action bar**: Contains home, hospitals, contact us, help, login and sign up. By clicking onto any of these sections, it will redirect the user to the specified or requested page. If a customer is already logged in, the menu will change to include these pages as well, which are Profile, Appointments and Logout. In addition to that it will also greet and show the username at the top of the menu as shown in the figure, but if the user doesn't have an account or didn't login, he/she will be greeted as a guest.

- 2. **Sign up Button:** Once triggered, it will redirect the user to the Sign up page, where the user has to enter his information to create an account.
- 3. **Login Button:** Once triggered, it will redirect the user to the Login page, where the user must enter his credentials in order to access further features such as booking an appointment.



Figure 15: Home page and Menu

5.4. Hospitals Page

Either guests or users with accounts can perform the search operation while using the app. This page displays a list of the private hospitals in Bahrain, where the users can also go to the search field and search for another hospital upon their desires, as illustrated in the figure. Once the guest or user selects a hospital, for example if they choose the Royal Bahrain Hospital, they will be directed to the requested page, which will display all the required information that the user needs to know, such as the clinics provided in the hospital, about us page to display brief information about the hospital, offers and a contact us page.



Figure 16: Hospitals Page



Figure 17: Specific Hospital Page

6. Conclusion and Recommendations

6.1. Conclusion

Since it's a new idea that hasn't yet been implemented, we took that into our consideration and advantage to be the first to offer this useful idea and built this mobile application for private hospitals in Bahrain, and offered the users the ability to perform a search for the best hospitals out there, as well as the chance to book an appointment in the hospital that he/she desires. Also, to write reviews and rank the hospitals and be informed about the hospitals offers. The main aim of our project here is to help all users and tourists that are visiting the country to choose the best suited hospital for them whenever needed. Moreover patients can view and learn what each and every hospital has to offer for them in their area of expertise. We thought that this application would really be helpful for all the people out there, because it really solves the problem of crowded hospitals and the endless wait just to book an appointment, and the users can search and view a list of hospitals and different varieties of their services. promotions and get a chance to discover a new hospital that might be better than the ones they visited. Therefore we thought what's better than an application that would provide comfort to the user with an application that is user-friendly and convenient to use with a process of only few taps away.

6.2. Recommendations

In order to provide a great user experience, one must enable the users to achieve their objectives when using any kind of software application. Trying to understand how to make it easy for users to achieve their goal would be pointless if you don't place it within the context of what you know about your users and their preferences. The more you understand your users, their work and the context of their work, the more you can support them in achieving their goals and hence, the more usable your system will be. So in order to achieve that you must:

- Get a view on what your users want and how they want it.
- Customer needs keep changing, if you are not changing with the needs of your customers, you will lose them.
- Give attention to the smallest of details.
- And always perform testing on the requirements, systems and obtain an approval from the users.

And one of Steve Jobs best quotes about achieving success was "I'm convinced that about half of what separates the successful entrepreneurs from the non-successful ones is pure perseverance".

6.3. Limitations

Just like any other software or application, it may have some limitations to it as well, such as budget for developing this mobile application and offer more advancement might be more expensive. And while collecting the requirements, some of the hospitals or interviewees were very discreet and conservative of their information due to the competitiveness which formed a little set back, but in the end we got the information we need. In addition to that, it might also take time to include all the private hospitals and their branches in Bahrain.

6.4. Future work

With the changing and developing of new technologies year by year, there might be few improvements that could be implemented on this mobile application for private hospitals in Bahrain. Next semester we will start implementing this application. We have to keep in mind that the requirements may change a little bit. After that, it would be great to reach a wider audience than just private hospitals; we would like to take in the opportunity to include other public hospitals in Bahrain and include other GCC countries and their hospitals as well.



Appendix





Questions Chart



Features Percentage

7. References

(n.d.). Retrieved 10 10, 2016, from Artemis Hospitals: http://www.artemishospitals.com

Gibson Hospital App. (2014, 8 14). Retrieved 10 10, 2016, from google Play: https://play.google.com/store/apps/details?id =com.app_gibsonapp.layout&hl=en

Artemis. (2016, 5 18). Retrieved 10 10, 2016, from google Play: https://play.google.com/store/apps/details?id =com.mphrx.artemis&hl=en

Agile Requirements Change Management. (n.d.). Retrieved 4 25, 2016, from Agile Modeling:

http://agilemodeling.com/essays/changeMan agement.htm

Ambler's, S. W. (2014). *Agile Requirements Change Management*. Retrieved 12 2016, 10, from agile modeling: http://agilemodeling.com/essays/changeMan agement.htm

Bahrain, I. H. (2016, 11 6). *About Us.* Retrieved 10 30, 2016, from International hospital of Bahrain: http://www.fsz.me/index.asp

bdfmedical. (2017). *Online Appointments*. Retrieved 10 15, 2016, from Bahrain Defence Force Royal medical Service: https://www.bdfmedical.org/en/index.php/eservices-online-services/private-practiceclinics/online-appointments

Comcowich, W. (2014, 08 27). *The Value of Developing Mobile Apps for Brand Marketing*. Retrieved from Cyberalert: http://www.cyberalert.com/blog/index.php/t he-value-of-developing-mobile-apps-for-brand-marketing/

Cristina. (2015, 4 8). 7 *Reasons Why Mobile Apps Are Better Than Mobile Websites*. Retrieved 10 25, 2016, from fliplet: http://fliplet.com/blog/mobile-apps-vsmobile-websites/

gibson hospital. (n.d.). Retrieved 10 10, 2016, from gibson hospital: http://www.gibsonhospital.org/

Health, M. o. (2016). *Online Appointments in Health Centers*. Retrieved 10 30, 2016, from Kingdom of Bahrain Ministry of Health: http://www.moh.gov.bh/EN/E-Services/E-Services/OnlineAppointment.aspx

Hospital, K. H. (2014). *Appointment*. Retrieved 10 30, 2016, from King Hamad University Hospital: https://www.khuh.org.bh/main/Private-Practice/Appointment/

Jr., D. S. (2000). understanding data flow diagrams.

Kim, H. (2016). A Study on the Effects of Online Appointment Systems on Patients and hospitals. Retrieved 10 2016, 30, from ripublication:

http://www.ripublication.com/ijaer16/ijaerv 11n14_22.pdf

Laganiere, D. T. (2001). *object-oriented software engineering*. Mcgraw Hill.

Laganiere, D. T. (2001). *object-oriented software engineering*. Mcgriw Hill.

Markgraf, B. (2006). Benefits of Information Systems. *Importance of Information Systems in an Organization*.

MY DENTAL CLINIC MOBILE APP. (n.d.). Retrieved 10 10, 2016, from quantum X: http://quantumx.com/mobile-portfolio/mydental-clinic-mobile.php

Rosenblatt, S. a. (2012). *Analysis and Design for systems*. Cengage Learning.

Simon Bennett, S. M. (2011). *Object-Oriented Systems Analysis And Design using UML*. United Kingdom.

summervilla, l. (2016). *Software Engineering*. Pearson.

Technologies, N. (2013, 117). *My Clinic*. Retrieved 10 2016, 12, from Play Google: https://play.google.com/store/apps/details?id =com.ndot.pochealthcare

Wells, D. (2013, October 8). *Extreme Programming: a gentle introduction*. Retrieved from ExtremeProgramming: http://www.extremeprogramming.org/

Impact of Traffic Congestion on Drivers Commuting between Sharjah and Dubai Emirates

Amal Hussein Hamdan Bin Mohammed Smart University (HBMSU), Dubai, UAE

Abstract

Traffic congestion has been a rising problem, in the emirates of Dubai and Sharjah, over the past few years despite all efforts of the RTA to provide high quality infrastructure network. A lot of changes and improvements have been implemented in order to provide people with better roads and advanced transport system, all aiming to alleviate the problem of traffic congestion in the emirate of Dubai. However, many reasons exist to cause these traffic congestion, especially in the morning and evening times. Moreover, traffic congestion is becoming a public health problem as commuters between Dubai Sharjah emirates experience and congestions on a daily basis. As a result, they may be at higher risk for different types of problems including physical, psychological, emotional, and social in addition to workrelated ones. This research aims to describe the impacts of traffic congestion on commuters between Sharjah and Dubai emirates, describe the characteristics of traffic congestions that drivers are exposed to and identify factors that are associated with increased impacts of traffic congestions on subjects.

In this cross-sectional study, a convenient sample of 219 subjects who commute between Sharjah and Dubai emirates were enrolled from different public places and organizations in Dubai. They were asked to fill out an anonymous questionnaire that included closed-ended and open-ended items. Collected data were entered and analyzed using descriptive and inferential statistical tests on SPSS and results were summarized and presented in tables and charts as appropriate to the type of data.

Findings of the study showed that 71% of drivers often or always experienced traffic congestion as they commute from their home to work locations while 80% often/always experienced traffic congestion when getting back home in the evening. Average time that subjects spent to reach work from their home locations every morning was 70 minutes which was significantly different from the time that they actually need which was 25 minutes, as predicted by Google Maps. Moreover, time spent from home to work location was significantly lower than time spent backwards, from work to home locations, which was 78 minutes. Time spent commuting between different emirates was 90 minutes and that spent within same emirate was 38 minutes. 60% of subjects reported experiencing traffic mostly between emirates. Traffic was experienced on all days of the week but mainly on Sundays and Thursdays and morning and evening times of the day were mostly when traffic congestion were the main days of the weeks when traffic was experienced.

Physical impacts of traffic congestion reported by subjects were mainly back pain (68.9%), headaches (66.2%), neck pain (61.2%) and legs pain (59.8%) where the main psychological impacts reported were bad mood (78.1%), stress (71.7%), nervousness (56.6%), and anger (53%). Number of physical and psychological symptoms reported by subjects were significantly higher among Arabs and among drivers who commute between Dubai and Sharjah emirates. Exposure to traffic had also negative impacts on healthy practices like skipping breakfast (54.4%) and not practicing physical activity (59.5%). Traffic congestion was reported to have major negative impact on punctuality to work time (43.9%), level of concentration at work (26.5%), and work productivity (22.2%). Reaching late to work due to traffic was reported to occur sometimes to always by 65% of subjects. Driving behaviors were also negatively affected by traffic mostly in causing drivers to keep on changing lanes (31.8%), and use their mobile phones while driving (22.9%).

Reasons behind traffic congestion were identified by subjects to be mainly the increased number of vehicles, insufficient roads, discrepancies in rents between Sharjah and Dubai, improper driving behaviors, and same work timings among all sectors. Significant impacts of traffic congestion on overall health, social life, work performance, and family life were described by subjects.

In conclusion, results of this study indicated that traffic congestion is a serious public health problem that needs immediate interventions to alleviate its negative impacts on drivers who commute between Dubai and Sharjah emirates.

Introduction and Background

Traffic congestion has been a highly prevalent problem experienced by most residents on a daily basis in the emirates of Dubai and Sharjah specifically. The United Arab Emirates in general, and the emirate of Dubai in particular has been undergoing tremendous economic growth in all its sectors. This fast growth caused a significant increase in its resident population especially the young adult workers. Although Dubai has been working on expanding the provision of its transport system within Dubai and between Dubai and the northern emirates, in order to accommodate the new demands, commuters in Dubai and in the adjacent emirates, specifically Sharjah, are still experiencing high levels of traffic congestions on a daily basis.

In an effort to resolve the problem of traffic congestions, and as reported by the director of Strategic Transport Planning at RTA, Mr. Nasser Abu Shehab, that in 2006, Dubai has significantly expanded its road network including the Metro and Tram, in addition to increasing the roads capacity as compared to what it was in 2003 (Shahbandari, 2015). Despite all these efforts, the problem of traffic congestion is not yet resolved and people commuting between the two emirates keep complaining about this persistent problem.

Commuters experiencing traffic congestion on a daily basis are at risk for several types of problems including health, social, psychological as well as professional. Thus traffic congestion appears to be a real public health problem that needs to be well studied. Studying the real negative impacts of traffic congestion on drivers is an essential step towards solving it. Therefore, this research aims to describe the impacts of traffic congestion on drivers who commute between Dubai and Sharjah emirates.

This study will help to develop a better understanding of the extent to which traffic congestion is affecting drivers in the two emirates of Dubai and Sharjah, UAE. The results of the study will provide evidence to identify whether there is a need to develop proper intervention strategies that aim to alleviate the negative effects of traffic congestion on drivers' physical, emotional and psychosocial well-being in addition to their work productivity. Accordingly, suggestions and recommendations will be provided for workplaces and concerned governmental agencies so that needed actions be taken.

Literature Review

Traffic congestion is defined as a condition that occurs on roads as a result of their overuse when too many people need to commute at the same specific time of the day. Traffic congestion is a by-product of modernization and is a phenomenon that is rising and even getting worse in several large metropolitan areas worldwide (Somuyiwa, 2015). According to the TomTom Traffic Index data of the year 2014, the United Arab Emirates, specifically the emirate of Dubai ranks 58th on the World rank of congested countries with congestion level of 28%, morning peak of 35% and evening peak of 56% (TomTom International, 2015). It is estimated that an average of 450,000 vehicles enter Dubai daily of which 40,000 are in the morning peak hour and of these 33,500 vehicles come from the northern Emirates (Shahbandari, 2015).

There are many reasons behind traffic congestion in Dubai emirate. The rapid economic growth that occurred over the past few years in the emirate was accompanied by a huge rise in the size of the population residing in Dubai and adjacent emirates as well. Although, road network expansion was aimed to accommodate the increased density of cars, the problem of traffic congestion persisted and even is on the rise. One of the main reasons behind this problem is the huge vehicle density that is recorded in Dubai. Dubai vehicle density is not only found to be the highest as compared to other countries in the region but also it has been recorded as one of the highest worldwide. In 2013, car ownership rate in Dubai per 1000 population was 541 as compared to 305 in New York City, 213 in London, 386 in Vienna, 101 in Kong Singapore and 63 in Hong (Shahbandari, 2015). Thus, in Dubai, on average, every two people own one car. For example, in 2014, the total number of cars registered in Dubai was 1.4 million, which is twice that of the year 2006 (740,000 registered cars). Therefore the average annual increase in the number of cars was 8.2%, and if this rate has been consistent over the coming years, it is estimated that there will be 2.22 million vehicles in the year 2020 (Shahbandari, 2015).

Several research studies have highlighted the negative economic effects of traffic

congestion in terms of wasted fuel and tailpipe emissions and others have estimated the annual economic burden in monetary value (Schrank & Lomax, 2007 In Levy, 2010; Victoria Transport Policy Institute, 2009 In Levy, 2010). However, Levy (2010) emphasized the importance of studying the public health impacts of traffic congestion in order to be considered while developing policies to resolve congestion problem.

Traffic congestion has several potential negative effects on drivers including physical, mental, and psychosocial health. Continuous exposure to traffic road noise was found to be associated with hypertension (Chang et al, 2014), poor health outcomes in general (Welch etal, 2015) and reduced health-related quality of life (Dratva etal, 2010). Time spent commuting in traffic congestion was also found to be associated with reduced time for physical activity which in turn negatively affected a driver's wellbeing (Hilbrecht, 2014). In studying its impact on mental health, driving in traffic congestion was also found to be associated with increased stress levels among drivers. Venkatesh & Pushpa (2014) reported higher stress levels among drivers stuck in traffic congestion as compared to non-drivers. Traffic congestion has been also studied in its relation to a driver's work productivity. Somuyiwa et al (2015) concluded that traffic congestion was inversely associated with workers' productivity.

All previous research that studied the impact of traffic congestion were conducted in western countries and very few have addressed this issue among middle-eastern populations in general. Although traffic congestion has been a clear problem facing drivers in Dubai and Sharjah emirates, to our knowledge, no studies have been conducted to understand the impact of this public health problem on drivers. Therefore, the purpose of this study is to develop a deep understanding of the negative impact of traffic congestion phenomenon among drivers in the emirates of Dubai and Sharjah.

Methodology

Research Design

This study has a descriptive cross-sectional research design. Subjects who commute between Dubai and Sharjah emirates were eligible to participate in this study. After taking their consent for participation, subjects were asked to fill out, at a single point in time, a questionnaire that included both quantitative and qualitative components. The use of mixed methods was intended to fulfil the aim of the study which is to enrich a deep understanding about the impact of traffic congestion on drivers.

Target Population

Drivers who commute between the emirates of Sharjah and Dubai constitute the target population of this study.

Eligibility Criteria

A subject was considered eligible to participate in this study if he/she commute between Sharjah and Dubai emirates and was being exposed to traffic congestion. Drivers who spoke neither Arabic nor English languages were considered not eligible to participate in this study as the research tool was prepared only in these two languages.

Sampling Method

Subjects were selected from different places using a convenience non-probability sampling method where those who fit the eligibility criteria were selected from different organizations that were accessible for the researcher. Questionnaires were distributed among all employees in organizations that gave permission to the researcher. In addition, subjects were further approached in different public places and asked to be enrolled.

Sample Size

The minimum number of subjects needed to conduct the survey is 196, as calculated using the formula of sample size calculation used in cross-sectional studies which is:

 $N = [1.96^2 \text{ x p x } (1 - p)] / ME^2$ where ;

N is the minimum sample size needed

P is the expected prevalence; ME is the margin of error between the sample estimate and the population parameter and it will be set at 7%.

Expected prevalence will be set at 50%, as there is no prior knowledge about the proportion of subjects suffering from negative impact of traffic congestion in UAE. This expected value of 50% will yield the maximum value for the minimum sample size.

Research Instrument

Data was collected using a questionnaire that included two components: a structured one including closed-ended questions and a qualitative semi-structured component including a set of five open-ended questions. In order to develop the questionnaire items, the researcher developed a tree diagram where the objectives of the research were drafted from general to specific till individual items in the questionnaire were developed framed. The structured part of the questionnaire included 46 questions and were organized into the following six sections: (1) demographics (9 questions), (2) characteristics of traffic congestion (6 questions), (3) physical impacts of traffic congestion (5 questions), (3) psychological /emotional impacts of traffic congestion (1 question), (4) impacts of traffic congestion on work productivity (7 questions), and (5) impacts of traffic congestion on driving behaviors (5 questions). The questions contents were developed based on previous research work and were mainly measured on a 5-point Likert scale. For questions measuring impact of traffic congestion the Likert scale used ranged between 1 for "No effect" and 5 for "Major effect". Likert scale questions inquiring about frequency ranged between 1 for "Never" and 5 "Always". All questions and answer options were coded on the questionnaire in order to facilitate the stage of data entry.

Each subject was asked to specify on the questionnaire the emirate as well as the name of the area where he/she lives. Similarly subject was asked to specify the emirate and the name of the area of his/her work location. Google maps application was then used to record the estimated time, under normal conditions (non-rush hour) between the residence and work locations of each study subject.

The qualitative semi-structured component of the questionnaire included four openended questions. One question inquired about the reasons behind traffic congestion as perceived by subjects. In the other three questions, subjects were asked to describe in their own words the effects of traffic congestion on their overall health, social life, work performance and family at home.

The questionnaire was coded anonymously as subjects were not required to write down their names or any identification number. Questionnaires were coded by serial numbers for the sake of data entry and cleaning. An information sheet including details about the study was used as a cover page for the questionnaire. The information sheet as well as the questionnaire were both translated from English to Arabic language and each copy of the questionnaire included both versions on back to back papers. Thus, a subject had the choice whether to use the Arabic English or version of the questionnaire.

To assess the content validity of the data collection tool, the questionnaire items were mapped across the main study objectives to make sure that all objectives were addressed in data collection and that no questions in the questionnaire were useless for the study purposes. The validation mapping table is included in Appendix B.

To test for the questionnaire reliability, internal consistency reliability was conducted using Cronbach's Alpha test statistic.

Research questionnaire was pilot tested prior to data collection on five subjects similar to the intended study population. Accordingly minor amendments were made on the questionnaire mainly through replacing few words in the Arabic version of the questionnaire to make it clearer. In addition, the time needed to fill out the questionnaire was estimated during the pilot study and a statement was added on the Information sheet that "filling out the questionnaire will take no more than 10 minutes of your time". Following the pilot study, questionnaire was finalized and printed to be used for data collection.

Data Collection/Field Work

Primary data was collected by the researcher herself who visited various work places to enroll study subjects. Informed consent was obtained from subjects who fit the eligibility criteria by using an Information sheet that was used as a covering page of the research questionnaire. The sheet included basic information about the study purpose, researcher's affiliation. method of enrollment, study requirement, and potential risks and benefits. Subjects were assured about the confidentiality and privacy of the collected information. Upon obtaining the consent. the researcher proceeded bv questionnaire distributing the among respondents to fill them out in the presence of the researcher in case they have any doubt or needed a clarification related to any item.

Data Analysis

Data collected from the questionnaire was coded, entered and analyzed using SPSS 22. To assess the internal-consistency reliability of the research questionnaire, Cronbach's Alpha was performed on all questions measuring impact of traffic congestion. Descriptive univariate analysis was performed using frequency tables, including counts and percentages for categorical variables and measures of central tendency (including means, medians and mode) and measures of variability (including standard deviation, and range) for interval/ratio data. To conduct bivariate analysis and study associations between two variables, different inferential tests were used as appropriate to the type of data studied. For example, to study association between two nominal variables, Chi-square test was performed. When testing differences between two means

pertaining to two independent groups, the independent t-test was used after checking for its assumptions. Paired samples t-test was used to test for differences between two means that pertain to the same group. ANOVA test was used when testing for the difference between three or more means and Tukey test was performed for post hoc pairwise comparison of means. Level of significance was set at 5% and thus a p-value less than or equal to 0.05 indicated significant statistically results. 95% Confidence Interval was reported for means differences.

Qualitative data collected from the openended questions were analyzed using content thematic analysis where responses were grouped in themes that they reflect. Subsequently, the frequency of terms and phrases within each theme was calculated and the relative frequency (proportion) was calculated for each theme by dividing the number of responses in that theme by the total number of responses for that question in order to estimate the weight of each theme relative to the other themes mentioned.

Results were presented in marginal tables and pivot tables in addition to pie charts, bar charts, and histograms as appropriate to the type of the presented data.

Results

The reliability of the 29 questionnaire items that measured impact of traffic congestion was high as indicated by a Cronbach's Alpha of 0.85. Content validity of the questionnaire was tested by mapping the questionnaire items to the research objectives of the study.

Demographic Characteristics

A total of 219 subjects participated in this research, of whom 63.9% (n=140) were males and 36.1% (n=79) were females. The age of the participants ranged between 18 and 63 years with a mean age of 34.8 years (sd=8.692) and median age of 34.5. Of the total sample, 29% (n=62) were below the age of 30, 45.8% (n=98) aged between 30 and 39 years, while 25.2% (n=54) were 40 years and above.

Table 1:	Demographic Characteristics of Study
	Participants (N=219)

Variable	Ν	%
Gender		
Male	140	63.9%
Female	79	36.1%
Age		
Mean	34.8	
(SD)	(8.692)	
Minimum	18	
Maximum	63	
< 30	62	29%
30 - 39	98	45.8%
\geq 40	54	25.2%
Nationality		
Arabs	159	74.3%
Non-Arabs	55	25.7%
Educational Level		
Below University	35	16.1%
University & Above	183	83.9%
Work Status		
Student	6	2.7%
Working	203	92.7%
Unemployed	6	2.7%
Others	4	1.8%
Number Working Days Per		
Week		
≤ 5	124	58.5%
> 5	88	41.5%
Emirate of Residence		
Sharjah	126	57.5%
Dubai	81	37.0%
Other	12	5.5%
Emirate of Work Location		
Sharjah	17	7.9%
Dubai	191	89.3%
Other	6	2.8%
Frequency of commuting		
Between Residence & Work		
Locations (per week)		
Up to once	5	2.3%
2-3 times	4	1.8%
4-6 times	159	72.9%
7 days a week	50	22.9%

Study participants were from 24 different nationalities where about three fourths (74.3%, n=159) of them were Arabs and the rest (25.7%, n=55) were non-Arabs. University degrees, whether Bachelor's, Master's or higher degree, were held by 83.9% (n=183) of subjects and 92.7% (n=203) were employed workers at the time of data collection. More than half of the participants (58.5%, n= 124) were working

for 5 days a week or less while others (41.5%, n=88) worked for six or seven days per week (Table 1, Figure 1). When asked about the emirate of residence, 57.5% (n=126) of the respondents lived in Sharjah, 37% (n=81) lived in Dubai while the others (5.5%, n=12) lived in other emirates mainly in Ajman. The emirate of Dubai was identified by 89.3% (n=191) of the study participants to be their emirate of work location while 7.9% (n=17) of them worked in Sharjah emirate, and 2.8% (n=6) worked in other emirates (Figure 2). The frequency of commuting between the

two locations, residence and work, was reported by 72.9% (n=159) to be 4 to 6 times per week, and by 22.9% (n=50) of participants to be 7 days a week. Of the total sample, 57.1% (n= 120) were commuting from Sharjah to Dubai emirate (from residence to work location), while only 2.9% (n=6) were commuting in the opposite direction, 40% (n=84) and reported commuting within the same emirate (Figure 3). Therefore, 60% of the study participants commuted between the two emirates while 40% commuted within the same emirate.







Characteristics Related to Traffic Congestion

The mean number of hours that were daily spent in driving during weekdays was 2.79 (sd=1.5, median =2.8, 95% CI was 2.58 to 3.01) and 1.95 hours (sd=1.06, median = 2, 95% CI was 1.80 to 2.10) on a weekend day (Table 2). There was a statistically significant difference between the average

number of hours spent in weekdays and weekdays with a mean difference of 0.842 (95% CI 0.605 to 1.079, t= 7.005, df = 192, p-value< 0.0005).

Days and times of the day when traffic congestion were mainly experienced and direction of traffic are summarized in Table 2 (Figures 4 -6).







Table 2: Characteristics of Traffic Congestion asReported by Study Participants

Ν	%				
Average hours spent driving daily					
2.79					
(1.51)					
1.95					
(1.05)					
Frequency of experiencing traffic congestion as					
you commute from HOME to WORK					
8	3.7%				
18	8.4%				
35	16.4%				
50	23.4%				
103	48.1%				
	N daily 2.79 (1.51) 1.95 (1.05) caffic congest o WORK 8 18 35 50 103				

Variable	Ν	%			
Frequency of experiencing traffic congestion as					
you commute from WORK to HOME					
Never	6	2.8%			
Rarely	10	4.7%			
Sometimes	27	12.6%			
Often	56	26.2%			
Always	115	53.7%			
Place Where Traffic Congestion is Experienced					
From Dubai to Sharjah	162	74.0%			
From Sharjah to Dubai	150	68.5%			
Within Dubai	69	315%			
Within Sharjah	88	40.2%			
Day of the week when traffic congestion is					
experienced the most					
Sunday	190	86.8%			
Monday	138	63.0%			
Variable	Ν	%			
---------------------------	--------------------	----------			
Tuesday	140	63.9%			
Wednesday	138	63.0%			
Thursday	197	90.0%			
Friday	66	30.1%			
Saturday	67	30.6%			
All days of the week	57	26.0%			
Time of the day when tra	affic conges	stion is			
experienced the most					
Morning time	186	85.3%			
Middle of the day	51	23.4%			
Evening time	163	74.8%			
All the time	26	11.9%			
Time to Reach Work fr	om Home	Every			
Morning (minutes)					
Mean (sd)	69.3				
	(37.1)				
Median	70.0				
Minimum	5				
Maximum	180				
Time to Reach Home from W	ork Every F	Evening			
(minutes)					
Mean (sd)	78.8				
	(42.7)				
Median	80				
Minimum	5				
Maximum	220				

Reasons behind Traffic Congestion

Study subjects were asked to specify, in an open-ended question, reasons they perceive to be behind the problem of traffic congestion. Out of the total 219 subjects, 190 responded to this question and provided a total of 298 comments. The main reason behind traffic congestion was identified by 26.5% of subjects (n=79) to be the "Increased number of vehicles" including cars, buses, and trucks on roads. Some subjects considered this increase to be caused by the fact that each member within the same household owns his/her own car and commute individually every morning to his/her work locations. Others attributed the increased number of cars to the reduced costs and easy installment schemes (Table 3, Figure 7). The following quotes represent actual subjects' responses that support the above theme:

"Increased number of cars and school buses. Each person is travelling in his own car"

"Number of cars is increasing every day and roads are the same"

Table 3: Reasons Behind Traffic Congestion AsPerceived By Study Participants

	Ν	%
Increased Number of Vehicles	79	26.5%
Insufficient Roads	70	25.2%
Discrepancies in Rents in Sharjah and Dubai	42	14.1%
Improper driving behaviors	36	12.1%
Same Work Timing in All Sectors	29	9.7%
Lack of Public Transportation	18	6.0%
Others	19	6.4%
Total	298	100%



The second reason perceived to be behind traffic congestion was identified by 25.2% (n=70) of subjects as being "Insufficient or narrow roads". The number of exits and entrances between the two emirates Sharjah and Dubai were considered insufficient to handle the increased numbers of cars and thus causing traffic congestion. Following are three responses that support the above theme:

"Narrow roads at some points going from Sharjah to Dubai"

"Improper road design in congested areas"

"Narrow routes connecting Sharjah to Dubai. New routes should be added to the existing ones"

The third reason perceived by study participants to be responsible for traffic congestion between the emirates of Sharjah and Dubai is the "High discrepancy in the rents of flats in the two emirates". Due to the expensive rents in Dubai, as compared to that in Sharjah and Ajman, many employees working in Dubai live in Sharjah and Ajman to save some money and thus have to commute every morning and evening on a daily basis between the two emirates. This huge number of daily commuters create or at least aggravate the problem of traffic congestion. The following two quotes are example of subjects' responses:

"Discrepancies between rents in Dubai and rents in Sharjah and Ajman as workers cannot afford to rent flats close to their workplace"

"Expensive rent rates in Dubai and much lower rates in Sharjah makes all people who work in Dubai to live in Sharjah so this leads to a huge traffic congestion in rush hours"

Improper driving behaviors" practiced by some drivers was identified by 12.1% (n=36) of study participants to be one cause of traffic congestion. Main behaviors identified included changing lanes continuously, not abiding by traffic rules, slow driving, and fast driving leading to accidents that in turn cause congestion. The following are relevant quotes from subjects:

"Drivers keep changing lanes and using smart devices while driving. So they are not abiding by driving rules"

"Drivers who drive slowly on high ways like 60 km cause traffic"

One additional reason identified by 9.7% (n=29) of subjects to be causing traffic congestion was the "Similar work timings among all work sectors and schools". This similarity in timings results in that

employees, workers and school students all move at the same time in the morning and thus causing congested roads. The following are examples of subjects' responses as related to the above theme:

"All workers in all sectors leave to work at the same time"

"All workers leave their homes at the same time and take the same route to Dubai which makes me leave my house immediately after fajr prayer to go to work"

"As per my experience of last years of driving, when schools are closed there is a 50% reduction in traffic. So in my opinion it may be due to same timing for schools and working people especially"

Other subjects (6%, n=18) considered the "Lack of adequate and affordable public transportation" between Sharjah and Dubai emirates to be causing traffic congestion as people are obliged to use their own private cars causing traffic. The following are examples of responses:

"Inappropriate public transport for employees"

"No metro or train service between Dubai and Sharjah emirates"

Other reasons causing traffic congestion as mentioned by some subjects included traffic lights, and the vertical expansion within the two emirates causing an increase in the population.

Physical Impact of Traffic Congestion

The main physical symptoms experienced by subjects due to traffic congestion were back pain (68.9%), headaches (66.2%), neck pain (61.2%), legs pain (59.8%) and fatigue (53.9%) (Table 4, Figure 8).

The average number of symptoms reported by all study subjects was 7, maximum of 16 symptoms reported by few subjects (Figure 9, Figure 10).

Table 4:	Physical Impact of Traffic Congestion
	on Study Participants

Impact	N	%
Headaches	145	66.2%
Dizziness	45	20.5%
Nausea	33	15.1%
Chest Pain	27	12.3%
Pain in the legs	131	59.8%
Back Pain	151	68.9%
Neck Pain	134	61.2%
Fatigue/less energy	118	53.9%
Stress	157	71.7%
Aggressiveness	57	26.0%
Anger	116	53.0%
Anxiety	65	29.7%
Depression	56	25.6%
Bad Mood	171	78.1%
Nervous	124	56.6%
Others	7	3.2%





Number of Symptoms





Subjects were asked whether they practice healthy behaviors like eating breakfast and exercising. Of the study sample, 30.9% (n=67) reported never eating breakfast meal, 23.5% (n=51) rarely ate breakfast, 7.8%

reported eating breakfast often and 19.4% (n=42) stated that they eat breakfast meal every day before going to work. Exercising for at least 30 minutes a day was always practiced by 10.2% (n=22) of the study subjects, while 59.5% (n=128) reported never or rarely doing exercise (Table 5, Figure11)

Table 5: Frequency of Doing the followingBehaviors On Weekdays [% (n)]

Behavior	Never	Rarely	Sometimes	Often	Always
Eating	30.9%	23.5%	18.4%	7.8%	19.4%
Breakfast	(67)	(n=51)	(n=40)	(n=17)	(n=42)
before					
going to					
work					
Exercise	42.3%	17.2%	20.9%	9.3%	10.2%
for at	(91)	(37)	(n=45)	(n=20)	(22)
least 30					

minutes a			
day			



Sleep duration is another aspect of a healthy lifestyle that was measured in this study. Study participants were asked to specify the times when they sleep at night and wake up in the morning. Accordingly, the sleep duration was calculated by subtracting the two variables and thus the number of hours of sleep were indicated for each participant. The mean duration of sleep of the total sample was found to be 6.5 hours (sd=1.3). The latest recommendation of the National Sleep Foundation is that adults above the age of 26 are required to sleep an average of 7-9 hours per night (National Sleep Foundation, 2016). Based on this recommendation, the average sleep duration of the total sample was compared to the value of 8 hours using the one-sample t-test. Results showed that the mean difference between the recommended value and the average sample value was -1.5 hours (95% CI of the difference is -1.64 to -1.29). The results of the t-test indicated that the average number of hours slept by the sample subjects was significantly different from the average recommended value of 8 hours (t = -16.466, df=214, p-value<0.0005). The average number of hours slept by study subjects were even found to be significantly different from the minimum number of hours (7 hrs) recommended by the National Sleep Foundation (t=-5.191. df=214. nvalue<0.0005). It was further found that 45.4% (n=99) of the total sample sleep at least 7 hours per night while 54.6% (n=119) sleep less than 7 hours (Table 6, Figure 12).



			Lower	Upper			
Duration of sleep							
Study Sample	6.54	-1.46	-1.64	-1.29	-16.466	214	<0.0005
	(1.30)						
Average	8.0						
Standard							
Duration of sleep							
Study Sample	6.54	-0.460	-0.64	-0.29	-5.191	214	<0.0005
	(1.30)						
Minimum	7.0						
Standard							

 Table 6: One sample t-test comparing the Average Hours Slept by Subjects to the Average of Standard Hours and The Minimum Hours Recommended by the National Sleep Foundation

Study participants were asked to report the number of hours that they, on average, spend sitting. The average number of hours spent sitting was found to be 6.44 (sd=3.62). In addition, 56.6% (n=124) of the study sample spend 6 hours or more of sitting per day (Figures 13 & 14).

Figure 13: Histogram Showing the Average Number of Hours Spent in Sitting During





Psychological Impact of Traffic Congestion

Subjects reported some psychological impacts due to traffic congestions. The main psychological effects reported were bad mood (78.1%), stress (71.7%), nervousness (56.6%) and Anger (53.0%). Other symptoms reported were anxiety (29.7%), aggression (26.0%) and depression (25.6%) (Table 4, Figure 8).

Impact of Traffic Congestion on Work Performance

The negative impact of traffic congestion on work performance was found to be highest on punctuality to work time as it was reported by 67.8% of study subjects to have moderate to major effect. Moreover, traffic congestion was reported to have moderate to major negative impacts on level of concentration at work (54.9%), work productivity (53.7%), communication with work colleagues (35.2%) and on work performance in general (54.0%) (Table 7, Figure 15).

Table 7: Impact of Traffic Congestion on Work Performance [% (n)]

Behavior	No	Minor	Neutral	Moderate	Major
	impact	impact		impact	impact

Punctuality to work time	7.0%	18.7%	6.5%	23.8%	43.9%
	(15)	(40)	(14)	(51)	(940
Level of concentration at work	10.7%	21.9%	12.6%	28.4%	26.5%
	(23)	(47)	(27)	(61)	(57)
Work productivity	11.6%	22.2%	12.5%	31.5%	22.2%
	(25)	(48)	(27)	(68)	(48)
Communication with your colleagues	16.9%	25.4%	22.5%	21.6%	13.6%
	(36)	(54)	(48)	(46)	(29)
Performance at work in general	13.5%	14.9%	17.7%	32.1%	21.9%
	(29)	(32)	(38)	(69)	(47)



Reaching late to work in the morning was reported by 14.9% (31) of the study participants to occur often or always, while 50.7% (n=105) reported it to occur sometimes (Table 8, Figure 16).

Table 8:	Frequency	of Reaching	late to	Work in	the Morr	ning [%	(n)]
----------	-----------	-------------	---------	---------	----------	---------	------

Behavior	Never	Rarely	Sometimes	Often	Always
Reaching late to work in the morning	7.5%	27.1%	50.7%	10.6%	4.3%
	(15)	(56)	(105)	(22)	(9)



Impact of Traffic Congestion on Driving Behaviors

The main impacts of traffic congestion on driving behaviors of study participants were on changing lanes continuously and using mobile phones while driving. Thirty two percent (n=66) of subjects reported that they often/always practice the behavior of changing lanes when they experience traffic congestion while 23 % (n=48) of them stated that they often/always use their mobile phones while they are stuck in traffic. Other behaviors found to be practiced by subjects at least sometimes are violating driving rules (15.9%, n=34), practicing aggressive driving (15.7%, n=33), and fighting with other drivers (20.7%, n=43) (Table 9, Figure 17).

Tabla 0.	Frequency	of Doing the	following	Dehaviora	While D	iving in	Troffic	Congestion	Г0/	(n)]
Table 7.	rrequency	or Doing in	; tonowing	Denaviors	while Di	iving m	Trainc	Congestion	[/0	(II)

Behavior	Never	Rarely	Sometimes	Often	Always
Use mobile phone	23.4% (49)	27.3% (57)	26.3% (55)	14.8% (31)	8.1% (17)
Keep on changing lanes	11.1% (23)	24.5% (51)	32.7% (68)	21.2% (44)	10.6% (22)
Violating driving rules	49% (102)	35.1% (73)	12.0% (25)	2.9% (6)	1.0% (2)
Practice aggressive driving	59.3% (124)	24.9% (52)	10.5% (22)	3.3% (7)	1.9% (4)
Fighting with other drivers	53.1% (110)	26.1% (54)	16.4% (34)	2.9% (6)	1.4% (3)



Hypotheses Testing

Research Question#1: Is there a difference in the time spent to reach work from home in the morning and the time spent to reach home from work in the evening?

Testing Hypotheses#1:

Ho: There is no difference in the time spent to reach work from home in the morning and the time spent to reach home from work in the evening

H1: There is a difference in the time spent to reach work from home in the morning and the time spent to reach home from work in the evening.

To test this hypothesis, the paired t-test is used to conduct the analysis after checking the assumptions for a parametric test. As shown in the table below, that the mean difference between the time spent to reach home from work in the evening (77.95 minutes) and that needed to reach work from home in the morning (68.99 minutes) is 8.96 minutes (95% CI is 4.85 to 13.07). This difference was found to be statistically significant (t=4.298, df=198, p-value< 0.0005). Therefore, the null hypothesis is rejected and we conclude that there is a significant difference between the time spent commuting in the morning and evening (Table 10).

 Table 10: Paired sampled t-test Comparing the Average Spent by Subjects to Reach Work from Home and the Average Time Spent to Reach Home from Work

			Lower	Upper				
Average Time Spent from								
Work to Home	77.95	8.96	4.85	13.07	4.298	198	<0.0005	
	(42.13)							
Home to Work	68.99							
	(37.26)							

Research Question#2: Is there a difference in the time spent to commute between work and residence and the time needed to commute between work and residence locations as predicted by Google Maps?

Testing Hypotheses#2:

H₀: There is no difference in the time spent to commute between work and residence and the time needed to commute between work and residence locations as predicted by Google Maps.

H₁: There is no difference in the time spent to commute between work and residence and the time needed to commute between work and residence locations as predicted by Google Maps. The time spent to commute between work and residence location in the morning was 70.85 minutes (sd=37.15) while the time needed to commute between work and residence locations as predicted by Google Maps was 24.96 minutes (sd=13.62). The difference between the two timings was 45.89 (95% CI was 41.43 and 50.68) and it was highly statistically significant from zero (t=18.92, df = 192, p-value < 0.0005) (Table 11, Figure 18). Therefore, as the p-value is less than 0.05, we reject the null hypothesis and conclude that there is a significant difference between the time spent to reach work from home location and the needed time as predicted by Google Maps. Drivers spent on average an extra 46 minutes to get to their work locations.

			Lower	Upper			
Time (minutes)							
Spent to Reach	70.85	45.896	41.111	50.680	18.921	192	<0.0005
Work in Morning	(37.153)						
Predicted by	24.96						
Google Maps to	(13.62)						
Reach Work							

 Table 11: Paired sampled t-test comparing the Time Spent by Subjects to Reach Work in the Morning and the Time Needed to Reach Work from Home as Predicted by Google Maps

Figure 18: Average Time Spent By Drivers While Commuting From Residence to Work, Work to Residence Locations, and Time Predicted Between the Two Locations As Per Google Maps



Research Question#3: Is there a difference in the time spent to reach work from home between subjects who commute between emirates and those who commute within emirates?

Testing Hypotheses#3:

H₀: There is no difference in the time spent to reach work from home in the morning between subjects who commute between emirates and those who commute within emirates

H1: There is a difference in the time spent to reach work from home in the morning between subjects who commute between emirates and those who commute within emirates

The mean time spent to reach work every morning by subjects who commute between different emirates was 90.588 minutes (sd=29.0) while that spent by subjects who commute within same emirate was 38.19 minutes (sd=23.44). This difference between the two averages (52.4 minutes) was found to be significantly different (t =13.468, df=197, p-value< 0.0005) as shown in the below analysis conducted using the Independent ttest. Since the p-value is below 0.05 (level of significance), the null hypothesis is rejected and we conclude that there is a difference in the time spent to reach work from home in the morning between subjects who commute between emirates and those who commute within emirates (Table 12).

			Lower	Upper				
Time (minutes) Spen	Time (minutes) Spent to Reach Work in Morning							
Between Emirates	90.588	52.401	44.728	60.074	13.468	197	<0.0005	
	(29.00))							
Within Emirates	38.187							
	(23.441)							

Table 12: Independent t-test comparing the Time Spent by Subjects to Reach Work in the Morning Between those commuting between Emirates and Within Emirates

Factors Associated with Increased Physical Impact of Traffic Congestion

<u>Physical Impact</u>: Number of Physical Symptoms Due to Traffic Congestion

The number of physical symptoms experienced during traffic congestion is one of the important physical impacts that is analyzed. Factors that were found to be significantly associated with the number of symptoms were nationality and the direction of commuting. Among Arabs, 17.6% reported experiencing more than 11 physical symptoms when commuting in a traffic congestion as compared to 3.7% among the Non-Arabs (p-values < 0.0005). In addition, 18.3% of subjects who commute between emirates reported experiencing more than 11 physical symptoms as compared to 8.4% among those who commute within emirates (p-value < 0.0005). Other demographic factors including gender, and age were not found to be significantly associated with the total number of physical symptoms (Table 13).

Number of Physical Symptoms								
	<	5	6 -	10	11	· 16	Total	p-value
Variable	Ν	%	Ν	%	Ν	%		
Gender								
Male	44	31.7%	75	54.0%	20	14.4%	139	0.827
Female	23	29.1%	46	58.2%	10	12.7%	79	
Age								
< 30	21	34.4%	31	50.8%	9	14.8%	61	0.786
30 - 39	26	26.5%	57	58.2%	15	15.3%	98	
40 +	16	29.6%	32	59.3%	6	11.1%	54	
Nationality								
Arabs	37	23.3%	94	59.1%	28	17.6%	159	<0.0005
Non-Arabs	28	51.9%	24	44.1%	2	3.7%	54	
Commute Pattern								
Between Emirates	25	19.8%	78	61.9%	23	18.3%	126	<0.0005
Within Emirates	38	45.8%	38	45.8%	7	8.4%	83	

Table 13: Number of Physical Symptoms Experienced By Demographic Factors of Study Subjects

Number of hours driven daily was found to be significantly associated with the number of physical symptoms reported by participants. Participants reporting five symptoms or less were found to drive an average of 2.26 hours per day as compared to 2.85 hours among those reporting 6-10 symptoms and 3.47 hours among subjects reporting 11-16 symptoms (F=7.34, p-value = 0.001) (Table 14). Pairwise comparison using Tukey post hoc test, indicated a significant increase in the number of hours driven per day among subjects reporting 6 or more physical symptoms due to traffic congestion as compared to those who report five or less symptoms.

Number of Symptoms	N	Mean hours of driving	sd	95% CI	F	p-value
≤ 5	64	2.26	1.44	1.90 - 2.62	7.34	0.001
6 – 10	113	2.85	1.37	2.59 - 3.10		
11 – 16	29	3.47	1.81	2.78 - 4.16]	

Table 14: Mean Number of Hours Driven Daily by Number of Symptoms Experienced Due to Traffic Congestion

<u>Physical Impact</u>: Eating breakfast before going to work

Of the total sample, more than half (54%) never or rarely eat breakfast before going to work and only 27% reported eating breakfast often or always. Gender, age and the pattern of commuting were all not found to be

associated to eating breakfast before going to work. However, nationality was found to be significantly associated to eating breakfast where 38.9% of the non-Arabs often/always eat breakfast before going to work as compared to 22.8% among the Arabs (Table 15).

Table 15: Eating Breakfast Befe	ore Going to Work B	By Sociodemographic	Characteristics of Subjects
---------------------------------	---------------------	---------------------	------------------------------------

	Never	/Rarely	Sometimes		Often/	Always	Total	p-value
Variable	Ν	%	Ν	%	Ν	%		
Gender								
Male	75	54.0%	25	18.0%	39	28.1%	139	0.922
Female	43	55.1%	15	19.2%	20	25.6%	78	
Age								
< 30	29	46.8%	13	21.0%	20	32.3%	62	0.322
30 - 39	51	53.1%	20	20.8%	25	26.0%	96	
40 +	35	64.8%	6	11.1%	13	24.1%	54	
Nationality								
Arabs	96	60.8%	26	16.5%	36	22.8%	158	0.010
Non-Arabs	20	37.0%	13	24.1%	21	38.9%	54	
Commute Pattern								
Between Emirates	76	60.8%	20	16.0%	29	23.2%	125	0.199
Within Emirates	40	48.2%	18	21.7%	25	30.1%	83	

<u>Physical Impact</u>: Exercising for at Least 30 minutes a Day

Exercising for at least 30 minutes a day was significantly associated with age, commute pattern and with nationality but with borderline significance. Exercising for at least 30 minutes a day was least practiced by subjects of age 30-39 years old (12.8%) and highest among those who were below 30 years old (29.0%). Subjects who commute between emirates were less likely to practice exercise daily as compared to those who commute within emirates (13.7% versus 29.3% respectively, p-value=0.002) (Table 16).

Table 16:	Exercising for at	Least 30 Minutes	A Day By S	ociodemographic	Characteristics	of Subjects
-----------	-------------------	------------------	------------	-----------------	-----------------	-------------

	Never	/Rarely	Some	etimes	Often/	/Always	Total	p-value
Variable	Ν	%	Ν	%	Ν	%		
Gender								
Male	80	57.6%	29	20.9%	30	21.6%	139	0.576
Female	48	63.2%	16	21.1%	12	15.8%	76	
Age								
< 30	31	50.0%	13	21.0%	18	29.0%	62	0.033
30 - 39	57	60.6%	25	26.6%	12	12.8%	94	
40 +	36	66.7%	6	11.1%	12	22.2%	54	

Nationality								
Arabs	102	64.6%	29	18.4%	27	17.1%	158	0.062
Non-Arabs	24	46.2%	14	26.9%	14	26.9%	52	
Commute Pattern								
Between Emirates	85	68.5%	22	17.7%	17	13.7%	124	0.002
Within Emirates	37	45.1%	21	25.6%	24	29.3%	82	

Perceived Effects of Traffic Congestion on Overall Health

Study Participants were asked to write down the general effects of traffic congestion on their overall health. Out the 219 participants, 176 responded to this question and wrote 179 answers (Table 17, Figure 19). Thematic analysis of responses resulted in four clusters of effects. Of all responses, 40.8% (n=73) clustered under "Physical Body Pains" mainly including pains of the back, neck, legs and headaches. The following quotations clearly reflect the above theme:

"It has huge impact as I am having back and neck pain"

"I experience headache and dizziness due to traffic"

The second cluster or theme was "Psychological Impact" and it included 26.8% (n=48) of all subjects' responses. Main psychological impact included stress, bad mood, aggression, and anger. The following quotations support the above theme.

"It causes me stress, anger and nervousness"

"Traffic congestion causes me mental tension"

"Fatigue" was reported by 21.2% (n=38) of respondents as they reported being tired and exhausted most of the times as shown in the following responses.

"I utilize most of my energy and I feel exhausted and tired"

"I experience significant fatigue"

Twenty responses (11.2%) were related to long term effects of traffic congestions including hypertension, reduced blood sugar levels and spinal cord problems. "Traffic congestion causes high blood pressure and weight gain on the long term" "Extreme effect as I started to suffer from infection in knee tendons"

Table 17: Effects of Traffic Congestion onOverall Health As Perceived By StudyParticipants

Physical Body Pains	73	40.8%
Psychological Effects	48	26.8%
Fatigue	38	21.2%
Chronic Diseases	20	11.2%
Total	179	100%



Perceived Effects of Traffic Congestion on Social Life

Study participants reported a total of 103 responses that clustered into four main effects that traffic congestion has on their social lives (Table 18, Figure 20). The main effect was "Poor Communication with People" reported by 35.9% (n=37) of subjects. As traffic congestion caused drivers a lot of anger, bad mood and stress, it had a major effect on the way they communicated with other people. This effect is clearly reflected in the following quotation:

"Traffic causes stress that negatively affects my communication with my friends"

Another main effect of traffic congestion was "Lack of time for social life" reported in 34.9% (n=36) of all subjects responses. Subjects spent a great deal of their time in traffic and this leaves no time for them to participate in social events as indicated in the following response made by one of the subjects:

"No time for social life at all as I spend most of my time on the road"

Social isolation is the third effect that was reflected in the subjects' perceptions about the impact of traffic congestion on their social life. 20.4% (n=21) of subjects considered themselves to be socially isolated and that they lacked social life given the amount of time that they spent in traffic. The following two quotations support this theme:

"Social life is limited as I am rarely going out after reaching home"

"What social life? I don't see my family or friends"

Finally 8.7% (n=9) of subjects reported that traffic congestion results in "Lack of Punctuality to Social Commitments" as they are sometimes late to social events or meetings due to traffic as indicated in the following quotations.

"Traffic congestion has negative effect on my social life as I reach late to important events"

"I am always late for meeting with friends"

Table 18: Effects of Traffic Congestion on SocialLife As Perceived By Study Participants

Communication with people	37	35.9%		
No time for Social life	36	34.9%		
Social Isolation	21	20.5%		
Lack of Punctuality to Social	9	8.7%		
Commitments				
Total	179	100%		



Perceived Effects of Traffic Congestion on Work Performance

Study participants were asked to specify in an open-ended question, their perception about the impact of traffic congestion on their work performance. A total of 135 responses were recorded and clustered into six different themes (Table 19, Figure 21). The first theme was "Low energy at work" which was reflected in 40 responses (30% of the total). Respondents explained that as they experience traffic congestion on their way to work locations, they reach there already exhausted and tired and thus start their working day with reduced energy and fatigue. Some subjects even mentioned that they need to have some time to rest from the traffic before starting their work duties. The following quotes from subjects' responses support the above mentioned theme: "I reach work so tired that I have to spend some time to relax before I can start working"

"Most of the time I wake up very early to reach work on time and as a result I lose part of my energy to perform my work at its best"

"Bad Mood" was another theme that emerged from 21% of subjects' responses about the impact of traffic congestion on their work performance. Subjects reported that they perform their work while being stressed, nervous and in bad mood since the morning as indicated in the following responses:

"Psychological stress and bad mood at work"

"Traffic causes me bad mood at work"

The third theme that emerged from the responses provided was "Poor work quality" as indicated in 21% of the responses given. Subjects considered that their overall work performance and quality of the work that they do is highly affected by exposure to traffic as indicated in the following quotes:

"Reduced quality in level of performance because of being stuck for long time in traffic" *"Reduced efficiency and productivity at work"*

Of all responses, 15% were related to the theme of "Being late to work". Punctuality to work timings is one of the important aspects that are affected due to traffic and in itself it causes stress to employees as well as problems with the work administration.

"Sometimes I reach my work late and so I am stressed because of that"

"Inability to be punctual to important meetings at work"

"Concentration" was another theme that emerged from 10% of the given responses as shown in the quote below:

"Traffic congestion affects concentration level and the way of dealing with problems faced at work"

Table 19: Effects of Traffic Congestion on WorkPerformance As Perceived By Study Participants

Low energy at work	40	30%
Bad mood	29	21%
Quality of work	29	21%
Punctuality to work	20	15%
Level of concentration	13	10%
Relationship with colleagues	4	3%
Total	135	100%



Perceived Effects of Traffic Congestion on Family at Home

Five different themes emerged from the 137 subjects' responses pertaining to their

perceived impact of traffic congestion on their family at home (Table 20, Figure 22). The first theme "Anger and aggression with family members", was representing 35% (n=48) of all subjects responses. Traffic congestion had negative impact on the drivers mood and thus they enter their own houses in a state of stress, anger, nervousness and as a result become aggressive when dealing with their wives/husbands and their own kids. Therefore, not only drivers but also whole families suffer from the negative implications of traffic congestion. The following quotes clearly support the above mentioned theme:

"Being stuck in traffic makes me stressed and nervous against my wife and kids" "I become aggressive towards my own sons and am not giving them enough attention"

The second theme identified was "Less time to spend with family" which was derived from 28.5% (n=39) of all subjects' comments. Due to spending excessive time in traffic, subjects expressed their worries of not spending enough time with their own families or at least quality time as they should be. They reach their homes late in the evening when their kids have already slept and have to leave their residences very early in the morning to avoid traffic and therefore, are deprived of even sometimes seeing their family members especially their children. Few of the subjects' expressions are shown in the following:

"Because of the very big traffic, I don't spend a lot of time with my family"

"Inability to sit with family in the morning and also at night because of being late due to traffic congestion"

Subjects' perceptions about the impact of traffic congestion on family reflected the theme of "Poor communication with family members" as indicated in 16.8% (n=23) of the total responses. The continuous fatigue and stress that drivers are exposed to due to traffic, reduces their communication abilities with their close family members as shown below:

"Affects and minimizes communication with my family because of continuous fatigue"

"Traffic makes me lose communication with my own family"

"Being away from kids" is another important theme that emerged from some of the subjects responses (11.7%).Parents considered themselves to be detached from their own kids as they are not able to spend adequate time with them. In addition due to stress they are exposed to during traffic congestion, parents become stressed and practice aggression towards their own kids as they become less tolerant to any noise and stressful situations. The following quotes were mentioned by some of the parents in this regard:

"I become aggressive towards my sons and not giving them the needed attention"

"Inability to satisfy the needs of children and the needs of the household in general"

"Not fulfilling my duties towards my family" was the last theme identified as it was supported by 8% (n=10) of the subjects responses. Subjects stated that they postpone going out with their family members in order to avoid exposure to traffic. This makes them feel that they are not satisfying the needs of their family. In addition, they postpone or are unable to fulfil their family and households chores and duties because of the time they lose in traffic. The following quotes support the above theme:

"Cause delay in reaching home and thus taking time off teaching children and housework"

"I often cancel my commitments with my family especially to go out so I feel I am not fulfilling my duty towards them"

Table 20: Effects of Traffic Congestion on Family Members At Home As Perceived By Study Participants

Anger and Aggression with family	48	35.0%
Less time to spend with family	39	28.5%
Poor communication with family members	23	16.8%
Being away from kids	16	11.7%
Not fulfilling duties towards family	10	8.0%
Total	137	100%



Conclusions and Recommendations

In this research, impact of traffic congestion on drivers commuting between Dubai and Sharjah emirates was quantitatively and qualitatively measured. The questionnaire used in data measurement was highly reliable (Cronbach's alpha was 0.85) and valid. The study included 219 subjects mainly living in Sharjah and Dubai emirates. The dominant emirate of work location was Dubai as reported by 90% of study participants. Sixty percent mainly commuted between Sharjah and Dubai emirates while 40% commuted within the same emirate. On average, time spent in daily driving by sample subjects was around 3 hours during weekdays. Around 71% of study participants experienced traffic congestions when going from home to work locations every morning and around 80% reported experiencing traffic in the evening time when going home from work locations. Traffic congestion was mostly experienced during all weekdays but mostly on Sundays and Thursdays (beginning and end of the week). Moreover, in day times, morning and evening were the most times when traffic is experienced.

Subjects reported physical symptoms that they experienced as a result of traffic congestion and these were mostly back pain, headaches, neck pain, legs pain, and fatigue. In addition, subjects reported psychological impacts of traffic congestion including bad mood, stress, nervousness, anger, anxiety and aggression.

More than half the sample subjects reported practicing unhealthy behaviors because of exposure to traffic and these include skipping breakfast before going to work and not practicing physical activity during the week. Sleep duration was significantly affected by exposure to traffic congestion as subjects reported that they had to wake up very early every morning to leave to their work. On average, subjects were sleeping significantly less than the number of hours recommended by the National Sleep Foundation.

Traffic congestion was also found to have negative impacts on work-related aspects such as punctuality to work time, level of concentration at work, performance at work, work productivity and the employee's communication with his/her colleagues. More than 65% of subjects reported being late to their work because of traffic. Driving behaviors were also affected by exposure to traffic mainly keeping on changing lanes and using mobile phone while driving.

The qualitative thematic analysis of subjects' responses about their perceived reasons behind traffic congestion clustered answers under six main themes: Increased number of vehicles, insufficient roads, discrepancies in the rents between Dubai and Sharjah emirates, improper driving behaviors, same

work timings in all sectors and inadequate public transportation between the two emirates.

Subjects' responses on the effects of traffic congestion on health revealed four main themes including physical body pain, psychological effects, fatigue and chronic diseases on the long term. Traffic congestion effects on social life were mostly represented in poor communication among people, lack of time for social life, social isolation, and lack of punctuality to social commitments. Negative impacts on work performance were mainly characterized in reduced energy at work, bad mood at work, poor quality of lack of punctuality to work work. commitments, poor concentration, and negative relationships with colleagues. Family at home was negatively affected by exposure to traffic congestion. Subjects' responses were clustered under five main themes: anger and aggression practiced against with family members, less time to family spend with members, poor communication with family, being away from kids, and inability to fulfill duties towards the family.

The findings of this study indicated that traffic congestion is a real public health problem that many drivers are currently suffering from. Its impacts were so prominent in all life aspects of drivers including their physical health, work performance, driving behaviors, social life, and family. Solving the problem of traffic congestion should be made a priority. Knowing that RTA has been putting intensive efforts over the past few years to provide high quality roads to alleviate the traffic congestion problem, such efforts seem to not enough by itself to solve the problem. Policy makers have to consider other methods, targeting other domains, to solve this serious problem. One solution could be changing the starting working times for Reconsidering different sectors. the differences in the house rents in the emirates of Dubai and Sharjah is another way that can the traffic congestion problem. solve Another solution could be to activate, between Dubai and Sharjah emirates, an effective transport system that is acceptable to be used by employees commuting between the two emirates. This would reduce the volume of vehicles commuting everyday between Dubai and Shariah and even within the two emirates.

Future Research Directions

This research has studied the impact of traffic congestion on drivers commuting between the emirates of Dubai and Sharjah using a cross-sectional research design. The study investigated the impact quantitatively and qualitatively. However, future research studies on this topic are recommended to use focus groups and in-depth interviews in order to reach a more in-depth understanding about the impacts.

Research studies are also needed to study other impacts of traffic congestion including its costs and financial burden on drivers as well as on the country's economy in general. The environmental impact of traffic congestion is also an essential area that needs to be researched.

Research studies are needed to discover effective methods that can alleviate traffic intensity as well as its impacts on drivers. Therefore, transportation researchers should be encouraged to study the best methods to reduce congestion in traffic.

References

Chang, T., Beelen, R., Li, S., Chen, T., Lin, Y., Bao, B. & Liu, C. (2014). Road traffic noise frequency and prevalent hypertension in Taichung, Taiwan: A cross-sectional study. *Environmental Health*, *13*, 37. Available at doi: 10.1186/1476-069X-13-37.

Dratva, J., Zemp, E., Dietrich, D., Bridevaux, P., Rochat, T., Schindler, C. & Gerbase, M. (2010). Impact of road traffic noise annoyance on health-related quality of life : results from a population –based study. *Quality of Life Research*, 19, 37-46.

Hilbrecht, M., Smale, B. & Mock, S. (2014). Highway to health? Commute time and wellbeing among Canadian adults. *World Leisure Journal*, *56*(2), 151 – 163.

Levy, J., Buonocore, J., Stackelberg, K. (2010). Evaluation of the public health impacts of traffic congestion: a health risk assessment. *Environmental Health*, *9*: 65.

National Sleep Foundation (2016). National Sleep Foundation Recommends New Sleep Times. Retrieved on April 21st, 2016 from <u>https://sleepfoundation.org/media-</u>center/press-release/national-sleep-

foundation-recommends-new-sleep-times

Shahbandari, S. (2015). For every two Dubai residents there is one car. Retrieved on April 22, 2016 from http://gulfnews.com/news/uae/for-every-two-dubai-residents-there-is-one-car-1.1472177

Somuyiwa, S., Fadare, B. & Ayantoyinbo, B. (2015). Analysis of the cost of Traffic Congestion on Worker's productivity in a Mega City of a Developing Economy. *International Review of Management and Business Research*, 4(3), 644.

TomTom International (2015). Tomtom Traffic Index Measuring Congestion Worldwide. Retrieved on February 16th, 2015 from <u>http://www.tomtom.com/en_gb/trafficindex/</u> <u>#/list</u>

Welch, D., Shepherd, D., Dirks, K., McBride, D. & Marsh, S. (2013). Road traffic noise and health-related quality of life: A cross-sectional study. *Noise & Health*, *15*: 65, 224-230.

Venkatesh S, Pushpa G. Effect of Traffic Congestion on Mental Health (2014). *Journal of Evolution of Medical and Dental Sciences*, *3* (42), 10490-10493. DOI: 10.14260/jemds/2014/3368

Insights into the Diagnosis Related Group (DRG) payment method in Abu Dhabi Health care system)

Saeed Abdullah Mohammed Hussein Hamdan Bin Mohammed Smart University (HBMSU), Dubai, UAE

Abstract

Background: Abu Dhabi Health Authority legislate the Diagnosis Related Group (DRG) system as a payment method for inpatient hospital service in both public and private sectors.

Purpose: This study purpose is to provide insight into the DRG system in Abu Dhabi health care system and to develop initial understanding of the whole process of DRG with different organization: the legislative, the health care providers and the payers. In addition, to measure the DRG system end user evaluation and to compare public and private health care sector in term of market share for DRGs claims.

Design/Methodology: A mixed approach; qualitative and quantitative with in depth interviews with different stakeholders from HAAD, SEHA, and Insurance Company will be used. The author will use UEQ to measure DRG end user's evaluation and experience, in addition to that the author will use DRGs claims of 2013 in Abu Dhabi health care system to compare between public and private health care sectors.

Hypothesis: The DRG system fulfils the general expectations of end-users.

Public and private health care sector have the same market share related to DRGs claims.

Conclusion & Recommendations: In conclusion DRGs system is efficient system which helped Abu Dhabi health care system to determine its priorities and compare hospitals and physician's performance. The coders are happy with their experience with DRGs system as it is attractive with good pragmatic and hedonic quality. Public sector outperforms private sector in health care service as private sector is less risk taker with concentration on surgical related cases.

Key wards: DRG (Diagnosis Related Groups), Abu Dhabi Health Authority.

Background

History of DRG

Medicare was established in 1965; Congress approved the private health insurance sector's "retrospective cost-based reimbursement" scheme as a payment method for hospital services. Where Medicare made periodic payments to hospitals during the hospital's financial year. The hospital expected to file a cost report by the end of fiscal year and the interim payments to be agreed with the allowable costs that were mentioned in the policy and regulation. Medicare's hospital costs under this payment system amplified dramatically; between 1967 and 1983, costs increased from \$3 billion to \$37 billion yearly. (Mihailovic, N., Kocic. S., Jakovljevic, M., 2016).

In 1982, Congress ordered the construction of a prospective payment system (PPS) to Congress control costs. studied the achievement of State rate regulation systems in costs controlling and mandated the application of a prospective payment system framework that had been fruitful in several States. This system is a per-case reimbursement technique under which inpatient admission cases are alienated into relatively similar categories named diagnosis-related groups (DRGs). In DRG prospective payment scheme, Medicare pays hospitals a flat amount per claim for inpatient hospital care so that effective and efficient hospitals have a real incentive of being

efficient and inefficient hospitals have the motivation to become more well-organized and to improve their efficiency. (Mihailovic, N., Kocic, S.,Jakovljevic, M., 2016).

Although DRGs development started in the late 1960's the first version to be largely spread was consist of 383 categories after that in early 1982 second revised set of 467 categories was released. Both versions were designed to distinguish patients with comparable predicted resource utilized for management and to link it to the hospitalization period or length of stay in the hospital during that admission. The former version was developed by New Jersey hospital using data of around 500,000 patients but the revised version based on nationally representative sample of patients. (United States., Congress.,Office of Technology Assessment., 1983)

Abu Dhabi Health and the DRGs System

Several important payment reforms have been introduced to Emirate of Abu Dhabi started in 2007 with the implementation of obligatory health insurance system which ensures the accessibility to medical care of almost all UAE nationals and residents working in Abu Dhabi. (Hamidi, Samer,Akinci, Fevzi, 2015).

Abu Dhabi succeeded to separate the health care regulator Health Authority Abu-Dhabi (HAAD) to be responsible for policy development and to formulate regulatory requirements for the health care professional, providers and payers in addition to that HAAD monitor the compliance with requirements and to take the necessary action to enforce compliance. (Hamidi, Samer,Akinci, Fevzi, 2015).

In late 2010 had replaced the fee for service payment framework with new prospective payment method called diagnosis-related groups to became mandatory for reimbursement of all inpatients visits in public and private hospitals. (Hamidi, Samer,Akinci, Fevzi, 2015).

Research Questions and Hypotheses

Do SEHA hospitals have more cases than non-SEHA hospitals?

Are medical cases more than surgical once in Abu Dhabi Healthcare system?

Are the medical and surgical cases equally distributed between public and private hospitals?

On the other side, the UEQ will answer the following questions

Is DRG system attractiveness?

Is the design of DRG with high quality in term of stimulation and novelty? Is the DRG efficient system?

Theoretical Framework

The construction of user experience questionnaire relies on a theoretical framework of user experience. This research context differentiates between identified ergonomic quality, identified hedonic quality and identified attractiveness of a product. The framework adopts that the three characteristics of the product describe independent possibilities of the user experience it is supposed that individuals perceive several distinct aspects when they assess a software product. The recognized attractiveness of the product is then an outcome of an averaging process from the perceived quality of the software concerning the related aspects in a given usage circumstances.

Based on this assumption the questionnaire should contain two classes of items: items, which quantify the perceived attractiveness immediately and items, which measure the quality of the product on the relevant aspects. (Schrepp, 2016).

Nature of the Study

The researcher selects to do mixed approach qualitative and quantitative study to provide insight into the DRG system in Abu Dhabi health care system and to develop an initial understanding of the whole process of DRG and its component and mechanism. According to qualitative research is said to be a useful tool for exploratory study. According to Jean Lee 1992 both quantitative and qualitative approaches should be equally highlighted which indicate that both types of study quantitative and qualitative are complementary (Jean Lee, 1992).

Scope and Delimitations

DRG is introduced by HAAD to be used by health care providers in Abu Dhabi in both sectors public and private as a tool for reimbursement by insurance companies for inpatient visits. In order to explore this unique payment of method, it is important to interview individuals who are involved in this dynamic process from different organizations like HAAD, SEHA, private sectors and DAMAN.

The researcher also intended to measure the level of satisfaction of the end user of DRG system (the coders) with such system for this purpose user experience questionnaire will be used to be filled by the coders. The sample size according to the UEQ handbook can be between 20 and 30 persons will be sufficient to evaluate ideal product but the more data collected, the more stable the scale of means and the saver will be the conclusion based on such data. (Schrepp, Martin, Hinderks, Andreas,Thomaschewski, Jörg, 2014).

Limitations of the Study

Although this research was carefully prepared, the researcher aware of its limitations and shortcomings, for instance, the number of people interview was limited, and it was not possible to meet them at the same time as they are from a different organization. In addition to that, some hospitals did not allow DRGs coders to answer UEQ which limit their participation in the evaluation of DRGs system.

The Significance of the Study

This study expected to uncover hidden issue and connect the dots by looking at this system from different angles which may be added value to knowledge about the DRG system in this part of the world. Moreover, this research will provide recommendations to HAAD related to the coder's experience with the DRG. Also, this study will be a helpful guide for policymakers in the health sector in the UAE and region to adopt DRG payment method in their system.

Literature Review

In this chapter the author looks to the health care system in UAE with a focus on the payment methods for healthcare providers then the author looks to DRGs development starting from the USA health care system and European countries and outside these countries as well. The author will also look to other issues related to the DRGs like malpractice in this payment method, the impact of DRGs scheme on the quality of care and length of stay.

The UAE consists of seven major cities Abu Dhabi which is the capital and six emirates Dubai, Sharjah, Umm al-Qaiwain, Ajman, Ra's al-Khaimah and Fujairah, was officially recognized 2 December on 1971. (UAEInteract, 2016). UAE stands seventh on the list of the world's recoverable oil reserves; UAE GDP was estimated to record USD 378 billion in 2013, reaching a growth of 3.8%. Actual GDP growth dropped from 3.3% in 2008 to -1.60 % in 2009, and consequently -1.8% in 2010, mainly because of the global economic downturn and reducing oil prices (MRICS. 2013). Although the decrease in real GDP following the crisis, the UAE economy continued to be durable and recovered its growth in 2011, significantly exceeding 2008 figures, a time when most of the developed countries of the world recorded negative or at best, remained constant. (MRICS, 2013)

The per capita income in 2012 in the UAE (USD 47,893) is the third highest in the Region, whereas Qatar has the highest income per capita at US\$ 88,3140 (MRICS, 2013)

UAE has one of the largest and quickest growing population in the GCC. According to the National Bureau of Statistics (NBS), the UAE population at the end of 2012 reached approximately 9.2 million. Colliers International estimated that By 2018, the UAE population may exceed the 14.5 million, subject to continuing the present growth patterns Compound Annual Growth Rate CAGR (7.9 %) (MRICS, 2013). The percentage of UAE Nationals as a proportion of the total population in 2012 was 11.5 %. It is expected to be reduced significantly if the same growth rate between Nationals and Expatriates continues (MRICS, 2013)

The Healthcare system in the UAE is mostly managed by the government through the Ministry of Health and the authorities that operate under its management in each Emirate. Dubai Health Authority DHA in Dubai and Health Authority of Abu Dhabi (HAAD) (MRICS, 2013). The private sector is considered a major key player in UAE health sector where it contributes to around 64 % of the total patients encounters within UAE healthcare market.

Budget Allocation

Since 2007, the healthcare budget allocated by the UAE has approximately folded, from USD 6.5 billion in 2007, above USD 12 billion in 2012. During the same period, the healthcare budget as a percentage of the GDP has experienced a growth from 2.5% to 3.1% in 2012, with a high point of 4.4%, recorded in 2009 following financial crisis around the Accordingly, the UAE Healthcare globe. budget has been fluctuated by periods of increase and decrease. affecting the steadiness of the growth pattern from 2008 onwards. The UAE's healthcare expenditure as a is relatively small compared with developed countries which represent the percentage of the GDP of 3.3% is one of the highest in the GCC, coming third to Bahrain and KSA. As opposed to advanced countries, where it is roughly one-third or even one-fourth, such as 9.3% in the UK and 12.0% in Holland. (MRICS, 2013).

Abu Dhabi Healthcare System

Starting from January 2006, all populations of Abu Dhabi are covered by a new widespread health insurance program; costs will be shared between employers and employees. Earlier to 2007, government owned health care services were managed by the General Authority for Health Services, In 2007, this authority GAHS. was reorganized into HAAD which is responsible for regulating the healthcare industry and developing Abu Dhabi's health policy. SEHA is in-charge of managing governmentowned healthcare facilities in Abu Dhabi. Currently, SEHA operates thirteen Hospitals, fifty-six Primary Health Care Centers, three Maternal and Child Health Centers, three Specialized Dental Centers, one Center for Autism, and five Specialized Facilities like rehab, blood bank and herbal center (SEHA, Thirty-nine hospitals 2016). (14)governmental, twenty-five private; twentysix are JCI accredited), with 4,226 beds, or 2.7 beds for every 1500 of the population. servicing approximately 2.5 million people.

Dubai Healthcare System

The number of physicians in Dubai reached to 27 per 10,000 people, which considered less than the average of 32 in OECD countries. The nurse number per 10,000 citizens in Dubai in 2012 was less than the average of OECD countries; only 56 compared with 87 in OECD countries. The number of bed per 10,000 people was 19 beds compared to 48 beds in OECD countries. The health sector in Dubai is governed mainly by DHA in addition to the small role of Ministry of Health of a federal government. (S. Hamidi , 2015)

Health services are provided by DHA, MOH private sectors, including Dubai and Healthcare City (DHCC). Five public hospitals owned by DHA, with 2063 beds capacity and fourteen primary health care in addition to two hospitals owned by MOH with 284 beds capacity and nine primary health care center. On the other hand, the private sector plays a significant role in delivering health service through twenty-two hospitals with 1468 beds and more than 1000 ambulatory clinics, most of Dubai Hospital accredited by Joint are Commission International (JCI) (S. Hamidi, 2015).

According to DHA 2012 (33 %) of funds for health came from government, (45 %) from employers and (22 %) from households. (DHA, 2014).

The SEHA Health System consists of 12 hospitals with 2644 beds, 37 healthcare centers, one occupational health center, ten disease prevention and screening centers. nine dialysis centers and clinics, and two blood banks. It is the largest healthcare in the UAE, providing a continuum of care to residents and utilizing leading edge technologies. SEHA's facilities accommodate 100,000 inpatients annually and conduct 41,000 surgeries, as well as treating more than five million outpatients (SEHA, 2016).

DRG and another Type of Provider Payment Schemes

According to WHO, there are several methods to pay for the health care providers used for Economic Co-operation and Development (OECD) members, but the most common approach are salaries, the fee for service payments (FFS), diagnosis-related groups (DRGs), per-diem payments or capitation and Budget. (Park, Braun, & Carrin, 2007) What is the difference between these methods and what are their advantages and disadvantages?

a) Salary

Most OECD countries pay salaries for doctors either partially or complete payment methods. Under this payment method, the income of the physician is not linked to the output and quality of services or quantity of items which is associated with low motivation, low quality of service and low productivity. However, such method can be combined with other methods like capitation to increase motivation as well as to improve productivity and quality of service. The cost containment considered high in salaries framework method. (Park et al, 2007)

The salary-based system used in many countries in Europe and elsewhere for a wage of health care employees. For example, Albania, Bulgaria, Croatia, Estonia, Finland, Greece, Lithuania, Poland, Portugal, Romania, Slovenia, Sweden and Turkey. (Chawla, Windak, Berman, & Kulis, 1997). According to Chawla et 1997 salary based remuneration scheme almost has no financial incentives for physicians to work longer hours or looking after more patients also they do not provide an incentive to reduce operating costs. Physicians also have no incentive to build the good relationship with the patients. (Chawla et al, 1997)

b) Fee-for-Service (FFS)

The number of services provided is the main factor in determining the amount to be paid to the providers which are considered strong incentive to provide more service especially the profitable items even more than it is required. FFS is considered the weak tool for cost containment also doctors who are using FFS framework try to undertake more efforts to deliver a higher quality of health care services so that they attract more patients. (Park et al, 2007). Germany combined FFS with sectoral budgets as a cost containment policy. (Park et al., 2007)

Some examples of countries follow a fee-forservice scheme for compensation of health care providers. Include: Germany (private physicians and dentists), Czech Republic, Belgium, France, Switzerland, Holland (private sector), Bulgaria (private sector), Ireland (private sector), Greece (private sector), Turkey (private sector) and Slovenia (private sector). (Chawla et al., 1997)

Such payment method gives the provider incentives to increase the volume of services which result into overuse and oversupply of services. (Chawla et al., 1997)

According to Averill et al. 2009 fee for service does not incentivize primary care physicians to act as financially prudent gatekeepers i.e. they will not be rewarded in case they spend more time with the patient to avoid unnecessary hospital admission. (Averill RF, Goldfield NI, Vertrees JC, McCullough EC, Fuller RL, Eisenhandler J, 2010).

c) Case-Based Reimbursement System

Diagnosis Related Groups (DRG): The (DRG)-system is a patient classification system established to categorize patients into clusters economically and medically comparable, expected to have similar hospital resource use and expenses. Based on the final diagnosis for the admitted patient the providers will be reimbursed at prospective fixed rate per discharged according to the diagnosis. DRG framework considered suitable instrument for cost control providers is inspired to deliver services as cost-effective as possible with the minimum possible duration of stay in the hospital. On the other side, DRG system has a potential risk about premature discharges in addition to that the provider may select the patients with low cost. (Park et al., 2007). Some examples of countries follow a casebased system for remuneration of a health care professional. Include: United States of America, Germany, Argentina, and Brazil. Health care providers have strong incentive to contain costs per case as the payment is based on the diagnosis of the case not according to the treatment offered. (Chawla et al., 1997).

Figure 1a Shows the risk of different payment methods on payer and provider according to (Averill et al., 2010)

d) Capitation

A fixed amount of money is paid to the providers based on the number of patients to deliver a variety of services. DRG3 Under this scheme the providers get a fee for each enrollment to cover a defined package of services for a certain period. (Chawla et al., 1997) Some countries in Europe and elsewhere apply a capitation-based scheme for the payoff of health care providers. Some example includes Hungary, Ireland, Italy, Holland and Croatia (private sector). In capitation, physicians have a strong incentive to select healthy individuals who require less visit and less cost. Physicians have strong incentive to avoid expensive treatment and refer patients to higher level of care to save own operating costs. (Chawla et al., 1997).

e) Per Diem

In this framework, the providers are paid per day of admission which gives a strong incentive for the hospital to increase the length of admissions. The length of stay in hospital in Japan is the longest globally this could be attributed to this type of payment method. 167 (Muramatsu N, 1999). Germany introduced DRGs as payments method due to the excessively high length of stay under the per diem scheme. (Park et al., 2007).

In summary, each of the above payment methods for the healthcare provider carries a risk for both provider and payer but with different degree. DRGs payment system has balance risk for both of them.



Figure 1a: Payment bundling continuum (Source (Averill et al, 2010))

Table 1a: Summarized advantages and disadvantages associated with different payment methods.(Averill et al, 2010).

	Salary	Capitation	Fee-for- Service	Case-based Reimbursement
Physicians have appropriate incentives to provide optimally the quantity of care quantity of service)	Limited	Limited	High	Limited

Physicians have appropriate incentives to	Limited	Limited	High	Limited
provide high quality of care (Quality of				
service)				
Physicians have appropriate incentives to	Low	High	Low	High
keep costs down (Cost control)				
Patients are not denied access	High	Limited	Limited	Limited
Patients can exercise choice	Low	Limited	High	Limited
The payment system is easy to administer	High	High	Limited	Limited
The payment system requires a	Low	Low	High	High
sophisticated information and cost				
accounting system				
Unit of payment	Monthly payment	Per patient	Per	Per case of
	regardless of	_	service	different
	services rendered		item	diagnosis
Financial risk	Low	Provider:	Provider:	Moderate
		High	Low	
		Payer: Low	Payer:	
		-	High	

DRGs Development

DRGs represent a multivariable system including but not limited to the principal diagnosis, operating room procedures, comorbidities, complications (secondary diagnosis, age, sex and may discharge status. (The US, Office of Research and Demonstrations., 1984)

Diagnosis-related group progress and refinement have been an ongoing process during the past three decades Freeman et al. 1995 suggested to develop an alternative patient classification systems based on secondary diagnosis in term of disease severity and patient care management. By adding subgroups based on presence or absence of substantial comorbidity or complication (CC) by making an accurate list of secondary diagnosis that would increase the duration of stay at the hospital at least one day in 75 % of the cases based expectation of panel of expert physicians. (Freeman JL, Fetter RB, Park H, Schneider KC. Lichtenstein JL, Hughes JS, Bauman WA, Duncan CC, Freeman DH Jr, Palmer GR, 1995).

According to Evers et al. 2002 additional factors highly correlating with inpatient costs are the level of functioning after stroke, complications, comorbidity, and days of stay for non-medical reasons. (Evers, Silvia, Voss, Gemma, Nieman, Fred, Ament, André, Groot, Tom, Lodder, Jan, Boreas, Anita, Blaauw, Gerhard, 2002).

It is unlikely to draw clear-cut decisions about the superiority of one version of a casemix system over another, the need to adopt the local system or the further development of an existing version from another country. Without the evidence provided by accurately designed studies, policy-makers and leaders may place excessive dependence on personal judgments and the views of the most influential, but not essentially best-informed healthcare interest groups. (Palmer G, 2001).

The DRG system is, basically, a case-mix reimbursement system that, hypothetically, compensates hospitals for treating patients based on the average volume of hospital resources used in treating a patient within the particular diagnostic classification. While the DRG regulations recognize that there will be discrepancies in severity within each of the four hundred sixty-seven diagnostic groups, it is reasoned that as hospitals are repaid on a meaningful average and adequate cases within each DRG category. (Eisenberg BS, The coder can use only 1984). documentation by physicians who are directly caring for the patient during admission. (Ballentine, 2009).

In summary, each of this payment method for healthcare providers has its pros and cons, but DRG payment system lies in the middle that helps to balance the risk for the payers and the provider which support in cost control in the healthcare system.

Guideline for physicians for appropriate documentations that help the coder to select the most accurate code

- 1) Avoid abbreviations and document the full diagnosis in longhand without symbols or abbreviations. It is not enough to mention the symptom without the diagnosis.
- 2) Write comprehensive and complete SOAP notes
- 3) Be aware of the rules and concepts of coding and documentation
- All clinically significant conditions should be coded and documented according to the authority standards and regulation. For example, treatment, diagnostic procedures, extended length of stay and clinical evaluation.
- 5) Avoid rule-out diagnosis
- 6) Identify the principal diagnosis that leads to the admission of the patient to the hospital.
- Include secondary diagnoses this will help to put the case at the most suitable level of DRGs coding based on comorbidity or complication. (Ballentine, 2009).

Physicians get no direct benefit from ensuring that hospitals obtain the maximum appropriate reimbursement but when hospitals have strong profit margins this may lead to an indirect benefit to the physicians and other staff as this will improve staffing level, capital expenditures, additional programs, service, and growth. (Ballentine, 2009)

It is important to capture present diagnosis on admission to avoid considering that conditions as hospital acquired which may prevent receiving additional reimbursement. (Ballentine, 2009).

Strategies for Success with DRGs: Educational initiatives: Introductory didactic presentation, online tutorial coding, and documentation, periodic memos with coding tips (Tip of the Month website references on coding tips (comprehensive list) Posters, announcements, and branding. (Ballentine, 2009).

Physician support services: Website reference wit FAQs, Direct contact with coding specialists, RN/ coding specialist liaison, Computerized medical record, Staff feedback associated with query process, Physician champions. Coding department changes: Increase staffing, RN/ coding specialist: real-time chart reviews, Physician coding specialist Standing Coding, and document. (Ballentine, 2009).

According to Gracey et al. 2002, DRG 475 created severe financial problems for hospitals in many areas especially in patients receiving mechanical ventilation as it leads to a significant monetary loss for those hospital providing care for such patients. (Gracey DR, 2002).

In a study conducted by Lichting et al. 1989 who tried to develop modified DRGs for pediatric as the pediatric care are not adequately classified by the use of DRGs. A total of 46 PM-DRGs has been designed to replace the 7 DRGs for neonates. (Lichtig LK, Knauf RA, Bartoletti A, Wozniak LM, Gregg RH, Muldoon J, Ellis WC, 1989).

The new guidelines recognize three levels of severity as a secondary diagnosis in level one with no complication in the second tier of comorbidity or complication and the third level where the patient have major comorbidity or complication. (Ballentine, 2009).

According to Lezzoni et al. the term diagnosis may be a misnomer as some of the DRGS based symptom related group like chest pain DRG 143 other may be called pathology related groups for instance atherosclerosis DRGs 132 and 133. While other may be labelled as severity related groups like shock and heart failure DRG 127, so the relative weight is the primary factor for the reimbursement amount. (Iezzoni LI, 1986). According to Sanderson et al. 1989, the greatest homogeneity of DRGs is found in gynecology and ENT surgery and the least in orthopedic surgery and general medicine. (Sanderson HF, Storey A, Morris D, McNay RA, Robson MP, Loeb J, 1989).

Muller et al. 2003 suggested that the presence of electronic medical record will enhance adequate coding of the diagnosis and procedures as it helps for quick access to clinical guidelines for appropriate treatment which will result in accurate DRGs coding. (Müller ML, Bürkle T, Irps S, Roeder N, Prokosch HU, 2003).

In October 2007, the Centers of Medicare and Medicaid services had transformed its methodology that regulates the diagnosis related group for hospitalized patients. The addition of new DRGs to the current one will help to improve the accuracy of the diagnosis which will be the most accurate reflection of the severity of illness. For this purpose, the 538 DRGs have been converted to 745 new Medicare Severity DRGs. (Ballentine, 2009).

Principle of DRGs

Case mix is a way of defining a hospital's product or output by recognizing clinically homogeneous groups of patients that utilize similar bundles of treatments tests and (Doremus services. HD, 1983). The reliability of a case-mix measure calculated using the DRG methodology is dependent on complete and accurate diagnosis and surgical data. (Doremus HD, 1983). According to Doremus et al 1983 complete and precise surgical data is essential for the reliability of a case-mix measure when DRG methodology is used as a payment method. (Doremus HD, 1983).

The main aim of the creation of the DRGs was a definition of case types, each of which could be anticipated to obtain similar outputs or services from a hospital. So that the set of definitions be readily applied in a wide range of sceneries as well as meaningful to different medical and nonmedical users, it was considered necessary that the new classification system has the following characteristics:

- a. It should be explainable medically, with subclasses of patients from similar diagnostic groups. That is, when the patient classes are informed to physicians, they should be able to link these patients and can recognize a particular patient management process for them.
- b. Individual classes must be well-defined on variables that are usually available on hospital abstracts and are relevant to output utilization, about either the disorder of the patient or the treatment or procedure.
- c. There should be a controllable number of classes, preferably in the hundreds instead of thousands, that are mutually exclusive and exhaustive. That is, they must cover the whole range of probable disease conditions in the acute-care setting, with-out the intersection.
- d. The classes should contain patients with expected comparable measures of output utilization.
- e. Class definitions must be equivalent across the different coding schemes. (Fetter, 1980)

The completeness and the accuracy of medical information used in the calculation of the index are of utmost importance. Patients within a particular DRG are thought to need roughly similar regimens of care and hence are supposed to consume similar amounts of hospital resources with the exception of unusual cases or outliers those who have very long or very short hospital stays. (MAY JJ, 1984). Hospitals are paid rate based on the DRGs regardless of the costs they, in fact, incur during therapy. (MAY JJ, 1984). For example, if the payments exceed the costs of providing care the hospital allowed to retain the difference on the other hand when the payments are less than incurred cost hospitals should absorb the loss. Which serve as a strong incentive to minimize costs by reducing the length of patient stays, reduce the therapeutic and

services provided in quantity and scope which make DRG as an excellent tool for efficiency and cost containment. (MAY JJ, 1984). Physicians education is essential on the importance of using hospital resources wisely. (MAY JJ, 1984).

DRG Payment Rate for Direct Patient Care=

The cost of Hospital-Based Physician Services PLUS Portion of Hospital's Own Non-Physician Cost PLUS A portion of Standard Non-Physician Cost. (MAY JJ, 1984)

After the establishment of the direct cost, they are inflated by a hospital-specific factor based on indirect and capital-related costs in addition to other financial costs like working capital, uncompensated care, and a working cash infusion. (MAY JJ, 1984)

Medical records departments importance has increased dramatically under DRGs as they are responsible for collecting the information and coding which lead to determine the amount that will be reimbursed to the hospital. This department after DRGs implementation needs to hire highly skilled personnel. (MAY JJ, 1984).

DRGs also lead to shifting the in the managerial perspectives of administrators their focus has moved away from inputs management to output and or product where the products are the different DRGs which lead to substantial changes in the operational management as well as the strategic planning styles. (MAY JJ, 1984).

The importance of vigilance in monitoring the impacts of DRGs on the delivery of health care should not be undervalued. Only through research and evaluation can we be sure that the amount paid for hospital cost containment is a reasonable one. (May JJ, 1984).

Each hospital discharged is assigned to only one MDC based on its principal diagnosis code. Then each MDC is partitioned on the presence or absence of procedure performed in the operating room. (The US, Office of Research and Demonstrations., 1984)

This can be referred surgical as hospitalizations and those without procedures called medical admissions. Then medical cases can be split into clinically coherent groups or main categories or surgical admissions. These classes are hierarchical based on the intensity of resource consumption, further partitioned can be made by age, the existence of comorbidities and complications. (The US, Office of Research and Demonstrations., 1984)

The DRGs were first designed and compiled at Yale University's Center for health studies in the late 1960's the initial motivation for developing DRGs was to create the practical framework to monitor the quality of care. (The US, Office of Research and Demonstrations., 1984)

In summary, DRG is evolved over the years and spread globally, but the most important strategy to successful implantation of DRGs complete system is and accurate documentation. The provider should understand it is not necessary to reimburse all expense per case but as an average. For major diagnostic category see appendix 1 (The US, Office of Research and Demonstrations., 1984)

DRGs and ICD

The latest version of DRGs based on ICD 9-CM where the code condensed into 23 mutually exclusive and exhaustive Major Diagnostic Categories (MDCs) as a function of organ system it predominantly affects or according to the specialist who would provide the care. (US, Office of Research and Demonstrations., 1984)

Carthy et al 2000 raise concerns_related to the clinical validity of using ICD-9-CM codes for quality monitoring. This study also raises questions about whether the clinical conditions characterized by ICD-9-CM codes used by the Complications Screening Program were in fact always present. (Horn SD, Bulkley G, Sharkey PD, Chambers AF, Horn RA,Schramm CJ, 1985).

DRGs in the USA

The DRGs were first designed and compiled at Yale University's Center for health studies in the late 1960's the initial motivation for developing DRGs was to create an effective framework to monitor the quality of care. (United States., Health Care Financing Administration. Office of Research and Demonstrations., 1984). On 1 October 1983, the Medicare system initiated a phased transition to a novel payment method for hospitals based on uniform payments by diagnosis-related group (DRG). (Vladeck BC, 1984). The Congress has directed that DRG relative weights be recalculated yearly to account for the changes in resource consumption. (Latta VB, 1991).

There are two ways used by Medicare for predicting relative DRG weights either using charge information from the hospital bill or by adjusting these charges using cost information obtained from the Medicare Cost Report. (Price KF, 1989).

United States spend more than European countries such as France, England, Sweden, the Netherlands, and Germany not only per capita but also as a percentage of gross domestic product at the same time these countries provide similar quality of care to US standard. Although DRGs scheme evolved and developed in the US but European countries adopt this system more efficiently than the US, and now it is the turn for the US to learn from these countries practice. (Quentin W, Scheller-Kreinsen D, Blümel M, Geissler A,Busse R, 2013).

DRGs in European Countries

Over the past 30 years, most European countries have used DRGs or comparable grouping systems as tools for hospital reimbursement for inpatients services. (Schreyögg, Jonas, Stargardt, Tom, Tiemann, Oliver, Busse, Reinhard, 2006). Busse et al 2013 reviewed the experience with DRG systems in twelve European countries and they compared the different systems and discussed current trends and the possibility of improvement. The 12 countries (Austria, England, Estonia, Finland, France, Germany, Ireland, the Netherlands, Poland, Portugal, Spain, Sweden). (Busse R., Geissler A., Quentin W., Aaviksoo A., Cots F., Hakkinen U., Kobel C., Mateus C., Or Z., O'Reilly J., Serden L., Street A., Tan S.S., 2013).

The main two reasons to adopt DRGs in these European countries either to increase transparency or to improve efficiency. DRGs enhance transparency because they shorten the confusingly a bulky number of individual treated by hospitals patients into а controllable number of clinically meaningful and economically similar groups. DRGs can help to differentiate whether one hospital treats more complicated cases than another and it allows comparisons between different hospitals. (Busse et al, 2013). DRGs are believed to improve efficiency because they provide motivations for hospitals to limit the services per patient and to treat more patients. According to Busse et al. fee for service motivates hospitals to offer many services for each patient but may result in needless or unsuitable treatment and regardless of treatment costs which may lead to overuse of the services. On the other hand, global budgets contain costs by restricting total expenditure but run the risk of hospitals not making sufficient services to meet patient requirements or population needs which result in underuse of the services. (Busse et al, 2013)

Most of Europe countries started to use their DRG systems in the 1990s with an exception of Portugal which started in the early 1980s. Some countries developed from scratch their own DRG, for example, Austria, England, and the Netherlands others obtained a DRG system from abroad that was used by other country and used such system as the starting point for evolving their own for example Ireland, Portugal, and Spain imported systems from the US or Australia. А common system has been created by the Nordic counties. (Busse et al, 2013) .Most of this Europe countries started with small number of DRGs groups and then increased

for example Germany in 2005 started with 878 then increased to 1137 in 2008 and reached to 1194 in 2011 but France started with 701 in 2005 then increased to 800 in 2008 and reached to 2375 in 2011 the only exception was Netherlands which started with big number of groups 100000 in 2005 then reduced to 30000 in 2005 and reached to 4000 categories in 2011. (Busse et al, 2013).

DRG may lead to intended and unintended consequences for example of intended effects include reduce the length of stay and reduction the cost of treatment on the other side DRG may reduce the quality of care and early discharged for example in France 30 day readmission rates after discharge have increased after the introduction of DRGbased payment which may indicate early discharged on the other side a study from Sweden showed that patient perceived quality of care declined after introduction of DRG. (Busse et al, 2013).

picking, up-coding, Cherry dumping, frequent readmissions and overtreatment are other potential unintended consequences of DRG payment system. Cherry picking happens when the hospitals select the less costly patient from the same group and avoid the patient with higher cost in a systematic transfer unprofitable way and cases (dumping). Up-coding means moving the patients into higher paying group in order to increase their revenue which may lead to providing unnecessary procedures just to ensure the higher code. Readmission patients for unnecessary treatment which can be treated as outpatients. (Busse et al, 2013).

According to the author these unintended outcomes are relatively rare or they could be detected by regular audits by review and monitoring bodies, but there is evidence that cherry picking is existing only in England and France as the private hospitals have been found to select less complex cases than public sectors. (Busse et al, 2013). Policies have been introduced in several countries in order to prevent frequent readmissions and overtreatment. For instance, Germany hospitals not paid for readmissions within 30 days from the discharged day. High-quality data can help to avoid such unintended consequences and to detect manipulation. (Busse et al, 2013)

Medical specialists may play a role when they are more engaged in the classification of the DRG to create more homogeneous groups. (Busse et al, 2013).

United States spend more than European countries such as France, England, Sweden, the Netherlands, and Germany not only per capita but also as a percentage of gross domestic product at the same time these countries provide similar quality of care to US standard. Although DRGs scheme evolved and developed in the US but European countries adopt this system more efficiently than the US and now it is the turn for the US to learn from these countries practice. (Quentin W, Scheller-Kreinsen D, Blümel M, Geissler A,Busse R, 2013).

In a large study done by Quentin et al. 2013 where he compared acute myocardial infarction in 11 European countries, the author concluded that there is the large variation in the classification of AMI across these Europe countries which may require revision of this classification by looking to what other countries were doing in this regard which may help for improvement. (Quentin, Wilm, Rätto, Hanna, Peltola, Mikko, Busse, Reinhard,Häkkinen, Unto, 2013).

DRGs Outside Europe and USA Countries

Mathauer et al. 2012 conducted a search of the literature published from 1980 until December 2012 in PubMed, the Pan American Health and Google on DRG, piloting or implementation in low- and middle-income countries. Most of these countries in this study use a DRG-based hospital payment system consisting of about 500 to 800 case groups. Most of the low- and middle-income countries in this study use a DRG-based hospital payment system consisting of about 500 to 800 case groups. With exception of Kyrgyzstan and Mongolia having less number of DRG on the other

hand Indonesia (1077) and Thailand (2700). The higher number of groups reflect that health care system is more sophisticated in that particular country. (Mathauer, Inke,Wittenbecher, Friedrich, 2013).

Universal or widespread health coverage for all population may lead to the efficient use of resources regardless the level of the country income as the expenditure on hospital services considered one of the largest shares of total health-care spending in all countries. (Mathauer, et al, 2013). Although DRGs are used mainly by purchasers to reimburse providers for acute inpatient care it can be used to reimburse them for non-acute inpatient care. (Mathauer, et al, 2013).

DRGs categorize cases according to the certain variables: principal and secondary diagnoses, patient sex and age, the existence of complications and co-morbidities and the surgeries performed. Cases classified as belonging a particular to DRG are characterized by a similar resource consumption manner and, at the same time, DRGs are clinically meaningful. Thus, cases within the same DRG are medically and economically similar. (Mathauer, et al, 2013).

The two fundamental design characteristics of a DRG-based compensation scheme are:

- An exhaustive patient case classification system (i.e. the system of diagnosisrelated groupings)
- The payment formula, which is based on the base rate multiplied by a relative cost weight specific for each DRG. (Mathauer, et al, 2013).

Before the introduction of the DRG-based system, it is essential to have data generation system in place, besides, the support from information technology as it helps in data collection that is required for DRG classification. (Mathauer, et al, 2013). The absence of standardized and systematized data generation and coding has been hindered the introduction of DRGs in low and middleincome countries. (Mathauer, et al, 2013).

A feasibility study done by Kawabuchi 2012 who tried to answer if DRGs can be applied in Japan as cost containment is a large concern especially with the fee for service based operation. The author collected three types of data (hospital cost, patient discharged and hospital characteristics data from 17 acute general hospitals in Japan then variance for the length of stay for 3 US based DRG has been calculated to examine the financial impact for hospitals by budget simulation as DRG is used as a payment method. The author concluded that shifting to DRGs as a prospective payment system in Japan will provide the hospitals with a powerful incentive to become more efficient. In addition to that, this will open hospital capacity to provide top class services for aging population in a cost effective manner. (Kawabuchi K, 2000). The life expectancy of men in Japan are expected to reach up to an age of 79 and women up to age 86 by the year 2050. (Kawabuchi K, 2000). Japanese patients remain in hospitals for an average of about 34 days. (Kawabuchi K, 2000).

Cost Effective of DRGs

According to Mathauer et al. 2012, The most frequent explanations for introducing DRGbased payments are to improve efficiency and contain costs. (Mathauer, et al, 2013). In a prospective observational study bv Carpenter et al 2007 who looks at the data of one thousand nine hundred and forty-two consecutive emergency admissions in the period from March to July 2004 with one or more of six presenting conditions (fracture of neck of femur, stroke, acute respiratory infection, myocardial infarction, falls and chronic obstructive airways disease). These old patients who present with such conditions would have incurred estimated annual cost of 1.9 million UK ponds in excess of their HRG tariff based reimbursement which lead to conclusion that physical function which defined as the degree of dependency in activities of daily living should be incorporated into HRGs to reduce the financial risk faced by acute hospital services under Payment by Results in the UK

diagnosis group reimbursement system. (Carpenter, Iain, Bobby, Jacqui, Kulinskaya, Elena, Seymour, Gwyn, 2007). Jones et al. 1985 predicated that non-teaching hospitals have lower charges than teaching hospitals. (Jones KR, 1985). John et al also reviewed the variations in admission rates among 30 hospital market areas for years 1980 through 1982 and he Concluded that that per admission hospital prices would need to ensure effective control of hospitalization rates to have successful cost containment program. (Wennbero, John E., McPherson, Klim, Caper, Philip, 1984). DRG system will promote decreases in aggregate expenditures of the hospital in two ways firstly by reduction the inputs to achieve treatments. Secondly, hospitals will select to specialized in the DRGs with the lowest expected costs. (Dranove, 1987).

Case mix is a useful administrative tool to partition patient services and determining resource allocation (Doremus HD, 1983). This study focuses on the original of 383 DRG's as DRGs weights for 467 DRGs were not available yet. (Doremus HD, 1983). The author compared the health care finance administration (HCFA) compared with originally discharged order, he found 160 cases disagreement with representing 61 %. In 63 cases HCFA DRGS having the higher weight which represents 39.4 % and in 72 cases the originally discharged order DRG's having the higher weight which represents 45 %. (Doremus HD, 1983).

Sedman et al. 2004 concluded that adjusted severity indicators were very useful for improvement in cost effective patient care without compromising in quality indicators. (Sedman AB, Bahl V, Bunting E, Bandy K, Jones S, Nasr SZ, Schulz K, Campbell DA, 2004). DRG groups support to establish the hospital's budget or revenues, and can also support to study the financial consequences of different clinical management strategies. DRGs have been a key instrument in the retrospective move from payment classifications, based on compensation per stay or past budgets, to prospective payment systems, which provide motivations to improve hospital efficiency. If the payer reimburses a constant amount per case (the mean cost of a given DRG), the hospital can keep the difference between the costs of less expensive hospitalizations and the average cost of the DRG. (Librero J, Marín M, Peiró S,Munujos AV, 2004).

According to Davis et al. 2005, et al. concluded that the presence of acute inpatient palliative medicine unit functioning within a comprehensive, integrated palliative medicine program is cost effective in delivering specialized care for people with advanced disease. (Davis MP, Walsh D, LeGrand SB, Lagman RL, Harrison B,Rybicki L, 2005).

In a study done by Munoz et al. 1988 on ninety-seven patients transferred surgical patients to their hospital to compare the cost treating these patients with similar DRG transferred patients. Transferred patients generated a yearly deficit of 238717 US Dollar i.e. 4922 US Dollar per patient for the hospital on the other hand patients within the same DRG who are directly admitted generated a profit of 489 US Dollar per patient. This may lead to hospital rejection to accept transferred patient as it carries the high financial risk which may lead to the decrease in the access of care for the complicated surgical patient. (Muñoz E, Soldano R, Gross H, Chalfin D, Mulloy K,Wise L, 1988).

Halloran et al. 1987 found that amount of variation in length of stay, cost, and charges within DRG's was significantly greater in medical than surgical cases. (Halloran EJ, 1987). Knoer et al. 1999 who did an evaluation of benchmarking database for specific DRGs. The author concluded that benchmarking was found to be the useful tool for identifying opportunities for cost reduction. (Knoer SJ, Couldry RJ,Folker T, 1999).

Canada Case-Mix Groups (Canada)

The first CMG scheme was introduced in 1983 in Canada they replace Major

Diagnostic Categories with Major Clinical Categories and instead of the principal diagnosis CMG grouping used the Most Responsible Diagnosis that has the greatest influence on the length of stay. Five predefined factors were used to split CMGs: Age categories (9 levels Comorbidity driven severity categories (5 levels) Flagged interventions (lists for 14 categories of interventional procedures) Number of interventions (3 categories) Intervention carried out outside the hospital (list). (Fischer, 1999).

DRGs and Outliers

Outliers are those patients whose cost of care deviates from the norm of resource consumption for their group. For example, Patients whose medical complexity eliminates grouping because of limitations in the abstracted clinical data or patients whose medical care deviated because of complications of therapy or inappropriate diagnostic and therapeutic interventions last but not least those patients with the medical course is so unique that they would never match any classification system. (McMahon LF Jr, 1984).

According to Munoz et al. 1989, the current DRG hospital payment system appears to be unfair for the patient who receives treatment in the intensive care unit during the hospital stay. (Muñoz E, Josephson J, Tenenbaum N, Goldstein J, Shears AM, Wise L, 1989). According to Berke et al. 1987 outliers happened up to five times more often among premature neonates than among ordinary and occurred in teaching new-borns hospitals, especially those with more than 400 beds. (Berki SE, 1987). In the study by Butler et al. 1985 who examined the financial impact of DRG scheme for Medicare intensive care patients for around 446 patients in one year. The payment for those patients was 4.7 US dollar below costs which represent an average of 10,567 US dollar per discharged patient but 28 percent of medical intensive died care unit during hospitalization the average of this particular group was 21,651 US dollar below the average based on this finding the author recommended to revaluate the payment scheme for intensive care patients. (Butler PW, Bone RC,Field T, 1985).

Gupta et al. 1990 who calculates the loss of 10 centers in different parts of US on 566 patients undergoing lower extremity arterial reconstructions for limb salvage or non-limb salvage indications. The overall loss for all centers was 3,653,918 US dollar with a mean of 8158 per patient. Gupta. According to Demaerschalk et al. 2007 the cost at the stroke center in Arizona has exceeded the Medicare reimbursement for patients care with acute ischemic attack which lead to introduction of new DRG 559 which will establishment of help in the new economically favourable for the center where the US Centers for Medicare and Medicaid Services recompenses hospitals around 6000 US dollar more per case when thrombolysis is given to the patient. (Demaerschalk BM, 2007).

Horn et al. 1986 looked at the cost and resources used in the treatment of cystic fibrosis patients from 14 cystic fibrosis centers. The number cystic fibrosis patients were 1763. The average length of stay of patients with cystic fibrosis was 14.9 days, as compared with an average of 8.3 days for the other patients (P<0.001). The average cost of treating patients in three centers with cystic fibrosis was 7,262 US Dollar, as compared with 2,908 US Dollar for all other patients in the same diagnosis-related group (P<0.001). The author recommended developing new DRG code that leads to fair payment for the hospital providing care cystic fibrosis patients. (Horn SD, Horn RA, Sharkey PD, Beall RJ, Hoff JS, Rosenstein BJ, 1986).

Berkes et al 1988 stated that it seems that the care given for intensive care patients may have resulted in a financial loss to the health care organization. If this were to remain, the economic influence might have an adverse consequence upon attempts to regionalize intensive care services which in turn lead to impact on accessibility of patient to health care. (Bekes C, Fleming S, Scott WE, 1988). According to Pon et al. 1993 Under a DRGbased reimbursement system, the operation of an active pediatric intensive care unit with a broad referral base may not be desirable from a financial perspective which may need to redefine DRGs for this group of patients. (Pon S, Notterman DA, Martin K, 1993).

Thomas et al. 1987 indicated that hospitals that receive large numbers of critically ill cardiac patients, referred for critical care are at a substantial financial disadvantage under the Medicare health insurance. (Müller ML, Bürkle T, Irps S, Roeder N, Prokosch HU, 2003). Munoz et al. 1988 concluded that older medical patients with age equal or greater than 75 years had on average higher total hospital cost, more diagnosis per patient a longer hospital length of stay, a higher mortality rate and a higher percentage of outliers in comparison with younger patients. (Muñoz E, Rosner F, Chalfin D, Goldstein J, Margolis IB, Wise L, 1988).

Quantin et al. 1999 developed a model that may help health care providers to negotiate with the payers in the case of a real high cost compared with reimbursement amount for some high-cost diseases like leukemia and lymphoma which will help to reduce the adverse effect of DRG as a prospective payment system. (Quantin, C, Brunet-Lecomte, P, Dusserre, L, Entezam, F, Guy, H, Lepage, E, 1999). Quentin et al. 2013 also showed there are significant variations in the classification of stroke patients and the author recommended to learn from other DRG system which may reflect on patient outcome. (Peltola M, 2013).

Pediatr et al. 1986 showed that diagnosisrelated group payment systems are lacking validity to be applied to an intensive care population, for example, the low charge of \$7172 per pediatric intensive care unit (PICU) and \$2946 per ward patient (P less than 0.01). (Gracey DR, 2002).

Malpractice Related to DRGs

Under prospective payment system, the provider may attempt to admit a big number of patients especially those with simply treated illnesses with short lengths of stay. They may divide the illnesses into two parts for the plan to spread patient care over two different hospital admissions or split diagnostic procedures by shifting the patient to ambulatory setting (outside prospective payment system). The provider may upgrade diagnostic code in order to get higher paying DRG assignment, over unnecessary complex surgical procedures to inflate the DRG and admit the patient for an extended period to qualify him as outlier patient. (Gertman PM, 1984).

DRG may lead to intended and unintended consequences for example of planned effects include the reduce the length of stay and reduction the cost of treatment on the other side DRG may minimize the quality of care and early discharged. For example, in France, 30-day readmission rates after discharge have increased after the introduction of DRG-based payment which may indicate early discharged on the other side a study from Sweden showed that patient perceived quality of care declined after introduction of DRG. (Busse et al., 2013)

Cherry picking, up-coding, dumping, frequent readmissions and overtreatment are potential unintended consequences of DRG payment system. Cherry picking happens when the hospitals select a less expensive patient from the same group and avoid the patient with higher cost in a systematic way and transfer unprofitable cases (dumping). Up-coding means moving the patients into higher paying group to increase their revenue which may lead to providing unnecessary procedures just to ensure the higher code. Readmission patients for unnecessary treatment which can be treated as outpatients. (Busse et al., 2013)

According to the author these unintended outcomes are relatively rare or they could be detected by regular audits by review and monitoring bodies, but there is evidence that cherry picking is existing only in England and France as the private hospitals have been found to select less complicated cases than public sectors. (Busse et al., 2013). Policies have been introduced in several countries to prevent frequent readmissions and overtreatment. For instance, Germany hospitals not paid for readmissions within 30 days from the discharged day. High-quality data can help to avoid such unintended consequences and to detect manipulation. (Busse et al., 2013).

Medical specialists may play a role when they are more engaged in the classification of the DRG to create more homogeneous groups. (Busse et al., 2013).

DRGs and Quality of Care

Chuang et al. 2003 conducted a study on one thousand six hundred twelve patients aged 70 and older to test if the patients who required activities of daily living costing higher than those patients who did not need ADLS. (ADLs are routine activities that individuals tend to do on daily without needing support. There are six fundamental ADLs: dressing, bathing, eating, transferring (walking), toileting, and continence).

It was concluded that hospital cost is higher in those patients with worse functional status who need more ADL assistance even after adjusting for DRG payments which considered strong incentives for hospitals to reject such type of patients and make more financial risk in hospitals with more dependent on ADLs patients. (Chuang, Kenneth H., Covinsky, Kenneth E., Sands, Laura P., Fortinsky, Richard H., Palmer, Robert M., Landefeld, C.Seth, 2003).

According to Menke et, al. 1998 case mix reimbursement is a potentially useful instrument for improving the efficiency of inpatient care for different types of diagnoses and all age groups. (Menke TJ, Ashton CM, Petersen NJ, Wolinsky FD, 1998).

DRGs system offers a unique opportunity for the development of innovative approaches to quality assurance. (McMahon LF Jr, 1984).

According to Margaret et al. 1988 findings who did a qualitative study in eight hospitals in a Midwest health system and interviewed with 118 persons affiliated with community hospitals DRGs have a critical impact on discharge planning, patient care, and professional practice. (BULL, 1988).

Hospitals are under increasing pressure to control patient care costs through the adoption of effective management techniques that may not increase the efficiency but also improve the quality of the patient care. (The US, Office of Research and Demonstrations., 1984)

DRGs are believed enhance to the effectiveness because they provide motivations for hospitals to limit the services per patient and to treat more patients. (Busse et al., 2013). According to Busse et al. fee for service motivates hospitals to offer many services for each patient but may result in unwanted or unsuitable treatment and regardless of treatment costs which may lead to overuse of the services. On the other hand, global budgets contain costs by restricting total expenditure but run the risk of hospitals not making sufficient services to meet patient requirements or population needs which result in underuse of the services

DRGs and Performance

According to Wenzel et al. 1985 hospitals can advance their economic situation by having effective infection control programs under the current diagnosis-related group reimbursement scheme as this will lead to reducing hospital acquired infections. (Wenzel RP, 1985). DRGs can be used to assess hospitals performance, for example, that of surgeon's performance. (Quentin, Wilm, Scheller-Kreinsen, David, Geissler, Alexander, Busse, Reinhard, 2012).

DRGs and Length of Stay

In DRG system the most important grouping criterion was the length of stay due to the high correlation with the case complexity and total charge with duration of stay in the hospital but the input from the treated physicians should also be used to ensure the clinical relevance of the case with its class in
the DRG system. (Roos NP, Wennberg JE, McPherson K, 1988.

In the study conducted by Epstein et al. 1988 on 402 patients who studied the association of patient's socioeconomic features with the length of stay and hospital charges within diagnosis related groups. The authors stated that the length of stay was higher in the lower socioeconomic and they used greater resources compared with another socioeconomic group. (Epstein AM, Stern RS, Tognetti J, Begg CB, Hartley RM, Cumella E Jr, Ayanian JZ, 1988).

The mean length of stay was reduced in 20 major diagnostic categories out of 22 MDCs for example for MDC 12 (Diseases and Disorders of the male reproductive system the average length of stay declined from 8.3 days in 1983 to 6 days in 1988 which represent a decline of around 27.7 percent. (Latta VB, 1991).

In summary, DRGs payment has been used successfully in the different part of the world as it has a lot of advantages firstly it may lead to utilize the resource efficiently secondly may be used to enhance health care providers performance, last but not least it could also reduce the length of stay.

Research Method

The researcher used in-depth interviews with different stockholders to understand DRGs process. Also, the data related to DRGs reported by HAAD used to compare SEHA and Non-SEHA market share of medical and surgical DRGS. The researcher also will use UEQ to evaluate the experience of the coders with DRGs system.

Methodology and Research Design

The researcher intends to collect primary data based on mixed approach qualitative and quantitative. As an exploratory research, it is used to provide insight into the DRG system in Abu Dhabi health care system and to develop an initial understanding of the whole process of DRG and its component and mechanism. The researcher will do in-depth interviews with a different stakeholder who is involved in the process to uncover underlying motivation, beliefs, attitudes and feeling related to the DRG system. The researcher will follow a semi-structured research technique using laddering method; this technique may help us at the beginning of the project to elicit the goals and underlying values.

According to the Means-End Chain Theory, there is a hierarchy consumer perceptions and product knowledge that ranges from attributes to consequences to personal values. (uxmatters, 2016).

Results

The researcher collects the primary data via interviews as well as the survey related to user experience questionnaire in addition to that the researcher used the secondary data which is available on HAAD website related to the DRGs for the year 2013 to compare between SEHA and non-SEHA hospitals in term of DRGs utilization.

Data Collection Procedures

The data collection process began with UEQ being distributed to the coders in different hospitals in addition to the data collected via interviews with people from the concerned organizations.

Sample Description

A total of 25 coders responds to the UEQ which in the range of 20 to 30 as minimum sample size according the UEQ developer all coders complete the questionnaire. Three indepth interviews with people expert in DRDs system from three different organization. The researcher did not collect demographic data from the respondents as it is not required by the developer of UEQ.

Research Questions and Hypotheses

Do SEHA hospitals have more cases than non-SEHA hospitals?

Are medical cases more than surgical cases in Abu Dhabi Healthcare system?

Are the medical and surgical cases equally distributed between public and private hospitals?

On the other side, the UEQ will answer the following questions

Is DRG system attractiveness? Is the design of DRG with good quality in term of stimulation and novelty? Is the DRG efficient system?

UEQ Results

Item	Mean	Variance	Std. Dev.	No.	Left	Right	Scale	
1	1 2.0	1.1	1.0	25	annoying	enjoyable	Attractiveness	
2	1.1	1.1	1.1	25	not understandable	understandable	Perspicuity	
3	1 .6	2.1	1.4	25	creative	dull	Novelty	
4	→0.6	2.8	1.7	25	easy to learn	difficult to learn	Perspicuity	
5	1 .8	2.2	1.5	25	valuable	inferior	Stimulation	
6	1 .6	2.2	1.5	25	boring	exciting	Stimulation	
7	1 2.0	1.2	1.1	25	not interesting	interesting	Stimulation	
8	1 .1	2.5	1.6	25	unpredictable	predictable	Dependability	
9	1 .3	2.1	1.5	25	fast	slow	Efficiency	
10	1.3	2.5	1.6	25	inventive	conventional	Novelty	
11	1 2.0	1.1	1.1	25	obstructive	supportive	Dependability	
12	1.8	1.9	1.4	25	good	bad	Attractiveness	
13	-} 0.6	3.8	1.9	25	complicated	easy	Perspicuity	
14	أ 1.6	1.7	1.3	25	unlikable	pleasing	Attractiveness	
15	1 .0	3.1	1.8	25	usual	leading edge	Novelty	
16	1 .7	1.5	1.2	25	unpleasant	pleasant	Attractiveness	
17	1.4	2.7	1.6	25	secure	not secure	Dependability	
18	1.9 🕋	1.2	1.1	25	motivating	demotivating	Stimulation	
19	1.8 🕋	2.0	1.4	25	meets expectations	does not meet expectations	Dependability	
20	1.8 🕋	1.8	1.3	25	inefficient	efficient	Efficiency	
21	1 .5	2.0	1.4	25	clear	confusing	Perspicuity	
22	1 .8	1.3	1.2	25	impractical	practical	Efficiency	
23	1 .7	2.1	1.5	25	organized	cluttered	Efficiency	
24	1.8	1.9	1.4	25	attractive	unattractive	Attractiveness	
25	1.8	1.4	1.2	25	friendly	unfriendly	Attractiveness	
26	1.5	2.0	1.4	25	conservative	innovative	Novelty	

Table 1: The means of the scales per Item (26)

Table 2: The means of the scales for UEQ Scales per scale (6)

UEQ Scales				
Attractiveness (1,12, 14, 16, 24, 25.)	1.793			
Perspicuity (2,4, 13, 21)	1.200			
Efficiency (9,20, 22, 23.)	1.640			
Dependability (8,11,17, 19.)	1.560			
Stimulation (5,6,7, 18.)	1.840			
Novelty (3,10, 15, 26)	1.350			

Table 3: The means of attractive vs Pragmaticquality vs Hedonic quality

Pragmatic and Hedonic Quality					
Attractiveness	1.79				
Pragmatic Quality					
(Perspicuity, Efficiency, Dependability)	1.47				
Hedonic Quality					
(Stimulation, Novelty	1.60				



Figure 1: The means of the scales for UEQ Scales per scale (6)



Figure 2: The means of Attractive vs Pragmatic quality vs Hedonic quality

The scales of the UEQ can be grouped into pragmatic quality (perspicuity, efficiency, dependability) and hedonic quality (stimulation, originality). Pragmatic quality describes task related quality aspects, hedonic quality the non-task related quality aspects. Below the mean of the three pragmatic and hedonic quality points is calculated.

Confidence intervals (p=0.05) per scale							
Scale	Mean	Std. Dev.	Ν	Confidence	Confidence	ce interval	
Attractiveness	1.793	1.125	25	0.441	1.353	2.234	
Perspicuity	1.200	1.056	25	0.414	0.786	1.614	
Efficiency	1.640	1.141	25	0.447	1.193	2.087	
Dependability	1.560	0.990	25	0.388	1.172	1.948	
Stimulation	1.840	1.175	25	0.460	1.380	2.300	
Novelty	1.350	1.262	25	0.495	0.855	1.845	

Table 5:	Confidence	interval	per item	(26)
----------	------------	----------	----------	------

Confidence interval (p=0.05) per item							
Item	Mean	Std. Dev.	Ν	Confidence	Confidence	e interval	
1	2.000	1.041	25	0.408	1.592	2.408	
2	2.120	1.054	25	0.413	1.707	2.533	
3	1.560	1.446	25	0.567	0.993	2.127	
4	0.600	1.658	25	0.650	-0.050	1.250	
5	1.800	1.472	25	0.577	1.223	2.377	
6	1.640	1.497	25	0.587	1.053	2.227	
7	2.000	1.080	25	0.423	1.577	2.423	
8	1.080	1.579	25	0.619	0.461	1.699	
9	1.280	1.458	25	0.572	0.708	1.852	
10	1.280	1.595	25	0.625	0.655	1.905	
11	1.960	1.060	25	0.415	1.545	2.375	
12	1.800	1.384	25	0.543	1.257	2.343	
13	0.560	1.938	25	0.760	-0.200	1.320	
14	1.640	1.319	25	0.517	1.123	2.157	
15	1.040	1.767	25	0.693	0.347	1.733	
16	1.720	1.208	25	0.474	1.246	2.194	
17	1.360	1.630	25	0.639	0.721	1.999	
18	1.920	1.115	25	0.437	1.483	2.357	
19	1.840	1.405	25	0.551	1.289	2.391	
20	1.760	1.332	25	0.522	1.238	2.282	
21	1.520	1.418	25	0.556	0.964	2.076	
22	1.800	1.155	25	0.453	1.347	2.253	
23	1.720	1.458	25	0.572	1.148	2.292	
24	1.840	1.375	25	0.539	1.301	2.379	
25	1.760	1.165	25	0.457	1.303	2.217	

Confidence interval (p=0.05) per item								
Item	Mean	Std. Dev.	Ν	Confidence	Confidence	e interval		
26	1.520	1.418	25	0.556	0.964	2.076		

Attractiveness				
Items	Correlation			
1, 12	0.72			
1, 14	0.91			
1, 16	0.83			
1, 24	0.73			
1, 25	0.76			
12, 14	0.76			
12, 16	0.84			
12, 24	0.70			
12, 25	0.80			
14, 16	0.88			
14, 24	0.70			
14, 25	0.81			
16, 24	0.62			
16, 25	0.69			
24, 25	0.89			
Average	0.78			
Alpha	0.95			

Per	spicuity
Items	Correlation
2, 4	0.00
2, 13	0.11
2, 21	0.46
4, 13	0.46
4,21	0.34
13, 21	0.33
Average	0.28
Alpha	0.61

Efficiency		
Items	Correlation	
9,20	0.53	
9, 22	0.43	
9,23	0.37	
20, 22	0.86	
20, 23	0.76	
22, 23	0.83	
Average	0.63	
Alpha	0.87	

Dependability						
Items	Correlation					
8, 11	0.00					
8, 17	-0.08					
8, 19	0.08					
11, 17	0.64					
11, 19	0.78					
17, 19	0.64					
Average	0.34					
Alpha	0.68					

Stimulation					
Items	Correlation				
5, 6	0.80				
5,7	0.63				
5, 18	0.80				
6, 7	0.77				
6, 18	0.86				
7, 18	0.73				
Average	0.76				
Alpha	0.93				

Novelty					
Items	Correlation				
3, 10	0.51				
3, 15	0.59				
3, 26	0.62				
10, 15	0.47				
10, 26	0.52				
15, 26	0.56				
Average	0.55				
Alpha	0.83				

Benchmark

Table 7: Scale comparison benchmark

Scale	Mean	Comparisson to benchmark	Interpretation
Attractiveness	1.793333333	Excellent	In the range of the 10% best results
Perspicuity	1.2	Above Average	25% of results better, 50% of results worse
Efficiency	1.64	Good	10% of results better, 75% of results worse
Dependability	1.56	Good	10% of results better, 75% of results worse
Stimulation	1.84	Excellent	In the range of the 10% best results
Novelty	1.35	Excellent	In the range of the 10% best results



Figure 3: Scale comparison benchmark

DRGs Comparison SEHA vs. Non-SEHA

a) All DRGs (From 01 to 22)

The total number of claims that submitted from the providers for all DRGs in the period from Jan 2013 till Dec 2013 was 174093 out of that 106957 came from SEHA hospitals and 67136 provided from a non-SEHA hospital which represents 61 and 39 per cent respectively. There is 22 chapter in DRGS system the initial two-digit indicate the system or the chapter for example DRG 014221 start the code with 01 which suggest that this DRG is under Nervous System related DRGs or chapter 01. The third digit indicates either the case is under medical or surgical class. The total number of DRGs in Abu Dhabi healthcare system is 789 DRGS 462 under medical cases and 327 under surgical cases in the previous example the third digit was four which indicate this DRG under inpatient medical classification (IM) if the third number 1 it means that case will be classified as a surgical case. The top claim from all DRGs is one of medical code under New-borns & Other Neonates chapter came from the code (158171). This DRG counts (IM Neonate, Birth weight >2499 Grams Without Major Procedure) for total cases of 27501 which represent 16 % of all DRGs. That include 16370 cases from SEHA and 11131 cases from non-SEHA hospitals which represent 60 % and 40 % respectively.



Figure 4: All DRGs 2013 SEHA vs. Non-SEHA

b) Surgical related DRGs

There are 327 DRGs codes out of 789 of total DRGs in 2013 hospital from Abu Dhabi Health Care system submitted 51220 cases related to surgical DRGs which represent 29 % of DRGs provided in the same year (174093 cases). SEHA and None SEHA hospital share the cases by around 50 % each 26130 for SEHA and 25090 for non-SEHA organizations. Table 8 shows the top 10 DRGs belong to surgery section.



Figure 5: Surgical DRGs 2013 SEHA vs. non-SEHA

Table 8:	Top 10) DRGs r	related to	Surgical	cases from	SEHA a	and non SEHA	A claims 2	2013

DRG	Medical Diagnosis Category (MDC)	DRG Description	SEHA	Non SEH A	All	% from all surgical cases	% of SEHA	% of Non SEHA
146101	Childbirth	IP Cesarean Delivery	2,815	3,631	6,44 6	12.58	43.67	56.33
061131	The Digestive System	IP Appendiceal Procedures	1,331	2,197	3,52 8	6.89	37.73	62.27
146102	Childbirth	IP Cesarean Delivery w/CC	1,690	696	2,38 6	4.66	70.83	29.17
061501	The Digestive System	IP Anal Procedures	490	1,661	2,15 1	4.20	22.78	77.22
071141	The Hepatobiliary System & Pancreas	IP Laparoscopic Cholecystectomy	467	1,325	1,79 2	3.50	26.06	73.94
081701	The Musculoskeletal System & Connective Tissue	IP Knee & Lower Leg Procedures Except Foot	522	1,182	1,70 4	3.33	30.63	69.37
061141	The Digestive System	IP Inguinal & Femoral Hernia Procedures	535	1,117	1,65 2	3.22	32.38	67.62
081801	The Musculoskeletal System & Connective Tissue	IP Upper Extremity Procedures	983	610	1,59 3	3.11	61.71	38.29
051401	The Circulatory System	IP Percutaneous Cardiovascular Procedures	742	802	1,54 4	3.01	48.06	51.94
031201	The Ear, Nose, Mouth & Throat	IP Other Ear, Nose, Mouth & Throat Procedures	418	1,109	1,52 7	2.98	27.37	72.63

c) Medical Related DRGs

There are 462 DRGs codes out of 789 of total DRGs in 2013 hospital from Abu Dhabi Health Care system submitted 122873 cases related to surgical DRGs which represent 71 % of DRGs submitted in the same year (174093 cases). SEHA hospitals submitted 80827 cases while None SEHA hospitals send 42046 which represent 66 and 34 per

cent respectively. Table 9 shows the top 10 DRGs belong to a medical section.



Figure 6: Medical DRGs 2013 SEHA vs. Non SEHA

Table 9: Top 10 DRGs related to Medical cases from S	SEHA and Non SEHA claims 2013
--	-------------------------------

DRG	Medical	DRG Description	SEHA	Non	All	% from all	% of	% of
	Diagnosis			SEHA		medical	SEHA	Non
	Category (MDC)					cases		SEHA
158171	Newborns &	IM Neonate, Birthwt	16,370	11,131	27,501	22.38	59.53	40.47
	Other Neonates	>2499 Grams						
		Without Major						
		Procedure						
146131	Childbirth	IM Vaginal Delivery	10,617	6,718	17,335	14.11	61.25	38.75
064171	The Digestive	IM Other	2,191	3,456	5,647	4.60	38.80	61.20
	System	Gastroenteritis &						
		Abdominal Pain						
134161	The Female	IM Antepartum	3,260	647	3,907	3.18	83.44	16.56
	Reproductive	Disorders						
	System							
146132	Childbirth	IM Vaginal Delivery	2,268	840	3,108	2.53	72.97	27.03
		w/CC						
044161	Respiratory	IM Simple	1,219	1,569	2,788	2.27	43.72	56.28
	System	Pneumonia &						
		Whooping Cough						
044181	Respiratory	IM Asthma &	1,474	1,218	2,692	2.19	54.75	45.25
	System	Bronchiolitis						
034131	The Ear, Nose,	IM Epiglottitis, Otitis	1,349	1,128	2,477	2.02	54.46	45.54
	Mouth & Throat	Media, Upper						
		Respiratory Tract						
		Infection &						
		Laryngotracheitis						
158131	Newborns &	IM Neonate, Birthwt	1,138	520	1,658	1.35	68.64	31.36
	Other Neonates	2000-2499 Grams						
		Without Major						
		Procedure						
064181	The Digestive	IM Other Digestive	742	615	1,357	1.10	54.68	45.32
	System	System Diagnoses						

d) Nervous System (DRGs code start with 01)

The total number of claims that submitted from the providers for DRGs related to Nervous System in the period from Jan 2013 till Dec 2013 was 4927 out of that 3736 came from SEHA hospitals and 1191 submitted from a non-SEHA hospital which represents 76 and 24 per cent respectively.



Figure 7: Nervous System DRGs 2013 SEHA vs. non-SEHA

Under chapter 01 there are 72 DRGs 51 of them under medical cases and 21 of them under surgical cases. The top claims under Mental Diseases chapter came from the code (014221) which represent (IM Seizure) for total cases of 734 which represent 15 % of total Nervous System related DRGs 545 cases from SEHA and 193 cases from non-SEHA hospitals which represent 74 % and 26 % respectively.

e) The Eye (DRGs code start with 02)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 671 out of that 597 came from SEHA hospitals and 74 submitted from a non-SEHA hospital which represents 89 and 11 per cent respectively. Under chapter 02 there are 15 DRGs 9 of them under medical cases and 6 of them under surgical cases. The top claims under the Eye chapter came from the code (021301) which represent (IP Intraocular & Lens Procedures) for total cases of 219 which represent 33 % of total Eye related DRGs 202 cases from SEHA and 17 cases from non-SEHA hospitals which represent 92 % and 8 % respectively.



Figure 8: The Eye DRGs 2013 SEHA vs non-SEHA

f) The Ear, Nose, Mouth & Throat (DRGs code start with 03)

The total number of claims that submitted from the providers for DRGs related to

Digestive System in the period from Jan 2013 till Dec 2013 was 8416 out of that 4082 came from SEHA hospitals and 4334 submitted from a non-SEHA hospital which represents 49 and 51 per cent respectively.





Under chapter 03 there are 42 DRGs 18 of them under medical cases and 24 of them under surgical cases. The top claims under the Ear, Nose, Mouth & Throat chapter came from the code (034131) which represents (IM Epiglottitis, Otitis Media, Upper Respiratory Tract Infection & Laryngotracheitis) for total cases of 2477 which represent 29 % of total Ear, Nose, Mouth & Throat related DRGs 1349 cases from SEHA and 1128 cases from non SEHA hospitals which represent 54 % and 45 % respectively.

g) Respiratory System (DRGs code start with 04)

The total number of claims that submitted from the providers for DRGs related to Respiratory System in the period from Jan 2013 till Dec 2013 was 13936 out of that 9006 came from SEHA hospitals and 4930 submitted from a non-SEHA hospital which represents 65 and 35 per cent respectively. Under chapter 04 there are 51 DRGs 36 of them under medical cases and 15 of them under surgical cases. The top claims under Respiratory System chapter came from the code (044161) which represent (IM Simple Pneumonia & Whooping Cough) for total cases of 2788 which represent 20 % of total Respiratory System related DRGs 1219 cases from SEHA and 1569 cases from non-SEHA hospitals which represent 44 % and 56 % respectively.



Figure 10: Respiratory System DRGs 2013 SEHA vs. Non-SEHA

h) The Circulatory System (DRGs code start with 05)

The total number of claims that submitted from the providers for DRGs related to Circulatory System in the period from Jan 2013 till Dec 2013 was 10603 out of that 6757 came from SEHA hospitals and 3846 submitted from a non-SEHA hospital which represents 64 and 36 per cent respectively. Under chapter 05 there are 96 DRGs 45 of them under medical cases and 51 of them under surgical cases. The top claims under the Circulatory System chapter came from the code (051401) which represent (IP Percutaneous Cardiovascular Procedures) for total cases of 1544 which represent 15 % of total Circulatory System related DRGs 742 cases from SEHA and 802 cases from non-SEHA hospitals which represent 48 % and 52 % respectively.



Figure 11: Circulatory System DRGs 2013 SEHA vs. Non-SEHA

i) The Digestive System (DRGs code start with 06)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 21340 out of that 9196 came from SEHA hospitals and 12144 submitted from a non-SEHA hospital which represents 43 and 57 per cent respectively. Under chapter 06 there are 54 DRGs 27 of them under medical cases and 27 of them under surgical cases. The top claims under the Digestive System chapter came from the code (064171) which represent (IM Other Gastroenteritis & Abdominal Pain) for total cases of 5647 which represent 26 % of total Digestive System related DRGs 2191 cases from SEHA and 3456 cases from non-SEHA hospitals which represent 39 % and 61 % respectively.



Non-SEHA

j) The Hepatobiliary System & Pancreas (DRGs code start with 07)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 4128 out of that 1977 came from SEHA hospitals and 2151 submitted from a non-SEHA hospital which represents 48 and 52 per cent respectively.



Figure 13: Hepatobiliary System & Pancreas DRGs 2013 SEHA vs Non SEHA

Under chapter 07 there are 33 DRGs 15 of them under medical cases and 18 of them under surgical cases. The top claim under The Female Reproductive System chapter came from the code (071141) which represent (The Hepatobiliary System & Pancreas) for total cases of 1792 which represent 43 % of total Hepatobiliary System & Pancreas related DRGs 467 cases from SEHA and 1325 cases from non SEHA hospitals which represent 26 % and 74 % respectively.

 k) The Musculoskeletal System & Connective Tissue (DRGs code start with 08)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 8689 out of that 5754 came from SEHA hospitals and 2933 submitted from a non-SEHA hospital which represents 31 and 69 per cent respectively. Under chapter 08 there are 78 DRGs 36 of them under medical cases and 42 of them under surgical cases. The top claim under the Musculoskeletal System & Connective Tissue chapter came from the code (081701) which represent (IP Knee & Lower Leg Procedures Except Foot) for total cases of 1704 which represent 29 % of total Musculoskeletal System & Connective Tissue related DRGs 522 cases from SEHA and 1182 cases from non SEHA hospitals which represent 31 % and 69 % respectively.



Figure 14: Musculoskeletal System & Connective Tissue DRGs 2013 SEHA vs. Non-SEHA

1) The Skin, Subcutaneous Tissue & Breast (DRGs code start with 09)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 4691 out of that 3459 came from SEHA hospitals and 1232 submitted from a non-SEHA hospital which represents 74 and 26 per cent respectively. Under chapter 09 there are 27 DRGs 15 of them under medical cases and 12 of them under surgical cases. The top claim under the Skin, Subcutaneous Tissue & Breast chapter came from the code (091401) which represent (IP Other Skin, Subcutaneous Tissue & Breast Procedures) for total cases of 863 which represent 18 % of total Skin, Subcutaneous Tissue & Breast related DRGs 388 cases from SEHA and 475 cases from non SEHA hospitals which represent 45 % and 55 % respectively.



Figure 15: Skin, Subcutaneous Tissue & Breast DRGs 2013 SEHA vs. Non-SEHA

m) The Endocrine, Nutritional & Metabolic Systems (DRGs code start with 10)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 4970 out of that 3286 came from SEHA hospitals and 1684 submitted from a non-SEHA hospital which represents 66 and 34 per cent respectively. Under chapter 10 there are 21 DRGs 12 of them under medical cases and 9 of them under surgical cases. The top claims under the Endocrine, Nutritional & Metabolic Systems chapter came from the code (104111) which represent (IM Hypovolemia & Electrolyte Disorders) for total cases of 1316 which represent 26 % of total Endocrine, Nutritional & Metabolic Systems related DRGs 697 cases from SEHA and 619 cases from non SEHA hospitals which represent 53 % and 47 % respectively.



Figure 16: Endocrine, Nutritional & Metabolic Systems DRGs 2013 SEHA vs. Non-SEHA

n) The Urinary Tract (DRGs code start with 11)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 4443 out of that 2981 came from SEHA hospitals and 1462 submitted from a non-SEHA hospital which represents 67 and 33 per cent respectively. Under chapter 11 there are 39 DRGs 21 of them under medical cases and 18 of them under surgical cases. The top claim under the Urinary Tract chapter came from the code (114121) which represent (IM Kidney & Urinary Tract Infections) for total cases of 602 which represent 14 % of total Urinary Tract related DRGs 307 cases from SEHA and 295 cases from non-SEHA hospitals which represent 51 % and 49 % respectively.



Figure 17: Urinary Tract DRGs 2013 SEHA vs Non-SEHA

o) The Male Reproductive System (DRGs code start with 12)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 1437 out of that 584 came from SEHA hospitals and 852 submitted from a non-SEHA hospital which represents 41 and 59 per cent respectively. Under chapter 12 there are 24 DRGs 6 of them under medical cases and 18 of them under surgical cases. The top claim under the Male Reproductive System chapter came from the code (121121) which represent (IP Moderately Complex Prostate & Scrotal Contents Procedures) for total cases of 695 which represent 48 % of total Urinary Tract related DRGs 149 cases from SEHA and 546 cases from non SEHA hospitals which represent 21 % and 79 % respectively.



Figure 18: Male Reproductive System DRGs 2013 SEHA vs. Non-SEHA

p) The Female Reproductive System (DRGs code start with 13)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 13070 out of that 10009 came from SEHA hospitals and 3061 submitted from Non-SEHA hospital which represents 77 and 23 per cent respectively. Under chapter 13 there are 45 DRGs 24 of them under medical cases and 21 of them under surgical cases. The top claims under The Female Reproductive System chapter came from the code (134161) which represent (IM Antepartum Disorders) for total cases of 3907 which represent 30 % of total Female Reproductive System related DRGs 3260 cases from SEHA and 647 cases from non-SEHA hospitals which represent 83 % and 17 % respectively.



Figure 19: Female Reproductive System DRGs 2013 SEHA vs. Non-SEH

q) Childbirth (DRGs code start with 14)

The total number of claims that submitted from the providers for DRGs related to Childbirth in the period from Jan 2013 till Dec 2013 was 31085 cases out of that 18678 came from SEHA hospitals and 12347 submitted from a non-SEHA hospital which represents 60 and 40 per cent respectively.





Under Childbirth chapter there are 12 DRGs three of them under medical (IM) and the remaining nine are under surgical or procedure DRGs. The top claims under childbirth chapter came from the code (146131) which represent (IM Vaginal Delivery) for total cases of 17335 which represent 56 % of total childbirth DRGs 10617 cases from SEHA and 6718 cases from non-SEHA hospitals which represent 61 % and 39 % respectively.

r) New-borns & Other Neonates (DRGs code start with 15)

The total number of claims that submitted from the providers for DRGs related to Mental Diseases & Disorders in the period from Jan 2013 till Dec 2013 was 31828 out of that 19516 came from SEHA hospitals and 12312 submitted from a non-SEHA hospital which represents 61 and 39 per cent respectively. Under chapter 15 there are 48 DRGs 24 of them under medical cases and 24 of them belong to surgical cases. The top claims under New-borns & Other Neonates chapter came from the code (158171) which represent (IM Neonate, Birth Wight >2499 Grams Without Major Procedure) for total cases of 27501 which represent 86 % of total New-borns & Other Neonates related DRGs 16370 cases from SEHA and 11131 cases from non SEHA hospitals which represent 60 % and 40 % respectively.



Figure 21: New-borns & Other Neonates DRGs 2013 SEHA vs. Non-SEHA

s) Blood, Blood-Forming Organs, Immunological System (DRGs code start with 16)

The total number of claims that submitted from the providers for DRGs related to Blood, Blood-Forming Organs, Immunological System in the period from Jan 2013 till Dec 2013 was 2290 out of that 1943 came from SEHA hospitals and 347 submitted from a non-SEHA hospital which represents 86 and 15 per cent respectively.





t) The Myeloproliferative System & Poorly Differentiated Neoplasms (DRGs code start with 17)

The total number of claims that submitted from the providers for DRGs related to Digestive System in the period from Jan 2013 till Dec 2013 was 1360 out of that 1348 came from SEHA hospitals and 12 submitted from a non-SEHA hospital which represents 99 and 1 per cent respectively.



Figure 23: Myeloproliferative System & Poorly Differentiated Neoplasms DRGs 2013 SEHA vs. Non-SEHA

Under chapter 17 there are 15 DRGs all of them under medical cases. The top claim under the Myeloproliferative System & Poorly Differentiated Neoplasms chapter came from the code (174132) which represent (IM Chemotherapy w/CC) for total cases of 466 which represent 34 % of total Myeloproliferative System & Poorly Differentiated Neoplasms related DRGs all of the cases from SEHA.

u) Infectious & Parasitic Diseases of Systemic or Unspecified Sites (DRGs code start with 18)

The total number of claims that submitted from the providers for DRGs related to Factors Influencing Health Status & Other Contacts with Health Services in the period from Jan 2013 till Dec 2013 was 2961 out of that 1836 came from SEHA hospitals and 1125 submitted from a non-SEHA hospital which represents 62 and 38 per cent respectively. Under chapter 18 there are 18 DRGs all of them under medical cases. The top claims under infection chapter came from the code (184103) which represent (IM Septicemia w/MCC) for total cases of 522 which represent 18 % of total infection related DRGs 466 cases from SEHA and 56 cases from non-SEHA hospitals which represent 89 % and 11 % respectively.



Figure 24: Infectious & Parasitic Diseases of Systemic or Unspecified Sites DRGs 2013 SEHA vs. Non-SEHA

v) Mental Diseases & Disorders (DRGs code start with 19)

The total number of claims that submitted from the providers for DRGs related to Mental Diseases & Disorders in the period from Jan 2013 till Dec 2013 was 1175 out of that 443 came from SEHA hospitals and 732 submitted from a non-SEHA hospital which represents 38 and 62 per cent respectively. Under chapter 19 there are 30 DRGs all of them under medical cases. The top claims under Mental Diseases chapter came from the code (194101) which represent (IM Schizophrenia) for total cases of 343 which represent 29 % of total Mental Diseases related DRGs 104 cases from SEHA and 239 cases from non-SEHA hospitals which represent 30 % and 70 % respectively.



Figure 25: Mental Diseases & Disorders DRGs 2013 SEHA vs. Non-SEHA

w) Alcohol/Drug Abuse & Dependence (DRGs code start with 20)

The total number of claims that submitted from the providers for DRGs related to Alcohol/Drug Abuse & Dependence in the period from Jan 2013 till Dec 2013 was 298 out of that 173 came from SEHA hospitals and 125 submitted from a non-SEHA hospital which represents 58 and 42 per cent respectively.







The total number of claims that submitted from the providers for DRGs related to Factors Injuries, Poisonings & Toxic Effects of Drugs in the period from Jan 2013 till Dec 2013 was 1353 out of that 1169 came from SEHA hospitals and 184 submitted from a non-SEHA hospital which represents 86 and 14 per cent respectively. Under chapter 21 there are 24 DRGs all of them under medical cases. The top claims under infection chapter came from the code (214121) which represent (IM Poisoning & Toxic Effects of Drugs) for total cases of 432 which represent 32 % of total injuries related DRGs 399 cases from SEHA and 33 cases from non-SEHA hospitals which represent 92 % and 8 % respectively.



Figure 27: Injuries, Poisonings & Toxic Effects of Drugs DRGs 2013 SEHA vs Non-SEHA

y) Factors Influencing Health Status and Other Contacts with Health Services (DRGs code start with 22)

The total number of claims that submitted from the providers for DRGs related to Factors Influencing Health Status & Other Contacts with Health Services in the period from Jan 2013 till Dec 2013 was 482 out of that 426 came from SEHA hospitals and 56 submitted from a non-SEHA hospital which represents 88 and 12 per cent respectively. Under chapter 22 there are nine DRGs all of them under medical cases.



Figure 28: Factors Influencing Health Status & Other Contacts with Health Services DRGs 2013 SEHA vs. Non-SEHA

Discussion, Conclusions, and Recommendations

Discussion

The main three findings based on the interview, UEQ and secondary data collected from HAAD. DRGs system is efficient system and the end-users have good experience about this system. Public health care sector outperformed private health care sector in Abu Dhabi.

The payment method before the introduction of DRG was Fee for Service Payment system was enforced either through a standard provider contract or individually customized contract basis for non-Abu Dhabi providers in Dubai and the North Emirates. Abu Dhabi Health care system introduced GRGs to stabilize the increasing health care costs across the sectors. In addition to that DRGs expected to increase transparency between hospitals as DRGs will simplify costs and quality comparisons between hospitals. The insurance companies will no longer review each service performed by the hospital rather they will pay as a total predetermined payment based on the average.

There are different modalities of DRG, but the one that was adopted by Abu Dhabi government International refined DRGS (IR-DGRs) as it is dynamic and can be modified and customized based on health care system and the local requirement.

Emirate of Abu Dhabi selects to use the sixth digital code where the first two digits indicate major disease category (MDC) while the third digit indicates the DRG type whether surgical or medical the fourth and the fifth digits indicate DRG number the last digit indicate the severity level which consists of three level.

DRG was implemented to SKMC 2011 after DRG Assurance training conducted by 3M in this system providers share some of the financial risks with the payers. DRG system is efficient, but there is a high incentive for the vendor for early discharge of patient quicker and sicker which may lead to readmission, but in SKMC they noticed neither increase in mortality nor the readmission rate after applying this payment method. DRGs appears to help in enhancing the quality of inpatient care by discouraging unnecessary and potentially harmful procedures, and by encouraging the concentration of complex procedures in facilities in which the high frequency of these procedures promotes efficiency.

HAAD According to official, the implementation of the comprehensive insurance system in Emirate of Abu Dhabi helped to facilitate the GRG introduction, but the price applied in USA not suitable for UAE market for this reason HAAD evaluated the cost of DRG based on the data collected from the claim of all hospitals in Abu Dhabi. The most important factor that pushes HAAD to adopt DRG system is the high rejection rate either entirely or partially in addition to overuse of Fee for Service Payment method which results in unnecessary procedures. DRG is also helpful for planning as it shows which area need to add hospital or which specialty has a shortage in addition to that DRGs allow to compare between hospital performance based on severity level.

If DRGs is not monitored, it may lead to early discharged which may result in readmission

within the same month for this reason HAAD introduce a quality program called JAWDA for example if the same patient readmitted within one month the first provider will be questioned.

UEQ have been used in different studies to evaluate user experience, but this is the first time to use UEQ to evaluate DRGs user experience using 3M system. (Schrepp, Martin, Hinderks, Andreas, Thomaschewski, Jörg, 2014).

Table 1 shows the mean of the 26 items of UEQ values above 0.8 represent positive evaluation, Values between -0.8 and 0.8 represent a neutral assessment of the corresponding scale and < -0.8 represent a negative evaluation. We can notice that most of the means above 0.8 which reflect positive evaluation for 3M system used by the coder for DRGs coding the exceptions are item 4 and 13 which represent neutral evaluation.

Table 2 and figure 1 represent the means of attractiveness scales: the six which represented by items (1,12, 14, 16, 24, 25.) with mean of 1.793, perspicuity which represented by items (2,4, 13, 21) with mean of 1.2, efficiency which represented by items (9,20, 22, 23.) with mean of 1.64, dependability which represented by items (8,11,17, 19.) with mean of 1.56, stimulation which represented by items (5,6,7,18) with mean of 1.84 and novelty which represented by items novelty (3,10, 15, 26) with mean of 1.35 where of the means above 0.8 which represent positive evaluation of the DRG system.

Table 3 and figure 2 represent the means of pragmatic quality which include (perspicuity, efficiency, dependability) with an overall mean of 1.47, the hedonic quality which includes (stimulation and novelty) with an overall mean of 1.60 and attractive with mean of 1.79. Which again represent positive evaluation which is above 0.8.

Table 4 and 5 show the 5% confidence intervals for the scale means and the means of the single items the smaller the confidence interval, the higher is the precision of the estimation and the more the results can be trusted. The smaller confidence interval also reflects the more consistency of the person's opinion.

Table 6 shows the correlations of the items per scale and Cronbach's Alpha-Coefficient which is a measure of the consistency of a scale. In general value above 0.6 reflect excepted consistency of the scale all the six scale Cronbach's Alpha-Coefficient above 0.6

Table 7 and figure 3 shows the scale comparison to the benchmark where three of the scale were excellent and two were good and only one was above the average which again represents positive evaluation of the coders to the DRGs system.

Out of total 174093 DRGs, 71 % was medical cases, and 29 % was surgical cases. Figure 4 shows all DRGs claims in 2013 were 61 % (106957) came from SEHA hospitals while 39 % (67136) from Non-SEHA hospitals. Figure 5 shows that SEHA and non-SEHA hospital share the surgical DRGs market by around 50 % for each, but in a case of medical DRGs SEHA hospital got more than 70 % of the medical related DRGs 2013 compared with less than 30 % for non SEHA hospitals. The most common surgical DRGs was childbirth followed by appendix procedures, on the other hand, most common medical DRGs are those related to a digestive system and female reproductive system.

It can be noticed that the market share of the DRGs claim differs based on the system but most of the claim belong to SEHA hospital in case of the Myeloproliferative System & Poorly Differentiated Neoplasms 2013 claims 99 % from SEHA hospitals which indicate the shortage in this area in private sector but we notice 2015 the private sector started to access to oncology specialty via Burjeel Hospital who attracted good number physicians specialised in oncology (Burjeel, 2016) . 88% of DRGs claims related to the Eye 2013 in Abu Dhabi came from SEHA hospitals which indicate that private sector

has a role to grow in eye specialty. 86% of DRGs claims related to

Injuries, Poisonings & Toxic Effects of Drugs 2013 came from SEHA facilities, 77% of DRGs claims related to the Female Reproductive System 2013 in Abu Dhabi claimed by SEHA hospital, 76% of DRGs claims related to Nervous System 2013 in Abu Dhabi belong to SEHA hospitals, while 74 % of DRGs claims related to the Skin, Subcutaneous Tissue & Breast 2013 in Abu Dhabi health system applied by SEHA hospitals, 67 % of DRGs claims related to the Urinary Tract 2013 in Abu Dhabi came from SEHA hospitals, 66 % of DRGs claims related to the Endocrine, Nutritional & Metabolic Systems 2013 in Abu Dhabi came from SEHA hospitals and 65 % of DRGs claims related to Respiratory System 2013 claims from different health care providers in Abu Dhabi.

On the hand private sector outperformed public sector at least in 4 DRGs group for example 62 % of DRGs claims related to Mental Diseases & Disorders 2013 in Abu Dhabi health system came from non SEHA Hospital, 59 % of DRGs claims related to the Male Reproductive System 2013 in Abu Dhabi applied by private sector hospitals, 57 % of DRGs claims related to The Digestive System 2013 in Abu Dhabi came from non SEHA hospitals.

SEHA and non SEHA hospital share equally the DRGs claims related to the Hepatobiliary System & Pancreas and the Ear, Nose, Mouth & Throat 2013 with about 50 % for each sector.

In Abu Dhabi health system, private sector has significant role to expand and improve as most of DRGs claims came from SEHA hospital especially in medical cases

Is DRG system attractiveness?

DRGs system is attractive to the end user (coders) with mean above 0.8 (1.793)

Is the design of DRG with good quality in term of stimulation and novelty?

DRGs have good quality in term of stimulation and novelty with a mean of 1.84 and 1.35 which above 0.8.

Is the DRG efficient system?

DRGs considered an efficient system as it has the incentive to use only required interventions which help to avoid overuse of resources and push the provider for a minimum hospital stay.

Policy Implications

DRGs adaptation by hospitals can increase their profit margins by getting the maximum appropriate reimbursement which may be reflected indirectly on the physicians and other staff by improving staffing level, increasing capital expenditures, introducing additional programs, new service, and overall growth.

DRGs adaptation may lead to increase transparency and improve the efficiency of the healthcare system of the country. The system also helps to make a comparison between hospitals and differentiate whether one hospital treats more complicated and severe cases than another which may be reflected in the future by creating classification and rating system for hospital according to their performance.

DRGs may lead to a reduction in the length of stay in the hospitals which could reduce the risk associated with extended admission period like the infection with resistant organisms.

DRGs system may lead to early discharged of the patient which result in an increase the readmission rate for the same indication within thirty days of discharge. The regulatory body should monitor the rate of readmission within 30 days and make it as a key performance indicator and a quality measure.

DRGs system has the incentive for the hospitals to reject the complicated and more severe cases and to transfer unprofitable cases to public hospitals. HAAD may interduce new regulations that give incentive to private sector to deal with more medical DRGs for example to consider 5 % extra payment for challenging cases.

DHA and the Northern Emirate may adopt policy to implement DRGs system in as it is efficient system which will help to use the available resources in best way.

Limitations of the Study

This study has some limitation first of the number of persons interviewed was limited to three persons and it was not possible to make focus group as each of them from different organization second limitation related to sample size of coders who answered UEQ which was limited to 25 and selection not based on randomization but based on their agreement to participate in the survey.

Conclusions

In conclusion, DRGs system is an efficient system which helped Abu Dhabi health care system to determine its priorities and compare hospitals and physician's performance. The coders are happy with their experience with DRGs system as it is attractive with good pragmatic and hedonic quality. Public sector outperforms private sector in health care service as the private sector is less risk taker with a concentration on related surgical cases.

Recommendations

The Health Authority of Abu Dhabi HAAD recommended to monitor hospital quality of service as DRGs carry the risk for early discharge which will be associated with early readmission for the same diagnosis based this quality monitoring program the hospital could be classified based on performance and those with high performance get special incentive to help them to maintain such quality.

Private sector hospitals can adopt automated DRGs system which will be able to collect demographic data from patient profile automatically instead of the manual entry with a high risk of wrong entry. Private sector hospitals may play a bigger role in different specialty it takes more market share will help to increase the competition between private and public health care sectors.

The author believes that this the right time for different health authorities in the country to adopt DRGs system as a payment method to replace fee for service.

References

Averill RF, Goldfield NI, Vertrees JC, McCullough EC, Fuller RL,Eisenhandler J,. (2010). Achieving cost control, care coordination, and quality improvement through incremental payment system reform. The Journal of Ambulatory Care Management, 33(1)

Ballentine, N. H.,. (2009). Coding and documentation: Medicare severity diagnosis-related groups and present-on-admission documentation. JHM Journal of Hospital Medicine, 4(2), 124-130.

Bekes C, Fleming S,Scott WE,. (1988). Reimbursement for intensive care services under diagnosis-related groups. Critical Care Medicine, 16(5), 478-81.

Berki SE, S. N., (1987). Frequency and cost of diagnosis-related group outliers among newborns. Pediatrics, 79(6), 874-81.

Boyce, Carolyn., Neale, Palena.,Pathfinder International.,. (2006). Conducting in-depth interviews : A guide for designing and conducting in-depth interviews for evaluation input. Watertown, MA: Pathfinder International.

BULL, M.,. (1988). Influence of diagnosisrelated groups on discharge planning, professional practice, and patient care. Journal of Professional Nursing Journal of Professional Nursing, 4(6), 415-421.

Burjeel.(2016,Oct25).Burjeel.Retrieved from Burjeel:

http://www.burjeel.com/?cmd=burjeel__doc tors_admin

Busse R., Geissler A., Quentin W., Aaviksoo A., Cots F., Hakkinen U., Kobel C., Mateus C., Or Z., O'Reilly J., Serden L., Street A.,Tan S.S.,. (2013). Diagnosis related groups in europe: Moving towards transparency, efficiency, and quality in hospitals? BMJ (Online) BMJ (Online), 347(7916)

Busse, Reinhard,, World Health Organization.,Regional Office for Europe., EuroDRG.,. (2011a). Diagnosis-related groups in europe moving towards transparency, efficiency and quality in hospitals.

Butler PW, Bone RC,Field T,. (1985). Technology under medicare diagnosisrelated groups prospective payment. implications for medical intensive care. Chest, 87(2), 229-34.

Carpenter, Iain, Bobby, Jacqui, Kulinskaya, Elena,Seymour, Gwyn,. (2007). People admitted to hospital with physical disability have increased length of stay: Implications for diagnosis related group re-imbursement in england. Age and Ageing, 36(1), 73-78.

Chawla, M., Windak, A., Berman, P., & Kulis, M. (1997). Paying the Physician: Review of Different Methods. Boston, Massachusetts: Department of Population and International Health, Harvard School of Public Health.

Chuang, Kenneth H., Covinsky, Kenneth E., Sands, Laura P., Fortinsky, Richard H., Palmer, Robert M., Landefeld,C .Seth,. (2003). Diagnosis-related group-adjusted hospital costs are higher in older medical patients with lower functional status. Journal of the American Geriatrics Society, 51(12), 1729-1734.

Davis MP, Walsh D, LeGrand SB, Lagman RL, Harrison B,Rybicki L,. (2005). The financial benefits of acute inpatient palliative medicine: An inter-institutional comparative analysis by all patient refined-diagnosis related group and case mix index. The Journal of Supportive Oncology, 3(4)

Demaerschalk BM, D. D.,. (2007). How diagnosis-related group 559 will change the US medicare cost reimbursement ratio for stroke centers. Stroke; a Journal of Cerebral Circulation, 38(4), 1309-12.

DHA. (2014). Health Accounts System of Dubai 2012. Dubai: DHA. Retrieved from ISAHD:

http://www.isahd.ae/content/docs/HASD%2 0English%202012.pdf

Doremus HD, M. E.,. (1983). Data quality. an illustration of its potential impact upon a

diagnosis-related group's case mix index and reimbursement. Medical Care, 21(10), 1001-11.

Dranove, D.,. (1987). Rate-setting by diagnosis related groups and the hospital specialization. The Rand Journal of Economics (Washington), 18(03), 417-427.

Eisenberg BS, . (1984). Diagnosis-related groups, severity of illness, and equitable reimbursement under medicare. JAMA, 251(5), 645-6.

Epstein AM, Stern RS, Tognetti J, Begg CB, Hartley RM, Cumella E Jr,Ayanian JZ,. (1988). The association of patients' socioeconomic characteristics with the length of hospital stay and hospital charges within diagnosis-related groups. The New England Journal of Medicine, 318(24), 1579-85.

Evers, Silvia, Voss, Gemma, Nieman, Fred, Ament, André, Groot, Tom, Lodder, Jan, Boreas, Anita,Blaauw, Gerhard,. (2002). Predicting the cost of hospital stay for stroke patients: The use of diagnosis related groups. Health Policy Health Policy, 61(1), 21-42.

Fetter, R. B.,. (1980). Case mix definition by diagnosis-related group. Philadelphia: Lippincott.

Fischer, W.,. (1999). Diagnosis related groups (DRG's) im vergleich zu den patientenklassifikationssystemen von Österreich und deutschland : Eine problemzentrierte diskussion von patientenklassifikationssystemen für stationäre akutbehandlungen im hinblick auf deren verwendung in Vergütungssystemen. Wolferswil: ZIM.

Freeman JL, Fetter RB, Park H, Schneider KC, Lichtenstein JL, Hughes JS, Bauman WA, Duncan CC, Freeman DH Jr,Palmer GR,. (1995). Diagnosis-related group refinement with diagnosis- and procedure-specific comorbidities and complications. Medical Care, 33(8), 806-27.

Gertman PM, L. S.,. (1984). A research paradigm for severity for illness: Issues for

the diagnosis-related group system. Health Care Financing Review, , 79-90.

Gracey DR, . (2002). The problem with diagnosis related group 475. Chest, 122(1), 299-301.

Gupta SK, V. F.,. (1990). Inadequacy of diagnosis related group (DRG) reimbursements for limb salvage lower extremity arterial reconstructions. ad hoc committee of the joint council of the society for vascular surgery and the north american chapter of the international society for cardiovascular surgery. Journal of Vascular Surgery, 11(2), 348-56.

Halloran EJ, K. M.,. (1987). Nursing dependency, diagnosis-related groups, and length of hospital stay. Health Care Financing Review, 8(3), 27-36.

Hamidi, Samer, Akinci, Fevzi,. (2015). Examining the health care payment reforms in abu dhabi. HPM the International Journal of Health Planning and Management, 30(2), E69-E82.

Hamidi, S.,. (2015). Health services financing and delivery: Analysis of policy options for dubai, united arab emirates. CEOR ClinicoEconomics and Outcomes Research, , 133.

Health services financing and delivery: Analysis of policy options for dubai, united arab emirates. (2015). Unpublished manuscript.

Horn SD, Bulkley G, Sharkey PD, Chambers AF, Horn RA,Schramm CJ,. (1985). Interhospital differences in severity of illness. problems for prospective payment based on diagnosis-related groups (DRGs). The New England Journal of Medicine, 313(1), 20-4.

Horn SD, Horn RA, Sharkey PD, Beall RJ, Hoff JS,Rosenstein BJ,. (1986). Misclassification problems in diagnosisrelated groups. cystic fibrosis as an example. The New England Journal of Medicine, 314(8), 484-7. Iezzoni LI, M. M., (1986). Clinical overlap among medical diagnosis-related groups. JAMA, 255(7), 927-9.

Jean Lee, S. K.,. (1992). Quantitative versus qualitative research methods — two approaches to organisation studies. Asia Pacific J Manage Asia Pacific Journal of Management, 9(1), 87-94.

Jones KR, . (1985). Predicting hospital charge and stay variation. the role of patient teaching status, controlling for diagnosis-related group, demographic characteristics, and severity of illness. Medical Care, 23(3), 220-35.

Kawabuchi K, . (2000). Payment systems and considerations of case mix--are diagnosis-related groups applicable in japan? PharmacoEconomics, 18, 95-110.

Knoer SJ, Couldry RJ,Folker T,. (1999). Evaluating a benchmarking database and identifying cost reduction opportunities by diagnosis-related group. American Journal of Health-System Pharmacy : AJHP : Official Journal of the American Society of Health-System Pharmacists, 56(11), 1102-7.

Latta VB, H. C.,. (1991). Medicare short-stay hospital services by diagnosis-related groups. Health Care Financing Review, 12(4), 105-40.

Laugwitz, B., Held, T.,Schrepp, M.,. (2008). Construction and evaluation of a user experience questionnaire. Lecture Notes in Computer Science., (5298), 63-76.

Librero J, Marín M, Peiró S, Munujos AV,. (2004). Exploring the impact of complications on length of stay in major surgery diagnosis-related groups. International Journal for Quality in Health Care : Journal of the International Society for Quality in Health Care / ISQua, 16(1), 51-7.

Lichtig LK, Knauf RA, Bartoletti A, Wozniak LM, Gregg RH, Muldoon J,Ellis WC,. (1989). Revising diagnosis-related groups for neonates. Pediatrics, 84(1), 49-61.

Mathauer, Inke,Wittenbecher, Friedrich,. (2013). Hospital payment systems based on

diagnosis-related groups: Experiences in low- and middle-income countries. Bwho Bulletin of the World Health Organization, 91(10), 746-756A.

May JJ, W. J.,. (1984). Selected results from an evaluation of the new jersey diagnosisrelated group system. Health Services Research, 19(5), 547-59.

McMahon LF Jr, . (1984). Diagnosis-related group prospective payment. effects on medical quality assurance. Evaluation & the Health Professions, 7(1), 25-41.

Medicare hospital prospective payment system : How drg rates are calculated and updated. (2012). . [Place of publication not identified]: Bibliogov.

Menke TJ, Ashton CM, Petersen NJ,Wolinsky FD,. (1998). Impact of an allinclusive diagnosis-related group payment system on inpatient utilization. Medical Care, 36(8), 1126-37.

Mihailovic, N., Kocic, S., Jakovljevic, M.,. (2016). Review of diagnosis-related groupbased financing of hospital care. Health Services Research and Managerial Epidemiology Health Services Research and Managerial Epidemiology, 3

MRICS, I. A. (2013, December). Colliers. Retrieved from Colliers: http://www.colliers.com/-

/media/CF692F58BA4D44A08D55FE7F1E 54E584.ashx?la=en-GB

Müller ML, Bürkle T, Irps S, Roeder N,Prokosch HU,. (2003). The diagnosis related groups enhanced electronic medical record. International Journal of Medical Informatics, 70(2-3), 2-3.

Muñoz E, Josephson J, Tenenbaum N, Goldstein J, Shears AM, Wise L, (1989). Diagnosis-related groups, costs, and outcome for patients in the intensive care unit. Heart & Lung : The Journal of Critical Care, 18(6), 627-33.

Muñoz E, Rosner F, Chalfin D, Goldstein J, Margolis IB,Wise L, (1988). Financial risk and hospital cost for elderly patients. ageand non-age-stratified medical diagnosis related groups. Archives of Internal Medicine, 148(4), 909-12.

Muñoz E, Soldano R, Gross H, Chalfin D, Mulloy K,Wise L, (1988). Diagnosis related groups and the transfer of general surgical patients between hospitals. Archives of Surgery (Chicago, Ill.: 1960), 123(1), 68-71.

Muramatsu N, L. J., (1999). Hospital length of stay in the united states and japan: A case study of myocardial infarction patients. International Journal of Health Services : Planning, Administration, Evaluation, 29(1), 189-209.

Palmer G, R. B.,. (2001). Evaluation of the performance of diagnosis-related groups and similar case-mix systems: Methodological issues. Health Services Management Research, 14(2), 71-81.

Park, M., Braun, T., & Carrin, G. (2007). Provider Payments and cost-containment Lessons from OECD countries. GENEVA: World Health Organization.

Peltola M, Q. W.,. (2013). Diagnosis-related groups for stroke in Europe: Patient classification and hospital reimbursement in 11 countries. Cerebrovascular Diseases (Basel, Switzerland), 35(2), 113-23.

Pon S, Notterman DA, Martin K,. (1993). Pediatric critical care and hospital costs under reimbursement by diagnosis-related group: Effect of clinical and demographic characteristics. The Journal of Pediatrics, 123(3), 355-64.

Price KF, . (1989). Pricing medicare's diagnosis-related groups: Charges versus estimated costs. Health Care Financing Review, 11(1), 79-90.

Quantin, C, Brunet-Lecomte, P, Dusserre, L, Entezam, F, Guy, H,Lepage, E,. (1999). High cost factors for leukaemia and lymphoma patients: A new analysis of costs within these diagnosis related groups. Journal of Epidemiology & Community Health, 53(9901) Quentin W, Scheller-Kreinsen D, Blümel M, Geissler A,Busse R,. (2013). Hospital payment based on diagnosis-related groups differs in europe and holds lessons for the united states. Health Affairs (Project Hope), 32(4), 713-23.

Quentin, Wilm, Rätto, Hanna, Peltola, Mikko, Busse, Reinhard, Häkkinen, Unto,. (2013). Acute myocardial infarction and diagnosis-related groups: Patient classification and hospital reimbursement in 11 european countries. European Heart Journal, 34(26), 1972-1981.

Quentin, Wilm, Scheller-Kreinsen, David, Geissler, Alexander,Busse, Reinhard,. (2012). Appendectomy and diagnosis-related groups (DRGs): Patient classification and hospital reimbursement in 11 european countries. Langenbeck's Archives of Surgery, 397(2), 317-326.

Roos NP, Wennberg JE,McPherson K,. (1988). Using diagnosis-related groups for studying variations in hospital admissions. Health Care Financing Review, 9(4), 53-62.

Sanderson HF, Storey A, Morris D, McNay RA, Robson MP,Loeb J,. (1989). Evaluation of diagnosis-related groups in the national health service. Community Medicine, 11(4), 269-78.

Schrepp, M. (2016, October). UEQ. Retrieved from http://www.ueq-online.org/

Schrepp, Martin, Hinderks, Andreas,Thomaschewski, Jörg,. (2014). Applying the user experience questionnaire (UEQ) in different evaluation scenarios.

Schreyögg, Jonas, Stargardt, Tom, Tiemann, Oliver,Busse, Reinhard,. (2006). Methods to determine reimbursement rates for diagnosis related groups (DRG): A comparison of nine european countries. Health Care Manage Sci Health Care Management Science, 9(3), 215-223.

Sedman AB, Bahl V, Bunting E, Bandy K, Jones S, Nasr SZ, Schulz K,Campbell DA,. (2004). Clinical redesign using all patient refined diagnosis related groups. Pediatrics, 114(4), 965-9. SEHA. (2016, Jully 19). Retrieved from SEHA:

https://www.seha.ae/English/pages/default.a spx

Thomas F, Fox J, Clemmer TP, Orme JF Jr, Vincent GM, Menlove RL,. (1987). The financial impact of medicare diagnosisrelated groups. effect upon hospitals receiving cardiac patients referred for tertiary care. Chest, 91(3), 418-23.

UAEInteract. (2016, March 19). Retrieved from UAEInteract:

http://www.uaeinteract.com/english/govern ment/#6

United States., Congress.,Office of Technology Assessment.,. (1983). Diagnosis related groups (DRGs) and the medicare program : Implications for medical technology. Washington, D.C.: Congress of the U.S., Office of Technology Assessment : For sale by the Supt. of Docs., U.S. G.P.O.

United States., Health Care Financing Administration.,Office of Research and Demonstrations.,. (1984). The new ICD-9-

CM diagnosis-related groups classification scheme. Baltimore, Md.; Washington, D.C.: U.S. Dept. of Health and Human Services, Health Care Financing Administration, Office of Research and Demonstrations ; For sale by the Supt. of Docs., U.S. G.P.O.

Vladeck BC, . (1984). Medicare hospital payment by diagnosis-related groups. Annals of Internal Medicine, 100(4), 576-91.

Warner, H., James , J., & Göldner, F. (2011, Feb 17). Healthcare payment reform in Abu Dhabi: the case for Diagnosis Related Groups. MIDDLE EAST HEALTH.

Wennbero, John E., McPherson, Klim,Caper, Philip,. (1984). Will payment based on diagnosis-related groups control hospital costs? N Engl J Med New England Journal of Medicine, 311(5), 295-300.

Wenzel RP, . (1985). Nosocomial infections, diagnosis-related groups, and study on the efficacy of nosocomial infection control. economic implications for hospitals under the prospective payment system. The American Journal of Medicine, 78(6B), 3-7.

Environmental Studies

Public Awareness about Electromagnetic Radiation Pollution in Basra Community

Safaa M. Imran, Khulood M.Omran, and Qussay Mohammed Basra University, Iraq

Abstract

In recent years, there is world wide concern towards a new form of environmental pollution and health hazard. Some of the health problems may be caused by noise or other factors in the environment, or by the presence of new technologies. Electromagnetic radiation (EMR) emitted by cell phone and its towers is a new form of environmental pollution.

The present research aims at measuring the level of consciousness toward EMR among the people in Basra and its relation to other variables, namely age, gender and level of education

The instrument of the research has been the scale which was developed by the researchers. The scale has 20 Likert type items rated on a five point scale: strongly disagree, disagree, neutral, agree, and strongly agree. These responses were coded as 1, 2, 3, 4, and 5 respectively. Across sectional study of 542 persons age 18-65years, collected from Nov 2012 to June 2013, was asked questions distributed on two parts: The statements in the first part involve the perception of the people toward the EMF effect. The second part involves their knowledge toward its effect. Exploring the various dimensions of perception and knowledge variables about EMR effect in Basra community showed low level of general awareness. The respondents recorded a mean of perception and knowledge scores were 30.35(Standard deviation 3.36) and 30.20(Standard deviation 3.82) respectively, and there have been differences according to the variable of age and gender.

Key words: public awareness, electromagnetic pollution, Basra pollution

Introduction

Electromagnetic radiations (EMR) are all around us and in everyday life we are all exposed to EMR from variety of sources ^[1]. There are natural sources such as Earth's magnetic field and sun light, also there are many man-made sources of EMR generated wherever an electrical current flows^[2,3].

Wireless devices such as cell and cordless phones and smart meters transmit and receive signals from fixed base stations: cell towers in the case of cell phones and a base component in the case of cordless phones. The signal used for this communication is electromagnetic radiation (EMR).

The electromagnetic spectrum spans from high energy X-rays and gamma rays at one end to lower energy radio waves and microwaves at the other, with visible light in between. Higher energy radiation is referred to as ionizing, while lower energy radiation is referred to as non-ionizing.

Ionizing radiation has sufficient energy to break molecular bonds and to remove electrons from atoms or molecules, resulting in the formation of a charged atom, called an ion.

The damaging effects of ionizing radiation result from this ability to change the composition of matter. Non-ionizing radiation, which is the type emitted by cell and cordless phones, emits only sufficient energy to vibrate atoms (heating), but not enough to remove electrons. The area occupied by the EMR is referred to as the electromagnetic field (EMF), and the farther away from the source of the EMR, the weaker the EMF becomes. ^[1].

EMR emitted by cell phone and its tower is a new form of environmental pollution and is a health hazard. This pollution is an issue of word wide concern due to its undesirable effects on human health, flora and fauna. ^[4-9].

There are recommended exposure limits for EMF frequencies, which measured by Specific Absorption Rate (SAR), the amount of energy in watts that a body absorbs per kilogram in an electromagnetic radiation ^[10]. In May 2011, the World Health Organization's International Agency for Research on Cancer announced it was classifying electromagnetic radiation from mobile phones and other sources as "possibly carcinogenic to humans" and advised the public to adopt safety measures to reduce exposure [11, 12]. Awareness of the people about the possible harms of EMR on human health should be measured. Therefore, there is a need to have scale to help us to measure that. In the current study the researchers developed scale to measure electromagnetic pollution awareness of people in Basra. This scale will help us to exhibit concerns about possible effects of EMR on human health.

Method

A cross sectional study of 542 people, age 18-65 years, from Basra. They were selected randomly and interview questionnaires were used to collect data, from Nov 2012 to June 2013.

The data was collected with Electromagnetic Pollution Awareness Scale which was developed by the researchers, has 20 Likert type items rated on a five point scale: strongly disagree, disagree, neutral, agree, and strongly agree^[13]. These responses were coded as 1, 2, 3, 4, and 5, respectively. The minimum score 10 and the maximum score 50 for each part.

In order to write the items, the first step was to review the related literature. With the help of the results of the studies, the researchers developed 45 items that aim to measure electromagnetic pollution awareness.

The draft version of the Scale was provided to five experts that has PhD in science, education and related fields. In addition to these five experts, the items were checked by a language expert to ensure the correctness of its grammatical structure. After getting the expert opinions, the items were revised and administered to 80 people this step helped us to see if the items were understood. Moreover. readability. and semantic structure of the items were also checked with the help of this implementation. After all the revisions, the scale which has two subdimensions: perception of EMR effects and knowledge about EMR was administered to the sample.

The data collected from this sample was analyzed. Descriptive statistics (mean and stander deviation SD) were calculated. Moreover, in order to determine relationships between total score and scores of the sub-dimensions, Pearson correlation coefficients were calculated. All of the correlations are large and positive. One way ANOVA (analysis of variance) was applied to comparison the mean scores among the study groups and whether there are any differences in perception and knowledge scores among age, gender and education groups^[14].

Results

The results for aggregate perception variables showed the respondents scored mean of 30.35(SD3.36), while the respondents recorded a mean of knowledge score 30.20(SD3.82)

The results in Table (1) showed that there was a significant difference responding to perception of EMR effect score and knowledge about EMR score among the five level of age groups (p = 0.0001 and 0.001) respectively.

There was a statically significant difference at the p<0.05 level in perception score between males and females, but there is no significant difference between them with regard to knowledge score.

The results also show that there is no significant difference with regard to perception and knowledge scores for the three education levels.

Variable		Perception	of EMF	effect	Knowledge about EMF effect		
		Mean (SD)*	F	Sig**	Mean (SD)*	F	Sig**
Age	18-29	29.0(4.52)	3.601	0.0001	28.4(4.54)	2.352	0.001
	30-39	30.66(2.64)			30.93(3.20)		
	40-49	31.15(2.65)			30.97(3.03)		
	50-59	30.94(2.41)			30.85(3.30)		
	>60	30.92(2.39)			30.07(3.60)		
Gender	Male	30.95(3.26)	1.984	0.008	30.15(4.02)	0.906	0.587
	Female	29.97(3.41)			30.05(3.63)		
Level of	Master &Doctorate	31.05(2.45)	1.217	0.238	30.85(3.42)	1.123	0.317
education	Secondary& Parchment	30.29(3.29)			30.35(3.27)		
	Illiterate, Primary &	30.08(3.66)			29.85(4.20)		
	Intermediate						

Table 1: Statistical tests of respondents among age, gender level of education groups

*SD: stander deviation

**level of significance (p < 0.05)

Discussion

There is clearly an important difference between perception and awareness. Perception is the minds way of understanding events, which differs for each individual and is being influenced by many factors. while awareness is a condition of being alert and cognizant of one's surroundings and external phenomena, as well as one's personal state.^[15]

One of the very important factors that influence people awareness of risk is voluntariness. As early as in 1969,it was found that people are willing to take a thousand times bigger risks on voluntary base compared to involuntary risks^[16].EMR exposure can be both a voluntary and involuntary : mobile phone in most cases are used on a voluntary base, whereas exposure to base stations generally will be involuntary

In addition, people accept higher risk levels when the risk is seen as unknown to those exposed or unknown to science. The way lay people perceive risks therefore is determined by two main factors: the first is an emotional or affective factor. The other factor deals with uncertainty.^[17]

One other complication factor is trust, which enhances the perceived benefit, thus affecting the correlation between perceived risks and perceived benefit .In the study by Siegrist and colleagues, trust in the government decreased the perceived risk^[18]

A significant difference among five age groups was found, the age group (40-49) has the higher mean in both scores (31.15 and 30.97 respectively). These finding agree with finding of Hutter et al study in Austria, rating of health risks of mobile phones and cell towers showed correlation with age with higher ratings in older subjects. Whether this reflects a more pessimistic attitude with increasing age or a cohort effect cannot be decided ^[19].

A significant difference between genders in perception score was found and males has higher mean than females (30.95 and 29.97 respectively). Although there is no significant difference between genders in knowledge score, the mean of knowledge score were higher in males than females (30.15 and 30.05 respectively).

In Basra, like many other cities in developing countries, women face a number of problems due to their identity. The level of awareness of female is lower than male may be due to male respondent 's privileged position in getting different opportunities like good education, exposure to mass media , and learning any new concepts and ideas. This lower level of awareness of the women is an issue of concern as they constitute 50% of the country's total population.

Although there is no significant difference among three education levels, the mean of overall perception and knowledge scores in doctorate and master degree was high (31.05 and 30.85 respectively). People who are studying in high level of education (doctorate and master degree), because of their age and their level of education, there chance to learn more is great. In Parthaje etal study found the awareness towards health utilities of mobile phones among college going students in Mangalore, India were high and they concluded that Specific utility and training regarding mobile applicability Health need to be initiated for students across all the disciplines [20]

Conclusion

Exploring the various dimensions of awareness and perception variables about EMR effect in Basra community showed low level of awareness and perception although some differences according to the age and gender is found. There was a significant difference responding to perception of EMR effect score and knowledge about EMR score among the five level of age groups and there was a statically significant difference at the p<0.05 level in perception score between males and females, but there is no significant difference between them with regard to knowledge score

Recommendation

The general public interviewed in this study reflects the need for increase the effort to enhance public awareness and perception toward EMR.

References

- Sandstrom M. Eectromagnetic fields in offices. International Journal of Occupational safety and Ergonomics (JOSE) 2006; 12, 2:137-147
- 2. Martin C. &Sutton Practical radiation protection in health care. Oxford University Press, 2002; 3, 11,369-391.
- 3. Moulder J .Power-frequency fields and cancer.Crit Rev Biomed Eng .1998; 26:1-116.
- 4. Rochalska M. The influence of electromagnetic fields on flora and fauna. Med Pr.2009; 60(1):43-50.
- Qin F, Zhang J, Cao H. "Effects of 1800-MHz radiofrequency fields on circadian rhythm of plasma melatonin and testosterone in male rats," Journal of Toxicology and Environmental Health, Part A, vol. 75, no. 18, pp. 1120–1128, 2012
- Kesari K, Kumar S, Behari J, "900-MHz microwave radiation promotes oxidation in rat brain," Electromagnetic Biology and Medicine, vol. 30, no. 4, pp. 219– 234, 2011
- Dyche J, Anch M, Fogler, Barnett D, Thomas C, "Effects of power frequency electromagnetic fields on melatonin and sleep in the rat," Emerging Health Threats Journal, Article ID 10904, pp. 1– 8, 2012.
- Agarwal A, Singh A, Hamada A, Kesari K. Cell phones and male infertility: a review of recent innovations in technology and consequences. Int Braz J Urol. 2011;37:432–54.
- Bodera P, Stankiewicz W, Antkowiak B,Paluch M,Kieliszex J, Sobiech J, Niemcewicz M. Influence of electromagnetic field (1800 MHz) on lipid peroxidation in brain, blood, liver and kidney in rats. Int J Occup Med Environ Health. 2015; 28(4):751-9.
- 10. Vecchia P.Exposureof human to electromagnetic fields, standards and

regulations. ANN IST SUPER SANITA .2007; 43(3):260-267.

- 11. WHO .Electromagnetic fields and public health: mobile phones .Fact sheet N 193 .June2011WWW.Who.int/entity/mediac entre/factsheets/fs193/en/-33k.
- 12. World Health Organization, IARC Classifies Radiofrequency Electromagnetic Fields as Possibly Carcinogenic to Humans, International Agency for Research Cancer, Lyon, France, 2011
- 13. Jamieson S. likertScales: How to (Ab) Use Them. Medical Education. 2004; 38:1217-1218.
- 14. Gonzalez L.Manly J.Analysis of variance by randomization with small data sets.Environmetrics 1998; 9:53-65.
- 15. Siegrist M, Keller C, Kiers H. A new look at the psychometric paradigm of perception of hazards. Risk Anal 2005c; 25:211-222.
- 16. Starr C.Social benefit versus technological risk. Science 1969; 165:1232-1238.
- 17. MacGregor D., Fleming R.Risk perception and symptom reporting. Risk Anal 1996; 16:773-783.
- Siegrist M,Earle T,Gutscher H,Keller C.Perception of mobile phone and base station risks. Risk Anal 2005b; 25:1253-1264.
- Hutter H, Moshammer H, Wallner P, Kundi M.Puplic perception of risk concerning celltowers and mobile phones.Soz-Praventivmed.2004;49:62-66.
- 20. Prasanna M, Bhaskaran U, Rekha T, Nithin K, Elizabeth J, Elina G, Prajwal P, Vaman K, Ramesh H, Bhagwan B, Darshan, A, Rohil M, Ratna J. Perceptions and knowledge toward mobile-health among the college going students in Coastal South India. J Nat Sci Biol Med. 2016 Jan-Jun; 7(1): 75–79.

The Effect of Noise, Heat Stress and Efficiency of Safety Performance on Workers' Safety in Small Metal Workshops

Mahmoud Fathy El-Sharkawy University of Dammam, Kingdom of Saudi Arabia

Introduction

Work environment is a very important factor to ensure workers' health and safety and to productivity, product quality, improve economic gains and overall quality of the worker's life and society. (1) Work environment is generally characterized with the presence of different types of chemical, physical, biological and psychosocial hazards, depending on type and magnitude of the industry. Most of these hazards can adversely affect worker's health and wellbeing. ⁽²⁾ Workshops employing more than 10 and less than 50 workers are called small workshops.⁽³⁾ In most countries, particularly in developing countries, small workshops represent a major sector for economic investment with a lot of benefits to workers and the country as a whole. ⁽⁴⁾ On the other most of small workshops hand. are characterized by higher injury risk than large industries. ⁽⁵⁾ In comparison to large industries, small workshops are usually characterized by limited resources - both financially and on the management side, low background of education employees. ignorance of work safety awareness, inadequate input in work safety, and difficulties in complying with legislation. ^(6,7) It was reported that the injury accidents and deaths caused by safety accidents of small workshops are 60% and 70% respectively, particularly in small metal workshops. (8,9) Small workshops constitute a major challenge for the society's effort to improve occupational health and safety. This article was aiming to assess noise and heat stress levels, evaluate safety performance in the workplaces of different types of small metal workshops and study their effects on the worker's safety and health.

Materials and Methods

Four different types of small metal workshops were selected for this study foundries, metal processing, included aluminum processing and car repairing. From each type, five workshops were selected in Alexandria, Egypt. Selection of these twenty workshops was based on several considerations such as presence of more than one exposure or occupational hazards, particularly noise and heat stress (subject of the study), severity and degree of the worker's exposures to these hazards, higher number of workers exposed to these hazards and acceptance of the workshop owner to conduct this study.

Levels of noise and heat stress were assessed inside all the selected workshops during the summer months of the year 2014. Inside each workshop, both levels of noise and heat stress were simultaneously assessed basically near the source and at most other far places. Monitoring of these hazards was carried out at different time of the day, concerning the maximum workload. The monitoring was also conducted at different days of the week. except the weekend. According to the American Conference of Governmental (10) Industrial Hygienists (ACGIH) Occupational Safety & Health Administration (OSHA) (11), and National Institute for Occupational Safety and Health ⁽¹²⁾, the Wet Bulb Globe (NIOSH) Temperature (WBGT) is used to evaluate the hot environment. The area noise levels were monitored during this study by using the

calibrated TES 1352A Sound Level Meter, TES Electrical Electronic Corp. Levels of the steady noise were assessed representing the 8-hour time-weighted average (TWA) values as recommended by NIOSH. ⁽¹³⁾

Efficiency of the safety performance inside each selected workshop were evaluated by a prepared questionnaire including several items such as safety procedures at the work personal using of place. protective equipment, safety performance and presence of safety data sheets for each material in the workshop. Levels of the safety performance in each work place of the selected 20 workshops were evaluated as total score of corresponding questionnaire the after evaluating each single safety item by the point system. In the same prepared safety performance questionnaire, the total number, cause and type of accidents that occurred in the workplace of each workshop during the previous year, were collected from the records of the workshop if present or from the direct questions to owner and workers of the workshop.

Results and Discussion

Figure (1) represents mean levels of noise in Decibel (dB) inside the selected four types of small metal workshops, compared with the Threshold Limit Value (TLV) for noise. Statistically, using the One - Way ANOVA test, showed that there was a very strong statistically significant difference (p < 0.001) for levels of noise between metal and aluminum processing workshops from one side and the other two workshops from the other side, while there was no significant difference (p > 0.05) between noise levels in metal and aluminum processing workshops. In addition, mean levels of noise in the workplaces of all selected workshops were higher than the NIOSH time weighted average (TWA) 85 dBA which is recommended for an 8-hr work shift.



Figure (1): Mean levels of noise in workplaces of the selected metal workshops

The mean levels of heat stress that were assessed in WBGT °C are illustrated in figure (2). The ACGIH has set out limits for heat stress in the workplace (in °C WBGT) applying to the relationship between working and rest periods as shown in table (1).



Figure (2): Mean levels of heat stress inside the four selected metal workshops

The acclimatized worker in the table means person who has been previously exposed to hot conditions and display tolerance to working in the heat. In contrary, the unacclimatized worker is the person who has not previously been exposed to work in hot conditions and must be given time to acclimatize to work in the hot environment. ⁽¹⁴⁾ In all our studied workshops, the working shift started from 8.0 am to 5.0 pm including two-hour rest period, from 12.0 am to 2.0 pm. The net working period is about 75% of the total work shift in a heavy to very heavy work load. This means that levels of heat stress inside foundries were higher than the recommended values for all types of workers. Statistically, levels of heat stress in the workplace of foundries were the highest with strong statistical significant difference (p < 0.005) when compared with the other three workshops.

Allocation of work in	TLV (acclimatized)				Action limit (unacclimatized)			
a cycle of work and recovery	Ligh t	Moderat e	Heav y	Very Heav y	Ligh t	Moderat e	Heav y	Very Heav y
100% Work	31.0	28.0			28.0	25.0		
75% Work	31.0	29.0	27.5		28.5	26.0	24.0	
50% Work	32.0	30.0	29.0	28.0	29.5	27.0	25.5	24.5
25% Work	32.5	31.5	30.5	30.0	30.0	29.0	28.0	27.0

Table 1: TLVs for heat stress set by the ACGIH in WBGT $^\circ\text{C}$

Table (2) summarizes analysis of all safety questionnaires that have been used for the studied metal workshops. It is evident that the efficiency of safety procedures inside 15 (75%) of the studied 20 workshops was bad and very bad, while the other 5 (25%) workshops had fair safety performance inside their workplaces. Of the bad workshops, 100% of foundries were characterized by the bad and very bad safety performance. Percent of accidents during one year in the workplaces of foundries, metal processing, aluminum processing and car repairing were 59.5, 54.1, 51.4 and 50 % respectively. The most common safety problems that were recorded in workplaces of the small metal workshops included very bad housekeeping, completely absence of personal protective equipments, insufficient lighting, absence of safe access or emergency exits, inappropriate fire extinguisher systems and sever weakness in awareness of workers with the workplace hazards. In addition, it was recorded that the relation between workers and the workshop owners was bad

because of the lack of social insurance, shortage in emergency or periodical medical examination and completely absence of social services or recreation activities for workers.

To study the main causes for these high percent of accidents, a Pearson statistical correlation was conducted between levels of the three studied factors (noise and heat stress levels, and efficiency of safety performance) and percent of accident inside each type of the selected metal workshop. There was a strong positive correlation (> +0.75) between percent of accidents and both of heat stress and bad safety performance with very statistical significant differences (p < 0.005), while there was a weak positive correlation (< + 0.25) with the noise levels with no statistical significant differences (p > p)0.05). These results indicated that, although the three studied factors have adverse effects on worker's safety in the small metal workshops, but heat stress and bad safety performance have the utmost effects.

Two of workshop	No. of studied	Efficiency performance		of	safety	Total	Total	Percent
Type of workshop	workshop s	Good	Fair	Bad	Very bad	workers	accidents	(%)
Foundries	5	0	0	1	4	42	25	59.5
Metal processing	5	0	1	1	3	37	20	54.1
Aluminum processing	5	0	2	1	2	35	18	51.4
Car repairing	5	0	2	1	2	38	19	50
Total	20	0	5	4	11	152	82	53.8

Table 3: Efficiency of safety performance and accident percents in the selected workshops

Conclusions

Workers in all studied small metal workshops were exposed to sever noise levels higher than the TLV values. They were also exposed to high levels of heat stress in the workplaces of most metal workshops, particularly foundries. In addition, most of the studied metal workshops have bad or very bad safety performance. Heat stress levels and bad safety performance are highly responsible for accidents and injuries inside the small workplaces, higher than noise levels. Results of this study reflect the major challenge for the society's effort to improve occupational health and safety in such type of industry.

References

- Kifle M, Engdaw D, Alemu K, Sharma HR, Senafikish Amsalu S, Feleke A, Worku W (2014). Work related injuries and associated risk factors among iron and steel industries workers in Addis Ababa, Ethiopia. Safety Science 63: 211– 216.
- 2. Mirer FE, Stellman JM (2008). Occupational Safety and Health Protections. International Encyclopedia of Public Health 658-668.
- Hasle p, Kvorning LV, Rasmussen CD, Smith LH, Flyvholm MA (2012). A model for design of tailored working environment intervention programs for small workshops. Saf Health Work 3:181-91.
- 4. Bruce TF (1990). Occupational safety and health, small-scale enterprise and employment. African Newsletters on Occupational Health and Safety.
- 5. Fabiano B, Curro F, Pastorino R (2004). A study of the relationship between occupational injuries and firm size and type in the Italian industry. Safety Science 42: 587–600.
- Hasle P, Kines P, Andersen LP (2009). Small enterprise owners' accident causation attribution and prevention. Safety Science 47: 9–19.
- Hasle P, Limborg HJ, Kallehave T, Klitgaard C, Andersen TR (2012). The working environment in small firms: responses from owner-managers.

International Small Business Journal 30: 622-39.

- Xiongjun Y, Kaiquan W (2012). Study on safety management of small and medium-sized workshops based on BBS. Procedia Engineering 45: 208 – 213.
- Hasle P, Hans L, Kallehave T, Klitgaard C, Andersen TR (2011). The working environment in small firms: Responses from owner-managers. International Small Business Journal 1–18.
- American Conference of Governmental Industrial Hygienists (ACGIH) (1996). Threshold Limit Values and Biological Exposure Indices for 1996. Cincinnati, OH.
- 11. Occupational Safety & Health Administration (OSHA) (2012). Heat stress. Minnesota Department of Labor and Industry, Occupational Safety and Health Division.
- 12. National Institute for Occupational Safety and Health (NIOSH) (1986). Criteria for a recommended standard occupational exposure to hot environments. USDHEW(NIOSH) Pub. No. 86-113.
- NIOSH (1998). Criteria for a recommended standard - occupational noise exposure. NIOSH publication No. 98-126, Cincinnati, Ohio.
- 14. ACGIH (2009). Threshold limit values for chemical substances and physical agents & biological exposure indices. Cincinnati, USA.

The Blue Port with a Shade of Green: The Case Study of Skyros Island

Antonopoulos, K. Skyros Port Fund, Greece

Valentina Plaka, Adamantini Mparmpakonstanti, Despoina Dimitriadou, and Constantina Skanavis University of the Aegean, Greece

Abstract

The focus of this paper is on the environmental image of Linaria port. It is the Port of Skyros, a Greek island, which in the last six years is established as an environmentally friendly port. The aim of this paper is to confirm this small Greek public port as a paradigmatic case in Greek reality. Through a quantitative assessment process in a sample of tourist vessels, Linaria port has been found to operate with respect for the environment, increased its tourism percentage to 975%, since 2010, and promotes responsible environmental behavior of locals and visitors. In Linaria, the Port Authority Administration has adopted an environmental and sustainable agenda. This research confirmed, that Linaria is a Greek small port, which is a casual destination for tourist vessels' vacation plans. It has a friendly and highly competitive tourist services system tailored to the needs of the leisure crafts sector.

Keywords: Sustainable, environmentally friendly port, port as an educational tool, responsible environmental behavior, maritime tourism

1. Introduction

Maritime tourism activities constitute one of the world's largest markets and it is likely to show high growth in the future. Maritime tourism in Greece began developing during the 1960s. In recent years it has evolved at a rapid pace (Diakomihalis, 2007).

Greece has more than 2.500 islands, of which only 227 are inhabited. In these islands, the appropriate use of ports is a key factor for a bursting development of Greek marine tourism (Antonopoulos et al.. 2016). Yachting in Greece is very popular among both Greeks and foreigners and seems to have an upward economic development. The existing network of marinas and shelters of tourist vessels though, needs further development and improvement. Choices of maritime touring should be provided, which in turn can offer further enjoying to the visitors as well the acquaintance with many regions of the insular and continental Greece (Diakomihalis, 2007).

The current financial crisis that began in 2009 has created the greatest financial disorders since the Great Depression of the 1930s (Melvin and Taylor, 2009). This crisis hit Greece in 2009. According to researches, 2008 was a good year for the Greek tourism, the highest tourism visits ever, and the average per capita expenditure. Nevertheless, during the next two years (2009 and 2010) the impact of economic crisis on the Greek tourism figures is evident and resulted in negative rates (Kapiki, 2012). In turbulent economic periods, like the current global economic crisis, there are though some sectors and industries. like the marine time one that show a remarkable resistance to the Sirens' calls for economic recession (Lekakou et al., 2011).

1.1. The Port of Skyros Island
In the heart of the Aegean Sea there is the island of Skyros. Its harbor, Linaria, is a small ordinary public port, which has been presented as a model one in the list of Greek marinas. Itis used for various purposes, such as passenger transportation, cargo and fishing boats (Antonopoulos et al., 2016). Since 2010, the port of Linaria has adopted an effective sustainability approach, with a wise and conservative allocation of its financial resources (Antonopoulos et al., 2015).

Consequently, the port of Linaria is reasonably attracting high tourist interest. Antonopoulos et al. (2016) characterized Linaria as an environmentally sustainable community, where small port an environmentally responsible behavior is promoted to both visitors and residents. Furthermore, а friendly and highly competitive tourist services system has been enacted tailored to the needs of leisure crafts sector. As a result, today the arrivals of yachts have boosted traffic, reaching 975%.

Linaria is regarded as a port with high visibility and praise. The last six years, this small port constantly develops innovative ideas, such as the construction of seadromes, the use of electric scooters, the PV panels, a gas station and the cooperation of the Port Authority of Skyros with the University of the Aegean's Department of Environment, resulted in attracting the interest and respect of travelers (Antonopoulos et al., 2016). The name of the above mentioned academic collaboration is "SKYROS Project". All the mentioned innovative investments have resulted that this port has become the recipient of multiple awards. The most recent world recognition has been the "People's Choice" Award in the Global Video Competition, in the United Nations Framework Convention on Climate Change in Marrakesh, Morocco, on November 2016 (COP22). Specifically the SKYROS project was the recipient of this significant recognition of excellence. Linaria port has taken actionin the battle against climate change, by promoting environmentally responsible behavior.

2. Theoretical Data

Coastal marine ecosystems are changing world-wide under the action of global and local stressors, ranging from climate change (Barange et al., 2010). Climate change is a problem of global scope, with significant consequences for coastal communities (Lieske et al, 2014). In addition, climate change, human pressures and invasive species are intertwined in their ultimate causality: ocean warming is mostly an effect the anthropogenic introduction of of greenhouse gases in the atmosphere and biological invasions are favored both by ocean warming and human activities (Stachowicz et al., 2002). Humans, a driver of change that was not present in the geological past, are modifying marine ecosystems at an unprecedented fast rate (Bianchi et al., 2012).

Sea ports can be the source of considerable impacts both on marine and land habitats. Due to their special features, sea ports are very complex systems with wide range of environmental issues: releases to water, air and soil, waste production, noise and dredging among others (Darbra, 2005).

2.1. Maritime Tourism

Maritime tourism is one of the world's largest industries of contemporary tourism, with a significant participation in the tourist economies of the countries which have developed it (Hall, 2001), and with a tendency for continuous and fast rates of development (Orams, 1999). The concept of maritime tourism, at an international level, includes the total of tourist, recreational and leisure activities which take place in the marine space of a country receiving and offering hospitality to tourists (Pallis, 2007).

According to the characteristics of the product, nautical tourism may be divided into two main subtypes: (i) yachting, relating to navigation and stay on boats and yachts regardless of the ownership of the vessel, on which navigation is usually done in a company of friends or family. (ii) cruising, which is in some ways a similar product, but performed on larger vessel-cruisers, with professional crew and passengers who have not met before(Horak,2013). Finally, regarding the economic impact of yachting tourism, available studies agree that this form of tourism activity is beneficial for the respective economies. (Mikulić et all ,2015).

2.2. Port Policy

Human activities in the world's oceans and coasts are at an unprecedented scale and expanding rapidly. Some have described this as the colonization of the oceans, one phase in the wider history of world industrialization (Stojanovic and Farmer, 2013). So, shipping needs a global regulatory framework, because marine and coastal environments are threatened assets of global tourism, by maritime tourism (Kathijiotes, 2009).

In recent years, the European Union's (EU) marine and maritime polices have developed (Suris-Regueiro considerably et al.. 2013).Blue Growth is the long term strategy to support sustainable growth in the marine and maritime sectors as a whole(E.C., 2012). Seas and oceans are drivers for the European economy and have great potential for innovation and growth. It is the maritime contribution to achieving the goals of the Europe 2020 strategy for smart, sustainable and inclusive growth (E.C., 2012). Blue activities (e.g., growth shipping) are supported by ecosystems, but many others are also, especially fisheries, aquaculture, tourism, and biotechnology. The ecosystem service approach seems to be the most suitable way to show the connection between costal/ maritime human activities and the environment, and consequently, it is an effective methodological framework to analyze Blue Growth. (Mulazzani et.al., 2016)

Furthermore, the environmental impacts of yachting tourism are certainly the most controversial and most debated topics in this area of marine research. On the one hand, several authors argue that small and recreational vessels exert a significant pressure on the delicate ecological balance of maritime habitats (Davenport and Davenport, 2006). On the other hand, it is acknowledged also that small and recreational vessels do not have a significant influence on the environment, especially when they are considered in the context of environmental impacts of large cruise ships. However, it is also noteworthy that maritime and coastal tourism activities are generally considered to impact the environment in a negative way, even in spite of a lack of reliable data to support this view (Hall, 2001).

3. Research and Result

This research project is based on a case study approach. Through a quantitative assessment process, this paper aims to assess some answers about the sustainable development that takes place in the small port in Skyros, Linaria. This study was based on a previous research in the island of Chios about cruise shipping (Lekakou et al., 2011).

This research project started in summer of 2015, in Linaria, in a cooperation of Skyros Port Fund and University of the Aegean. The actual research was conducted between July and August 2016 on a sample of 129 tourist vessels that berthed in the port. A questionnaire was created and separated into two parts:

- Part A : Tourist's Profile
- Part B: Information on their staying at Linaria port

The initial aim of the research was to investigate:

- What attracts maritime tourists in Linaria port and why they prefer itover other ports?
- Is Linaria port a stop over for them or their final destination?
- Can a port serve as an environmental educational vehicle?

3.1. Tourist's Profile

First of all, tourists were asked to complete some of their demographic information. So, in the first question their gender was recorded, with 80% of them being men, and 20% women. The second question of this part was about the age range of the tourists. So, 25% belonged to the"46-55" age group, and same percent to the "56-65" age group. Other age groups: 18% in the "66+", 17% in the "36-45", 10% in the "26-35" and 5% in the "18-25" age group. Also, they were asked about their nationality, with 39% were Greek citizens and 61% came from other countries.

As far as the level of education is concerned, 85% of the tourists belonged to the higher level of education, 11% to the secondary and 4% to the primary. The final question was about the tourists' income. A 23% had "20,001 \in -40,000 \in " income range, 17% had 10,001 \in -20,000 \in , 15% had 80,001 \in -100,000 \in , 11% had more than150,000 \in , 10% had 60,001 \in -80,000 \in , 7% had 120,001 \in -150,000 \in , 6% had up to 10.000 \in and 2% had 100,001 \in -120,000 \in .

The participants were asked if they hold a skipper diploma. A 59% had a sailing certificate, 13% had a powerboat certificate, 12% had no certificate and 16% had both sailing and powerboat certificates. Then, in question "Are you a vessel/yacht/speedboat owner", a 62% answered yes and a 38% no. A 56% of the tourists that visited Skyros island and its port Linaria used a private vessel/yacht/speedboat for their holiday more than once a year, 20% of them once a year, 2% once every 10 years, 1% once every 2 years, 1% once every 5 years. Finally, 10% were owners and 10% didn't use a private vessel/yacht/speedboat.Also, in the question "what kind of vessel do they normally use for their holiday" a 46% of them responded bareboat, a 35% sailboat with a skipper, a 15% speedboat, a 2% mega yacht and a 2% motorsailer.

The majority of the participants spent more than 7 days on average on sailing (84%), a 13% spent 4-7 days, a 2% 2-3 days and 1% had a day trip.Furthermore, a 53% of the participants visited 4 to 7 ports during their yacht holidays.A 22% visited more than 10 ports during their vacation period, a15% visited 8 to 10 ports, a 10% a number of 2 to 3 ports.

When they were asked "What kind of destinations do you usually select for your holiday?", a 40% answered that they choose port of embarkation and ports of islands. A 32% responded for port of embarkation in large islands and ports in smaller islands, a 13% for port of embarkation in major cities and ports in smaller destinations and a 15 % stated other reasons. For the 75% of the participants, sailing was part of the touristic activity/experience.Many of them believed that it's a way of life, as they claimed that "sailing was a way of living", "a life experience", "school of life", "a way of life, it's our home", etc. Also, an 18% claimed that sailing was something different for them and 7% a way of travellingfrom place to place.

In asking how important was for the participants the existence of specific services such as port services (water, electricity, Wi-Fi, laundry, fuel etc),a 47% answered very important, a 34% important, a 13% moderately and a 5% stated that it had little value. The security aspect, for a 53% of the participants was very important, for a 23% important, for a 15 % of moderate importance, for an 8% of little and for a 1% of no importance. Affordable mooring costs, for a 39% were very important, for a 36% important, for a 19% of moderate significance, for a 5% of little and for a 1 % for no importance.Fast services from port and customs' authorities, such as support while submitting a charter party and/or supplementary documents, for a 40% of the participants was a very important aspect, for a 37% important, for a 16% of moderate importance, for a 4% of little significance and for a 3% of not at all. Technical support, such as shipyard, chandlery shops, found a 23% of participants to rate it as very important, a 37% as important, a 25% as of moderate importance, a 12% of little and a 3% of not at all. Specifically, the above data are elaborated in Figure 1.



Figure 18: The importance of the existence of services in Linaria Port

Also, port connections with mainland (frequent ferry and air connections), were for a 13% of respondents a very important part, for an 18% important, for a 28% of moderate significance, for a 24% of little and for a 17% of not at all. Accommodation services (hotel's availability near the port), found a 6% responding that was a very important consideration, for a 9% an important, for a 23% of moderate significance, for a 17% of little and for a 45% of not at all.Food services(restaurants, pubs, fast food etc) were for a 28% very important, for a 42%

important, for a 23% of moderate significance, for a 5% of little and for a 2% for not at all. Transport services for the hinterland/rest of the island (availability of public transport, car rentals etc), for a 20% was very important, for a 34% important, for a 31% of moderate importance, for a 13% of little and for a 2% of not at all.At the end, information services (tourism offices, printed press outlets, etc), were for 17% very important, for 34% important, for 30% a little, for 15% a little and for 4% not at all (Figure 2).



Last but not least, this study aimed to assess how important to them were any additional tourism services in the areas they visit. A 16% answered very important, a 31% important, a 34% of moderate importance, a 12% of a little and a 7% of not at all.

3.2. Stay in Linaria Port

In the second part of the questionnaire, the first question asked if "Is this the first time you visit the island?". A 68% answered yes, and a 32% no. A92% stated that during their visit in Skyros, they berth in Linaria port, a 3% that they berth in Acherounes beach, a 2% in Skyropoula island, a 1% in Kalamitsa, a 1% in Ormos and a 1% in Pefkos.

The majority of the tourists visiting Skyros island, made 2 overnights (45%) and a 21% of them stayed just for 1 night in the island and with a 12% for a 4 nights stay and with an 11% for a 3 overnights. Other answers were a 4% for six overnights, a 3% for 5 overnights and with a percentage of 1% for 7-11 overnights. In the question "During your stay in Skyros, did you stay on board or in a land accommodation?" a 98% stated that

they preferred to stay in their vessel and a 2% in land accommodations.

The tourists were asked to assess the facilities and amenities of the port/marina. So, as far as security is concerned, a 52% of them answered that the security is of high level, of satisfactory range was for the 38%, and for the 9% of moderate satisfaction and for the 1% unsatisfactory. As for the water services, a 67% of the tourists assessed them as high level, a 26% satisfactory, a 5% moderate and a 2% unsatisfactory. A 73% stated that the electricity services were of a high level, a 23% that they're satisfactory and a 4% that they were moderate. For the logistics, a 58% stated that they're of a high level.a 33% stated that they were satisfactory and for a 9% were moderate.

The cost of berth was commented as satisfactory from the majority of the tourists. A 49% found them very highly satisfactory, a 40% of high level, a 10% of moderate and a 1% unsatisfactory. For the Service of Customs' Authorities, a 68% found it of high level, a 27% satisfactory, a 4% moderate and a 1% unsatisfactory.

Figure 20: Tourists' assessment of facilities and amenities of the port/marina



Figure 21: Tourist's assessment of facilities and amenities of the port/marina



Also, the Service of Port Authority was commented as high level by the 74% of them, from a 20% as satisfactory, from a 5% as moderate and from a 1% as unsatisfactory. For the Port facilities, a 67% found them as of high level, a 28% as satisfactory and a 5% as moderate. For the related Technical services, a 47% found them as of high level, a 36% as satisfactory, an 8% as moderate, a 6% as unsatisfactory and a 3% as bad. Accessibility/ transportation (on the island), for a 50% was satisfactory, for a 38% of high level, for an 8% as moderate, for a 2% as unsatisfactory and for a 2% as bad. Information services, for a 63% was considered as of high level, for a 28% as satisfactory, for a 7% as moderate, for a 1% as unsatisfactory and for a 1% as of bad quality. The Environmental status, for a 66% was of high level, for a 27% as satisfactory, for a 6% as moderate and for a 1% unsatisfactory (Figure 3, 4). Also, tourists were asked to express their satisfaction about the tourist product and Skyros' Island services. So, as far as the quality of services in the port area is concerned, a 75% answered were excellent, a 15% as very good, a 7% as good and a 3% as satisfactory. As for the quality vs. service

value in the port, a 54% stated that it was excellent, a 29% as very good, an 11% as good, a 4% as satisfactory and only a 2% that it was of poor rating. Quality services in the destination were found very good by the 38% of the tourists, a 29% rated them as good, a 27% as excellent and a 6% as satisfactory.



Figure 23: Tourist satisfaction



Quality vs. price of service (except the ones related to port) it was commented by a 34% as of very good level, by a 30% as of excellent, by a 26% as good and by a 10% as satisfactory. As for the sightseeing, tourists found it very good (38%), a 33% found it excellent, a 21% rated it as good, a 5% as satisfactory and a 3% as poor. Access to attractions was found good by 37% of them good, a 32% found it very good, a 16% as excellent, an 8% as satisfactory and a 7% as poor. And as far as Beaches are concerned, a 51% found them very good, a 20% as excellent, a 20% as good, a 5% as satisfactory and a 4% as poor. In general, the total touristic product was assessed as very good by a 50% of the participants, by a 28% as excellent, by a 15% as good and by a 7% as satisfactory (Figure 5, 6).

In the question "Did you stay satisfied with the overall services offered", a 56% of the tourists answered very much, a 37% as very and a 7% as moderately satisfied. The final question of this part was "Will you return to Skyros" and an 84% of the tourists answered "yes, with a yacht", a 14% "yes, without a yacht" and only a 2% answered "no".

4. The Paradigmatic Case in Greece

Maritime tourism is one of the world's largest industries of contemporary tourism (Hall, 2001). Greece has more coastline than any other European or Mediterranean country (Brebbia and Beriatos, 2011). Especially in Greek islands, the appropriate use of ports is a key factor for a bursting development of the Greek marine tourism (Antonopoulos et al., 2016). But the Greek coastal shipping identifies the absence of a systemic approach that would take into account all the constituent parts of coastal transport and act the driving force towards as the modernization of coastal shipping services (Lekakou, 2007).

In some cases, the port authorities undertake the promotion of the destination, whilst marketing activities are diversified, and depended on the type of the port model (Di Vaio and Pisano, 2011). In Linaria, the port authority has adopted an environmental and sustainable promoting agenda. So, the last six years, using the limited financial resources, Linaria port has been characterized as a model one in the list of "marinas" and "small ports" category and has attracted high tourist interest and respect of travelers (Antonopoulos et al., 2016).

To describe the profile of a maritime tourist, who visited the island of Skyros, according to the highest percentages of the answers given by the questionnaires it would conclude to the following:

The tourist would be a man, between the age of 46 to 65, with a higher education level, he is not Greek and with an income of 20,001- $40,000 \in$. As with most industries, the hospitality and tourism sector is experiencing numerous challenges as a result of the global economic crisis (Kapiki, 2012).

Also, the profiled tourist by this study would be one who hold a sailing certificate and is a yacht owner. He would use his private yacht more than once per year and this would be a bareboat. He would spend more than 7 days sailing and during his holidays he would usually visit four up to seven ports, one of them would be Linaria. He would select ports of embarkation and ports of islands for his holidays, and would think that sailing is part of the touristic activity and experience. Such visitors assert pressure on the establishment of green technologies and practices in the ports they choose to spend time and money (Antonopoulos et al., 2016). The fact that they preferred to live in Skyros is notable. The charter yacht tourists are free to stop over at any of the handful of marinas or to spend an entire week anchored in some secluded and deserted covesand these crafts act on an individual basis as "hoteling" and have significant demands systems related to customized services. (Antonopoulos et al., 2016).So, this type of visitor/tourist assessed the accommodation services near the port as not important at all.

In 2009 and 2010 the impact of economic crisis on the Greek tourism figures is evident and resulted in negative growth rates (Kapiki, 2012). However, since then, tourism has increased for Linaria port by 975%. In turbulent economic periods, like the current global economic crisis, there are some economic sectors and industries that show a remarkable resistance to the scary signs of economic recession. Maritime tourism is an example. In this research, it is pointed out that an average visitor is a returning to the island one, and wants to berth in Linaria port. At least two overnight stays characterize the average tourist's visit to Skyros Island and rather stay on board. Therefore, Linaria is a destination. The main reasons a visit to Skyros Island would be sailing, the sun and the sea, water and electricity supply, level of port facilities and the existence of suitable port infrastructure.

Linaria is famous for its innovative of the approaches Port Authority Administration. The port services are considered by the results of this survey as very important. The beautiful and clean landscape is connected with contemporary service facilities, LED underwater lights, the lending outdoors library, the laundry facility, the gas station and many other services that respect and serve citizens and tourists, make Linaria port as the most convenient, innovative and promising Greek port (Antonopoulos, et al., 2015). The port Bunkering is an activity carried out in all types of ports, from economic point of view, it is more difficult for small ports to develop the infrastructure needed to supply fuels to vessels than for big ports (Puig, 2015) and Linaria is the first Greek small port which has managed it. Also, participants at this research pointed out that they assess the facilities offered by Linaria port as high quality ones in aspects as: security, water provision, supply, logistics, bearable cost of berth, service of customs authorities, service of port authorities, port facilities, technical services, satisfactory transportation on the island, information services and finally the environmental status is perceived of high standards. Linaria, being a small port, has impressed a large number of leisure crafts owners. Visitors in general have been lured by this "boutique" port's unique services (Antonopoulos et al., 2016).

He would express his satisfaction about the touristic product and the services provided as: excellent at the port and very good at the rest of the island. Also, he would assess the sights, access to attractions, beaches and the touristic product in general as very good. As to whether he stayed satisfied with the overall services offered, he would answer very much and he would definitely return to Skyros islandin a yacht.

5. Conclusions

This research confirmed that Linaria is a Greek small port, which is a destination for tourist vessels vacation and it has friendly and highly competitive tourist service systems and has been tailored to the needs of the leisure crafts sector. As a result, Linaria highly attracts tourists' interest and respect of travelers and today the arrivals of yachts have boosted traffic, like the reaching to 975% indicates.

Johnson (2002) mentions that the tourism industry has in it, the seeds of selfdestruction and can potentially lead to the downgrading of the environment at destination and ultimately affect the experiences of the visitors. Linaria's Port authority adopted a green behavior and tries to respect marine, coastal environment, the community of the port without jeopardizing the economic development.

It provides innovative solutions such as PV panels, electric scooters, seadromes, gas station, laundry and has cooperated with the University of the Aegean's Department of Environment. This golden cooperation has been awarded with many national and international awards and is concerned to be an innovative partnership project in which two Greek public organizations, due to their excellence, act as an example of replication. So, Linaria is characterized as an environmentally sustainable small port community, (Antonopoulos et al., 2016). When a port respects the environment and promotes a sustainable lifestyle then tourism rates increase. Delivered at the port innovative environmental education projects can promote environmentally responsible behavior for both visitors and residents. Also, this port can be used as a learning environment in researching methods that can promote sustainable development in the tourism sector.

Acknowledgements

This study was made possible, thanks to the support from Maria Lekakou and Ioannis Spilanis, professors at the University of the Aegean.

References

Antonopoulos, K., Plaka, V. & Skanavis, C., 2016. Linaria port, Skyros: An environmentally friendly port community for leisure crafts, Proceedings of the 13th International Conference on Protection and Restoration of the Environment (pp. 1054-1062). Greece: Mykonos island.

Antonopoulos, K., Skanavis, C. & Plaka, V., 2015. Exploiting futher potential of Linaria Port-Skyros: From vision to realization, Proceedings of the 1st Hellenic Conference on Tourist Port (pp. 101-111), Marinas, Greece: Athens.

Barange, M., Field, J.G., Harris, R.P., Hofmann, E.E., Perry, R.I. et al. 2010. Marine ecosystems and global changes, Oxford University Press, New York, pp.412.

Bianchi, C.N., Morri, C., Chiantore, M., Montefalcone, M., Parravicini, V. et al., 2012. Mediterranean Sea biodiversity between the legacy from the past and a future of change, in Stambler, N. (Ed.), Life in the Mediterranean Sea: a look at habitat changes, Nova Science Publishers, New York, pp.1-55.

Brebbia, C.A. and Beriatos, E. 2011. Sustainable Development and Planning V, WIT Press, United Kingdom.

Darbra, R.M., et. Al. 2005. 'A procedure of identifying significant environmental aspects in the sea ports', Marine Pollution Bulletin, Vol 50, pp. 866-874.

Davenport, J., and Davenport, J. 2006. 'The impact of tourism and personal leisure transport on coastal environments: A review. Estuarine', Coastal and Shelf Science, Vol 67 No. 1–2, pp. 280–292.

Di Vaio, A. and Pisano, S. 2011. The role of information systems in the port authority's promotion activities, in D'Atri, A., Te'eni, D. and De Marco, M. (Ed.), Information systems: A crossroads for organization, management, accounting and engineering, itAIS: The Italian Association for Information Systems, Springer. Diakomihalis, M.N. 2007. 'Greek Maritime Tourism: Evolution, Structures and Prospects. Research in Transportation Economics', Vol 21, pp. 419-455.

European Commission (E.C.). 2012. Communication From the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Blue Growth opportunities for marine and maritime sustainable growth, Brussels.

Hall, M. 2001. 'Trends in ocean and coastal tourism: The end of the last frontier?', Ocean and Coastal Management, Vol 44 No, 9–10, pp. 601–648.

Horak, S. 2013. Demand for nautical tourism in Europe, in Luković, T. (Ed.), Nautical tourism, Boston, pp. 159–185.

Johnson, D. 2002. 'Environmental sustainable cruise tourism: A reality check', Marine Policy, Vol 24 No. 4, pp. 261-270.

Kapiki, S. 2012. The Impact of Economic Crisis on Tourism and Hospitality: Results from a Study in Greece, General European Review of Economics and Finance, Vol 2 No.1, pp.19-30.

Kathijiotes, N., 2009. Protection of Coastal Cities - preview of the EU policy as applied to the Mediterranean Coast of Cyprus, IHAR-American Society of Civil Engineers Congress, Vancouver.

Lekakou, M., Stefanidaki, E. & Vaggelas, G. 2011. The economic impact of cruise to local economies. The case of an island, Proceedings of the Athens Tourism Symposium, Athens.

Lekakou, M. B. 2007. The eternal Conundrum of Greek Coastal Shipping, in Pallis, A.A. (Ed.), Maritime Transport: The Greek Paradigm Research in Transportation Economics Series, No. 21, Elsevier, London.

Lieske, J.L. and Wade, T. 2014. 'Climate change awareness and strategies for communicate', Estuarine, Coastal and Shelf Science, Vol 140, pp. 83-94.

Melvin, M. and Taylor, P.M. 2009. 'The global financial crisis: Causes, threats and opportunities. Introduction and overview', Journal of International Money and Finance, Elsevier, Vol 28, pp.1243-1245.

Mikulić J., Krešić D. and Kožić I. 2015. 'Critical Factors of the Maritime Yachting Tourism Experience: An Impact-Asymmetry Analysis of Principal Components', Journal of Travel & Tourism Marketing, Vol 32, pp. 30-41.

Mulazzani, L., Trevisi, R., Manrique, R. and Malorgio, G. 2016. 'Blue Growth and the relationship between ecosystem services and human activities: The Salento artisanal fisheries case study', Ocean & Coastal Management, Vol 134, pp.120-128.

Orams, M. 1999. Marine tourism: Development, impacts and management. Routledge, London.

Pallis, A.A. 2007. Maritime Transport: The Greek Paradigm. Elsevier, London.

Puig M., Wooldridge C., Michail A. and Darbra R. M. 2015. 'Current status and trends of the environmental performance in European ports', Environmental Science & Policy, Vol 48, pp. 57-66.

Stachowicz, J.J., Terwin, J.R., Whitlatch, R.B. & Osman, R.W. 2002. Linking climate change and biological invasions: ocean warming facilitates non-indigenous species invasions, Proceedings of the National Academy of Sciences of the USA, Vol 99, No. 24, pp.15497-15500.

Stojanovic, T.A., Farmer, C. 2013. 'The development of world oceans & coasts and concepts of sustainability.' Mar. Policy, vol. 42, pp.157-165.

Surís-Regueiro, J.C., Garza-Gil, M.D. & Varela-Lafuente, M.M. 2013. 'Marine economy: A proposal for its definition in the european union.' Marine Policy, Vol 42, pp. 111-124.

Ecotourism as an Educating Tool for Encouraging Sustainable Development: The Case of Skyros Island

L Constantina Skanavis and Aristea Kounani University of the Aegean, Greece

Abstract

The environmental problems facing the world today, including water contamination and depletion, global warming, climate change, pollution, wastes air and deforestation, stem mainly from the behaviors of individuals and societies. Environmentally responsible behavior is a characteristic of individuals who are knowledgeable and concerned about the environment and will therefore engage in a behavior that won't cause harm to the environment. Museums. science centers. zoos, aquariums, botanic gardens and environmental centers as well as eco- and wildlife tourism experiences have the potential to inspire, educate and influence large numbers of visitors in relation to their environmental behavior. These experiences, if well planned, can encourage and support visitors ' awareness and adoption of environmentally sustainable behaviors.

tourism industry is increasingly The adopting a conservation-based ethic that recognizes its dependence upon the natural environment and seeks ways to minimize related environmental consequences. Ecotourism is a form of tourism that promotes sustainable development and longterm preservation of the natural environment by limiting the negative impacts of tourism. Scuba diving ecotourism provides economic support for local human communities and assists the conservation of marine wildlife and coastal ecosystems. This way it can serve as a route to non-formal environmental education processes.

The present study is going to be conducted in a Greek island, known as Skyros. This island presents special and rare marine fauna and flora. The aim of the present research is to introduce a model that is going to be implemented in Skyros Island and assess the effectiveness ofan educationalinterpretational program, using scuba diving as a teaching tool to promote education for sustainable development. The change of environmental awareness, prior to and at completion of diving sessions, will be assessed. Additionally, this survey aims to present a case study where the central theme is the support of marine tourism and the delivery of education to all those involved in scuba diving activities.

Keywords: Education for Sustainable Development; Diving Tourism; Ecotourism; Skyros Island; Greece

Introduction

Nowadays, while ecosystems continue changing in response to the stress imposed by human activities, societies are trying to adjust their conduct affecting ecosystems in response to the alterations perceived in these systems (Scheffer et al., 2000). The behavioral modification happens as individuals begin to comprehend more that human societies intelligibly are contingent on services and functions administered by the planet's physical, chemical and biological systems (Luck et al., 2003). At any rate, the intent is to elucidate that ecosystems procure services essential to humanity, heavily dependent on biodiversity, so that the maintenance of species and habitats diversity beseems of fundamental importance for human life (Petrosillo et al., 2007). development Sustainable is indubitably one of the most significant challenges of synchronous evolution. To succeed it, it is required for someone to

identify the causes of environmental degradation and to estimate its extent, as well as find virtual, viable solutions to counteract it and restrict its negative effects on economic and social life (Minciu et al., 2012). A new set of individual and societal selections and practices are indispensable to contribute to tackle these effects (Ballantyne and Packer, 2011).

Tourism is a human activity that put a great pressure on the natural environment, and can be extremely harmful if it is unplanned and unregulated. Therefore, necessitates a more sustainable alternative that involves the local population in the planning and management of tourism. Thus, communicating the inherent relationships becomes crucial as an effort to minimize negative impacts and augment visitors' "awareness of" and "respect for" other significant places (Bidder et al., 2015).

Multitude developing countries in line with the millennium development goals have espoused sustainable tourism or ecotourism as a propitious tactic to confront with the problems of poverty and underdevelopment along with resource conservation. Tourism has considered as an efficacious instrument advocate sustainable development; to however, what specific form of tourism and development is required may vary with difference in destinations (Chan and Bhatta, 2013). Thus, marine ecotourism is the suitable form of tourism for coastal regions, since it is by definition a sustainable activity. In order to allow the definition of precise management measures able to efficiently forestall negative consequences, socioeconomic profiling of users is vital. In fact, in marine ecotourism the knowledge of environmental aspects of ecotourists, like recreational divers, is crucial for installing touristic facilities (Rangelm et al., 2014)

Greek Islands endowed with an abundance of natural resources and have opportunities for tourism development. However, most of them are facing obstacles in terms of appropriate design to enhance sustainable tourism. It is one of the frailties in tourism, and therefore a framework to ameliorate destination quality is required. In order to meet tourist satisfaction as well as to enhance sustainability for the numerous living creatures, understanding temporal and spatial distributions therefore becomes significant.

This paper offers a new direction in the field. It argues for a proactive approach in which free-choice environmental learning experiences are used to motivate visitors, specifically divers, to connect with post-visit learning materials once they leave the site. It thus re-conceptualizes the role of such experiences in offering, not only enjoyment, satisfaction and immediate benefits to their visitors, but also transformative experiences that have a long-term impact on visitors' understanding, attitudes and behavior in relation to the environment. Aside from providing knowledge, these findings may raise awareness among all stakeholders and policy makers so that they may more seriously consider environment conservation and its effects on the economic sustainability of local business communities. The present research is going to be held in Skyros Island, which is one of the multiple Aegean Islands with rich natural heritage. The aim of this study is to examine whether or not diving tourism could promote sustainability, and could be a strong teaching instrument that would contribute to the implementation of education for sustainable development (ESD), since it is studied the creating of a thematic marine park in the island. The central goal is to present a case study where marine ecotourism and the ESD is the main supporting issue, and an environmental educational and communicational project conducted there, which consists of many environmental activities that increase the environmental awareness of inhabitants and tourists as well.

Education on Sustainable Development (ESD)

Education has been identified by the United Nations and its agencies, national governments and the European Union as a key element in any program addressing sustainable development issues. Moreover, education is apprehended as vital to 'assist individuals build personal and social capability so that they, as learners and social actors, are enabled to wrestle with sustainability issues and affiliate them to their daily routine' (Ballantyne and Packer, 2011).

Despite the fact that formal education programs are doubtlessly significant, they subscribe only a small part to the public's understanding of environmental issues (Falk and Dierking 2002; Falk and Storksdieck, 2005). Access to a range of information means such as the media. Internet and other 'free-choice' educational experiences is desirable during human's lifetime in order to continually refine and modernize their knowledge understanding and of contemporary environmental challenges. Falk (2005) defined 'Free-choice learning' as the learning that occurs when it is mainly under the option and control of the learner, for example the environmental learning experiences that is accessible in tourism settings. It is argued that these free-choice environmental learning experiences have the prospect to make a significant contribution to community capacity building in relation to environmental issues (Ballantvne and Packer, 2011).

Because knowledge alone has been shown to be approximately inefficacious in altering people's behavior, effective an environmental education program targeted at affecting or modifying participants' conducts should not only augment knowledge, but would ideally concentrate on the emotional sector as well (Orams, 1995). This argument, implemented to an interpretive program, proffers that interpretive programs should not only intent to change participants' knowledge of marine ecosystems, but also weigh with their attitudes and values towards them, in order to achieve a greater appreciation of this environment and, in turn, potentially affect participants' behavior (Madin and Fenton, 2004). Consequently, through an interpretive program it could be more effective to provide the real spirit of sustainability in tourism.

Ecotourism and ESD

Ecotourism, as a subset of sustainable tourism, broadly considered to be a benevolent approximation to mass tourism (Chan and Bhatta, 2013). It is defined as "travel and visitation that is environmentally responsible to relatively undisturbed natural areas in order to enjoy and appreciate nature, promotes conservation, has low visitor impact and provides for beneficially active socio-economic involvement of inhabitants" (The National Ecotourism Plan, 1997). Occasionally, is referred as "nature tourism," "socially responsible tourism", "green travel," or "ecoventures," (Jaafar and Maideen, 2012), and its' attributes are more like norms and ethics, that regularly reflected in the forms of principles, guidelines, and regulations. These guidelines largely require the combination of both anthropocentric (development) and eco-centric (conservation) planning approach. Scholars argued that suitable approach to tourism planning is crucial to reflect the sense of sustainable development and sustainable tourism (Chan and Bhatta 2013).

As ecotourism is considered to be a form of tourism that focuses on experiencing natural the sites. emphasizes appeal of environmental conservation, provides and satisfaction with experiences for tourists attracted to natural sites (Bjork, 2000), it assuredly promotes sustainable development by limiting the negative impact of tourism on the environment (Liu, 2003). Hence, the environmental consciousness of ecotourists. environmentally and corresponding responsible conduct. is a sufficient precondition for as well as consequence of ecotourism (Chiu et al., 2014).

Environmentally responsible behavior is an attribute of atoms that are knowledgeable and anxious about environmental issues and will therefore adopt conducts that would dodge

the environmental degradation (Iwata, 2001; Mobley et al., 2010; Chiu et al., 2014).

Environmental education is thought to be a factor that affects environmental behavior, pointing out that personal experience and participation in the environment can promote environmentally responsible behavior. Direct experience enhances visitors' perceived value of the ecosystem and strengthens awareness about environmental preservation (Chiu et al., 2014). Academics have the claim that the roles of ecotourism are numberless, extending from education, conservation, and financial support for locals and protected areas (Hakim and Nakagoshi, 2010). Ecological Education is a significant objective of protected area management that internationally practiced. Important target groups are the inhabitants and the visitors, especially the youth, and educational or interpretation programs are gaining an ever larger scope. Multiple tourism sites. especially eco- and wildlife tourism sites, include a proconservation ethic in their mission statements, and intentionally provide opportunities for their visitors to learn about environmental sustainability issues (Ballantyne and Packer, 2011).

Diving Tourism and ESD

The popularity of scuba diving activity in recent decades has made it presently a multibillion dollar industry. Recreational scuba diving includes an intensive contribution in marine environment or marine parks all over the world (Fatt Ong and Musa, 2011). The continuously raise of number of participants in this activity has also been accompanied by uneasiness over the deterioration of the marine habitat. The detriment to the marine environment could jeopardize the future sustainability of the scuba diving industry. Much of the caused damage is preventable the alterations into divers' through underwater behavior (Fatt Ong and Musa, 2011). Effectual conservation requires mitigation of the negative impacts of diving, derivation of increased benefits and increased understanding of their nature and distribution, and implementation of adequate management interventions to reduce unpropitious effects and sprawl avails (Dearden et al., 2007).

Scuba diving tourism may offer financial support to expedite marine subsistence in many locations. Furthermore, local governments have the potentiality to invest in monitoring marine environments. encouraging surveys preventing the negative effects (Dimmock and Musa, 2015). However, diving activities themselves can also constitute a menace to marine ecosystems if not suitably managed. Direct and indirect impacts of divers include physical contact with delicate structures like coral reefs, noise from boats, or discomfort to marine wildlife (YALE, 2013).

To continue tourism activities in a sustainable way, negative ecological impacts of tourism required to be decreases or minimized. Some mitigation measures recommended so far include restricting the number of divers to below the carrying capacity (Hawkins and Roberts, 1994), predive environmental briefings for divers and promote training opportunities on reducing the negative ecological impacts of scuba diving (Toyoshima and Nadaoka, 2015) in order to increase ecological awareness of divers. This heightened awareness could make divers ambassadors of the ocean, as they can then pass on the knowledge and experiences to their family and friends at home who have not been exposed to the wonders of the sea and the work of its greatest supporters (YALE, 2013).

Many dive tourism destinations around the world have training programs for dive guides and instructors intended to improve the frequency and effectiveness with which environmental dive briefings are given to all dive groups. Such programs train the tourism industry staff about the nature of the marine environment, and teach them activities that can augment the opportunities for their divers to appreciate and enjoy their diving experiences. Divers are stimulated to become more active to profit the resource on which their activity is based, once the need has been demonstrated. Indeed, with a strong educational or interpretational component, strengthened links to marine enhancement and a clear focus on nature, diving could be one of the most effective ecotourism activities that clearly illustrate the potential benefit of tourism for conservation (Dearden et al., 2007).

Scuba Diving in Greece

Greece offers miles of stunning blue coastline, hundreds of isles and millennia of ancient history onshore. Greece's cerulean waters boast dramatic landscapes, colorful sponges and reef sharks. Also, there is a cornucopia of wrecks to explore as well as amazing sea life, vast underground caves, and a varied and beautiful coastline.

Scuba diving is a popular sport in Greece and the Greek islands. The Greek sea is a wonderful place to discover, full of rare fish species and impressive sea plants. The amazing thing about the Greek sea is that divers get to explore many shipwrecks, even wrecks of ancient triremes, medieval vessels and war ships from 2nd world war. Many scuba centers and clubs for diving in Greece are based on the beaches and others in hotel Thev offer the necessarv premises. equipment for diving and also courses for all ages and levels, totaling up to 90 scuba diving centers in the whole country.

Scuba diving is an environmental activity, which attracts high end tourists willing to spend generously to pursue this wonderful endeavor. This is the tourist demographic Greece certainly needs and should be attracting, particularly at this time of economic hardship since divers' spending can provide growth in almost every corner of the country.

Until 2005, divers were given access to just 620 miles of the 10,000 miles of Greek coastline. Then the legislation changed and diving is now allowed throughout the seas of Greece. Prior to 2006 scuba diving was greatly restricted in Greek body of waters the fear being that the sea floor was teaming with rare and unique antiquities of great value that easily could be grasped and smuggled for sale to dubious "art" dealers. This flawed thinking led to scuba diving being forbidden throughout Greece except in locations that were few and far between, with one bay (Limanaki) at Vouliagmeni in Athens and some locations in Mykonos and a few other locations in islands such as Rhodes and Corfu (GGR, 2014).

Project Skyros 2017-Environmental Communication Model

The Project "Skyros 2017" following the footsteps of the previous years' similar and multi awarded program is based on a successful cooperation between two governmental organizations, the University of the Aegean and the Skyros Port Fund. The geographic area that takes place is at the Linaria Port of Skyros Island, a boutique port that has been assessed as the best one of its category in Greece.

This year's program, "Skyros 2017", similar to the last year's one, consists of a group of researchers from the Research Center of Environmental Communication and Education of the University of the Aegean, that aims to best implement a comprehensive environmental campaign focusing at disseminating information and environmental raising awareness. It includes environmental campaigns targeted at citizens. tourists, boat passengers and children, providing printed information about the biodiversity of Skyros and several environmental issues as well. A Tourism Observatory has been setup as well as an environmental camp. The environmental activities include overseeing that the Linaria Port is clean and well taken care of. Various outdoor activities in collaboration with the Port Fund of Skyros are going to be organized in order to attract residents and visitors environmental interest (Apostolopoulou et al., 2016).

Moreover. the Research Center of Environmental Communication and Education of the University of the Aegean, is going to propose the implementation of an innovative educationalinterpretational program. using scuba diving as an enlightening instrument to sustainability. The program will be assessed as a teaching tool for promoting environmental consciousness of the participants. Finally a complete model, incorporating all of the above, is going to be proposed.

Methodology of the Proposed Educational-Interpretational Program

Research Area

The research area is recommended to be the island of Skyros, and specifically the port of Linaria. The small tourist port of Linaria is considered a key port, with a high tourist interest. The tourist port of Linaria has adopted a new way of sustainable approach to the management of its environmental impact, without spending lot of its limited financial resources. Also, a series of innovative measures. such as the establishment, construction and waterways, the use of electric bicycles and the collaboration with the University of the Aegean, resulted in intense public interest in the innovative activities of the small port of Linaria, at Skyros Island, increasing this way the environmental support from citizens. Due to all the aforementioned facts, Skyros is selected to be the island at which this educational- interpretational program is going to be implemented and assessed (Apostolopoulou et al., 2016).

Research Sample

The Proposed Model

This educational-interpretational model is going to have its basis on Orams model and will consist of five vital steps, as it is presented below (Fig.1). The research sample is proposed to be the inhabitants and tourists of the island that select the scuba diving for their entertainment.

Research Instruments

The data of the suggested program will be collected through personal interviews with each of them individually. The interviews will be held before the implementation of the educational program and after its end. Two questionnaires tailored to the specific needs have been put together in order to address and assess divers knowledge on local environment. The participants' attitudes and environmental behavior will also be evaluated. Ouestionnaire number one is composed of 40 questions, which were selected after an extensive literature search. questions first will The 5 inquire demographics information (e.g. gender, age, educational class). The next 35 questions will assess the participants' views about some environmental issues such as sea level rise, global warming, ice melting, coastal erosion etc, their knowledge about the diversity of the region and whether or not they have the will to act sustainable in order to protect the local natural marine life.

The final questionnaire consists of 40 questions. The first 5 of them will be about demographics' information (e.g. gender, age, educational class). The next 35 questions are going to give data about the alterations on participants' knowledge, behavior and attitudes on the above issues, and their willingness to participate in actions that provide sustainable development of the region. The comparison of both questionnaires is going to give the data for the assessment of the program and consequently of scuba diving as a teaching tool.





awareness, so they become more sustainable in their actions. An educational activity, which would reveal meanings and relationships, by firsthand experience, and by coming in contact with the actual nature, rather than simply communicating, factual information. Furthermore, it is going to use environmental interpretation as a basis of communicating the relevant information, since interpretation is a particular type of education that focuses on meanings and relationships. The teaching methods that are going to be used are lectures, briefings, simulation and modeling, outdoor education and field study. Finally, through assessment processes, it will be determined whether the participants have acquired environmental knowledge and skills in order to exhibit a responsible environmental behavior.

Conclusions

Marine tourism presents a policy dilemma because it has both positive and negative impacts on society. On the one hand, it generates significant incomes for regional and national economies. However, on the other hand, it contributes to the destruction of valuable marine resources. In recent decades, a number of approaches for managing marine resources have been proposed (Asafu-Adjaye and Tapsuwan, 2008).

A sustainable future for diving tourism requires cooperation inclusion, and collective responsibility between all key stakeholders. It also requires effective policy, problem solving and practice to which hall stakeholders are committed. It represents an innovation that has the potential to build sustainable futures for marine ecologies, scuba divers, scuba diving operators, tourism interests and host communities. Scuba diving insensitive and fragile scuba diving locations requires effective management to defend ecological and cultural values and ensure the use of resources. sustainable Marine environmental sustainability is a vital global issue which, nevertheless, has the prospect to be a strategic business opportunity for host communities and the scuba diving tourism industry that pursues to attract tourists to a destination (Dimmock and Musa, 2015).

Effective interpretational and educational programs can have a 'transformative' influence that induces among participants not only a deeper understanding of the attraction itself, but also a consequent adherence to a more ethical and environmentalist ethos. Especially, education-based strategies should induce visitors to espouse an active role in contributing to the health and sustainability of the environment (Ballantyne and Packer, 2011). In situ interpretation and education could raise environmental awareness, increase divers' satisfaction and their perception about the surrounding environment (Rangelm et al., 2014).

Having this fact in mind the aforementioned educational-interpretational program, based on the above model, will be examined if it visitor enjoyment increases and understanding, and prompts more environmentally responsible behavior. Participants should be taught how to interact with each other and how to have a beautiful relationship with nature, with a higher desire for active participation in environmental issues that affect their region.

Based on the results of the conducted educationalinterviews. the proposed interpretational program is going to be assessed if it could harmonize dive tourism with nature conservation such as increasing divers' education on marine wildlife and human impacts. This could take place in the form of revising diving curricula to prioritize conservation education and awareness. Since the survey is going to be conducted in one specific eco-site only; the findings should also be interpreted in this light. After the evaluation the proposed program could be replicated at different types of ecodestinations to enhance the robustness of the base model.

References

Apostolopoulou, S., Grigoroglou, G., Karamperis, M., Skanavis, C., Kounani, A. 2016. Environmental Summer Camp in a Greek Island. Proceedings of the 13th International Conference on Protection and Restoration of the Environment, Mykonos Island, Greece, 3rd to 8th of July 2016, pp.1024-1030.

Asafu-Adjaye, J., Tapsuwan, S. 2008. A contingent valuation study of scuba diving benefits: Case study in Mu Ko Similan Marine National Park, Thailand, Tourism Management, Vol 29, pp. 1122-1130.

Ballantyne, R. Packer, J. 2011. Using tourism free-choice learning experiences to promote environmentally sustainable behavior: the role of post-visit 'action resources', Environmental Education Research, Vol 17 No.2, pp.201–215.

Bidder, C., Kibat, S. A., Fatt, B.S. 2015. Cultural Interpretation toward Sustainability: A Case of Mount Kinabalu6th International **Symposium** Service Research in Management, IRSSM-6 2015, 11-15 August 2015, UiTM Sarawak, Kuching, Malaysia, (Procedia - Social and Behavioral Sciences Vol224, pp. 632-639, Available online at www.sciencedirect.com, Published by Elsevier Ltd. doi: 10.1016/j.sbspro.2016.05.454, ScienceDirect).

Björk, P. 2000. Ecotourism from a conceptual perspective, an extended definition of a unique tourism form, International Journal of Tourism Research, Vol 2 No. 3, pp.189-202.

Chan, R., Bhatta, K. 2013. Ecotourism Planning and Sustainable Community Development: Theoretical Perspectives for Nepal, SAJTH, January 2013, Vol 6 No. 1, pp.69-96.

Chiu, Y.T. H., Lee W.I., Chen, T.-H. 2014. Environmentally Responsible Behavior in Ecotourism: Exploring the Role of Destination Image and Value Perception, Asia Pacific Journal of Tourism Research, Vol 19 No. 8, pp.876-889.

Dearden, P., Bennett, M., Rollins, R. 2007. Perceptions of Diving Impacts and Implications for Reef Conservation, Coastal Management, Vol 35 No. 2-3, pp.305-317.

Dimmock, K., Musa, G. 2015. Scuba Diving Tourism System: A framework for collaborative Management and sustainability, Marine Policy, Vol 54, pp. 52-58.

Falk, J. H. 2005. Free-choice environmental learning: Framing the discussion. Environmental Education Research, Vol11 No. 3, pp.265-280.

Falk, J.H., Dierking, L.D. 2002. Lessons without limit: How free-choice learning is transforming education. Walnut Creek, CA: AltaMira Press, http://dx.doi.org/10.1590/S0104-59702005000400008

Falk, J.H., and Storksdieck, M. 2005. Learning science from museums. Historia, Ciencias, Saude – Manguinhos, Vol 12, pp. 117-44.

Fatt Ong, T., Musa, G. 2011. An examination of recreational divers' underwater behaviour by attitude behaviour theories, Current Issues in Tourism, Vol 14 No. 8, pp.779-795.

Greece, Greek Reporter (GGR). 2014, A Complete Guide to Scuba Diving in Greece, Retrieved December1, 2016 From http://greece.greekreporter.com/2014/06/13/ a-complete-guide-to-scuba-diving-ingreece/.

Hakim, L., Nakagoshi, N. 2010. Ecotourism in Asian tropical countries: Planning a destination's site-plan to meets education objectives, Journal of International Development and Cooperation, Vol 16 No.1, pp. 13-21.

Hawkins, J.P., Roberts, C.M., 1994. The growth of coastal tourism in the Red Sea: present and future effects on coral reefs. Ambio, Vol 23, pp.503-508.

Iwata, O. 2001. Attitudinal determinants of environmentally responsible behavior. Social Behavior and Personality, Vol.29, pp.183–190.

Jaafar, M., Maideen, S.A. 2012. Ecotourismrelated products and activities, and the economic sustainability of small and medium island chalets, Tourism Management, Vol 33, pp.683-691.

Liu, Z. 2003. Sustainable Tourism Development: A Critique, Journal of Sustainable Tourism Vol 11No.6, pp. 459-475.

Luck, M. 2003. Education on marine mammal tours as agent for conservation but do tourists want to be educated? Ocean & Coastal Management, Vol 46, pp.943–956.

Luck, G.W., Daily, G.C., Ehrlich, P.R., 2003. Population diversity and ecosystem services. Trends Ecol. Evol., Vol 18 No.7, pp.331– 336.

Madin, E.M.P., Fenton, D.M. 2004. Environmental Interpretation in the Great Barrier Reef Marine Park: An Assessment of Programme Effectiveness, Journal of Sustainable Tourism, Vol12 No.2, pp. 121-137.

Minciu, R., Padurean, M., Popescu, D., Hornoiu, R. 2012. Demand for Vacations /Travel in Protected Areas – Dimension of Tourists' Ecological Behavior, Amfiteatru Economic, Vol 14 No. 31, pp.99-113.

Mobley, C., Vagias, W.M., DeWard, S.L. 2010. Exploring additional determinats of ERB: The influence of environmental literature and environmental attitudes. Environmental and Behavior, Vol42 No.4, pp.420-447.

Orams, M.B. 1995. Using interpretation to manage nature-based tourism. Journal of Sustainable Tourism, Vol 4 No. 2, pp. 81-94.

Orams, M.B. 1996. A conceptual model of tourist-wildlife interaction: the case for education as a management strategy, Australian Geographer, Vol 27 No.1, pp.39-51.

Petrosillo, I., Zurlini, G., Corliano, M.E., Zaccarelli, N., Dadamo, M. 2007. Tourist perception of recreational environment and management in a marine protected area, Landscape and Urban Planning, Vol 79, pp. 29-37.

Rangelm, M.O., Pita, C.B, Goncalves, J.M.S. 2014. Developing self-guided scuba dive routes in the Algarve(Portugal) and analyzing visitors' perceptions, Marine Policy, Vol 45, pp.194-203.

Scheffer, M., Brock, W., Westley, F. 2000. Socioeconomic mechanisms preventing optimum use of ecosystem services: an interdisciplinary theoretical analysis. Ecosystems, Vol 3, pp.451–471.

Toyoshima, J., Nadaoka, K. 2015. Importance of environmental briefing and buoyancy control on reducing negative impacts of SCUBA diving on coral reefs, Ocean & Coastal Management, Vol 116, pp.20-26.

YALE 2013. Yale Environment Review: Diving tourists with environmental awareness can conserve oceans", Yale School of Forestry and Environmental Studies, New Haven, USA Retrieved in December 1, 2016 from http://environment.yale.edu/yer/article/divin g-tourists-with-environmental-awarenesscan-conserve-oceans#gsc.tab=0.

The national ecotourism plan: Ecotourism guidelines for Malaysia (part 3). 1997. Ministry of Culture Arts and Tourism Malaysia, pp.139.

Middle School Students' Environmental Literacy Assessment in Thessaloniki, Greece

Ilias Nastoulas, Kalliopi Marini, and Constantina Skanavis University of the Aegean, Greece

Abstract

"Environmental literacy is essentially the capacity to perceive and interpret the relative health of environmental systems and to take appropriate action to maintain, restore, or improve the health of those systems, and it is defined in terms of observable behaviors" (Disinger & Roth, 1992). The present research aims to investigate the environmental literacy of middle school students in Thessaloniki, cocapital of Greece. The methodology was based on the 2008's National Environmental Literacy Assessment Project in the USA titled "National Baseline Study of Middle Grades Students" by McBeth. Hungerford, Marcinkowski, Volk & Meyers (2008). The basic instrument used, was the Middle School Environmental Literacy Survey (MSELS), which was developed by Hungerford, Volk, Bluhm, McBeth, Mevers, and Marcinkowski in 2008. The MSELS was translated into the Greek language. The cited environmental stories, wherever necessary, were adjusted in order the participants' environmental familiarity to be ensured. The used sample consisted of 200 students from the ages of 13 and 15 years, all from high schools in Thessaloniki. The collected data from middle school students were analyzed, aiming to measure the level of environmental literacy of first and third grade students. The topics of interest were based on the following (a) ecological knowledge, (b) variables: verbal commitment; (c) actual commitment / environmental behavior, (d) environmental sensitivity, (e) issue identification and issue analysis skills, and (f) action planning. The research framework was based on the four domains of environmental literacy, that is: (1) Knowledge, (2) Affect, (3) Cognitive

Skills, and (4) Behavior. The study attempted to assess the general level of environmental literacy of the participants and point out the related to the study differences between first and third grade students. The research provides a basis to study environmental literacy in detail and an effort to identify potential methodologies and tools. Furthermore, this study could serve as a pilot one for the determination of environmental literacy in high school students at a national scale.

The results of this project will supply baseline data that can be used in the development and of appropriate environmental education programs.

Keywords: environmental literacy, environmental education, Greek middle schools, assessment tools

Introduction and Background

Definition of Environmental Education

Even though there is not one universally accepted definition of environmental education (EE) (Disinger 1983, citied McBeth et al. 2008), during the 1960s and 1970s a variety of short, one or two sentence definitions were published. Among these, one of the most noteworthy ones was the definition offered by the International Union for the Conservation of Nature:

"Environmental Education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among men, his culture and his biophysical surroundings. EE also entails practice in decision-making and selfformulation of a code of behavior about issues concerning environmental quality." (IUCN 1970).

According to the research of McBeth et al. (2008), these definitions were expanded into sets of goals, objectives, and guiding principles (e.g., UNESCO 1977, Harvey 1977, Hungerford, Petyon & Wilke 1980, Hart 1981). Among these, the most widely recognized ones have been those agreed upon at UNESCO's Tbilisi Intergovernmental Conference (UNESCO 1978). These provided the basic principles for proposals and recommendations that resulted from the United Nations Conference on Environmental and Development (UNESCO 1992) and subsequent international Tbilisi categories gatherings. The of objectives include Awareness, Knowledge, Affect, Skills, and Participation. When these categories of objectives are viewed in the context of the Tbilisi goals, they represent stepping stones to prepare and enable citizens, including young students, to become actively involved in the prevention and resolution of environmental problems and issues (McBeth et al. 2008).

Frameworks for Environmental Literacy

According to Hollweg (et al. 2011) an environmentally literate person is defined as "someone who, both individually and with others, makes informed decisions concerning the environment, is willing to act on these decisions to improve the well-being of other individuals, societies, and the global environment; and participates in civic life. Those who are environmentally literate possess, to varying degrees, the following:

- the knowledge and understanding of a wide range of environmental concepts, problems, and issues,
- a set of cognitive and affective dispositions,
- a set of cognitive skills and abilities and,
- appropriate behavioral strategies to apply such knowledge and understanding, in order to make sound and effective decisions in a range of environmental contexts."

According to McBeth et al. (2008) EE is determined by the formulation of frameworks for environmental literacy in the 1990s. According to McBeth's research, the sets of goals, objectives, and guiding principles were permutated into frameworks for environmental literacy (e.g., Roth 1992, Simmons 1995, Wilke 1995). In general, these frameworks for environmental literacy have two features in common: (a) they reflect at least four of the Tbilisi categories of objectives, namely Knowledge, Affect, Skills, and Participation (Behavior), and (b) they address at least three major thematic emphases apparent across the history of EE (Stapp 1974, Swan 1975), namely the natural world, environmental problems and issues, and sustainable solutions to these problems and issues.

In summary, the Frameworks of the Environmental Literacy feature A. Knowledge, B. Affect, C. Skills and D. Behavior, and consists 6 individual Components:

- 1. Ecological Knowledge
- 2. Verbal commitment
- 3. Actual commitment
- 4. Environmental Sensitivity and Environmental Feeling
- 5. Issue Identification and Issue Analysis
- 6. Action planning

Justification for the Study

Students of middle school age were selected for inclusion in this study because this developmental age has been identified as the. "last best chance to avoid a diminished future" (Carnegie Council 1989, citied McBeth et al. 2008). The middle school years represent the time when early adolescents are developing the ability to think abstractly (McBeth et al. 2008). Such cognitive abilities are strongly stated or implied in a variety of definitions or goals of environmental education (EPA 1992, 1996, Hungerford, Peyton, & Wilke, 1980, NAAEE 1999, 2000; NEEAC 1996, 2000, Simmons, 1995, Stapp et al, 1969, 1979, UNESCO, 1978). Adolescence is a time when environmental issues are primary among their concerns and

interests (Beane, 1993). The adolescents are progressing toward full participation as citizens and developmentally, they are moving through the acquisition and refinement of both abilities and inclinations to become engaged in environmental decision-making (McBeth et al. 2008). In a research sense, targeting adolescents will also permit longitudinal studies to move through their high school and college years. Concerning Greece, this is the first study that investigates the Environmental Literacy of middle school students in the second largest city of Greece, Thessaloniki.

Methodology

The present research is based on the research National Environmental Literacy Assessment Project in the USA titled "National Baseline Study of Middle Grades Students" by McBeth et al (2008). The specific research tool is a questionnaire (Middle School Environmental Literacy Survey / MSELS), which was translated and adjusted to Greek language. It consists of seven parts which correspond to the Components of the Environmental Literacy. More specifically, the questionnaire includes various demographics and measures the following Components of the Environmental Literacy: (a) ecological knowledge, (B) verbal commitment, (C) actual commitment performance, or environmental (d) sensitivity. issue environmental (e) identification and issue analysis and (f) action planning. Therefore, it includes measures for each of the four Frames that are to the Environmental Literacy: vital Knowledge, Affect, Cognitive Skills and Behavior. The questionnaire contains multiple choice questions and questions to be answered in Likert scales. It is designed to be taken in a period of 45-50 minutes.

Table 1 provides an overview of the *Middle School Environmental Literacy Survey*. Through the items and scales used in the questionnaire the six Components of the environmental literacy are tracked, reflecting the four Frames.

Frames of	Components of	Parts of the
Environmental	Environmental	MSELS
Literacy	Literacy	
A Ecological	 Ecological 	Part II:
A. Ecological Knowledge	Knowledge	Ecological
Kliowledge		Foundations
	2. Verbal	Part III: How
	Commitment	You Think About
	(Intention)	the
В.		Environment
Environmental	4. Environmental	Part V: You and
Affect	Sensitivity	Environmental
	and	Sensitivity
	Environmental	Part VI: How
	Feeling	You Feel About
		the
		Environment
	5. Issue	Part VII.A: Issue
	Identification	Identification
C. Cognitive	and Issue	Part VII.B: Issue
Skills	Analysis	Analysis
	6. Action	Part VII.C:
	Planning	Action Planning
	3. Actual	Part IV: What
	Commitment	You do About the
D. Behavior	(Pro-	Environment
	environmental	
	Behavior)	
	Age, grade,	Part I: About
	gender,	Yourself
	ethnic/racial	
	background	

Table 1: Frames and Components of Environmental Literacy and Parts of the questionnaire

Sampling Strategy

Two populations were involved in this assessment: first grade and third grade students, in Thessaloniki over the 2015-16 school year. The data collected on April-May of 2016, after receiving the proper school board authorization. The sample included 219 students, or approximately 10 different classes.

In the skill scale Parts (VII.A/B/C) there were noticeable missing responses something that was taken under consideration in the analyses. More specific 65 (29.7%) responses were missing in the Action Planning part, 25 (13.24%) in the Issue Identification part, and 21 (9.59%) in the Issue Analysis part.

Conversion of Alpha Responses to Numeric Data and t-test of the data For further analysis and processing of the data, converting the responses into numerical data was necessary in order to track individual scores for the 6 Components and at the end come up with a final grand score. The correct answers for the Part II, Part VIIA, and Part VIIB were coded with a value of 1. For the Likert type scale (Part III, Part IV, Part V, Part VI) responses were scored A=4, B=3, C=2, D=1, E=0 (negatively worded items had to be coded for reverse scoring, A=0, B=1, C=2, D=3, E=4).

Independent samples t-tests were conducted to compare the individual Components of the

Environmental Literacy for the 1st and 3rd grade students, males and females, different ages and nationalities.

Preparation of Composite Environmental Literacy Scores

For the analysis of the data, the methodology of the research "National Baseline Study of Middle Grades Students" by McBeth et al. (2008), was followed. To permit these analyses, data files were created containing records for all students. Analyzed using SPSS version 20 program and with the use of Excel 2013.

Frames of Environmental Literacy	Components of Environmental Literacy	Parts of the MSELS	N items	Range of Possible Scores	Multiplier	Adju Sco	sted ore
A. Ecological	1. Ecological	Part II:	17	0.17	2 520	6	h
Knowledge	Knowledge	Foundations	17	0-17	5.329	0	J
B. Environmental	2. Verbal	Part III: How					
Affect	Commitment	You	12	0-48	0.625	30	
		Think About the Environment					
	4. Environmental	Part V: You and					
	Sensitivity	Environmental	11	0-44	0.5682	25	
	and	Sensitivity					60
	Environmental	Part VI: How					
	Feeling	You	2	0-8	0.625	5	
		Feel About the					
		Environment					
C. Cognitive	5.Issue	Part VII A : Issue					
Skills	Identification	Identification	3	0-3	6.67	20	
	and	Part VII B: Issue					
	Issue Analysis	Analysis	4	0-4	3.33	20	
	6.Action Planning	Part VII C:			1.00	•	(0)
		Action	8	0-20	1.00	20	60
		Planning					
D. Behavior	3. Actual	Part IV: What					1
	Commitment	You	12	0-48	1.25	6)
		do About the					
		Environment					
			69	0-192		24	0

 Table 2: Frames and Components of Environmental Literacy, Parts of MSELS, number of items, range of the possible scores, the multipliers and the adjusted scores.

Table 2 provides the range of possible scores, the multipliers, and the adjusted scores in order to demonstrate how the adjusted scores were derived. In order to derive a composite score of the Frames, the mean scores on the individual parts of the questionnaire were adjusted with multipliers so that the sum of each of the Four Frames of Environmental Literacy equated to 60. Each Frame of environmental literacy, as measured by the MSELS, is then reported by grade as "Combined Mean" and the final mean reported as "Environmental Literacy Score", with maximum possible total score of 240. In summary:

- The mean scores on each part of MSELS • were multiplied to give an adjusted score.
- The individual adjusted scores, were combined to give "Combined Means" of the four Frames and,
- The final mean of the four Frames were • reported as "Environmental Literacy Score"

Table 3 provides the final form of the data analysis.

Part of MSELS	Adju sted	Frames of Environme	Combi ned	Environm ental
	Scor	ntal Literacy	mean*	Literacy Score**
Ecological Foundatio ns Verbal Commitm ent Environm ental Sensitivity		A. Ecologic al Knowle dge B. Environ mental Affect		Store
Environm ental feeling				
Issue Identificati on		C. Cognitiv e Skills		
Issue Analysis Action				
Planning Actual Commitm ent		D. Behavio r		

Table	3:	Overview	of the	final	form	of	the	analys	is
Labic	J .		or the	imai	101 III	UI	unc	anarys	1.5

Results

The demographic items were included in Part I of the questionnaire such as the age, the class of the students, the gender and the nationality. Table 3 provides all the information about demographics. 50.7% were 3rd class students, 49.3% were 1st class students. 53.9% were females, 46.1% were males and 97.7% were of Greek nationality.

Table 3: Demographic data

Demographics Frequency Percent

Age		
12 years old	60	27.4%
13 years old	49	22.4%
14 years old	63	28.8%
15 years old or older	47	21.5%
Class		
1 st of high school	108	49.3%
3 rd of high school	111	50.7%
Gender		
Girl	118	53.9%
Boy	101	46.1%
Nationality		
Greek	214	97.7%
Other	4	1.8%
Missing Responses	1	.5%



Figure 2: Class



Figure 4. Nationality

Results for Research Question One

Research Question One: What is the level of environmental literacy of the middle school students in Thessaloniki on each of Components of the environmental literacy:

- 1. Ecological knowledge,
- 2. Verbal commitment,
- 3. Actual commitment,
- 4. Environmental sensitivity and general environmental feelings,
- 5. Environmental issue identification and analysis and,
- 6. Action skills?

The results of these analyses are summarized in Table 4. On the cognitive scales, student scores were higher on the knowledge scale (Part II) than the skills scale (Part VII.A/B/C).

Table 4: Summary of Descriptive Statistics

Parts of the	Mini-	Maxi-	Mean	Std.
MSELI	mum	mum		Dev.
II. Ecological	.00	17.00	9.97	3.18
Foundations				
III. Verbal	.00	48.00	30.48	6.03
Commitment				
IV. Actual	.00	48.00	29.20	6.58
Commitment				
V. Environmental	.00	44.00	18.86	6.57
Sensitivity				
VI. Environmental	.00	8.00	7.46	1.23
Feeling				
VII.A. Issue	.00	3.00	0.79	0.84
Identification				
VII.B. Issue	.00	4.00	1.36	1.08
Analysis				
VII.C. Action	.00	20.00	7.40	6.42
Planning				

For the Ecological Foundations part, the scores of the sample were close to the average value. For the Verbal Commitment part the scores were lower than the average value. In Part III for the negative wording questions, the points of the answers were reversed. Table 5 provides the frequency of the answers in Verbal Commitment part in percentages.

Table 5: Frequency of the answers in VerbalCommitment part

Question	Answers (in %)				
	Yes	Rathe	Ι	Rather	Ν
		r	don't	No	0
		Yes	Know		
Stop buying	32.	47.9	10.5	3.2	5.
products for	9				5
the protection					
of animals					
(Not willing	34.	27.9	12.8	12.8	12
to) use of less	2				.3
air-condition					
to save energy					
Use of less	48.	24.7	10.0	8.2	8.
water to save	9				2
energy					
(Not willing	32.	23.7	25.6	9.1	9.
to) give	0				6
money to help					
the					
environment					-
More walking	54.	23.3	6.8	6.8	8.
for pollution	3				7
reduction	-		10.0		10
(Not willing	50.	15.1	12.8	8.2	13
to) recycle	7				.2
garbage		0 0 f	10.0		
Money for the	32.	30.6	18.3	8.2	11
protection of	0				.0
animals					

Use of LED	53.	21.5	15.5	4.6	4.
lambs to save	9				6
energy					
Tap turn off	81.	8.7	2.3	5.9	1.
	3				8
Environmenta	36.	29.7	19.2	5.0	10
l information	1				.0
communicatio					
n					
Writing a	27.	31.1	17.8	11.9	11
letter to ask	9				.4
for help for					
the					
environmental					
protection					
Call for	35.	31.1	13.7	9.6	10
recycling	6				.0

For the Actual Commitment part the mean was nearly the same as the average value. In Part IV for the negative wording questions the points of the answers were reversed. Table 6 provides the frequency of the answers in Actual Commitment in percentages.

Table 6: Frequency of the answers in ActualCommitment part

Question	Answers (in %)				
	Yes	Rathe	Ι	Rathe	No
		r	don't	r	
		Yes	Kno	No	
			w		
I haven't	23.	12.8	9.1	8.2	46.
written to	7				1
anyone for					
a pollution					
problem					
Discussion	43.	19.2	3.7	9.6	23.
with	8				7
parents for					
the					
environmen					
t	-0	= 0			
Tap turning	79.	5.0	4.1	3.2	7.8
off to save	9				
water	60	155	4.1	1.6	6.0
Lighting	68.	15.5	4.1	4.6	6.8
turning off	9				
for saving					
energy	21	10.0	0.6	10.5	20
Ask parents	51.	10.0	9.6	10.5	38.
not to buy	Э				4
unings from					
loothor					
Ask parants	55	14.2	07	7 9	12
to do	55. 7	14.2	0.7	7.0	13.
recycling	/				/
Ask others	27	16.9	91	15.1	31
how to	4	10.7	7.1	15.1	5
reduce	-				5
pollution					
Pollution					

Get information about the environmen t	21. 9	19.6	7.3	13.7	37. 4
Let the tap flow only when necessary	71. 7	11.0	5.9	3.7	7.8
Close the fridge door when I decide what I want to take	76. 3	10.0	0.9	3.2	9.6
Put a bird nest near the house	15. 5	1.8	6.8	7.3	68. 5
Don't separate things for recycling	53. 4	6.4	10.0	6.8	23. 3

For the Environmental Sensitivity part the mean was slightly lower than the average value. For the Environmental feeling part the mean was nearly the same as the average.

Table 7 provides the frequency of the "I love the environment" Item. The scores ranged from 4.6% to 75.8%. For the "I hate the environment" Item, the points of the answers were reversed because of the negative wording. And as it was expected the results were nearly the same as the results in "I love the environment" Item.

Table 7: Frequency of the answer in Part VI

I Love the	Frequency	Percent (in
environment		%)
I agree	166	75.8
I slightly agree	27	12.3
I can't decide	14	6.4
I slightly disagree	2	.9
I disagree	10	4.6



Figure 5: Diagram of the "I love the environment" Item

The possible correlation between Verbal, Actual Commitment and Environmental Sensitivity was examined. The values were more than 0 indicating that there is a positive linear correlation. More specific, for Verbal Commitment / Environmental Sensitivity the correlation was 0.185 - weak positive, for Actual Commitment / Environmental Sensitivity the correlation was 0.289 – weak positive. and for Verbal / Actual Commitment the correlation was 0.453 moderate positive. Indicating that high scores in one dimension means high scores to the other. Table 8 provides the correlations' values.

 Table 8: Correlations between Verbal, Actual and Environmental Sensitivity parts

Correlations		Total Verbal Comm itment	Total Actual Commit ment	Total Environme ntal Sensitivity
Total Verbal Commit ment (Part III)	Pearson Correlati on	1	.453**	.185**
	Sig. (2- tailed)		.000	.006
	Ν	219	219	219
Total Actual Commit ment (Part IV)	Pearson Correlati on	.453**	1	.289**
	Sig. (2- tailed)	.000		.000
	Ν	219	219	219
Total environme ntal Sensitivity (Part V)	Pearson Correlati on	.185**	.289**	1
	Sig. (2- tailed)	.006	.000	

	Ν	219	219	
dut a 1			0.011 1.0	

** Correlation is significant at the 0.01 level (2-tailed).

For the Issue Identification, Issue Analysis, and Action Planning parts the number of missing responses increased substantially. The means were lower than the average value.

Independent sample t-tests were contacted to the total Ecological Knowledge, Verbal Commitment, Actual Commitment, Environmental Sensitivity and Feelings, Issue Identification and Analysis, and Action Planning for all 1st and 3rd grade students, males and females, different ages and nationalities. However, no statistically significant found concerning the above, except one.

Possible Differentiation between 1^{st} and 3^{rd} Grade Students

An independent samples t-test was conducted to compare the total Verbal Commitment scores for 1^{st} and 3^{rd} grade students. There was a significant difference in scores for 1^{st} grade (M=31.50; Sd=4.84) and for the 3^{rd} grade (M=29.48; Sd=6.87, t=2.49 and p=0.013). The magnitude of the difference in the means is small (eta squared=0.027).

Results for Research Question Two

Research Question two: What is the general level of Environmental Literacy of middle school students in Thessaloniki, Greece?

The general level of the environmental literacy is one composite score arising from the individual mean scores of the four Frames of the environmental literacy (Knowledge, Affect, Skills and Behavior).

Table 9 identifies the parts of MSELS that was combined to give the means for the four Frames (after adjusting with multipliers, so that the sum of each of the Four Frames of Environmental Literacy equated to 60). Each Frame of environmental literacy, as measured by the MSELS, is reported by grade as "Combined Mean" and the final mean reported as "Environmental Literacy Score".

Part of MSELS	Frames of Environmental Literacy	Combi ned mean*	Environ mental Literacy Score**
Ecological Foundations	E. Ecological Knowledge	35.18	
Verbal Commitment Environmenta I Sensitivity Environmenta I feeling	F. Environment al Affect	34.43	123.31
Issue Identification Issue Analysis Action Planning	G. Cognitive Skills	17.2	
Actual Commitment	H. Behavior	36.5	

 Table 9: Components of Environmental Literacy and Composite Score

*Total possible points = 60, **Total possible points = 240

More specific, Ecological Knowledge's combined mean, after applying the 35.18. multiplier, became The Environmental Affect's combined mean was 34.43. The Cognitive Skills' combined mean was 17.2. Behavior's combined mean was 36.5. Finally, the Environmental Literacy composite score was 123.31. Figure 6 demonstrates the Combined Means of the four Frames of Environmental Literacy.





Discussion of the Findings

Concerning the Research Question One about the level of the environmental literacy of the Components, the results were relatively normal. The obtained scores were close to average or lower. More specifically, Ecological Knowledge. Verbal on Commitment. Actual Commitment and Environmental Sensitivity the mean scores were really close to average, while on the rest of the parts of the MSELS the mean scores were lower, indicating that the students have an average knowledge on ecological subjects and that they are sensitive about the environment. In addition, even though there was no big difference (on the amount of 1.28), on the action-oriented scales the related student scores were higher on the intention to act scale (Verbal Commitment = 30.48) than on the self-reported behavior scale (Actual Commitment =29.20). Also, there was a positive correlation between Verbal-Actual Commitment indicating that the dimension of the students' "intention" had a positive correlation with the actual commitment. Although one might have expected that the Verbal Commitment /Environmental Sensitivity and Actual Commitment/Environmental Sensitivity correlations would be moderate positive or strong positive, the research data arising from the analysis were a weak positive. For the skill scale parts: Issue Identification, Issue Analysis and Action Planning there were a lot of missing responses, maybe because these items appeared at the end of the questionnaire, and the participants were tired.

Concerning the comparisons between the gender. class and age differences. independent samples t-tests were conducted, only statistically but the significant difference was the one for the total Verbal Commitment scores. Even though it was statistically significant, the magnitude was small (2.7%), indicating that 1st graders have higher intention to commit to the environment than the 3rd graders. Probably 1st grade students because of their age alongside with their recent primary-school memories, are closer to the verbal commitment. Meanwhile, 3rd grade students, as they get older probably other interests, along with teenage anxieties, re focus their attention and they seem to lose some of their interest and verbal commitment for the environmental issues.

Concerning the Research Question Two about the general level of environmental literacy, the final score was 123.31 and it is in the mid-range (97-168) of possible scores reflecting a moderate level of environmental literacy. That result indicates that the students need more education and information about environmental issues, something that can be accomplished, by adding environmental educational programs in schools. Comparing the results of this study with the results of the American it is noticeable students. that both nationalities ranked at a moderate level, indicating that the environmental literacy issue is probably a worldwide one.

Regarding the four Frames of environmental literacy, the highest score was attained in Behavior with a combined mean of 36.5. Slightly lower score was obtained in Ecological Knowledge with a combined mean of 35.18. The Environmental Affect combined mean was 34.43. These three components share the same moderate range level. The lowest score was observed in Cognitive Skills with a combined mean of 17.2, with a low range level. It is noteworthy that the Frame of environmental literacy, Behavior, had the highest score, indicating the highest Actual Commitment intention of the students. Meanwhile, American students' highest score was in Ecological Knowledge, indicating that even though both nationalities ranked in a moderate level, the American students appear to be a bit more environmentally educated. Probably this has to do with the fact that in USA schools, the students are informed about environmental issues from young age, before they go to middle school, while in Greece the students, is quite recent, that they participate from early age in environmental programs.

Environmental Literacy is very essential for all societies who claim to be civilized. The environmental education system has to be further strengthened. As Skanavis et al. (2005) indicate "our youth is the most precious Supporting their asset. environmental conscious, would later on enable them to actively participate in the environmental decision making. When environmentally educated young individuals grow up, as residents they would willingly participate in a societal movement, especially when they observe that their way of life is endangered".

Limitations – Further Implications

This research was conducted in Thessaloniki with a sample of a 219. Future studies should examine the same topic in Athens and other big cities of Greece in order to come up with conclusions about the environmental literacy Taking at a national level. under consideration the big amount of missing responses in the last parts, it is suggested that a smaller questionnaire should be used or the last part of the present questionnaire should be administered in a second time, as it is shown that the subjects get overwhelmed.

The results of this research can provide data to be used in the development and advancement of environmental education planning in Greece. Also, this research could help future researchers to identify promising educational practices as they relate to environmental literacy. In addition, future study using the same instrument (MSELS) in schools could compare the results with the provided data from this research and observe relative effectiveness of diverse potential environmental education programs. The comparison will help to determine the extent to which environmental education efforts can make a difference in environmental literacy.

References

Beane, J. A. (1993). A middle school curriculum: From rhetoric to reality. Columbus, OH: National Middle School Association.

Carnegie Council on Adolescent Development. (1989). Turning points: Preparing American youth for the 21st century. (The Report of the Task Force on Education of Young Adolescents.) Washington, DC: Author.

Disinger, J. (1983). Environmental education's definitional problem. ERIC Clearinghouse Information Bulletin #2. Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Disinger, John F. - Roth, Charles E. (1992). Environmental Literacy. ERIC/CSMEE Digest, ERIC Clearinghouse for Science Mathematics and Environmental Education Columbus OH.

Environmental Protection Agency. (1992). Federal Register, October 16, 1992. p.47516.

Environmental Protection Agency. (1996). Federal Register, December 10, 1996. p.65106.

Hart, P. (1981). Identification of key characteristics of environmental education. The Journal of Environmental Education, 13 (1), 12-16.

Harvey, G. (1977). A conceptualization of environmental education. In J. Aldrich, A. Blackburn, and G. Abel (Eds.), A Report on the North American Regional Seminar on Environmental Education (pp. 66 72). Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education. Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). Developing a framework for assessing environmental literacy. Washington, DC: North American Association for Environmental Education. Available at http://www.naaee.net.

Hungerford, H.R., Peyton, R.B., & Wilke, R.J. (1980). Goals for curriculum development in environmental education. The Journal of Environmental Education, 11(3), 42-47.

IUCN (1970): International Working MEETING on Environmental Education in the School Curriculum, Κάρσον Σίτι Νεβάδα, ΗΠΑ.

McBeth, B. et. al (2008). National Environmental Literacy Assessment Project: Year 1, National Baseline Study of Middle Grades Students Final Research Report. August 12, 2008.

National Environmental Education Advisory Council. (December, 1996). Report Assessing Environmental Education in the United States and the Implementation of the National Environmental Education Act of 1990. Washington, DC: U.S. Environmental Protection Agency.

National Environmental Education Advisory Council. (2000). What is Environmental Education? presented at NEEAC's Town Hall Meeting, NAAEE Conference, South Padre Island, TX, October 20.

North American Association for Environmental Education. (1999, 2000). Excellence in Environmental Education: Guidelines for Learning (K-12). Rock Spring, GA: North American Association for Environmental Education. Roth, C. (1992). Environmental literacy: Its roots, evolution, and directions in the 1990s. Columbus, OH: ERIC/SMEAC.

Simmons, D. (1995). Working Paper #2: Developing a framework for National Environmental Education Standards. In Papers on the Development of Environmental Education Standards (pp. 10-58). Troy, OH: NAAEE.

Skanavis, C., Koumouris, G.A., Petreniti, V. (2005). Public Participation Mechanisms in Environmental Disasters. Environmental Management. Vol. 35, Issue 6, pp 821-837.

Stapp, W.B. et al. (1969). The concept of environmental education. Journal of Environmental Education, 1 (1), 30-31.

Stapp, W.B. (1974). Chapter 3: Historical setting of environmental education. In J. Swan and W. Stapp (Eds.) Environmental Education (pp. 42-49). New York: J. Wiley & Sons.

Stapp, W.B. et al. (1979). Towards a national strategy for environmental education. In A.B. Sacks & C.B. Davis (Eds.) Current Issues in Environmental Education and Environmental Studies V, Columbus, OH: ERIC/SMEAC ED 180 822. Swan, M. (1975). Forerunners of environmental education. In N. McInnis and D. Albrecht (Eds.), What Makes Education Environmental? (pp. 4-20). Louisville, KY: Data Courier.

UNESCO. (1977). Trends in Environmental Education. Paris, France: Author.

UNESCO. (1978). Final Report: Intergovernmental Conference on Environmental Education. Paris, France: Author.

UNESCO. (January, 1978). The Tbilisi Declaration. Connect (UNESCO/UNEP Environmental Education Newsletter).

UNESCO. (June, 1992). Agenda 21. Connect (UNESCO/UNEP Environmental Education Newsletter).

Wilke, R. (Ed.). (1995). Environmental Education Literacy/Needs Assessment Project: Assessing Environmental Literacy of Students and Environmental Education Needs of Teachers; Final Report for 1993-1995 30-76). (Report (pp. to NCEET/University of Michigan under U.S. EPA Grant #NT901935-01-2). Stevens Point, WI: University of Wisconsin - Stevens Point.

Is an Ecovillage Type of Living Arrangement a Promising Pathway to Responsible Environmental Behavior?

C. Andriopoulos, E. Avgerinos, and C. Skanavis University of the Aegean, University Hill, Mytilene, Greece

Abstract

The proposed ecovillage project is an attempt to strengthen responsible environmental behavior efforts. Furthermore, the concept of an ecovillage's impact on society in general, is being investigated.

There are examples of successful case studies, as the ecovillage at Ithaca (Richard W. Franke, March 24,2016) and the ecovillage Sieben Linden (Marcus Andreas – Felix Wagner, August 8,2012). The underlying characteristic of ecovillages is that, people who are going to live in the ecovillage would share common resources and environmental vision. A study by Moos, Whitfield, Johnson, and Andrey (2006) estimates that the average Ecovillage at Ithaca (EVI) resident lives at 40 percent the ecological footprint of residents in a "conventional" neighbourhood in the same region. Also the average water use at EVI was 29% of the New York State average use (Richard W. Franke, March 24,2016).

The main goal of this project is the thorough study of potentially establishing an ecovillage at Skyros Island, Greece. This specific ecovillage would also serve as a model for replication in the long run.

The methodology to be followed will consist of the following phases: a) literature review b) identification of the principles and values that make ecovillages vital to sustainable development processes c) assessment of the variables that would determine the establishment of an ecovillage at Skyros Island.

Skyros Island is located in the center of the Aegean Sea. Skyros is a place with vivid

tradition, biodiversity and cultural wealth. During the summer, the island receives large tourist pressures while at the same time it is characterized by all the peculiarities of the small islands of the Aegean Archipelagos (small size, isolation, rich but fragile natural / cultural environment). Without any doubt the road to sustainable development goes through environmental protection and sustainable management of local natural resources.

Thus one of the big problems Skyros island, is facing has to do with the inadequate management of natural resources (LIFE09NAT/GR/000323,2012). Skyros Island due to its unique environmental characteristics is considered to be the ideal place for such a project.

The Skyros ecovillage project will be accessible to locals, visitors, students and professionals from environmentally friendly oriented backgrounds and beliefs. Skyros ecovillage would provide a shining example of sustainable development approach, as well as a place of experimental environmental education in real time conditions.

Keywords: ecovillage, sustainable development, environmental education, Skyros island

Introduction

Ecovillages: A General Overview

The 1960s and '70s saw a resurgence of utopian ideals. Sparked by a deep dissatisfaction with the prevailing institutions of economic materialism and people global domination, responsive relocated to the refuge of the countryside in droves to create a better, purer lifestyle for themselves. This 'back-to-the-land' movement was a crude predecessor to the current ecovillage response (Mare, 2000).

The ecovillage, a term that came into common usage in the early 1990s, is a specific form of intentional community. When Findhorn community in northern Scotland announced the topic for their annual autumn conference in 1995 as "Ecovillages and Sustainable Communities", they were overwhelmed with applications from all over the world, breaking all previous records. Eventually, they had to turn away about 400 people for lack of capacity in beautiful Universal Hall. After October 1995, most of like them. Findhorn, began calling "ecovillages", themselves and а new movement was born. Following the conference, a group of about 25 people, from almost as many countries, decided to formalize the sense of a major historic event by founding the Global Ecovillage Network (GEN) to link the hundreds of small projects that had sprung up around the world with a common motivation, but without having knowledge of each other. Gaia Trust, Denmark, committed on the spot to fund the network for the first five years (Jackson R, 2004).

GEN has since divided itself into three regional representations: GEN Oceania and Asia (including Asia, Australia, and the Pacific Islands), ENA (Ecovillage Network of the Americas, including North, Central, and South America), and GEN Europe (including Europe, Africa, and the Middle East) and is partnered with a number of international organizations, including the Nations (Best Practices United and Economic and Social Council), EU Pologne, Hongrie Assistance à la Reconstruction Economique, and European Youth for Action.

What is an Ecovillage?

"An ecovillage is an intentional or traditional community using local participatory processes to holistically

integrate ecological, economic, social, and cultural dimensions of sustainability in order to regenerate social and natural environments." (GEN- Global Ecovillage Network)

The ecovillage model is a conscious response to the extremely complex problem of how to transform our human settlements, whether they be villages, towns or cities, into fullfeatured sustainable communities, harmlessly integrated into the natural environment.

It is best understood as a part of the antiglobalization movement. But while the more visible parts of the anti-globalization movement protest the corporate-dominated global economic model through demonstrations in the streets and consumer boycotts and through single issues movements, eco-villagers have a different approach (Jackson R., 2004).

An ecovillage is most frequently defined in the following way: a human-scale settlement (usually between 50 and 500 members, though there are exceptions) that is intended to be full-featured — providing food, manufacturing, leisure, social opportunities, and commerce — the goal of which is the harmless integration of human activities into the environment in a way that supports healthy human development in physical, emotional, mental, and spiritual ways, and is able to continue into the indefinite future (Bang 2005).

The First Ecovillages

Who were the first "ecovillages"? It is a difficult question because many of the current members of GEN were founded before this word existed. In the 1960s several spiritually based projects were initiated in different parts of the globe: Findhorn in Scotland, The Farm in Tennessee, USA, Sarvodaya in Sri Lanka, and the NAAM movement in Bukino Faso. Solheimer in Iceland has roots going all the way back to 1930 (Jackson H&R.,2004).
Analysis of Ecovillage's Characteristics

Motivation

According to GENNA (Global Ecovillage Network of North America),

The motivation for ecovillages is the choice and commitment to reverse the gradual disintegration of supportive social/cultural structures and the upsurge of destructive environmental practices on our planet. For millennia, people have lived in communities close to nature, and with supportive social structures. Many of these communities, or "ecovillages", exist to this day and are struggling for survival. Ecovillages are now being created intentionally, so people can once more live in communities that are connected to the Earth in a way that ensures the well-being of all life-forms into the indefinite future. Ecovillages are one solution to the major problems of our time the planet is experiencing the limits to growth, and our lives are often lacking meaningful content.

Dimensions of Sustainability

Ecovillages are communities in which people feel supported by and responsible to those around them. They provide a deep sense of belonging to a group. They are small enough that everyone feels safe, empowered, seen and heard. People are then able to participate in making decisions that affect their own lives and that of the community on a transparent basis: Recognizing and relating to others, Sharing common resources and providing mutual aid, Emphasizing holistic and preventive health practices, Providing meaningful work and sustenance to all members, Integrating marginal groups, Promoting unending education, Encouraging unity through respect for differences, Fostering cultural expression. (GEN, Global Ecovillage Network)

The Social Dimension

Ecovillages create holistic social models for an alternative to the destructive trends of our fragmented modern society. They create the possibility of raising children so that they experience the whole of society and nature within walking distance. They offer an alternative to consumerism and the institutionalization of social services. For women they pose a realistic compromise between leaving the children to institutions or being isolated in sleepy suburbs. The increasing number of elderly is posing a real problem in many countries. The senior cohousing trend in Denmark is one solution for senior citizens. But an even better idea with superior social characteristics would be to integrate them in ecovillages having all age groups represented (Jackson R., 2004).

Community means: Recognizing and relating to others, Sharing common resources and providing mutual aid, Emphasizing holistic and preventive health practices, Providing meaningful work and sustenance to all members, Integrating marginal groups, Promoting unending education, Encouraging unity through respect for differences, Fostering cultural expression (GEN, Global Ecovillage Network).

The Ecological Dimension

Reduction of the pressure of human settlements on nature is the key to sustainability. The issue is lifestyle! Building ecovillages brings together home, workplace and recreational activities. It is this triple settlement structure that is the main culprit in consuming energy and producing CO₂ in our car-based society, as our gas-guzzlers race back and forth between home, work and summer cottage. But this structural aspect, which is partly a result of the dominant Money-based economic model with enormous indirect subsidies to the automobile, is seldom recognized in the public debate. Ecovillages create work where people live, produce fresh local foods and allow for a diversity of recreational and creative activities, all within walking distance, resulting in a higher quality of life while using fewer resources (Jackson H&R.2004).

Ecology means: Growing food as much as possible within the community bio-region supporting organic food production there, Creating homes out of locally adapted materials Using village-based integrated systems, energy Protecting renewable biodiversity. Fostering ecological business principles, Assessing the life cycle of all products used in the ecovillage from a social and spiritual as well as an ecological point of view, Preserving clean soil, water and air through proper energy and waste management, Protecting nature and safeguarding wilderness areas (GEN, Global Ecovillage Network).

The Cultural-Spiritual Dimension

Many ecovillages have been created by people who want a more spiritual lifestyle. A change in consciousness is often a factor in choosing such a lifestyle. They try to live a new worldview of global interconnectedness and solidarity (Jackson R., 2004).

Within GEN, spiritual and religious diversity is seen as a blessing and not as a problem. Cultural and spiritual vitality means: Shared expression. creativity, artistic cultural activities, rituals and celebrations, Sense of community unity and mutual support Respect and support for spirituality manifesting in many ways, Shared vision and agreements that express commitments, cultural heritage and the uniqueness of each Flexibility and community, successful responsiveness to difficulties that arise, Understanding of the interconnectedness and interdependence of all the elements of life on Earth and the community's place in and relation to the whole, Creation of a peaceful, loving, sustainable world (GEN, Global Ecovillage Network).

The Economic Dimension

As local groups and communities create their own local scrip currencies and exchange systems, they learn about economist's deepest secret: money and information are equivalent - and neither is scarce! - Hazel Henderson, The Ecovillage economy is quite robust and full of vitality compared to other local economies. Economic Vitality means: Keeping the money in the community, Circulating it through as many hands as possible, Earning it, spending it, and investing it in member-owned retail and service businesses, Saving it in home-grown financial institutions.

Living in an Ecovillage

Ecovillages serve as models of environmental, social, economic and spiritual sustainability, meeting the increasingly urgent global need for viable, sustainable human settlements.

Residents and members agree to several ecological covenants and guidelines upon joining the community, which offer boundaries as far as what is acceptable within the realm of our consumption and impact.(Ziggy, 2012)

Intentional ecological communities. ecovillages, are cohesive social structures, united by common values. They aim to restore the balance between the four elements: earth, air, fire and water, returning humans to a sustainable relationship with all other communities of life. Working with the principle of not taking away from the Earth more than they give back, they are consciously diminishing their ecological footprint. The ecovillage model can be applied equally to urban and rural settings, in developing and developed countries. (Findhorn Ecovillage, 2016)

To be a part of the ecovillage, every person gives 2-4 hours of work per week on a work team. There is the cooking team cooks, the dishwashing and clean-up team, the common house cleaning team, maintenance team, landscaping team, recycling team, etc. Doing chores together in this way increases the efficiency of work and allows for a finer division of labor. Everyone can find something suited to his or her abilities or interests. Members also participate in committees that help the village run smoothly. There is a land use committee, a social events committee, an education committee, a planning committee, finance committee, etc. When a large job needs to be done, such as building a bridge between the two neighborhoods, the community throws a work party and everyone shows up to help (Fang, 2014).

There are examples of successful case studies, as the ecovillage at Ithaca (Franke, 2016) and the ecovillage Sieben Linden (Andreas,2012). The underlying characteristic of ecovillages is that, people who are going to live in the ecovillage would share common resources and environmental vision. A study by Moos, Whitfield, Johnson, and Andrey (2006) estimates that the average Ecovillage at Ithaca (EVI) resident lives at 40 percent the ecological footprint of residents in a "conventional" neighborhood in the same region.

Also the average water use at EVI was 29% of the New York State average use (Richard W. Franke, March 24,2016). Cloughjordan Ecovillage in Ireland, has an ecological footprint of 2 global hectares (gHa), the lowest of any community recorded in Ireland. The results based on the first complete survey of ecovillage residents, carried out last April and May, were presented at a meeting on November 24th by Dr. Vincent Carragher of the Tipperary Energy Agency (TEA).

Ecovillages as "test-fields" of Radical Environmentalism

Ecovillages have been gaining prominence, since the mid-20th century, as sites of research, demonstration and training on social and environmental technologies that support the development of sustainable human settlements. These initiatives can be defined as communitarian endeavors that seek to integrate human activities with the natural world, as well as gain some measure of control over its resources, in a way that is supportive of lasting human development and environmental sustainability (Dawson, 2006).

Despite their diversity, ecovillages share the purpose of being "laboratories for the future", "test-fields" for a structural transition towards a socio-economic systems based on post-carbon technology and the reconstitution of the commons. They also share a radical environmental approach, rooted in a holistic cosmo-vision that regards ecology, community building, science and spirituality as integrated, inseparable fields (Esteves, 2016).

However, the ideal ecovillage does not exist. It is a work in process — a fundamental component of the new paradigm, where much is yet to be learned. What do exist are thousands of partial solutions in a myriad of variants on the same general theme, in different cultures, under different climactic conditions, and under different kinds of societies, but linked together, as if in one extended global family, by a common Lifebased value system that defies traditional divisions of race, religion and culture. (Jackson,2004)

The Skyros Project

The Island of Skyros

Skyros island lies almost in the center of the Aegean Sea, and placed in Sporades island complex. Its area is estimated to be approximately 209.5 sq. km while its population is 2,994 inhabitants according to the 2011 census.

In the southern part of Skyros, the area around Mount Kohilas (the highest mountain on the island with 792m altitude) is included in the European Natura 2000 network and living the Bantam breed Skyros horse (race equus caballus) is today one of the rare breeds horses in the world. In this area there are many kinds of rare and endemic plants, some of which have been included in the Red Book of Rare and Threatened Species of Greek Flora. In the same area there are maple clusters are an important habitat for local biodiversity unique in the Aegean region, especially for birds that nest and shelter there.

In coastal areas of Skyros and the islets of nesting protected seabirds like Shag, the Audouin's Gull, the Artemis and Shearwater while Skyros is still the largest colony of Eleonora's falcon (Falco Eleonorae) in the Aegean, a migratory hawk which is globally threatened species.

Skyros is one of the richest island in biodiversity of Aegean Sea with special ecological importance. Especially the southern part of the island, Mount Kohilas, the surrounding islands and the remaining wetlands of the island are important regions for birds especially migratory while have been recorded important species of bats in the area.

Also, the island is being the natural habitat of "Equus caballus Skyriano". The unique, world-wide, small horse of the breed of Equus Caballus lives in the natural environment of Skyros, in the area of the "Mountain" which is in the south-east part of the island.

It's an old breed of semi-savage horses, with roots in the Classic period, or even the Prehistoric period, the origin of which can be lost in the depths of the Geological centuries.

In the island, are living a native kind of lizard, while the Mediterranean seal Monachus monachus frequently found in caves of the island. Finally, there are several important species of flora and a significant number of endemic and endangered plant species.

Notable Characteristics of Skyros

Until recently Skyros was one of the few islands where the natural environment and biodiversity maintained satisfactorily. This is due mainly to the sustainable way in which they used the ecosystems of the region, in the passage of the centuries.

Of course this method of growth was directly related with the biodiversity's benefits provided to the residents. First provided largely the nourishment of the inhabitants and their livestock. In Skyros are living a large number of sheep and goats which with the Skyros horse needed large area pasture and feed crop in order to meet their needs. The raw materials used by the residents (e.g. wood, dung) was from the island of Skyros, while sources of the island ensured water for people, animals and crops.

Skyros is also famous for its ceramics, wooden furniture and special interior architecture of its houses. In the old days, the traditional workshops of ceramics of Skyros were engaged in creating and manufacturing handy objects (such as pitchers, cookingpots, etc.). These objects were decorated with white-linear designs having neither vitrification nor color designs. The woodcraft, as it is presented through the furniture manufacture and the woodcarving, is the most important and the most known branch of craftsmanship in Skyros. he variety in forms, the wealth and the superior aesthetics of the decorative patterns, the unique technique of carving let the woodcarving of Skyros claim an artistic independence in the Greek territory.

Skyros gives you a glimpse into the truly traditional Greek style of houses and buildings. The villages are very traditional and give you the feeling of walking through a museum. Due to the Cycladic influence, the architecture of Skyros has retained all the key elements associated with it, such as the cubeshape, the white walls, and the wooden doors

Skyros Nowadays

In recent years, however, as in many other island regions, this model of living began to crumble mainly due to strong development and tourism.

Devastating arson fires and wildfires and the subsequent overgrazing resulted in the appearance of very shallow soils of limited productivity. Also, the road opening of the land and the harvesting of springs' water led to the intensification of exploitation of resources but also favored the expansion of overgrazing.

The abandonment of the older years, multiemployment of residents with varying (agroagricultural and livestock) activities, led to a shift of the local economy to tourism, but so anarchic and without ecotourism orientation. In recent years, the trend of the phenomenon of tourism monoculture and shrinkable tourist season, the tourist movement mainly concentrated in July and August.

Thus one of the big problems Skyros island is facing has to do with the inadequate management of natural resources (LIFE09NAT/GR/000323.2012)

Many tourist residences built in recent years, which unregulated endanger its physiognomy landscape and has begun to emerge a pressure on the natural resources of the island.

At the same time due to lack of tourism planning, it is impossible to turn Skyros to other forms of tourism that will lead to the lengthening of the period on the island.

Tourism could not, except in a few cases, to compensate to some extent the losses from other sectors. Nonetheless the model of mass tourism seems to be reaching its limits, presenting problems in economic, social and environmental levels (Spilanis.2005).

However, an important factor in the assessment of life quality, is the evaluation of economic conditions in Skyros and in Greece in general. According to the Hellenic Statistical Authority, the gross domestic product (GDP) has fallen during the period 2009-2015 at a rate of 25.90% while at the same time the unemployment rate for the third quarter of 2016, calculated at 22.60%. Similarly, the average unemployment rate in the European Union in May 2016, was 10,1% (Eurostat.2016).

Obviously economic crisis plaguing Greece, causing great pressure on the social fabric of the country, while at the same time these pressures multiplied in small communities and small-scale economies, where the available resources are fewer. The negative economic climate, the long and ever increasing pressures, which continued from 2009 to today, the lack of investment and mainly the lack of hope and solutions, leading to distortions in the Greek society. Especially in small scale economies like Skyros, unemployment and economic difficulties leading a portion of the population (especially young people) to move to urban centers or even in other countries. The abandonment of traditional arts and lifestyle, which are no longer profitable, finally enhance trend of global tourism monoculture.

The Ecovillage type of living arrangement a promising pathway to responsible environmental behavior: Skyros ecovillage project

The purpose of this paper is to analyze the qualitative characteristics of the two main pillars of the study, which is the ecovillage and the island of Skyros. Through literature research, recognition of quality characteristics and problems, we try to find pathways of responsible environmental behavior by improving the quality of life and assist in solving environmental problems.

The philosophy and way of understanding life and society, through the four dimensions ecological, spiritual, economic) (social, which are basic principles-values of ecovillages, can form the fundamental core which to base the responsible on environmental behavior as treatment of not only environmental problems but also to and distortions problems of local communities.

Our proposal and our goal is the holistic approach, through the four dimensions of the ecovillage, keeping in account the problems, beliefs, culture, needs of the local community.

The island of Skyros chosen as field of study as showing remarkable characteristics. For centuries and until recently, the inhabitants lived in harmony and balance with the natural environment with rational management of resources. It would not be an exaggeration to say that the local community for centuries lived like in an ecovillage with absolute equilibrium, social, ecological, cultural. intellectual. and economic dimensions.

The establishment of an experimental ecovillage in Skyros will help to detect the principles and values of responsible environmental behavior that were existing in earlier societies and either lost or in danger of vanish. Of course, in any way, it should not neglect the needs of individuals and the modern lifestyle.

We consider that due to the economic crisis that exist currently in Greece, the ecovillage in Skyros should be initially establish in limited spatial area, in order to reduce the cost of the initial investment and operating costs.

in our proposal, Innovation is the establishment of ecovillage in Skyros as an experimental model of ecovillage which operating periodically (for example the period from July to August) will be part of an educational institution (University) or other non-governmental government or organization and will address to students, academics, scientists and citizens in general. We vision on an ecovillage in which predominates the fairness, respect and transparency, and will be a meeting point for education, thinking and exchange of ideas of all those factors that are sensitive to environmental issues.

Mainly it will be an extrovert community, with its basic principle the pursuit of responsible environmental behavior and communication with individuals, institutions, communities, organizations. Ecovillage in Skyros will seeking for actions with the local community, in a holistic approach.

The Skyros ecovillage project will be accessible to locals, visitors, students and professionals from environmentally friendly oriented backgrounds and beliefs. Skyros ecovillage would provide a shining example of sustainable development approach, as well as a place of experimental environmental education in real time conditions.

Conclusion

The search for a sustainable lifestyle, combined with the reduction and the solution of environmental problems is a field of research of scientific community and an aim for governments and societies. The adoption of responsible environmental behavior of all stakeholders (society, individuals, organizations, governments, etc.) is one of the key solutions. The ecovillage with their principles and values, are an example of responsible environmental behavior, a remarkable issue for scientific research.

As mentioned above, the main characteristics of Skyros, which provoke research interest, are the lifestyle, the biodiversity, the traditional arts, the rich cultural heritage, the raw materials, and traditions and food.

Nonetheless, beyond the attractive features of Skyros, the modern lifestyle, the economic crisis, and the fluctuations in tourism development have led to distortions in the well being of the community experienced through unemployment, immigration, the aversion of young people in traditional arts, and the phenomenon of tourism monoculture.

The Skyros Ecovillage project is a proposal for establishing a meeting point for scientific community and those interested in environmental issues in real conditions and in complete communication with the local community. The local community which until a few years ago lived in perfect harmony with the natural environment, can provide in scientific research a great impulse, while at the same time has the opportunity to toward find pathways sustainable development, preserving the unique natural environment of the island.

Through analyzing the dimension of sustainability that characterize ecovillages as a viable pathway, in relation to Skyros's features, we tried to assess the prospects of ecovillage at Skyros. establishing an Furthermore an attempt was done to address the ecovillage's positive effects on the local community. Table analyzes 1. the characteristics of the island of Skyros in

accordance with the sustainability ecovillages (social, dimensions of cultural-spiritual, economic), ecological, information derived from literature search. The assessment of Skyros ecovillage's potential, has been studied from two points of view, seen into the two columns of Table I. In the first column the characteristics/advantages of Skyros per ecovillage dimension are stated while in the other column the ill situated points, that could be treated, are recorded.

TABLE 1					
ECOVILLAG E	SKYROS ECOVILLAGE PROJECT ANALYSIS				
Dimensions of Sustainability	Characteristics/ Distortions/ Advantages Targets				
Social Dimension	Living in Skyros, everyone feels safe, sharing common customs and traditions, knowing each other.	Economic crisis, unemployment , immigration especially in young people.			
Ecological Dimension	Rich Biodiversity, habitat for protected species, raw materials, amazing landscape	Pressure of human settlements on nature especially tourism, wildfires,			

ECOVILLAG E	SKYROS ECOVILLAGE PROJECT ANALYSIS			
Dimensions of Sustainability	Characteristics/ Advantages	Distortions/ Targets		
	Traditional Arts	tourism's pressures (new roads etc.)		
Cultural- Spiritual Dimension	(Ceramic, woodcraft, Embroidery, Architecture), Traditional lifestyle and customs, monuments.	aren't viable anymore. Young people fostering a 'urban lifestyle'		
Economic Dimension	Local raw materials (marble etc.), Traditional Arts, amazing landscape, local traditions and foods.	The phenomenon of tourism monoculture led to a shift from past years multi- employments to an anarchic tourism orientation.		

Thus, we advocate not for any specific responsible environmental behavior, but rather for a lifestyle where actions are consciously and reflectively driven by values and a vision for the world (Skanavis and Manolas, 2014).

References

Andreas, Marcus – Wagner, Felix .2012. Realizing Utopia: Ecovillage Endeavors and Academic Approaches

Bang, J.M. 2005. Ecovillages: A Practical Guide to Sustainable Communities. New Society Publishers.

Bower, Robert.2015. Grassroots innovation for urban sustainability: Comparing the diffusion pathways of three ecovillage projects. www.Researchgate.net

Dawson, Jonathan. 2006. Ecovillages: New frontiers for sustainability. Cornwall: Schumacher Society

Esteves, Ana Margarida . 2016. Radical Environmentalism and "Commoning": Synergies Between Ecosystem Regeneration and Social Governance at Tamera Ecovillage, Portugal .

Fang, Clara Changxin. 2014. Ecovillage at Ithaca.

https://residenceonearth.net/2014/03/05/eco village-at-ithaca/

Franke, W.Richard – Chasin H. Barbara.2016.Ecovillage at Ithaca

Jackson, Ross. 2004. The Ecovillage Movement. Permaculture Magazine No. 40

Jackson, Hildur and Ross. 2004. Global Ecovillage Network History 1990-2004

Kasper, Debbie Van Schyndel 2008. Redefining Community in the Ecovillage. Human Ecology Review, Vol. 15, No. 1

Kunze, Iris.2015. Transformative social innovation narrative of the Ecovillage of Schloss Tempelhof. University of Natural Resources and Life Science Vienna

Mare, E.C 2000, A Concise History of the Global Ecovillage Movement. Elisabeth's House - Village Design Institute

Moos, M. Whitfield J, Johnson L C, Andrey J, 2006, "Does design matter? The ecological

footprint as a planning tool at the local level" Journal of Urban Design 11 195–224

Skanavis, C. and Manolas E. 2014. School Gardens and Eco villages: Innovative

Civic Ecology Educational Approaches at Schools and Universities,

Spilanis, J. Vayianni H., Vakoufaris H., Kondili J. 2005. Sustainable development of insular space. University of Aegean.

Spilanis, J. et al. 2015. Atlas of the islands. University of Aegean

Theocharis, A.2009. PHD Thesis. University of Aegean

Tinsley, Stephen and Heather George.2006. Ecological Footprint of the Findhorn Foundation and Community Report

Ziggy,Brian.2012. Modern Pioneers: What it's like living in an Ecovillage.

LIFE09NAT/GR/000323, 'Demonstration of the Biodiversity Action Planning approach, to benefit local biodiversity on an Aegean island, Skyros',2012

Websites

- http://www.statistics.gr Hellenic Statistical Authority [Accessed 26 Jan. 2017]
- http://ec.europa.eu/eurostat European Statistics [Accessed 26 Jan. 2017]
- https://www.findhorn.org Findhorn Foundation [Accessed 26 Jan. 2017]
- http://gen.ecovillage.org/ Global Ecovillage Network [Accessed 26 Jan. 2017]
- http://www.dancingrabbit.org/ Dancing Rabbit Ecovillage [Accessed 26 Jan. 2017]
- http://ecovillageithaca.org/ Ecovillage at Ithaca [Accessed 26 Jan. 2017]
- https://www.researchgate.net [Accessed 26 Jan. 2017]

Performance Evaluation of a Management Scheme in Order to Upgrade the Diversion of MSW: Full Scale Application in Kalamata (Greece)

D.F. Lekkas^{*} and E.E. Klontza University of the Aegean, Mytilene, Greece

concerning In Greece the legislation municipal solid waste management (MSW) is described by the law 4042/2012, in line with the EU Waste Framework Directive 2008/98/EC. The Greek Joint Ministerial 51373/4684/2015 Decision (JMD) has resulted in a revision of the guidelines in order to meet the 2020 EU targets. Municipal administrative authorities are responsible of creating a regional decentralized waste management plan in compliance with the new JMD and the 2020 EU main target which is to reduce waste landfilling to less than the 30% of total amount produced.

The aim of this work is the presentation of a proposed methodology that has been implemented for the management of the municipal solid wastes in the municipality of Kalamata (Greece). The scheme is based on a Mechanical Biological Treatment (MBT) approach, with some alterations resulting to a modular system that allows for flexibility in the input materials: a feature that is important especially in municipalities with diverse characteristics (urban, rural and tourism). Significant numbers of recyclable materials are recovered from the MSWs upgrading the performance of the Municipality as far as the diversion of packaging materials in conjunction with the Material Recovery Facility (MRF). The organic fraction that is also diverted, is composted using a closed static aerated system – a low cost installation that serves its purpose.

Composting has proved to be a suitable method for the treatment of the organic fraction of MSW and the reduction of the remaining wastes which will end up in the landfills (Hargreaves *et al.*, 2008), thus

represents approximately 40% (wet weight) of the total amount of MSW depending on the country, season and environmental policies (Lopez et al., 2010). Composting is an aerobic biodegradation process that could stabilize and sterilize the organic wastes and produce compost (Jakobsen, 1995). It is defined as the biological degradation process of the organic matter under controlled aerobic conditions which leads to the formation of a product that is biologically stable and does not consume oxygen, neither is able to generate phytotoxic metabolites (Ciavatta et al., 1993; Cesaro et al., 2015). Composting systems can either be passively aerated and turned or actively aerated. While windrow technology belongs to the first one, aerated static pile technology belongs to the second one.

In Maratholaka area, 10 Km from Kalamata center, a Mechanical Biological Treatment (MBT) Unit is operated. The treatment process comprises the following steps:

- 1. The total daily amount of MSW produced is collected in the green bins and separated into two streams, the biodegradable fraction and the residual
- 2. Recyclable materials are selected by hand in the sorting unit by the residual stream
- 3. The biodegradable fraction is being treated by composting and the final product is refined by sieving (15mm)
- 4. The residue (non-biodegradable and nonrecyclable materials) is baled and stored on site

In the final product (compost) heavy metals, organic pollutants (PAH's & PCB's),

moisture and Salmonella spp colonies were determined. Physicochemical parameters such as pH, EC, nitrogen, ash content, C/N, and phytotoxicity have also been monitored in order to evaluate the produced material. The concentration levels of heavy metals did not exceed the limits set by legislation, while moisture values were in the range of 23-56,4%. The pH values were ranging between 6,51 and 8,70 and the ash content between 40.65 and 58.20. The C/N ratio minimum value was 11.85 and its maximum value was 18,90. None of the samples was found to be phytotoxic. The produced compost could be used only as coverage material in restoration facilities such as dumps and mines according to the recently revised JMD (56366/4351/2014).

With the suggested management scheme, only 33% of the produced municipal solid wastes are disposed, so Kalamata municipality is close enough to achieve the targets set for 2020. The method is efficient for handling mixed wastes from commingled collection.

The research program started in November 2013. During four distinct periods (11/2013-2/2014; Period 1), 4/2014-12/2014; Period 2, 5/2015-11/2015; Period 3, 11/2015-4/2016; Period 4) 41 windrows in total have been monitored.

Samples	Monitoring duration	Production Periods	Monitoring sessions defined by the change in Greek legislation
Compost 1 (C1)	25/11/2013 - 26/02/2014	Period 1	
Compost 2 (C2)	15/04/2014 - 19/09/2014	Period 2	2/2014-1/2015
Compost 3 (C3)	23/04/2014 - 08/01/2015	Period 2	
Compost 4 (C4)	17/12/2014 - 04/06/2015	Period 3	
Compost 5 (C5)	26/04/2015 - 25/08/2015	Period 4	4/2015-4/2016
Compost 6 (C6)	25/08/2015 - 26/04/2016	Period 4	

 Table 1: Compost Samples from different production periods

The first monitoring session was organised from February 2014 until January 2015. The quality parameters were evaluated according to the Greek JMD 114218/1997. During the second monitoring session (4/2015-2/2016) the parameters were determined according to the new Greek JMD 56366/4351/2014. Results are presented in Table 2.

Although the concentration levels of heavy metals in the compost produced in Kalamata

are not exceeding the legislation maximum according to Greek JMD values. 56366/4351/2014, the produced compost cannot be used in agriculture. The moisture values of the final compost are within the legislation limits (<40%) and in some cases they may be higher depending on the season. For example, sample C3 was collected and analysed in winter months when precipitation was extremely high (the produced compost has not been covered).

		JN	ID 1997	7			JMD 2014		
Parameter	C1	C2	С3	Maximum value (JMD 114218/1997)	C4	C5	C6	Maximum value (JMD 56366/4351/2014)	
Cd (mg kg ⁻¹)	0,47	0,37	1,55	10	3,78	1,73	1,85	3	
Cu (mg kg ⁻¹)	189	93,7	215	500	216	260	95	400	
Ni (mg kg ⁻¹)	77,1	28,0	53,5	200	42,4	43,8	45,7	100	
Pb (mg kg ⁻¹)	204	56,2	129	500	146	127	168	300	
Cr (mg kg ⁻¹)	43,9	26,1	31,9	510	155	39,3	42,3	250	
Zn (mg kg ⁻¹)	114	154	542	2000	478	484	397	1200	
As (mg kg ⁻¹)	1,95	4,21	3,92	15	0,10	4,95	4,01	10	
Hg (mg kg ⁻¹)	2,18	3,18	2,54	5	0,89	2,38	1,95	2,5	
Moisture %	39,3	32,3	40,9	≤40%	33,2	31,5	56,4	≤40%	
pH	8,82	8,91	7,15	6-8	7,91	8,49	6,51	-	
Salmonella spp.	-	-	-	-	absence	absence	absence	absence	
Impurities > 2 mm %	-	-	-	-	15,3%	10,2%	11,8%	\leq 3% on dry weight	
Plastic content %	4,76	4,87	3,13	≤0,3% on dry weight	-	-	-	-	
Glass content %	3,56	6,34	6,76	≤0,5% on dry weight	-	-	-	-	
Material granulometry %	56,3	67,2	62,5	≤10 mm (90%)	-	-	-	-	
OM %	42,9	44,0	43,1		48,2	44,3	40,7		
TKN %	1,18	1,32	1,81		1,63	1,40	1,81		
C/N	20,2	18,2	13,2		16,4	17,6	12,5		

 Table 2: Determination of qualitative parameters in compost samples

Keywords: composting, municipal solid waste, recycling, waste management, organic waste

References

Cesaro A., Belgiorno V. and Guida M. (2015), Compost from organic solid waste: Quality assessment and Europeanregulations for its sustainable use, *Resources*, *Conservation and Recycling*, **94**, 72–79.

Ciavatta C., Govi M., Simoni A. and Sequi P. (1993), Evaluation of heavy metals during stabilization of organic matter in compost produced with municipal wastes, *Bioresource Technology*, **43**, 147–153.

Hargreaves J.C., Adl M.S. and Warman P.R. (2008), A review of the use of composted

municipal solid waste in agriculture, *Agriculture, Ecosystems and Environment,* **123**, 1–14.

Jakobsen S. (1995), Aerobic decomposition of organic wastes 2. Value of compost as fertilizer, *Resources, Conservation and Recycling*, **13**, 57–71.

Lopez M., Soliva M., Xavier Martínez-Farré F., Fernandez M. and Huerta-Pujol O. (2010), Evaluation of MSW organic fraction for composting: Separate collection or mechanical sorting, *Resources, Conservation and Recycling*, **54**, 222–228.

Al Bastakiya: Passive Design Techniques in Traditional Architecture

Isra Abu Zayed American University in the Emirates, Dubai, UAE

Abstract

Dubai's image is one of a fast-paced, modern metropolitan city reaching for the stars. A city whose buildings grasp the highest peaks and construction phases change quarterly. But there is one part of Dubai which remains unchanged. It is Dubai's grip on its heritage and cultural identity. It is from this origin which one must extract the true nature of sustainable living which the countries' elders first introduced as simple fishermen on the coastlines of the Dubai creek. Although traditional architecture in Dubai has taken a back seat during Dubai's rise to fame, it is still one of a pride and identity. Through its modest architecture, Al Bastakiya excels at incorporating sophisticated passive design techniques. Systems which have now been brought to the forefront of sustainable architecture. This paper looks at the passive design techniques incorporated in the Bastakiya Heritage community. Through studying the benefits of the area's urban design, wind towers, mashrabiya, etc, we can learn from the sustainable design processes of the past and how to incorporate them into Dubai's modern architecture to ensure a sustainable future.

Keywords: Sustainable Architecture, Sustainable Design, Dubai, Passive Design, Al Bastakiya

Introduction

Dubai's international image is one of high glass adorned skyscrapers such as Burj Khalifa and the Emirates Towers. The country's economic boom in the early nineties has allowed the nation's ambition to grow into one of the leading business and tourism hubs in the region. In order to

represent itself as a modern city Dubai took on modern building practices. Techniques which have been imported by western architects as symbols of an urban city. Unfortunately this perception of modern architecture has placed the region's own architectural aspirations on hold. As a result the city's skyscrapers took center stage as traditional architecture such as that of Bastakiya and Fahidi Fort took a back seat. But just as with many things in life, there always comes a time to return to the roots. Traditional architecture in the UAE has taken center stage once again as a great example of sustainable architecture which incorporates many passive design techniques. That is why it is important to study the city's humble beginnings in order to extract passive cooling techniques which can be reused today.

Literature Review

In order to assess the quality of the passive cooling techniques found within the Al Bastakiya community, a look at the best practices of passive cooling techniques is needed. This will aid in benchmarking the standard in order to identify the successful application of passive cooling in Al Bastakiya

Kamal (2012), studied an overview of the passive cooling strategies. Addressed the importance of textured exterior walls in order to increase self-shading and minimize heat absorptions. The research also looking at the importance of air circulation and ventilation and how this can be achieved through having ventilation

Abro et al, recognized the relevance of traditional passive design techniques when applied in modern architecture. This was done through a case study of a hospital in the city of Hyderabad, Pakistan in which passive cooling techniques were adopted. In addition to reducing the electrical load on the hospital, researchers found social benefits to the natural cooling process which was apparent on the staff and clients of the hospital (1994).

Bahadori (1978), documented the passive cooling systems found in traditional Iranian architecture. In discussing the passive cooling techniques which have utilized for thousands of years in Iran, great emphasis was places on air circulation, and ventilation throughout the space. The air was mainly collected through wind towers, which captured the cooler, and higher air and circulated it to the interior spaces. Additionally, air ventilation openings were places at the highest points of the structure, the let out the rising hot air (1978).

Location

Traditionally the Bastakiya was placed on the creek in order for the tenants, who were mostly pearl divers, to have excess to their boats and water. It was a means of easing the transportation.

For the residents of Bastakiya, there were many more added benefits to this location. Having the structures situated close to the water front encourages the movement of air. During the day, the ground heats up allowing the air to rise, which brings the breeze in from the creek in order to fill in the air gap. At night, the ground cools down and the opposite occurs. This shift in air temperature moves the air from one direction to the other which allows the residence to enjoy the breeze (Kamal 2012).

Additionally as the air is coming in from the creek, it is likely to cool down as it passes over the water. This extraction of the air's heat also adds to the pleasant effect of the air as it enters the neighborhood and reaches the tenants.

Urban Design

The Bastakiya is found of the south side of the creek. The majority of the houses were aligned parallel to the creek with a slight inclination towards the north-west angle - as seen on the map in Figure 1.



Figure 24

The homes were arranged in a cluster like manner in order to avoid being overly exposed from the sun. The proximity of the homes allows for each home to shade the walls of the home next to it. In addition to this, the proximity of the homes created long and narrow alleyways. These alleyways were shaded by the height of the structures and played as passageways from the breezes to collect and develop. As the air enters the area the proximity of the passageways creates a high pressure area which makes the air move faster. Additionally the density of the urban layout required that residents build wind towers in order to find another means of drawing wind down into their homes.

Wind Tower

The wind tower, a prominent fixture in the Bastakiya area was utilized by many of the residence. The height, frequency and design of the wind tower varied from one home to the other. This depended on the family's financial capabilities. They are a great means of capturing the higher cool air and bringing it inwards into the room. The towers were generally situated on the north end of the room. Traditionally the rooms with the wind towers would be the family's favorite area. Children would sit under it during the day and the father would sleep under it as well. This shows us that the families were not concerned about the collection of dust or sand coming in from the wind tower. This could be due to the cleanliness of the air coming in from the creek which is another added benefit to the location. On the inside of the wind tower there is a cross structural element at a 45 degree angle. This angle helps in strengthening the structure, making sure it withstands high winds and long periods of time. Additionally this cross structural element allows the wind tower to collect air on a unique angle. When the tower is oriented at 45% angle towards the prevailing wind, there is a larger surface area to collect the air inside. This allows for two of the quadrants to absorb the air while the remaining two allow the hot air to exit

Horizontal Badgheer

Traditionally families would sit on the roof of the home at night time in order to enjoy the outdoor breeze. But due to concerns about privacy they also needed to build high walls around the roof. These high walls would then block the desired air flow. Therefore horizontal windows, often referred to as badgheer would be added to the walls on the roof. These windows would allow the air to slide into the wall and downwards through the small opening which still preserved the family's privacy.

The way in which the badgheer is designed has two positive outcomes. Initially the badgheer is designed direct to air downwards. The air is directed downwards due to the fact that the residence would usually be sitting on the ground. Therefore the breeze would sweep down and be refreshing. In addition to this, even when the residents are not sitting on the roof, this airflow can help in reducing the temperature of the roof resulting in a lesser amount of heat gain.

Mashrabiya

References

A more prominent window found in the Bastakiya is the Mashrabiya, The mashrabiya is found on the higher part of the wall. Traditionally the mashrabiya is a means of allowing ventilation without compromising privacy the of the tenants. The aim of the mashrabiva is to utilize the small patterns and shading device in order to avoid direct sunlight penetration into the space. While at the same time allow the breeze to enter at ease. This helps in the prevention of heat gain through solar radiation while allowing the cool air to enter.

Courtyard

The Majority of the homes in Al Bastakiya have a courtyard. The size and design however is related to the family's financial capabilities. The courtyards were utilized as a private outdoor area for the family to site during the winter and enjoy the weather. It is almost like that of a current day back or front yard. Due to the courtyards central location it is shaded from all sides allowing for a cool area. This cool area can play as a ventilation tool for the sounding rooms. Therefore when the doors to the rooms are open, the hot air can make its way to the courtyard and rise out of the home. When the room doors are open this can create for great ventilation through the homes as the air circulates in through the windows or wind towers, out the doors and to the central courtyard.

Conclusion

Al Bastakiya area has several passive design techniques which were very useful to the inhabitants of the area at that time. But today's high energy and face paced society it is important to stop and take note of the many efforts which they took into account to reach thermal comfort within their spaces. Through the use of orientation, urban design, wind towers, different window shading techniques and a courtyard, the residence were able to live comfortably.

Abro, R.S., 1994. Recognition of passive cooling techniques. *Renewable energy*, *5*(5-8), pp.1143-1146.

Bahadori, M.M., 1978. Passive cooling systems in Iranian architecture. Sci. Am.;(United States), 238(2)

Isra I.A., 2015. Site Visit. Al Bastakiya. UAE

Kamal, M.A., 2012. An overview of passive cooling techniques in buildings: design concepts and architectural interventions. *Acta Technica Napocensis: Civil Engineering & Architecture*, 55(1), pp.84-97.

Survey on Households Solid Waste Management among Emirati Households

Aysha Almansoori and Mayada Moussa Hamdan Bin Mohammed Smart University (HBMSU), Dubai, UAE

Abstract

Background: Waste generation is one of the major challenges that face United Arab Emirates (UAE). The total amount of solid waste generated in 2012 in UAE was more than 26 million tonnes. The estimated daily municipal waste generation in UAE was about 1.82 kg per capita in 2014.These figures are expected to grow with the increase in the population and the industry. This survey examines the status of household solid waste management among Emirati households and their level of awareness of solid waste management and its impacts along with their willingness to participate in recycling and compost programs.

Aim & Objectives: To investigate the behaviors and attitudes about households' solid waste disposal, recycling, and waste reduction among Emirati households.

Methodology: A total of 10 Emirati households were interviewed for this study. The Survey on household waste practices and knowledge was adapted from Waste Reduction Study Questionnaire Survey (WRSQS). The Survey was conducted by face-face interviews (40%) or by the phone (60%) by the researcher.

Result: Female were 70% of the total responders. Households were located in Al Ain (5 households), Abu Dhabi (2 households), Dubai (2 households) and Sharjah (1 household). 5 households reported food as the most common household solid waste, 4 households reported plastic as the most common household solid waste, and 1 household reported that paper is the most common household solid waste. Only 2 households had recycling program in their neighborhood. 70% of the households don't separate the waste before disposal. All respondents showed concern about health related issues and diseases that can result from mishandling of waste. All the respondents were willing to participate in recycling programs and program to compost food and yard waste if offered; yet only 50% are willing to pay for pickup of recyclable material from their households. 90% of the respondents believe that they have an important role in the management of waste in the community and 100% of the respondents believe that it is important to educate the public about environmental health and proper waste management.

Conclusion: Waste is an environmental challenge in UAE that requires collaborative efforts from the community, private sector and the government to reduce, recycle and reuse household solid wastes to have a sustainable environment.

Keywords: household waste, waste management, recycling, food waste

Introduction

United Arab Emirates (UAE) is facing different environmental challenges due to the rapid population growth, increased energy and water demand and fast-paced urban development. UAE has one of the world highest energy, water and carbon footprint along with the challenging hot and dry weather that result in increased demand on energy and importing goods that cannot be produced locally. One of the main challenges is the limited freshwater resource in UAE for that the country is depending more on desalinated water as source of water. Another challenge that faces the country is the UAE's per-capita waste generation, as UAE is considered one of the highest among the world in waste-production that mostly ends up in landfills (MOCCAE, 2014).

The municipal solid waste is the waste collected by or on behalf of municipal authorities and disposed of through the municipal waste management system. The municipal solid waste mostly produced by households; other sources are waste from offices, public institutions, etc. Other types of solid waste are construction waste, industrial waste, agricultural waste, medical waste, and sludge from wastewater treatment (MOCCAE, 2016). Household waste. commercial and industrial organizations waste and construction and demolition waste are considered controlled waste, while the includes non-controlled waste waste generated from mines and quarries, agriculture, and from dredging operations (Rushton, 2003).

There are different waste management ways like recycling, composing, incineration and using landfills to dispose the waste. Recycling is the recovery of materials from products after being used by consumers, while composting is the aerobic, biological process of degradation of biodegradable organic matter. Incineration is the process of burning designed to recover energy and reduce the volume of waste to be disposed. Landfill is the deposition of waste in a specific designated area, which in modern sites consists of a pre-constructed 'cell' lined with an impermeable layer and to control and minimize emissions (Rushton, 2003).

Background

The total amount of solid waste generated in 2012 in UAE was more than 26 million tonnes (MOCCAE, 2014). In 2014, the estimated daily municipal waste generation in UAE was about 1.82 kg per capita, compared to United States (1.99 kg per capita in 2011), Switzerland (1.90 kg per capita in 2012) and Germany (1.67 kg per capita in 2012) (MOCCAE, 2016).

Non-hazardous solid waste generated in Abu Dhabi generated in 2013, was 11.8 million tonnes (not accounting for waste generated and discarded illegally), which slightly decreased compared to the amount produced in 2012 (12.84 tonnes), yet the amount is still considered high (AED, 2014). Of the total 2013 solid waste generated in Abu Dhabi, 27% of the total waste was recycled, 3.9% was composted and 68.8% sent to landfills or dumpsites (AED, 2014). In Abu Dhabi, the construction and demolition sector produce 65% of the total waste followed by the municipal sector with 13%, industrial and commercial sector with 11%, agriculture 8%, sludge 1% and other 3% (EAD, 2015). The amount of waste produced in Abu Dhabi in 2015 was 1.7 Kg/person per day compared to 1.32 Kg/person per day in UK, 2.04 Kg/person per day in US and 2.2 Kg/person per day in OECD countries (EAD, 2015).

The total Solid municipal waste in Abu Dhabi was about 1.5 million tons in 2013, of which 59% disposed in dumpsite, 17% composted to be used in agricultural, 16% recycled and about 8% end in landfill (SCAD, 2014). The total number of waste management projects in Abu Dhabi was 35 projects in 2013, including 9 landfills, and 7 special treatment projects (SCAD, 2014). In Dubai, the municipal solid waste generation increased from 550,350 tonnes in 1997 to 2,689,808 in 2011 (Saifaie, 2013).

The municipal Solid Waste consists of organic materials and trash generated in kitchen and other households uses that ends up in landfills or dumpsite where a large amount of methane, a potent greenhouse gas is produced from organic waste (SCAD, 2014 & MOCCAE, 2014). The Green House Gases (GHG) produced from waste in UAE had increased over the years. Methane had increased from 108 kilo tons in 1994 to 339 kilo tons in 2005, while total Carbon dioxide equivalent increased from 2,552 kilo tons in 1994 to 7,122 kilo tons (MOEW, 2015). According to the Greenhouse Gas Emission Inventory Report for Abu Dhabi, about 6.9%

of total greenhouse gas emissions came from the waste sector in 2012 (EAD, 2014).

Currently 25% of the municipal solid waste product is diverted from landfill, yet the aim in 2018 is to have 85% of the municipal solid waste product is diverted from landfill thorough waste reduction and increase in recycling and reuse. To achieve this target more infrastructure development, revision of the legal and policy framework and financial support are needed (EAD, 2013).

The local authorities mainly coordinate waste management. The public sector spending was about 0.67% of GDP that is mostly used in waste management and wastewater treatment (MOCCAE, 2014 & MOCCAE, 2016). In Abu Dhabi, AED 979 million were spent in 2011 as the total annual operating and capital expenditure for waste management, and about 72% of the total expenditure was via direct funding from the government. The current tariff system raised AED 188 Million during 2012 (about 28% of waste management costs). Compared to other countries the Fees are currently applied are much lower. In general the total waste management cost is around 654,226,224 AED and the revenue is 188,353,443 AED (Degree of cost-coverage through revenue of 28.8%). Due to the high cost and low revenue Abu Dhabi needs to invest in infrastructure upgrades, operation and maintenance of new facilities, data gathering and increase in the awareness campaigns (EAD, 2013).

Aim/Objective of the Report

To investigate the behaviors and attitudes about household solid waste disposal, recycling, and waste reduction among Emirati households.

Methodology

Sample Size & Survey Population

A total of 10 Emirati households were interviewed for this study. Households were chosen as a convenience sample. One member from each household was interviewed. Respondents were Emirati adults of 21 years of age or older living in UAE.

Survey Design

Survey about household waste practices and knowledge adopted from Waste Reduction Study Questionnaire Survey (WRSQS) was used. Survey questionnaires were administered among Emirati households. Survey was conducted by face-face interviews (40%) or by the phone survey (60%) by the researcher.

The questionnaire design consists of 6 sections: Demographics, household solid management, waste concerns about household solid waste management, willingness to participate in recycling and compost food programs, household solid management attitude and waste recommendation section.

Data Analysis

IMB SPSS Statics ©Version 23 was used for data entry and analysis.

Results

Female represent 70% of the total responders, majority of the age group was between 30-39 years (60%), with university postgraduate or education (70%)predominant. Households were located in Al Ain (5 households), Abu Dhabi (2households), Dubai (2 households) and Sharjah (1 household) (figure 1), with Villa being the most common household type (7 household). 40% of households had 5-9 persons, 30% had 1-4 persons, 20% had 10-15 persons and 10% had 16 persons or more. 90% of the household had income equal to or more than 15,000 AED per month (90%). More details are shown in table 1.



Table 1: Demographics of respondents

Location of Househol d	Gender	Age Group	Househol d	Number of persons in household
Abu	Male	30-	Apartme	1-4
Dhabi		39	nt	persons
		years		
	Femal	20-	Villa	5-9
	e	29		persons
		years		
Al Ain	Femal	30-	Villa	10-15
	e	39		persons
		years		
	Femal	30-	Traditio	5-9
	e	39	nal	persons
		years	house	
	Femal	30-	Villa	5-9
	e	39		persons
		years		_
	Male	20-	Traditio	10-15
		29	nal	persons
		years	house	
	Femal	20-	Villa	1-4
	e	29		persons
		years		_
Dubai	Femal	30-	Villa	5-9
	e	39		persons
		years		_
	Male	40-	Villa	1-4
		49		persons
		years		
Sharjah	Femal	30-	Traditio	16
-	e	39	nal	persons or
		years	house	more
Total	10	10	10	10

Majority of the households use closed container for household solid waste storage (7 households), one household use open container and one household use plastic bags.

5 households reported that food is the most common household solid waste, while the other 5 households reported it as the third most common type of household solid waste. 4 household reported that plastic is the most common household solid waste produced, 5 household reported as the second most common household solid waste, and 1 household reported it as the third most common household solid waste. Only one household reported that paper is the most common household solid waste.

60% of the households depend on the housemaid on waste disposal, while 40% of households depend on a family member for waste disposal (brother, housewife). 70% of the households don't separate the waste before disposal, while only 2 separate the waste before disposal, and only 2 households have separate bin for recyclable material.

Table 2: Concerns Related to households'	solid
waste management	

Concern	Concerned	Not Concerned	Don' t Kno w	Tota l
Health risks and diseases related to mishandling of household and solid waste	100%	0%	0%	100 %
The reduction of natural resources used to make the products we buy and use	90%	10%	0%	100 %
Waste- collection in your neighborhoo d	100%	0%	0%	100 %
Waste production in your neighborhoo d	60%	40%	0%	100 %
Mishandling of household and solid waste	100%	0%	0%	100 %

100% of the respondents surveyed showed concern about health related and disease that can result from mishandling of waste, and about the services provided in their neighborhood. 60% of the sample surveyed showed concern about the waste generated in their neighborhood, while 40% did not show concern about the waste production in their neighborhood (table 2).

Only 2 households have recycling program in their neighborhood. All the respondents were willing to participate in recycling programs and program to compost food and yard waste if offered; yet only 50% are willing to pay for pickup of recyclable material from their households.

90% of the respondents believe that they have an important role in the management of waste in the community. 90% of the respondents believe that their purchase decisions can increase or decrease the amount of waste produced.

100% of the respondents believe that it is important to educate the public about environmental health and proper waste management and that environmental education should be part of school curriculum.

All the respondents are aware of the UAE initiatives to reduce the burden of the solid waste and agreed to force laws and recycling programs.



Discussion

50% of the respondents reported that food is the most common household waste, with 50% reporting that food waste constitutes 20-39% of the total solid household waste (figure 2). This finding support the reported that the percentage of food waste can be up 33% especially during the holy month of Ramadan (Baldwin, 2016). 4 households reported that plastic was the most common household solid waste generated and only one house used plastic bag for waste collection.

It was reported in 2012, that the solid municipal was composed of organic waste (45%), paper (18%), plastic (14%) and others (23%) (MOCCAE, 2016). Another study on Waste composition analysis done in 2012 in Dubai, showed that 35 % of the general waste was organic waste, about 24% plastic and about 24% paper, about 3% glass and glass bottles and about 2% metals, about 1% wood among other waste (Saifaie, 2013).

More concern was raised concerning the use of non-degradable plastic bags especially with the death of camels and sea turtles in UAE after consuming these plastic bags, which was highlighted in the media. As reported by the Environmental Agency- Abu Dhabi (EAD), about half of the camel deaths were considered related to plastic bags eaten by camels. A survey done by the Ministry of Environment and Water showed that about 11.6 billion plastic bags were used annually, with 53.3% non-biodegradable plastic bags. The Plastic bags and other plastic material consist about 10.9% of the total household waste (MOCCAE, 2014).

Recycling is relatively a new concept in UAE, yet different emirates have introduced integrated waste management system and initiatives to efficiently manage waste collection and encourage the recycling of establishing through recycling waste infrastructure, like compost facilities, wasteto-energy facilities. material recovery facilities, and waste collection centers in residential areas, as well as public education and communication campaigns (MOCCAE, 2016).

Only one family had a recycling program and separate the waste for recycling in Dubai. One family in Al-Ain also separate the solid waste for recycling without having a recycling program in their neighborhood, which reflects the willingness of Emirati families to recycle the solid waste. All the respondents were willing to participate in recycling program and food compost programs yet only 50% were willing to pay to pick there recycling solid waste.

About 77% of the solid municipal waste ends up in the landfills because of the lack of separation schemes in UAE (MOCCAE, 2014). The current best practice of recycling rates is between 50% and 60% of total waste produced internationally (AED, 2014). The municipal solid waste recovery in 2014 was about 14.08%. The UAE Vision 2021 and the UAE Green Agenda set a target of 75% recovery from municipal solid waste by year 2021 (MOCCAE, 2016). The percentage of treated waste in UAE is 21.55% in 2015, yet the target goal in 2021 is 75% (Mazumder, 2016).

There is a great potential for recycling, reusing and recovering resources like energy from generated waste (EAD, 2014). In Abu Dhabi, waste recycling had increased from 23.6% in 2009 to 27% in 2013. Solid waste composted increased also from 170,667 tons in 2009 to 946,92 tons in 2013 (SCAD, 2014). Recycling in Dubai has started early 1990s. Around 175,000 tonnes of recyclable material was collected in 2011; majority was waste paper and Old Corrugated Containers (OCC). In Dubai the Construction and Demolition Recycling Facility, completed in 2010 and operated by Emirates Recycling LLC used to recover steel components and produce aggregates from Construction and Demolition Wastes. Another facility in Dubai is the Materials Recovery Facility operated by Tadweer LLC that has been established in 2006 (Saifaie, 2013).

Different sectors are moving toward waste recycling, one of these organizations is ENOC by adopting the first "green service station" in Dubai, by introducing new waste segregation systems, which provide colorcoded bins, centralized vacuum system to support power conservation and reduce noise and waste and furniture made from recycled materials (MOCCAE, 2014). All the respondents surveyed showed concern about health related issues and diseases that can result from mishandling of waste, and about the services provided in their neighborhood as increase solid waste generation and inappropriate disposal may have adverse effect on the environment (water, soil and atmosphere contamination) and human health causing major public health impact (EAD, 2014, Kiyasudeen S, et al, 2015, pp. 245 & Rushton, 2003). There is a potential for exposure to hazardous material that is generated during waste management, yet the long-term health effects from exposure to substances in waste or that which are produced during waste disposal are difficult to measure (Kiyasudeen S, et al, 2015, pp. 245& Rushton, 2003). There is insufficient and inconclusive evidence about the potential health risk posed on general population especially living in area near to composting landfill sites. facilities, incinerators and nuclear installations (Giusti, 2009), for that more education o the general population about the proper handling and disposal of the waste is needed, as believed by all the study responders, who also supported the idea of educating the children in school and advised to include environmental education in their curriculum.

education is needed More as the Environment and water Ministry 2014 report, showed that the public awareness about waste issue in UAE was 62% (highest in Sharjah 70%, lowest in Ras Al Khimah 43%) and that the positive behavior in general population regarding waste segregation was 45% (highest in Abu Dhabi 55%, lowest in Ras Al Khimah 20%). Only 51% of school student, 60% of vocational student and 73% of university students have awareness on waste issue in UAE (MOEW, 2014), so more awareness and education is needed especially for the young generations. One of the lunched campaigns to educate the community about the dangerous effects of illegal and improper waste dumping on the environment and the natural resources is the "Stop Illegal Dumping of Waste" campaign, lunched in Abu Dhabi 2012, with the slogan

of 'See it, Report it, Stop it' (EAD, 2013). 'Waterwise and Powerwise' initiative lunched in 2013 in Abu Dhabi, aimed to educate the public community and support wise behavior and attitude of energy and water saving, and so reduce the waste produced (MOCCAE, 2014).

All respondents were aware about the UAE initiatives in waste recycling, especially household waste recycling, as different initiatives have been taken in UAE. UAE have established National Waste-to-Resource Program that aims to address the waste generation and landfilling. The program aims to reduce the waste generation, reuse and recycling. The program consists of three different programs: Integrated Waste Management Strategy and Standard, the 3Rs Promotion Scheme (reduce, reuse, recycle) and the Waste-to-Energy Support Scheme. The expected outcomes from the program is to have less landfill, reduce greenhouse gases emission, to have energy supply, to reduce the use of resources, reduce the production cost and growth in green economy jobs (MOCCAE, 2014).

In Abu Dhabi, TADWEEER, Centre of Waste Management was established in 2008 aiming to divert 85% of its waste from dumping grounds by year 2018. In Dubai, the Dubai Municipality's Waste Management Department aims to reduce the amount of waste sent to the landfills to zero in 20 years by using an innovative and integrated approach (MOCCAE, 2014). In Sharjah, Bee'ah (the Arabic word for environment) a municipal waste management company established in 2007, that developed a stateof-the-art waste management center to process and recycle waste. Two-stream waste collection and new tipping fee structure to incentivize waste reduction and to regulate landfill contents were introduced in 2012. Improved blue and green, odor-proof bins have been deployed across the emirate (MOCCAE, 2014).

In 2009, the UAE lunched the UAE Free of Plastic Bags initiative to reduce the amount of the non-biodegradable bags. This initiative was carried in 4 phases including increasing the awareness and educating the population, finding alternatives and issuing a decree banning the use of non-biodegradable plastic bags by the end of year 2012 (MOCCAE, 2014).

Another initiative is to generate energy from waste or Waste-to-energy project through extracting biogas from waste. One of the sites used for Waste-to-energy production is Al Qusais landfill site lunched in Dubai in 2013 and was registered under UN Clean Development Mechanism (CDM) and another waste-to-energy facility is planned in Abu Dhabi (MOCCAE, 2014). Another initiative to change waste to energy is to use waste cooking oil from McDonald's fast food restaurant chain into biofuel in Dubai, after processing it and adding certain chemicals to it that later can be used as fuel to specially adapted lorries. McDonald's collect 22,000 liters of waste cooking oil a month that can power all its UAE fleet (MOCCAE, 2014).

The Waste Management Strategy for the Emirate of Abu Dhabi and The Abu Dhabi Environment Policy Agenda (ADEPA) aim to decrease the domestic waste generation and divert more than 85% of waste streams from dumpsites to more appropriate and environmentally accepted treatment or disposal alternatives (AED, 2014). Abu Dhabi government aims to increase the energy produced from waste by 0.5% of the total Abu Dhabi energy output and to dispose 100% of landfilled waste in sanitary engineered landfills (AED, 2014). One of the uses of waste is to produce power like heat and electricity and materials in waste in production of other sources of energy like diesel, coal and natural gas. There are different techniques of power production from waste through waste incarceration, pyrolysis and thermal gasification, anaerobic digestion and refuse derived fuel (AED, 2014).

Sharjah aims toward Zero-waste-to-landfill goal, through establishing a municipal waste management company "Bee'ah" that introduced recyclable waste collection systems, distributed more than 1,700 threestream recycling bins for the residents to encourage them to separate plastics and cans, paper, and general waste among other services provided to reach the emirate goal. The recovery rate in Sharjah has increased from about 53% in 2012 to 70% in 2015, as waste has been recycled or recovered. A new waste-to-energy facility is planned in Sharjah, which is expected to covert 160,000 tons of waste into energy every year achieving the emirate's goal of diverting all waste from landfill (MOCCAE, 2014).

All the study responders' support having rules to support the recycling programs in UAE. Abu Dhabi Emirate works on main principles on its waste management policy which are to avoid waste production and reduce it amount as much as possible, maximize the reuse and recycle of the waste, and maximize energy production from nonrecyclable waste as much as possible, improve waste treatment for waste that cannot be utilized and providing sanitary engineered landfill sites for waste that cannot be recycled or utilized (AED, 2014), supported by the law No. (21) of 2005 for Waste Management in the Emirate of Abu Dhabi (ILO, 2005). In Dubai, a local Order 11 of 2003, prohibited littering and improper disposal (Saifaie, 2013). A tariff system has been introduced for construction, industrial, commercial, and agricultural sectors to waste and promote recycling reduce (MOCCAE, 2016).

Conclusion

This survey reflected the behaviors and attitudes of Emirati households toward the household solid waste disposal, recycling, and waste reduction among in different cities of UAE. Food was the most common household solid waste as per the responders. The paeticipants reported that food is the most common household solid waste produced in their households. The respondents are concerned about the effect of household waste in general, but they are not doing enough to reduce the burden of the solid waste through waste reduction, recycling and reuse, despite their willingness to participate in alleviating the burden of the solid waste especially if they were supported by the local government through supplying the appropriate equipment and support they need. To have a sustainable environment, a collaborative effort is needed from the general community, the private sector and the government to reduce waste management by the three big words of REDUCE, RECYCLE, REUSE waste.

Limitation

The survey was done on a limited number of Emirati households. The survey needs to be translated into Arabic and to be validated and piloted before using it in interviewing. A unified method of interviewing is needed to ensure that all the respondents are similarly treated to have more representative outcome.

Recommendations

One of the most efficient ways to control solid waste management is trying to eliminate as much as possible at source, through educating the community about the burden of solid waste and appropriate and affordable solutions. Having a fully functional waste-management system that can integrate with other sectors like environmental and energy sectors to generate energy from non-recyclable waste that can help to reduce the burden of waste.

As food comprises a significant percentage of the household waste, it is important to educate the public about healthy shopping habits, and to donate excess food that can be used to charity. Encouraging the food compost program in UAE, and trying to extract organic fertilizer, biogas and biofuel from organic waste and animal waste is another way to reduce the burden of the organic waste and use it as energy and fertilizer sources. Plastic is considered the second most common type of household waste among the survey respondents. Some of the solutions are to use recyclable plastic, to use paper or other re-usable container like glass that can be cleaned and reused. Another recommendation is to decrease the product prices that use recyclable container and increase the taxes on the plastic one, or to use degradable plastic container that is more echo friendly.

When starting a wide recycling program it is recommended to be for free or for law cost to be widely accepted by the general population especially those without prior recycling program.

All of the study respondents showed concern about health issues and disease associated with waste management, so more educational programs should be initiated in different cities to educate the public in different languages as most of the Emirati families depend on the house workers to dispose the household solid waste. It is essential to educate the youth about the environmental challenges in school curriculum, to have a positive behavior about proper waste treatment.

Policies and regulations across the UAE should be developed to regulate waste management that enforce waste reduction and increase recycling and waste reuse in different fields and encourage the general community toward more friendly choices that reduces the burden of waste generation.

References

Abu Dhabi Municipality (ADM). (2011). *NADAFA Program Permitting of Development & Infrastructure Projects*. Abu Dhabi, UAE. Retrieved from: <u>http://www.adm.gov.ae/English/downloadfil</u> <u>e.aspx?cGFnZW5hbWU9RG9jdW11bnRDZ</u> <u>W50ZXImemlwbmFtZT00NTIwMTIxMDE</u> <u>zMjA0NzUxMjUwX05BREFGQSBQcm9n</u> cmFtLnBkZg==

Baldwin, D. (2016, June 29). 33 per cent spike in food waste daily in UAE during Ramadan. *Gulf News*. Retrieved: <u>http://gulfnews.com/news/uae/government/3</u> <u>3-per-cent-spike-in-food-waste-daily-inuae-during-ramadan-1.1854899</u>

Environment Agency– Abu Dhabi (EAD). (2013). TOWARDS INTEGRATED WASTE MANAGEMENT IN ABU DHABI. Abu Dhabi, UAE. Retrieved from: <u>https://www.ead.ae/Documents/PDF-Files/Waste-PB-Eng.pdf</u>

Environment Agency– Abu Dhabi (EAD). (2014). Waste Management: Waste as a source of energy. Abu Dhabi, UAE. Retrieved from: https://www.ead.ae/Publications/Waste%20 Management%20Policy%20Brief/20-05-

2015_Policy%20Brief%20Waste%20Manag ement_EN-006.pdf

Environment Agency– Abu Dhabi (EAD). (2015). *Environmental Snapshot: Abu Dhabi* 2015. Abu Dhabi, UAE. Retrieved from: <u>https://www.ead.ae/Documents/Env-</u> <u>Snapshot-English-Final1.pdf</u>

Giusti,L. (2009). A review of waste management practices and their impact on human health. *Waste Management*. 29 (8). 2227-39. Retrieved from: <u>http://www.sciencedirect.com/science/articl</u> <u>e/pii/S0956053X09001275</u>

International Labour Organization (ILO). (2005). LAW NO. (21) OF 2005 FOR WASTE MANAGEMENT IN THE EMIRATE OF ABU DHABI. Abu Dhabi, UAE. Retrieved from: http://www.ilo.org/dyn/natlex/natlex4.detail ?p_lang=en&p_isn=83638

Kiyasudeen S, K., Ibrahim, M., Shlrene Quaik, S.,& Ismail, S. (2015). Organic Waste Management Practices and Their Impact on Human Health, *Prospects of Organic Waste Management and the Significance of Earthworms*. (pp. 245-252). Switzerland: Springer International Publishing. Retrieved from:

http://health.springer.com/chapter/10.1007/9 78-3-319-24708-3_11

Mazumder, L. (2016). Restructuring the economy through sustainability initiatives in UAE- a case study analysis. *The Business and Management Review*. 7 (5). Retrieved from:

http://www.abrmr.com/myfile/conference_p roceedings/Con_Pro_20588/conference_969 44.pdf

Ministry of climate change and Environment (MOCCAE). (2014). UAE OF GREEN ECONOMY REPORT. Dubai, UAE. Retrieved from: http://www.moccae.gov.ae/assets/e3bd136a/ uae-state-of-green-economy-report-2014.aspx

Ministry of climate change and Environment (MOCCAE). (2016). UAE OF GREEN ECONOMY REPORT. Dubai, UAE. Retrieved from: <u>http://www.moccae.gov.ae/assets/40a8d3c1/</u> green-economy-report-2016.aspx

Ministry of Environment and water (MOEW). (2014).2014 Report Environmental awareness study result United Arab Emirates. United Arab Emirates. Retrieved from: www.moew.gov.ae

Ministry of Environment and water (MOEW). (2015). *State of Environment Report: United Arab Emirates, 2015*. United Arab Emirates. Retrieved from:

www.moew.gov.ae/assets/.../state-ofenvironment-report-2015.aspx

Rushton, L. (2003). Health hazards and waste management. *British Medical Bulletin*.

68: 183–197. Retrieved from: <u>http://bmb.oxfordjournals.org/content/68/1/</u>183.full.pdf+html

Saifaie, A. (2013). Waste Management in Dubai *Envirocities eMagazine*. Issue 4. Retrieved from: http://en.envirocitiesmag.com/articles/pdf/w aste_management_eng_art1.pdf

Statics Center of Abu Dhabi (SCAD). (2014). *Waste Statistics 2013*. Abu Dhabi, UAE. Retrieved from: <u>https://www.scad.ae</u>

How Eco-Friendly are Abu Dhabi Residents?

Raya El Murr Hamdan Bin Mohammed Smart University (HBMSU), Dubai, UAE

Abstract

Background: The United Arab Emirates has one of the biggest ecological footprints in the world with 7.75 gha/pers. According to the Ministry of Environment and Water, Residential buildings account for 57 per cent of the country's ecological footprint, due to the high energy consumption by households.

Methods: The study is a cross-sectional study conducted through an online survey in Abu Dhabi. A total of 83 respondents answered the survey within a week. The survey included 20 multiple choice questions and 1 essay question.

Results: The respondents had varied responses to the survey. Responses were split into "high priority" and others. High priority answers (25% and more "Never" responses) included recycling bottles, cans, newspapers, cardboard, cartons and packaging, energy saving electrical equipment, the use of compost bin, use of public transportation/car-share on journeys to work, buy from charity/second hand shops, and use re-usable back when shopping. The essay question was optional, only 54 answered it and 50% of the responses said the biggest hinder towards becoming ecofriendlier "not enough is recycling facilities", other main hinders included, lack of awareness (14%), lack of reusable products (10%), and over consumption (9%). Other struggles included lack of recycling policies, rare local products

Conclusion: Respondents generally had good intentions towards being more environment friendly, however, in some areas they were handicapped due to lack of awareness and/or an absence of the proper infrastructure to support environmentfriendly actions. Therefore, in order to make the Emirate eco-friendlier, efforts are needed from the government to promote favorable practices and incorporate eco-friendly policies.

Keywords: Environment, United Arab Emirates, Abu Dhabi, recycling, energy consumption, transportation, ecological footprint.

Introduction

The United Arab Emirates (UAE) is a country located in the Middle East and part of the Gulf Cooperation Council (GCC). It was established in December 1971. The United Arab Emirates includes seven emirates with Abu Dhabi as their capital. The UAE's economy depended on fishing and pearls industries before the discovery of oil in 1950 and its export in 1962. (Emirates, U. A., 2007)

Ever since the oil revolution, the UAE's economy transformed and made the country a tourism and trading hub. The oil industry has definitely been a blessing for the UAE, pushing its economy to the top and attracting people from all over the globe, leading to fast urbanization especially in its three main emirates, Abu Dhabi, Dubai and Sharjah. (Kazim, Ayoub M., 2007)

This research surveyed people from Abu Dhabi, which is the largest emirate, to figure out their daily actions that are affecting the UAE's environment, since households have the biggest contribution to the high ecological footprint in the UAE.

Background

Urbanization on the other hand had some adverse effects on the UAE's environment. In 2006, the UAE had the biggest footprint in the world with 11.68 global hectares per person compared to the global average of 2.2 hectares per person at that time (Figure 1). In 2007, through a unique partnership with the Ministry of Environment and Water, Abu Dhabi Global Environment Data Initiative and the Global Footprint Network, EWS-WWF, launched the Ecological Footprint Initiative (Al Basma Al Beeiyah Initiative). This and other initiatives helped decrease the ecological footprint to the current level of 7.75 gha/person. With this number, UAE is still counted among the countries with the highest ecological footprints in the world. The majority of resource demands comes from households and their energy use. High energy consumption in the Emirates leads to high emissions of carbon; and with a landscape of sand and rocks that cannot offer enough help to soak up carbon emissions, the carbon footprint of the UAE is very high. Even with the country's efforts to increase the green landscape, it takes a lot of energy to desalinate seawater and produce 98 percent of the UAE's fresh water and to use a part of it to water greeneries.



Figure 1: Ecological Footprint by Country per person, 2007 (Network, Global Footprint, 2010)

Aim & Methodology

This small scale study aims to figure out some of the day to day habits residents in Abu Dhabi fail to be eco-friendly in, find out the struggles that make it hard to be ecofriendly, point out key actions to have a more environment friendly community, and prove that change is possible with the right actions and policies modification.

Due to the time limit, data collection was done through convenient sampling for only one week. All participants were anonymous and answered the survey online.

Methodology

It is a cross-sectional study to determine the presence or absence of some environment friendly practices. Study population included people residing in Abu Dhabi. Sampling design was convenience sampling. Sample size turned to be 83. Data collection involved a survey of 21 questions (20 multiple choice questions and 1 essay), it was an online survey to get as many responses as possible in the short data collection period of a week. Data was transferred to a spreadsheet to run appropriate quantitative analysis. Finally, qualitative analysis was done on the answers on the essay question.

Results & Discussion

Results showed different responses, some were in favor of the environment and some not. For example, people were cautious when it came to practices that have apparent effect on their electricity and water bills, and were reckless in other practices that had no financial consequences.

Due to the high diversity of answers, some responses were labeled as high priority which

includes responses with 25% or more of "never"; they include recycling bottles, cans, newspapers. cardboard. cartons and packaging, energy saving electrical equipment, the use of compost bin, use of public transportation/car-share on journeys to work, buy from charity/second hand shops, and use re-usable back when shopping. High priority ones show the areas where Abu Dhabi's population has a minimal percentage of people who are environment friendly. For example, compost bins are very rare in the country as well as decent public transportation there are only buses as a means of transport and sometimes they are not convenient time wise. Second hand shops are not available, although it could be a great solution to decrease waste. Re-usable bags are available in a number off shops, but reinforcement is needed for people to follow.



In relation to the UAE's 2021 Vision, Index 2 (Percentage of Treated Waste of Total Waste Generated) linked to the recycling part from questions 4 and 5, by increasing the practice of waste segregation within the population, recycling becomes easier and more feasible.

Regarding question number 21 (As a person living in Abu Dhabi, what pushes you back from being environment friendly?), 10 points were concluded from 54 responses on this question which was optional. As presented in figure 3, nearly 50% of the responses reported that there were "Not enough recycling facilities" in residential and public areas. In second place comes "Lack of awareness" with 14% of the responses, which included the government's initiative to advertise and educate about recycling and other environment friendly actions. 10% of the participants blamed their shortcomings in being environment friendly on the "lack of reusable products" like packaging materials or reusable bags at the market. Over consumption which is often linked to a luxurious lifestyle was voted for by 9% of the participants as the main reason for neglecting the environment. Other less important reasons for not being eco-friendly were: 1. Lack of recycling policies 2. Local products shops being rare 3. Lack of time 4. Laziness. 5. Expensive organic/recyclable products 6. Compost bins being not common.



Successful Eco-friendly Stories

According to (Bushak, 2015) the 10 ecofriendliest cities in the world were able to build an environment friendly culture and system, in addition to sustaining it. Fore example, Copenhagen, Denmark has been voted the world's eco-friendliest city because of its efforts and commitment to follow green ways of living and stick to them, like biking, which is popular mean of transportation in the city.

Another city famous for its high number of bike users is Amsterdam, Netherlands, which is the second eco-friendliest city in the world. Biking does not only promote healthier lifestyle but also reduces carbon emission, which is a serious problem in the Emirates.

Stockholm, Sweden is another city to look up to. It is one of the cleanest cities in the world, air and streets' wise. Their public transportation system is well managed and organized. Waste management system in Sweden is a great example of a successful and sustainable system to copy. In Sweden, (Lum, 2014) less than 1% of the waste goes to landfills and the rest, half of it is recycled and the other half is used for energy production. Because Sweden's waste is not enough for their energy production plan, it imports about 800,000 tons of waste from other countries (Plante, 2015). Wellstructured incineration of waste ensures the least possible harm to the environment, meaning, it has less adverse effects on the environment than landfills and it produces only half of the permitted carbon emission levels demanded by the authorities. Most importantly, Sweden made sure to raise awareness among its population on the need to recycle properly and not to throw things outdoors so they get recycled and reused, in addition to reinforcing policies that ensure consistency and adherence at all times.

Conclusion

One of the main environmental issues in Abu Dhabi, and in the UAE in general, is the lack of eco-friendly practices within the community and the absence of governmental enforcement of laws that support these practices. These practices include low usage of energy efficient bulbs and appliances, lack of recycling bins in public areas and homes, over dependence on individual cars, and the low preference for second hand market, mainly because life in the Emirates is well known for being luxurious and consumers tend to be frivolous when it comes to resources.

Recommendations

education People's on becoming environment friendly is critical and would pay off in favor of the Emirate's ecological system. Addressing the link between lifestyle in the Emirates and its effects on the environment is important. For example, people should be charged for each plastic bag they take from the supermarket to encourage them to use the re-usable shopping bags instead. Recycling bins should be distributed everywhere, in public areas first and then near homes to encourage people to be involved in the waste segregation process and later on, enforcing waste segregation by Energy consumption is another law. important issue to be addressed, people should have more knowledge on how much energy they are using, therefore, they will be more cautious when consuming it. The government should work more on the public transportation system to make it more favorable to the public and to accommodate a higher percentage of the population. Second-hand goods market should be introduced in a way that is attractive to people. Finally, local products should be supported by promoting them.

The government's involvement is critical in supporting any and all changes and to enforce them. А national awareness campaign is needed across schools and workplaces to teach people how to become environment friendlier and the impact they can have on the national and global level. In addition, learning from governments that were able to successfully manage waste and even benefit from it is very important. Creating a supportive culture is key to promote good and environment friendly practices. Finally, establishing laws and regulations that enforce environmental friendly behavior is very useful. People might refuse change, but with laws and regulations in place, this helps people to adopt the desired practices quickly.

References

Kazim, A. M. (2007). Assessments of primary energy consumption and its environmental consequences in the United Arab Emirates. Renewable and Sustainable Energy Reviews, 11(3), 426-446.

Lum, Z. (2014). 99 Per Cent of Sweden's Garbage Is Now Recycled. The Huffington Post Canada. Network, G. F. (2010). Ecological footprint atlas 2010. Retrieved May, 25, 2014.

Plante, C. (2015). Here's how less than one percent of Sweden's waste ends up in landfills. The Verge.

Reiche, D. (2010). Energy Policies of Gulf Cooperation Council (GCC) countries possibilities and limitations of ecological modernization in rentier states. Energy Policy, 38(5), 2395-240

Educators' Perceptions Concerning the Reactions of Students in the Presence of Environmental Education

Jana Bou Reslan Saint Louis University

Abstract

This study examines the perception of school leaders and teachers on how or if Environmental Education had an effect on school students' middle and high performance and reactions in terms of behavior and attitude toward the nature of *EE in relevance with its influence on middle* and high school students in terms of their behavior and attitude change as the school implemented environmental sustainability, identifying key messages emerging from the influence of the EE curricula, and whether limitations in terms of pragmatic underpinnings generalizability and occurred, and raising questions about the effectiveness of environmental education in formal learning setting, and suggesting priorities for future work.

A discussion of theories of environmental education models in addition to the history of EE builds a framework for situating the present contexts of how educators perceive middle and high school behavior, attitude and opinions in the presence of EE. The analysis and discussion follow interviews with school administrators and teachers of the middle and high school levels. Teachers were well informed about and engaged in the implementation of current environmental education practices, including the integration of the healthy food program with the adoption of a content and theme-specific EE curriculum such as plantation and recycling.

Key Words: Environmental Education, *Plantation, Attitude, Green Citizen*

Introduction

When people recognize their individual responsibility toward the environment, they will try to conserve nature as certain values, motivation, and community engagement methods are provided (Howell, 2013). Likewise, increased students' awareness about the significance of preserving the environment allows them to better protect mother earth from complete degradation Spedding, (Hasan. Ghose. & 2009). Developing student awareness and encouraging a positive attitude toward the environment can be through attained environmental education. Therefore. education is a fundamental social instrument that serves as a catalyst of change. Mostly, education provides knowledge, awareness, skills, attitude, and values helpful to have a good quality of life (Larijani & Yeshodhara, 2008).

In the Lebanese Constitution (Habachy, 1964), there is no direct reference to the environment. However, the only connection is found in Article 15 of the Constitution banning any form of land acquisition except for the public interest, broadly interpreted as the provision of public services including roads, electricity, and water (Darwich, 2011). Increased public concern over Lebanon's compounding environmental problems led to the creation of the Ministry of Environment on April 2, 1993 (El-Fadel, Zeinati, & Jamali, 2000). A major achievement of the Ministry of Environment (MoE) is the relation established with other organizations such as local non-governmental organizations (NGOs) and the Ministry of Environmental Education to establish Education. However, there are only a few studies conducted on students' awareness

and attitude about environmental education for students in Lebanon (Oweini and Houri, 2006).

In Lebanon, "environmental education was introduced in 1997 for the first time into the Lebanese general education curriculum, it is integrated mainly into the science and social studies at the elementary, intermediate, and secondary levels and the implementation is effective" (Makki, Khalick, not & Boujaoude, 2003, p. 3). Thus, to achieve awareness in tackling the environmental problems in a country, developing the right attitude, knowledge, and awareness at every level of education needs investigation and analysis of students' attitude, behavior, and intention about the environment (Athman & Monroe, 2001). Lebanese organizations must demonstrate putting more effort to promote responsibility corporate social (CSR) policies and programs and benefit from them as a basic competency (Hejase, Farha, Haddad, & Hamdar, 2012). The problem is students do not have a deep awareness about the need to protect the environment. With the right scope and sequence of environmental education; however, and by applying child development theories to develop a more effective environmental education program by educational leaders, students will develop intellectually and morally as they become more supportive toward the environment (Braus & Wood, 1993). Therefore. investigating middle and high school students' attitudes and behaviors resulting teaching of environmental from the education is important, investigating their attitudes and behaviors from the perceptions of teachers and administrators.

Purpose Statement

The purpose of this investigation was to determine the perception of school leaders and teachers on how or if Environmental Education had an effect on middle and high school students' performance and reactions in terms of behavior and attitude:

1) Toward the nature of EE in relevance with its influence on middle and high school students in terms of their behavior and attitude change as the school implemented environmental sustainability.

- Toward identifying key messages emerging from the influence of the EE curricula, and whether limitations in terms of pragmatic underpinnings and generalizability occurred. Bou Zeineddine (2013) argued environmental education influences students in several manners that favor pro-environmental activism.
- 3) Toward raising questions about the effectiveness of environmental education in formal learning setting, and suggesting priorities for future work. The rationale for this undertaking was as simple as a shortage of published reviews in the field of environmental education research in Lebanon, Makki, Khalick, & Boujaoude (2003) insisted EE is not available for many school students. El-Fadel, Zeinati, & Jamali (2000) mentioned compulsory signing of a cooperation agreement between the Ministry of Environment and the Ministry of Education is important. This has already begun to be implemented in schools through the subject of environmental education. Nonetheless the question remained how effective the implementation was.

Research Questions

To investigate the effect of EE on students, this investigation used guiding questions to assist the investigator. The guiding questions were:

- How does Environmental Education (EE) influence students' behavior from school administrators' viewpoint?
- 2) What are the teachers' perceptions on students' attitude change as a result of EE teachings?

Literature Review

History and Development of Environmental Education (EE)

Environmental education (EE) has a short history, but has been an important point of discussion among supporters and critics. The development of EE can be traced back to the Tbilisi Declaration of 1977, the result of an intergovernmental conference convened by the United Nations Educational Scientific and Cultural Organization (UNESCO), which became the strongest single voice for the development of EE (Hungerford, 1990). The focus of EE began with integrating topics of ecology, population, and pollution in education, and has expanded to include biodiversity, sustainable development, and climate change (Hungerford, 2009). With the emergence of EE, a community of supporters and critics has emerged (Gruenewald, 2004).

Giolitto, Mathot, Pardo, and Vergnes (1997) concluded the four major aims of environmental education are the creation of new behavior patterns, the development of values, attitudes, and skills necessary to protect and improve the environment. The debate surrounding EE centers on whether resources should be directed to the topic, and how EE should be taught. In 1997, Richard Wilke, a prominent EE scholar, delivered a speech arguing environmental educators "do not advocate particular actions but provide the skills necessary for people to be responsible citizens who can effectively make informed decisions" (Hungerford, 2009, p. 3). The NCLI Coalition (n.d.) identified EE as an interdisciplinary approach focused on the "interactions between natural and human systems" (para. 1). Many, including Wilke, argued teachers should be environmental educators, not environmentalists. However, critics argued it should rather be the other way around (Hungerford, 2009). They contend teachers should use EE curriculum to teach learners about the environment rather than how to make responsible decisions concerning the environment, and EE programs advance a biased, one-sided, environmentalist agenda (Sanera, 2008).

A linear model of behavior assumes students made more knowledgeable about the environment will participate and engage in making positive change on the environment (Meinhold & Malkus, 2005). However, many researchers found knowledge about the environment does not necessarily make an individual care and become environmentally conscience since it does not necessarily lead to favorable attitudes (Ramsey and Rickson, 1977), although it must be said people who are familiar with environmental problems have been found to be more likely to exhibit environmentally friendly behavior (Lindenberg & Steg, 2007). Knowledge of environmental issues is in fact regarded as an entry-level variable and a minor one (Hungerford & Volk, 1990).

The Influence of EnvironmentalEducation (EE)

Research has indicated integrating EE into a school's curriculum positively influences students' attitudes toward the environment (Ballantyne, Fien, & Packer, 2001) and has been found to develop students' analytical and problem-solving skills. (Ballantyne, et al., 2001; Bartosh, et al., 2006; Ernst & Monroe, 2004; Lozar-Glenn, 2000). Moreover, hands-on EE has been found to engage students in school as a whole (Skinner & Chi, 2012). In fact, school grounds programs, including gardens and outdoor classrooms, have been shown to be particularly effective in engaging students (Skelly & Zajicke, 1998; Malone, Karen, & Tranter, 2003). And engaged students have been found to accumulate more knowledge (McCormick, Miller, & Pressley, 1989).

Studies have documented most children learn best through concrete experiences as discovery and interaction play an important part in assimilation (Malone & Tranter, 2003), and green school grounds provide the perfect setting for natural experiences for children. which important for is environmental learning (Malone, Karen, & Moreover, outdoor Tranter, 2003). classrooms, including gardens, forests, and other natural environments, have a positive influence on children's social interactions (Keniger, Gaston, Irvine, & Fuller, 2013). In fact, bullying rates are lower in schools with greater access to natural environments, and children who play in green areas have been found to have more positive feelings towards each other (Thompson, Aspinall, & Montarzino, 2007). Activities, such as construction in the forest, encourage cooperation between students rather than competition (Malone, Karen, & Tranter, 2003).

Elements of Effective Environmental Programs

A key tenet of constructivism is the interplay between new experiences and the learner's prior knowledge based on past experiences and perceptions (Knapp, 1996). Ausubel (1978) insisted a learner's prior knowledge is the most important factor that influences readiness his/her to assimilate new information. Learning occurs by constructing knowledge actively, considering new information and comparing it with previous understanding (Argyris & Kaplan, 1994).

Intergovernmental Conference The on Environmental Education (UNESCO, 1978) primary categories outlined the of environmental education curriculum goals objectives: awareness, knowledge, and attitudes, skills, and participation. The purpose of the investigation was to build a meaningful foundation for understanding and explaining the perceptions EE had on student performance and reactions. The main focus of this research was to determine the presence of EE- how middle and high school teachers and school leaders perceived student attitude and behavioral changes.

Research Methodology

Instruments

The following instruments were constructed for the development of the evaluation tool. The first instrument was the interview with homeroom teachers of grades 7-12 through all sections. The 20 participants of this investigation consisted of two different parties of voluntary correspondents involved in environmental education programs at a Lebanese School. The first group, the teachers, consisted of 15 homeroom teachers. The second is the school leaders, where 5 administrators were interviewed. The school leaders were the principal, student affairs officer, and three supervisors. Homeroom teachers were interviewed on one-on-one basis to identify the influence and effect environmental education had on students' attitudes. Mosothwane (2015)argued schools should increase environmental education focus on student behavior and attitude construction. Each participant was asked 9 open-ended interview questions. The researcher studied the perceptions of teachers regarding the influence Environmental Education (EE) had on students' attitudes. The same interview question set was used with the school leaders to investigate the school leaders' perceptions of students' behavior as a result of EE. These questions were validated by experts in the field. The interviews were done individually and responses were recorded in exact words without paraphrasing or changing words. number-coded Responses were for confidentiality.

Perceptual Data Collection

Interview participants included middle and high school teachers and school leaders at Lebanese School). Thirteen teachers voluntarily participated in the project. Six administrators voluntarily participated in the project. In total, 20 participants were involved over the 2015-2016 School Term II. Interviews are methods common of qualitative perceptual data collection (Denzin & Lincoln, 2000). Teachers were questions to investigate their asked perceptions regarding the effect EE had on middle and high school students' behavior. Arrangements for the conduct of the investigation were made before visiting the regularly with administrators. school coordinators, and prospective teacher participants. Interviews with the homeroom teachers were conducted in English and lasted from 30 to 45 minutes each. The questions were thematic, open-ended, and sequenced with each participant in an individual teacher interview and individual interviews with school leaders. Language barriers were escaped by translating any term
or phrase not clear in English into Arabic. The 9 interview questions were:

- 1) Which age groups are actually changing the personal and social behavior?
- 2) Do you think the EE curriculum at the school can create a green citizen?
- 3) What's being done to engage students to ACT, and what needs to be changed in the EE to maintain action in the long term?
- 4) Which program or activity in the EE successfully engaged students to change their habits on the long-term?
- 5) To what extent do you think students' actions are environmentally conscious inside and outside schools?
- 6) What behavior changes do you think EE has created in students?
- 7) How did EE affect the affective development of students?
- 8) How has EE affected the cognitive development of students?
- 9) How has EE affected the personal and social development of students?

Interview Analysis

Document Analysis included analysis of personal documents such a personal journal of interviews. The researcher's personal journal, in the form of notes coordinated with a calendar, was a part of the perceptual data collection process, and included iterative "observers" comments," or integrative memos (Emerson, Fretz & Shaw, 1995) about ideas generated from past observations and suggested themes that may have been of interest to participants. 20 responses were number-coded and copied without any changes on a Microsoft Word document for each question. The investigator highlighted repeated words in addition the to complimentary or highly associated big ideas.

Organizing and Coding Perceptual Data

The perceptual data analysis evaluates perceptual data (Thorne, 2000) to detect and interpret thematic categorizations, search for inconsistencies and contradictions, and generate conclusions. During and after perceptual data collection, with the interview

with school leaders and individual interviews with homeroom teachers, the perceptual data was analyzed through a process of organizing and coding. Interviews were transcribed, in detail, from the recorders to Word documents as soon as possible following the interviews. This maximized accuracy of the literal words and interpretations spoken of meanings. The responses to thematic and open-ended questions. together with perceptual data from field notes and observations were then examined to find recurring themes and patterns, and these were matched with themes from the literature review and theoretical framework.

Results

The nine interview questions the researcher asked the 20 participants culminated in reporting the following basic concepts: First, EE curriculum has the ability to produce a green citizen according to almost all participants. Second, almost half the educators perceive many students to have become more responsible, caring, and innovative through reinforced critical thinking, authentic modes of learning, and real-life problem-based projects of plantation and cleanliness campaigns. They showed a tendency to lead a lifestyle of healthier food choices. Socially, half the participants agree EE curriculum has positively affected students' social skills through leadership and partnership skills, required to build productive teams. Third, around half the participants perceive students' awareness of seeing the consequences behind their environmental actions. Forth, more than half the participants reported the age of 9 to be the least resistant to changing behavior toward more environmental consciousness. Fifth, the activity that successfully engaged students to change their habits on the longterm was mainly the plantation activity (30%). Sixth, an estimate of 60% of participants reported around 57% of students was environmentally conscious, especially inside school. Outside school, 30% of participants reported it needs more parental and other stakeholders' involvement to keep

a consistent environmentally conscious behavior. Seventh, behaviors reported to have changed according to the perception of 20 educators was mainly related to improvement in cleanliness (80% of participants). Finally, more than 45% of the participants reported what the school needs to have is to push for governmental law enforcement pertaining to environmental challenges; also, a more applied school educational philosophy can bring about further consistency along with parental support to get students to maintain environmental actions on the long-run.

Answering the Research Questions

The research questions were reviewed and answered based on the findings. From the school leaders' standpoint, environmental education (EE) influenced students' behavior highly. positively and The five administrators agreed students prior to EE did not care about the environment. They used to throw tissues and bottles in the playground. They became more aware after and applying studying environmental projects. Students observe each other and apply their own punishment and reward system among each other. One administrator argued students became cleaner in the way they wash and take baths in a more regulated fashion; not just clean in their surroundings. All leaders in the school agreed the key to EE behavioral changes was follow-up and consistency.

Reviewing the second research question revealed teachers' perceptions on students' attitudes as an effect of EE instruction. All classroom teachers agreed students found new attitude and awareness related to the environment. One third of the teachers had pointed out they believed the change in attitude needs more than "EE school program" to become permanent. Five teachers gave examples of governmental policies and laws that should be developed and applied for the new environmentalfriendly attitude to become authentic. They insisted such changes were temporary if not all stakeholders in the whole community were involved in environmental work.

Recommendations & Implications

There are six recommendations made to improve environments education and implications concerning how each can be achieved. These recommendations are intended for educators, administrators, and the Ministry of Education.

Recommendation One: Evidence-Based Decision Making for Grade 4 Curriculum

The first step for the Lebanese School is to investigate whether the perception of educators regarding the susceptibility of 9year olds to change behavior and attitude to be more environmental. If proved to be true, the school should establish a program, formed by the leaders of School to encourage students' knowledge (especially 9-years old) industrial pollution, scientific about knowledge, socio-economic grouping, and TV science watching as studies have shown they were more powerful variables [than age] to reinforce EE values.

Implications for Recommendation One

Action research should be carried out during summer by Grade 4 homeroom teacher to investigate whether the age of 9 is more prone to gain environmentally conscious behavior and attitude. According to the research results, Grade 4 homeroom teacher should form a focus group along with other grade level teachers and Cycle II leader to develop a special EE program that attends to teaching core themes such as industrial pollution and scientific knowledge.

Recommendation Two: Customized EE Programs for Effective Teaching

Second, it is recommended school leaders should get their homeroom teachers to enroll in customized EE programs to become more effective at teaching the EE curriculum.

Implications for Recommendation Two

With the support of the Ministry of Environment (MoE), the school principal

should get a series of training workshops to equip teachers with the necessary EE teaching skills of instruction and evaluation. It should be done promptly, preferably during summer vacation, so that students can benefit from the beginning of the academic year.

Recommendation Three: Expanding Plantation and Farming Projects

Third, around half the participants perceive students' awareness of seeing the consequences behind their environmental actions. The School should continue to expand with the plantation and farming projects in the fields next to the school to change attitudes and behaviors of students towards becoming green citizens.

Implications for Recommendation Three

Expansion of plantation and farming projects should take place consistently and steadily. Students and teachers should put a plan and implement it accordingly throughout the academic year. Expansion of plantation and farming projects should result as an outcome of Science Fair projects and weekly activities in the fields. It should be arranged for through the school leaders and supervisors.

Recommendation Four: Adoption of a Content and Theme-specific EE Curriculum

Forth, the activities that successfully engaged students to change their habits on the longterm were mainly the plantation activities (30%), cleanliness, and recycling. It is recommended the School adopts a content and theme-specific curriculum of EE pertaining to plantations, recycling, and urine-powered generator for low energy use, just like the initiatives focused on specific content areas to help students acquire environmental long-term habits in the area of their focus (recycling, energy reduction, and plantations).

Implications for Recommendation Four

Theme-specific curriculum should be developed across all cycles. Each cycle leader along with the corresponding cycle teachers should form learning communities during the summer workshops. After acquiring the necessary EE teaching skills (as per Recommendation 2), teachers of the same cycle should develop together their theme-focused content of plantations, recycling, and urine-powered generator for low energy use. Then, they should link it through transitional phases from one cycle to another through creating coherence and big ideas. Cycle leaders should form another community to do a final draft of the curriculum until all its parts are associated and complimentary. A pilot project can start it during Year 1. Then, redrafting of the new curriculum is required until it meets learning objectives of each level, cycle, and school mission: in addition to national and international standards of teaching EE in contemporary schools.

Recommendation Five: "Green Leadership" Workshops for Stakeholders

Fifth, since around 60% of participants reported 57% of students were environmentally conscious (inside school) while outside school, 30% of participants reported it needs more parental involvement and consistency, it is recommended the School invite other stakeholders in the community such as parents and NGOs, in addition to environmental activists to arrange a series of "Green Leadership" for workshops in order to reinforce EE values with the stakeholders of the community outside the school. After the series of workshops are given, they will be monitored and evaluated. This method should help maintain a consistent and environmentally conscious behavior for students.

Implications for Recommendation Five

Stakeholders' workshop series "Green Leadership" should be planned and conducted holistically and across all stakeholders by EE experts; either from the school or outside from non-governmental organizations that help protect the environment. Each session, the focus should be on making effective EE behavior relevant

to students' experience and lives inside and outside school. The internal life of students inside and outside school should be the core content of one session to examine if and when students' environmental consciousness is highly related to school context of law and order, punishment and reward, actions and consequences in school.

Recommendation Six: School Advocacy for Governmental Law Enforcement

Sixth, behaviors reported to have changed according to the perception of 20 educators were mainly related to improvement in cleanliness (80% of participants). Finally, more than 45% of the participants reported the school needs to push for governmental law enforcement pertaining to environmental challenges. Further implementation of a greener educational philosophy of the school should bring about further consistency along with parental support to get students to maintain environmental actions on the longrun. For such purposes, it is recommended the School introduce EE gameplay to help players realize the importance of their personal actions, with reports of new ecofriendly behaviors and a knack to educate others on the environment.

Implications for Recommendation Six

Part of the Science Fair should encourage students to come up with electronic games that favor EE to help students learn new values and protect the environment through gamification. As more students show environmentally conscious behavior, the school should organize "Vicinity Influencers" debates every weekend to help each student voice his/her concern in his/her neighborhood as of the new academic year. Municipality programs and election results should reflect such EE changes in their agenda until a new law is drafted towards enforcement of environmentally conscious actions.

Recommendations for Future Research

It is important to further investigate different EE school model construction and the relevant development of theme-specific content and curricula. Educational model construction is made of phases and done by trial and error until the model finally proves its success. It is suggested The School conduct its own pilot investigation to check which model might serve best the Lebanese communities in an attempt to address the current environmental crisis the country is facing with its trash recycling and reduction.

References

Argyris, C., & Kaplan, R. S. (1994). Implementing new knowledge: The case of activity-based costi. *Accounting horizons*, 8(3), 83.

Athman, Julie A. and Martha C. Monroe 2001. "Elements of Effective Environmental Education Programs".

Ausubel, D. (1978). In defense of advance organizers: A reply to the critics. Review of Educational Research, 48, 251-257.

Ballantyne, R., Fien, J., & Packer, J. (2001). Program effectiveness in facilitating intergenerational influence in environmental education: Lessons from the field. *The Journal of Environmental Education*, *32*(4), 8-15.

Bartosh, O., Mayer-Smith, J., Peterat, L. (2006) Informal science learning on the farm: Teachers' and students' experiences in a long-term environmental education project. National Association for Research in Science Teaching, San Francisco, CA.

Braus, J. A. and Wood, D. (1993). Environmental Education in Schools: Creating a Program that Works! Manual M0044. District of Columbia: Peace Corps (ED 368584-for English version)

Bou Zeineddine, S. A. (2013, May, 3). [Environmental Education]. Retrieved from <u>http://almanarmodernschool.com/environme</u> <u>ntal-education/</u>

Cottrell, S. P. (2003). Influence of sociodemographics and environmental attitudes on general responsible environmental behavior among recreational boaters. *Environment and Behavior*, *35*(3), 347-375

Darwich, L. A. (2011). *The UNDP and the Reconstruction of Beirut Southern Suburbs Following the July 2006 War: Aims and Achievements* (Doctoral dissertation, LEBANESE AMERICAN UNIVERSITY).

Denzin, N. K. & Y. S. Lincoln (2000). Introduction: The discipline and practice of qualitative research. In N. K. Denzin & Y. S. Lincoln (eds.), Handbook of El-Fadel, M., Zeinati, M. and Jamali, D. 2000. Water resources in Lebanon: characterization, water balance, and constraints. J. of Water Res. Devel., 16: 619-642.

Emerson, R., Fretz, R., & Shaw, L. (1995). Writing ethnographic fieldnotes. Chicago: The University of Chicago Press.

Ernst, J., and M. Monroe. 2004. "The Effects of Environment-based Education on Students' Critical Thinking Skills and Disposition toward Critical Thinking." Environmental Education Research 10: 507– 522.

Fien, J (1992). Education for the Environment : A Critical Ethnography, Brisbane : University of Queensland, Australia.

Fien, J. (2004). 11 Education for sustainability. Studying society and environment: A guide for teachers, 184.

Goodlad, J. I., & Anderson, R. H. (1987). *The nongraded elementary school*. Teachers College Press.

Gruenewald, D. A. (2004). A Foucauldian analysis of environmental education: Toward the socioecological challenge of the Earth Charter.Curriculum inquiry, 34(1), 71-107.

Habachy, S. (1964). The Republican Institutions of Lebanon: Its Constitution. *The American Journal of Comparative Law*, 594-604.

Hasan, H. M., Ghose, A. K. & Spedding, T. A. (2009). IS solution for the global environmental challenge: an Australian initiative. Proceedings of the Fifteenth

Americas Conference on Information Systems: AMCIS2009 (pp. 1-7). San Francisco, California: San Francisco State University.

Hines, J. M., Hungerford, H. R., & Tomera, A. N. (1987). Analysis and synthesis of research on responsible environmental behavior: A meta-analysis. *The Journal of environmental education*, 18(2), 1-8. Howell, R.A., 2013. It's not (just) "the environment, stupid!" Values, motivations, and routes to engagement of people adopting lower-carbon lifestyles. Global Environmental Change, 23(1):281-290.

Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education*, 21(3), 8-21.

Keniger, L. E., Gaston, K. J., Irvine, K. N., & Fuller, R. A. (2013). What are the Benefits of Interacting with Nature?. *International Journal of Environmental Research and Public Health*, 10(3), 913-935.

Knapp, C. E. (1996). Just beyond the Classroom: Community Adventures for Interdisciplinary Learning. ERIC/CRESS, PO Box 1348, Charleston, WV 25325-1348.

Larijani, M. & Yeshodhara, K. (2008). An empirical study of environmental attitude among higher primary school teachers of India and Iran, *Journal of Human Ecology*, 24(3), 195-200.

Lindenberg, S., & Steg, L. (2007). Normative, gain and hedonic goal frames guiding environmental behavior. *Journal of Social Issues*, 63(1), 117-137.

Lozar-Glenn, J. (2000). Environment-Based Education: A Report on its Usefulness in Creating High-Performing Schools and Students, National Environmental Education & Training Foundation.

Makki, M. H., Abd-El-Khalick, F., & Boujaoude, S. (2003). Lebanese secondary school students' environmental knowledge and attitudes. *Environmental Education Research*, 9 (1), 21-33.

Malone, Karen and Paul Tranter. "Children's Environmental Learning and the Use, Design and Management of Schoolgrounds."*Children, Youth and Environments* 13(2), 2003.

McCormick, C.B., Miller, G.E., & Pressley, M. (1989). Cognitive strategy research: From

basic research to educational applications. New York: Springer-Verlag.

Meinhold, J. L., & Malkus, A. J. (2005). Adolescent Environmental Behaviors Can Knowledge, Attitudes, and Self-Efficacy Make a Difference?. Environment and behavior, 37(4), 511-532.

Mosothwane. M. (2015). Teachers' Perceptions of the Impacts of Environmental Children's Science on Environmental Behaviors in Lower Primary Classes in Botswana. International Journal of Innovative Research and Development, 4(13).

Monroe, M. C., & Kaplan, S. (1988). When words speak louder than actions: Environmental problem solving in the classroom. *The Journal of Environmental Education*, 19(3), 38-41.

Oweini A, Houri A 2006. Factors affecting environmental knowledge and attitudes among Lebanese college students. Appl Environ Educ Comm Int J, 5: 95–105.

Ramsey, J. M., Hungerford, H. R., & Volk, T. L. (1992). Environmental education in the K-12 curriculum: Finding a niche. *The Journal of Environmental Education*, 23(2), 35-45.

Ramsey, J., & Rickson, R. (1977). Environmental knowledge and attitudes. *The Journal of Environmental Education*, 8(1), 10-18

Sanera, M. 2008. The Problem with Environmental Education Today: Is the Tail Wagging the Dog? Dearborn, MI: Free Market Forum.

Skelly, S. M. & Zajicek, J. M. (1998). The effect of an interdisciplinary garden program on the environmental attitudes of elementary school students. HortTechnology, 8(4): 579-583.

Skinner, E. A., & Chi, U. (2012). Intrinsic motivation and engagement as "active ingredients" in garden-based education: Examining models and measures derived from Self-Determination Theory. *Journal of Environmental Education*, 43(1), 16–36.

Thompson, C. W., Aspinall, P., & Montarzino, A. (2007). The childhood factor: Adult visits to green places and the significance of childhood experience. *Environment and Behavior*.

Thorne, S. (2000). Data analysis in qualitative research. *Evidence based nursing*, *3*(3), 68-70.

Tranter PJ; Malone K, 2004, 'Geographies of environmental learning: An exploration of

children's use of school grounds', *Children's Geographies: advancing interdisciplinary understanding of younger people's lives*, vol. 2, no. 1, pp. 131 – 155.

UNESCO. 1978. Tbilisi Declaration (Final report of the Intergovernmental conference of EE: Tbilisi (USSR), 11-26 October 1977). Paris: UNESCO.

UNESCO (2003) United Nations Decade of Education for Sustainable Development (2005-2014): Framework for the International Implementation Scheme. Paris, UNESCO.

Recycling Attitude, Knowledge, and Behavior of Sharjah Households

Mahra Khalfan Al-Kitbi and Mayada Moussa Hamdan Bin Mohammed Smart University

Abstract

Introduction: Waste generation is a global environmental problem and a matter of public health. In 2014 the average municipal waste generation in the UAE was 1.82 kg per day. This number puts the UAE among the top countries producing waste in the world. In 2007, Bee'ah, a waste management company, was launched in the Emirate of Sharjah, and one of its goals is reducing generated waste and increasing recycling practices.

Objective: To evaluate the recycling attitude, knowledge, and behavior of Sharjah households.

Methods: A cross sectional study was carried out among a convenient sample of Sharjah Individuals in December 2016. A questionnaire was developed and used for data collection, then the results were analyzed using Numbers program (available on Mac OXS).

Results: 37 questionnaires were collected from Sharjah households. The mean score for attitude was 14.19±1.79 (the maximum *score*= 16) *showing a highly positive attitude* towards recycling. The mean score for knowledge was 9.27±2.05 (the maximum score= 12), which hinted at the good knowledge of the participants about recycling practices. Recycling practice was evaluated in part by the percent of items recycled, and this showed that 46.1% of the items were recycled most of the time, while 15.6% of items were never recycled. Only 7% of the participants never used the recycling bins, showing a positive result for the recycling practice.

Conclusion: Overall view of the result shows a positive result for the recycling attitude, knowledge, and behavior among the study participants, who are part of Sharjah community.

Introduction

Waste generation is a global environmental problem and a matter of public health. As increasing population growth this problem increases. More people lead to more garbage generation and it is expected that waste generation will increase by 70% by 2025. Waste management can help in reducing this problem and the impacts on the environment like reducing the greenhouse gases. Sustainable waste management is about reduce, reuse and recycle waste to reduce waste generation. (The World Bank, 2013)

UAE is one of top global countries in municipal waste generation. In 2014 the average was 1.82 kg per day. As part of the UAE's successful economic development and as a mean to reach its goal of Green Economy the country adapted strategy of waste reduction and recycling. The targets by 2021 is to reach 75% recovery rate and to reduce waste generating to reach 0.9 kg per capita (Ministry of Environment and Water, 2014).

In 2007, Bee'ah, a waste management company, has been launched in the Emirate of Sharjah. Their goals are to position Sharjah as the environmental capital of the region and to minimize waste to landfills to 0%. They have a plan to use waste-to-energy as the first in the region (LinkedIn, n.d.). They started to distribute two bins for every house planning to cover all the emirate of Sharjah. One is green for domestic waste and blue for recycling waste. Public participation is a key for the success of the recycling efforts (Pearson, Dawson & Breitkopf, 2012), so investigation about attitude, knowledge, and behavior of the community is very important. Unfortunately, no studies regarding this issue has been conducted in UAE. All the studies regarding this issue in the literature are outside the emirate. Furthermore, there is a need to investigate the use of the blue bins among Sharjah households. To achieve this objective, across sectional study will be conducted among a convenient sample of Sharjah families. The result of this study will be useful in planning education campaigns focusing on increasing awareness about recycling and using the blue recycling bins.

Many studies have been carried out investigating attitude, knowledge, and behavior of individuals in relation to waste recycling, as well as factors affecting behavior, motivation to recycling, and barriers to recycling at home.

Recycling seems to have a positive relationship with age, seeing that as age increases, the recycling behavior increases (Pearson, Dawson, & Breitkopf, 2012; Wright, 2013). Banga (2011) suggests that educational level influence the participation in recycling practices. It is also highly important to know the attitude of individuals toward recycling, because if their perception about recycling is that it is not important, they will not recycle (Wright, 2013). If people know what to recycle, this will increase the recycling behavior; so as knowledge increases the recycling rate increases (Wright, 2013). Recycling behavior was found to be affected by all the above-mentioned variables by Jennings in undergraduate students at а large Northeastern University in 2004. Accessibility to recycling collection area was also reported to increase the recycling behavior (Banga, 2011).

Objective of the Study

To evaluate the recycling attitude, knowledge, and behavior of Sharjah households

Methodology

This cross-sectional study was carried out among a convenient sample of Sharjah individuals in December 2016. The target population was all Sharjah households, and 37 households were included in the study. The sample included workers in Batayih Municipality (n=27) and Batayih Health Center (n=4), as well as neighbors of the researcher (n=6).

The questionnaire was developed by the author, and some questions were used from the study by Wright, 2013. The questionnaire included demographic questions; as well as four statements for determining attitude towards recycling; three questions to assess knowledge of the participants; and three questions to determine the recycling practices of participants.

The data was entered on Numbers program (available on Mac OXS); then frequencies for all demographic variables were calculated. Mean and standard deviation for the attitude, knowledge and behavior scores were also calculated, collectively and for each question. Lastly, the frequencies of using of the blue recycling bins and of teaching the maid about what to put in the blue recycling bins were also determined.

Results

The number of questionnaires collected was 41 but I excluded 4 participants because they don't live in Sharjah (Dubai:2, Ajman:2) and 7 participants were excluded from the last two questions which are about the blue recycling bin since they live within areas that don't have the blue recycling bins yet in Sharjah (Sajaa:1, Al-Dhaid:5, Al-etain:1). The remaining participants were mainly from Al-Batayih: Rashediyah, Barrair, Rafeea, Zubair, Tawi Alssaman, and Mahafiz.

Demographic variables

75.7% of the participants were females and 24.3% of them were males. Regarding the age of the participants, almost all the participant were below 40 years of age (18-29 years: 45.9%, 30-39: 51.4%) and only one participant was above 40 years (2.7%).

Approximately half of the participants were Bachelor degree holders, followed by diploma holders (24%), and then high school graduates (19%). The distribution of the participants by educational level is shown in figure (1).



Figure (1): Distribution of participants by educational level

With regards to geographical location, 29.7% of the participants were from Rafeea, 18.9% from Rashediya, 13.5% from AlDhaid, 10.8% from Zubair, and 8.1% from Barrair. The sample also included one participant from each of the following areas: Mahafiz, Tahil, Majaz, Batayih (not specified), Sajaa, and Al-Etain.

Regarding attitude, all participants were asked to rate 4 statements on a four-point Likert scale. The distribution of the participants with regards to the level of agreement or disagreement with each statement is depicted in table (1). It was obvious that the attitude of all participants (with very few exceptions) was very positive towards recycling and its importance. Interestingly, enough, nearly all participants showed their willingness to recycle more than they currently did, which reflects a commitment positive towards future recycling. The mean total score for attitude for all participants was 14.19 ± 1.79 , while the maximum total score that could be obtained was 16

	Dimension	Strongly agree n(%)	Agree n(%)	Disagree n(%)	Strongly disagree n(%)	Maximum score
	importance of recycling to the environment.	26 (70.3%)	11(29.7%)	0	0	
Attitude	importance of every one to recycle	17 (45.9%)	18 (48.7%)	2(5.4%)	0	
	importance of them personally to recycle	24 (64.9%)	13(35.1%)	0	0	
	desire to recycle more than they do	18 (48.6)	17(46%)	2(5.4%)	0	
	ATTITUDE Mean total score	14.19±1.79				16
	easy to them to select what is recyclable	13(36.1%)	17(47.2%)	6(16.7%)	0	
Knowledge	good background on recycling	10(27%)	16(43.3%)	10(27%)	1(2.7%)	
	know where are the recycling bins	12 (32.4%)	19(51.4%)	5(13.5%)	1(2.7%)	
	KNOWLEDGE Mean total score		12			

 Table (1): Distribution of participants with regards to attitude and knowledge

With regard to knowledge, table (1) shows that some participants, ranging from about

15% to about 30%, did not possess the necessary knowledge that make recycling

easy for them. For example, 15.7% of the participants did not know where the recycling bins were located. With 19.8% of participants lacking the basic knowledge about recycling, the mean total score for knowledge was 9.27 ± 2.05 , while the maximum total score that could be obtained was 12.



Figure (2): Frequency of recycling the different items of waste

As for practices related to recycling, figure (2) illustrates the frequency of recycling certain waste items as reported by the participants. Plastic grocery bags and paper were items reported to be recycled most of the time. Plastic containers, metal and glass items were reported to be recycled some of the time only, with about 8.5% of participants reporting that they never recycled metal and aluminum items.

Figure (3) demonstrates the distribution of participants with regards the two last questions on behaviour. Reflecting the positive attitude of the participants, almost all 93% were using the recycling bins provided by Sharjah municipality. However, more than half of the participants (57%) admitted, that they did not inform their housemaids yet about what to put in the blue recycling bins. This transgression is quite revealing, and suggests that there is still a lot room for improvement in the participants' behaviour towards recycling of waste.



Figure (3): Distribution of participants with regards to the last two behaviour questions

Discussion

The response rate to the questionnaire was 100%, which is a positive point for the study. The study suggests that Sharjah households, mainly AL-Batayih households have a generally positive attitude toward recycling with none of the participants showing any negative attitude towards recycling found by Rina Bao (2011) in a similar study done among students in Turku. The result in this

study could be expected, since people in the UAE in general like to be positive to the environment. They also perceive themselves as having good knowledge about recycling; but the study showed that a considerable proportion (19.8%) lacked the necessary knowledge for proper recycling. This percentage is considerably less than what was reported by Wright (2013) in a similar study conducted among University of Canada students. Wright found that 70.3% of

the participants perceived themselves having good background on recycling; however, only 58% were found to be confident about their knowledge.

The lack of knowledge in some participants may be the main factor behind finding a few who never recycled waste at all (two participants). and about 15.6% of participants who failed to recycle one or more item. Wright (2013) reported that only 6.5% of investigated items were never recycled. The high result in this study compared to Wright is quite surprising given the 100% positive attitude of the participants and the fact that most of them were workers in Sharjah municipality (73%).

Conclusion and Recommendations

The overall view of the results shows high scores for recycling attitude, knowledge, and behavior among the participants. This positive result should be promoted to achieve an overall green economic growth of the country. This can be achieved by educational campaigns, as recycling education has been reported to have a very positive affect on recycling attitude, knowledge, and behavior (Williams, 2011). Awareness of Sharjah residents can also be increased through social media campaigns that were also found to add greatly to awareness (Jennings, 2004). Already the municipality is sending regular sms to the community encouraging them to recycle and use the blue recycling bins. Distributing educational brochures, videos or such material can also help in increasing awareness. Indeed, in light of the fact that recycling bins are distributed now everywhere in Sharjah, there is little excuse for residents not to practice waste recycling. Every household should also teach their housemaids what the recyclable items in the waste are; as well as keep a separate bin in the house for the recyclable waste.

There is a need for future similar studies with large and representative sample size that explore the relations between attitude, knowledge, and behaviour and the factors that might affect them. Such studies will help in deciding on the best possible approaches to raise awareness about recycling in the community. They should also be conducted in several parts of the UAE to help the country move towards a greener future.

Limitations of the Study

Because of time constraints, the sample size for this study was very small. Together with the non-probability sampling design (a convenience sample), this led to difficulty of representing the sample the Sharjah population. Also, the used tool was not validated or piloted to judge its adequacy. The knowledge could have been better measured, if the participants were given a mix of recyclable and non-recyclable items and were asked to select the correct items to recycle.

References

Banga, M. (2011). Household knowledge, attitudes and practices in solid waste segregation and recycling: the case of urban Kampala. *Zambia Social Science Journal*, 2(1), 4.

Bao, R. (2011). Waste and Recycling Attitudes and Behavior of Students in Turku. Retrieved April, 13, 2015 from <u>https://www.lsjh.fi/wp-</u> <u>content/uploads/Rina-Bao masters-</u> thesis_print.pdf

Jennings, M. E. (2004). An Instrument to Measure the Recycling Attitudes and Beliefs of Undergraduate Students at a Large Northeastern University. Retrieved December 09, 2016, from http://files.eric.ed.gov/fulltext/ED490679.pd f

LinkedIn. (n.d.). Bee'ah. Retrieved December 8, 2016, from https://www.linkedin.com/company/bee'ah

Ministry of environment and water. (2014). UAE State of Green Economy. Retrieved December 7, 2016, from http://www.moccae.gov.ae/assets/e3bd136a/

<u>uae-state-of-green economy-</u> report-2014.aspx

Pearson, H. C., Dawson, L. N., & Breitkopf, C. R. (2012). Recycling attitudes and behavior among a clinic-based sample of low-income hispanic women in southeast texas. PLoS One, 7(4) doi:http://dx.doi.org/10.1371/journal .pone.0034469

The world bank. (2013, December 21). Solid Waste Management. Retrieved December 07, 2016, from

http://www.worldbank.org/en/topic/urbande velopment/brief/solid-waste management

Williams, H. (2011). Examining the Effects of Recycling Education on the Knowledge, Attitudes, and Behaviors of Elementary School Students. *Outstanding Senior Seminar Papers*. Paper 9. Retrieved from

http://digitalcommons.iwu.edu/envstu_semi nar/9

Wright, R. E. (2013). Demographics and recycling: Effects of types of materials. The Journal of Applied Business and Economics, 14(5), 11-18. Retrieved from <u>http://search.proquest.com/docview/150308</u> 8216?accountid=33317

Case Study: Change in the Approach of Chemical Control on *Oryctes* Leads to Better Pest Control, Cost Reduction, and Less Environmental Pollution

Mohamed E. Khogali and Aisha A. Al-Blooshi Al-Ain City Municipality, UAE

Abstract

Date palm tree (Phoenix dactylifera) is considered as a royal tree in UAE especially in Al-Ain City. As a result, Al-Ain City Municipality is providing services related to agricultural pest control as development and maintenance of Public parks, landscapes and date palms pest control in houses in order to fulfill the strategic plan that preserve Date palm trees in parallel with having a better customer satisfaction. In fact, Oryctes elegans, locally called (Ajoor) is one of the main pests of date palm tree worldwide that cause direct damage to the tree on the fronds, stem and consider as a predisposing tool for red date palm weevil infestation. As a previous practice, pesticide spraying was used to control this pest when the licensed contractor noticed the symptoms of the damage on the tree (V-shaped as an example) even without seeing the physical presence of the pest. However, this practice was not the optimal to control this pest comparing to the amount of pesticides used which resulting to increase the cost and pollute the environment. Therefore, we ceased aerial application of pesticides (tree canopy spraying) when the damage symptoms are only seen without actual presence of the pest. Instead, we shifted the control to ground treatment (in most cases granular pesticides) to control the pest's larva in case of pest availability. Consequently, this technique leads to reduce in pesticide used and cost consumed to control this pest by 70% with decrease in environmental pollution. Conversely, Aerial spraying was restricted only when the pest is seen on the tree, which is rarely observed under normal circumstances. Finally,

integrated pest management is used in light traps for the night active pests as Oryctes elegans that control the adult insects more efficient than chemical spraying.

Key words: Oryctes sp., Pest Control, Municipality

Introduction

Arecaceae Family plants include Coconut Palm trees, Oil Palm trees and Date Palm Trees (Hodgkiss, 2016). Here, UAE pays much attention to Date palm tree (Phoenix dactylifera) according to its importance of heritage, economic and aesthetic. Unfortunately, Arecaceae Family plants are targeted by Rhinoceros Beetles which are mainly three species O. rhinoceros, O. agamenon, and O. elegans (Al-Deeb, 2012) existing in UAE. Fundamentally, Oryctes rhinoceros is one of the most serious pests that have a record of damage, wherever it has become established in the tropics, to native palm trees and native Pandanus. In fact, there are natural factors that keep the beetle under control in its native range, its introduction into insular habitats without these natural control factors allows it to reproduce quickly and spread to become a serious pest. The coconut rhinoceros beetle is one of the most damaging insects to coconut palms and African oil palm in southern and south-East Asia and the Western Pacific islands.

The imago stages are the destructive because they bore into the crown of the palm resulting in wedge shaped or "V" cuts in the fronds that unfurl the beetle to feeds on tissue juices. As a result, some of the crushed fiber is pushed outside the entrance hole where it indicates the insect's presence. In India damage of inflorescence is also reported in severely infested areas which cause reduction in yield up to 10%, Ramachandran et al. (1963) has reported a loss in yield of 5.5 to 9.1% due to beetle attack (SIVAKUMAR & MOHAN, 2013). From artificially pruned leaf damage stimulation studies it was observed that damage to 50% fronds corresponds to leaf area reduction of 13% and decrease in nut yield by 23% (Young, 1974).

In oil palm O. rhinoceros bores into the base of cluster of spears, causing wedge shaped cuts in the unfolded fronds. In younger palms the effect of damage can be much more severe (WOOD, 1968). Attack by adults may reduce yield and kill seedlings. They may provide entry points for lethal secondary attacks by the palm weevil Rhyncophorus or by other pathogens, in some countries, apart from coconut and African oil palm recorded host plants include the date palm and a variety of palms grown for ornamental purpose, including Roystonea regia, Livistona chinensis, Corypha umbraculifera and Raphia ruffia (Bedford, 1980); also recorded are pine apple, sugarcane, pandanus and banana (Lever, 1969).

Habitat description

`Thought to be native to the southern Asiatic region, the coconut rhinoceros beetle was introduced throughout the Pacific primarily as a result of the increased sea traffic during World War II (Nishida & Evenhuis, 2000). The beetle breeds in dead standing coconut palms killed by pest /disease/ lightning, decaying organic materials like compost and sawdust heaps. (Bedford, 1980). Decaying pandanus trunk in Palau (Gressitt, 1953) and heaps of decaying cocoa pod shells in New Ireland (Bedford, 1976a) are also reported as breeding sites. In India (Kurian and Pillai, 1964; Nirula, et al. 1952) and Mauritius heaps of cattle-dung were the most important breeding sites, in Burma dead coconut stems, heaps of rotting paddy straw and farm yard manure were most important (Ghosh, 1923). Floating logs containing larvae in tunnels might spread the pest to new areas (Bedford, 1980).

Insect Description

Imagos of *Oryctes rhinoceros* are large 30-5mm long and 14-21mm breadth, black or reddish black in colour, stout and possesses a characteristic cephalic horn which is larger in males. The pygedium is densely clothed with reddish brown hairs on the ventral surface in the female (Nirula, et. al., 1952) a feature which helps in distinguishing it from the male.



Picture 1: the egg and the larva of *Oryctes rhinoceros*



Picture 2: The female of Oryctes rhinoceros



Picture 3: The male of *Oryctes rhinocero* Lifecycle Stages

Various authors under differing conditions have studied the duration of immature stages of Oryctes rhinoceros. Whitish brown eggs are 3 to 4mm long and take 8 to12 days to hatch. Developmental period is 1St instar larvae 10 to 21 days, 2nd instar larvae 12 to 21 days, 3rd larvae 60 to 165 days, pre-pupae 8 to 13 days and pupae 17 to 28 days (Bedford, 1976a; Catley 1969; Cherian and Anantanarayanan 1939; Goonewardena, 1958; Gressitt 1953; Hinckley 1973; Kurian and Pillai, 1964; Nirula 1955). Mature larvae are C- shaped, with brown head capsule and legs. The imagoes remain in the cocoon for about 11 to 20 days (Lever, 1979). Mating occurs in breeding sites (Zelazny, 1975). The life cycle lasts from 4 to 9 months allowing more than one generation per year. In India average adult longevity is about 4.7 months and fecundity per female is 108 eggs (Nirula. 1955). Life history data for Oryctes, and related species like Scapanus, and Strategus are summarised by Bedford (1980).

Control Measures

Integrated management: Integrated control measures adopted on a community basis are essential to bring an effective control of an Oryctes rhinoceros population. The major components the Integrated of Pest Management Package consist of mechanical, chemical biological and methods. Mechanical methods consist of examing trees for infestation and removing the beetle Prophylactic physically. methods (preventive measures) include the use of pesticides, napthalene balls etc. to repel the beetles. Oil cakes of neem and marotti (Hydnocarpus wightiana) have also provided good results.

The Problem

The aim of any control measures is to get rid of the pest from the specified site. We noticed that the approach, aerial spraying the tree canopy, used to control <u>Oryctes</u> spp. is not effective and result in chemical, time and money waste plus environmental pollution. This due to non-target pesticide application as spraying is directed to the symptoms resulted from <u>Orytctes</u> spp. feeding on the tree but not to the pest itself. Normally the adult will not stay long on its place and it fly away attracted by the light. The breeding sites is normally a rich organic matter site which is the basin of the tree.

Alternative Solutions

We have found that conducting aerial spraying to control Oryctes sp., on date palm trees is not the ideal treatment. Application of small amount of specified granular insecticide is ideal and economic. This was lead to saving of pesticide, money and effort. In addition to that and the most important thing is less environmental pollution. Good pest control achieved also by adopting the alternative method. The later targeted the breading site of the pest directly whereas aerial spraying is not. The date palm owners used to ask for aerial spraying for their date palm trees as they think that only aerial spraying will clean the tree from the pests. The next step, which we have done, is to overcome this prevailing culture and to convince the owners that granular pesticide application is more effective than aerial one. The result, which we have achieved, was the only answer to convince them.

Pesticide Quantity	Pesticide Used	No of date palm trees	No of claims	Month
112.75 L	sarban 4E	3892	74	Jan.
2 L	sarban 4E	75	2	Feb.
2 L	sarban 4E	140	2	Mar.
0	0	0	0	Apr.
0	0	0	0	May
0	0	0	0	Jun.
0	0	0	0	Jul.
0	0	0	0	Aug.
0	0	0	0	Sept.
97 L	sarban 4E	4477	79	Oct.
0	0	0	0	Nov.
0.72 Kg	delfos G5	6	2	Dec.
		8590	159	Total

Table 1: Chemical Treatment of Oryctes in 2015 in Southern Sector- AlAin



Figure 1: No. of Claim orders and Date Palm trees treated in different months for *White root grub (Oryctes spp.)*



Figure 2: Amount of Pesticides used to treat different Pests and diseases



Picture 4: Damage symptoms of Oryctes spp. on the stalk of the fruit bunch



Picture 5: Presence of the Oryctes spp. larvae in the basin of date palm tree



Figure 3: Comparison between 2014 to 2016 for the number of claims and treated trees in the Southern sector – Alain



Figure 4: Comparison between 2014, 2015 and 2016 for the pesticide used for treatment of *Oryctyes spp.* in houses in the southern sector

Recommendation

Controlling Oryctes spp. on date palm trees has to consider the following points:

- 1- Carefully examine of the tree to check the presence of the pest
- 2- Carefully checking the symptoms
- 3- If there is, only the symptoms do not make any aerial application.
- 4- Examine the basin of the tree and adjacent wet soils area for the presence of the larvae
- 5- No need to spray the tree canopy if the adult pest is not present
- 6- When the larvae is present use only granular or EC pesticides to drench the affected areas.
- 7- Recheck the treated areas to ensure the effectiveness of the treatment.
- 8- Talk to the tree owner and explain for them what you have done.

References

Al-Deeb, M. A., 2012. Date Palm Insect and Mite Pests and Their Management. In: A. Manickavasagan, M. M. Essa & E. Sukumar, eds. *Dates: Production, Processing, Food, and Medicinal Values.* New York: CRC Press, p. 115.

Bedford, G.O. 1976a. Use of a virus against the coconut palm rhinoceros beetle in Fiji. PANS 22:11-25

Bedford, G. O., 1980. Biology, Ecology, and Control of Palm Rhinoceros Beetles. *Annual Review of Entomology*, Volume 25, pp. 309-39.

Catley, A. 1969. *The coconut rhinoceros beetle*, Oryctes rhinoceros (L.) PANS 15: 18-30.

Cheriyan, M.C. and Ananthanarayanan, K.P. 1939. *Studies on the coconut palm beetle* (*Oryctes rhinoceros Linn.*) in South India. Indian J. Agric. Sci. 9: 541-59.

Ghosh, C.C. 1923. Oryctes rhinoceros and other important palm pests in Burma Proc. 5th Entomol.Meet. Pusa, pp.99-103.

Goonewardena, H.F. 1958. The *rhinoceros* beetle (Oryctes rhinoceros Linn.) in Ceylon Introduction, distribution and life history. Trop. Agric. Ceylon 114: 39-60.

Hinckley, A.D. 1973. Ecology of the coconut rhinoceros beetle Oryctes rhinoceros (L.). Biotropica 5:11-16.

Hodgkiss, R. J., 2016. *The Palm Tree Page Arecaceae Syn. Palmae.* [Online] Available at: <u>http://succulent-plant.com/families/arecaceae.html</u> [Accessed 30 Janusry 2017].

Kurian, C., Pillai, G.B., Antony, J., Abraham, V.A. and Natarajan, P. 1983. *Biological control of insect pest of coconut. In. Coconut Research and Development.* Proc. of the International Symposium I. CPCRI, Kasaragod. Dec 27-31, 1976. (ed. N.M. Nair) Wiley Eastern. New Delhi p.361-375.

Nirula, K.K., Antony, J. and Menon, K.P.V. 1952. *The rhinoceros beetle (Oryctes rhinoceros L.) life history and habits*. Indian Cocon. J.V (2).

Nirula, K.K., Radha, K. and Menon, K.P.V. 1955. *The green muscardine disease of Oryctes rhinoceros L. I. Symptomatology, epizootology and economic importance.* Ind. Cocon. J. 9: 3-10.

Nishida, G.M. & N.L. Evenhuis. 2000. Arthropod pests of conservation significance in the Pacific: a preliminary assessment of selected groups. Pp. 115-142 In: Sherley, G. Invasive species in the Pacific: a technical review and draft regional strategy. South Pacific Regional Environment Program (SPREP), Apia, Samoa. pp 190.

Lever, R. J. A. W. (. J. A. W., 1969. *Pests of the coconut palm.* Rome, Food and Agriculture Organization of the United Nations.

SIVAKUMAR, T. & MOHAN, C., 2013. Occurrence of rhinoceros beetle, Oryctes rhinoceros (L.), on banana cultivars in Kerala. Pest Management in Horticultural Ecosystems, 19(1), pp. 99-101.

WOOD, B. J., 1968. *Pests of oil palms in Malaysia and their control.* Kuala Lumpur: Incorporated Society of Planters.

Young, E., 1974. The epizootiology of two pathogens of the coconut palm rhinoceros beetle. *Invertebrate Pathology*, 1(24), pp. 82-92.

Zelazny, B. 1975. *Behaviour of young rhinoceros beetle, Oryctes rhinoceros Entomol.* Exp. Appl. 18:135-40

The Environmental Problems of the Current Landfill in Ajman

Waleed Abdulla Saif Alshehhi Hamdan Bin Mohammed Smart University

Abstract

The United Arab Emirates is facing a huge solid waste disposal problem, especially in the Emirate of Ajman. Ajman produced about 240,000 of solid wastes in 2012. Solid waste disposal is done in Ajman using a landfill. The rate of waste generation continuously increases in Ajman as result of the economic and population growth placing immense pressures on this landfill. The aim of this paper is to provide an environmental evaluation of the situation of Ajman's solid waste landfill. The methodology of the study is based on secondary data from the concerned official authorities such as environmental statistics and waste surveys. Face-to-face interviews were also conducted using semi-structured questionnaire with the head of Studies and Planning Unit -Environmental Protection Section in Ajman Municipality. The results of this study proved that the amount of the generated solid wastes in Ajman has exhibited rapid increase in the last few years. Such situation quickened the filling rate of the landfill which is approaching is maximum capacity raising questions about the future handling of the solid wastes in Ajman. The design and operation of Ajman landfill causes serious environmental problems. The inadequate lining allowed for the leachate to reach the groundwater in the landfill area. The improper covering and layering of wastes caused release of bad odors and other air pollutants as results of uncontrolled burning of the wastes in the landfill. The main solutions suggested by this study are related to promoting waste minimization as well as considering alternative waste treatment and disposal methods such as incineration to reduce the amount of waste to disposed in the landfill. There is also a need to establish and developed standards of landfills in Ajman.

These standards should be depending on the local and federal environmental laws and legislations.

Introduction

Where does our waste go? The answer of this question is not easy as it looks. The final phase of solid waste management is to disposal the collected waste. Landfilling is the most frequent waste disposal method worldwide. (Manaf, 2013) Having an adequate landfill becomes an essential issue for all countries. Landfills management needs to be improved to insure financial and economy improvement, mitigation environmental impacts and prevent any health risks.

The landfill in Ajman is an environmental issue, economic and financial issue and sustains the environment issue.

The disposal of waste must be adequate and concern to protect the environment and public health. There are many reasons guide to have adequate landfills by insuring implementation all environmental and economic requirements to establish a new landfill or maintain an exist landfill.

Waste generated from different sources such as, residential, agriculture, municipal services, industrial, commercial ...etc. needs to dispose in adequate way to prevent any environmental impacts. (Manaf, 2013)

Brief about Emirate of Ajman

Ajman is the smallest emirates which located in the north of The United Arab Emirates with a total surface area of 260 Km². (UAEPEDIA) Landfill in Ajman is important issue and the standard of waste management needs to be improved. The United Arab Emirates is facing a huge solid waste disposal problem, especially in the Emirates of Ajman. UAE citizens produce more than 15000 tons per day in 2013 (ALKHALEEJ, 2013) of waste per person per day while, Ajman citizens produce more than 665 tons per day in 2012 of waste per person per day. (AMAPD, 2013)



Figure 25: Location of Ajman's landfill area in Al-Jurf

The size of UAE is 83600 Km^2 while the size of Ajman is only 260 Km^2 (UAEPEDIA). The size of Ajman's current landfill is 155447.96 m² (0.155 Km2). Currently totals represent an increase of more than 22 % between 2010-2012 of waste generation that means, more waste than can be disposed of in an environmentally sound but economic and local manner.

Important and Significance

The significant of this study is the impact of continuous increasing on waste generations due to the urban development and population growth. This suggest that greatest challenge to provide more waste disposal facilities such as landfills. (Manaf, 2013)

The advantages of landfill that the landfill can be close to the source of the waste so transport reduce, local waste is dealt with locally, relatively cheap to set up and operate, can accept a wide variety of wastes and energy recovery from methane which consider as renewable energy. In the other hand there are many disadvantages of landfill such as, the difficulty to find suitable sites in many locations, loss of materials that could be recover, potential for pollution of air and water, potential to result in contaminated land, fire and explosion risk, need to collect and treat leachate even after closer, local nuisance from transport and odor, local opposition to new sites, methane emissions linked to climate change, landfill directive is increasing pressure to avoid its use and ongoing responsibility for sites after closer. (Waters, 2013)

Methodology

Quantitative data used to conduct this study. resources include data provided by governmental authorities as the following, formal statistics of solid waste by Ajman Municipality and planning department. These statistics are as the following:

- Environmental statistics, waste 2012, Aiman Municipality and planning department. This data and statistics give information such as, the quantities of collected waste by type and collector (collected by Ajman Municipality and planning department or by Privet Company). Quantities on nonhazardous waste collected by source such as, construction wastes, industrial general waste municipality waste, households streets and public waste. garden. Quantities of hazardous waste collected by source and method of disposing such as industrial waste, medical waste, agricultural waste and slaughterhouses. Waste quantities by components and disposing methods such as, papers and boards, plastic and organic materials.
- Governmental statistic of the quantity of liquid and solid waste in Ajman in the years 2010-2012 and the quantity of solid waste segregated or compost.
- Collected wastes survey 2013, Ajman Municipality and planning department, Environmental statistics. Quantities on nonhazardous waste collected by source such as, construction wastes, industrial general waste municipality waste, households waste, streets and public

garden. Quantities of hazardous waste collected by source and method of disposing such as industrial waste, medical waste, agricultural waste and slaughterhouses. Waste quantities by components and disposing methods such as, papers and boards, plastic and organic materials.

Moreover, Face-to-face interviews were also conducted using semi-structured questionnaire with the head of Studies and Planning Unit – Environmental Protection Section in Ajman Municipality.

Ajman's Landfill Challenges

Ajman's landfill is very close to be full of waste and near to close that means, Ajman fights back against a mountain of waste. The main problem of the landfill in Ajman is the lack of space for a new landfill due to the associated urban sprawl of affluent suburbs. Also, the costs to dispose of municipal solid waste than skyrocketed in recent years as well. The evidence indicates that Ajman currently face a national waste crisis, and perhaps our basic premise for solid waste management must change.

The second fact about the current Ajman's landfill is there isn't any sanitary landfill in Ajman. The important of having sanitary landfill is that the spouse of sanitary landfill to concentrate and contain the solid waste at a specific site and minimal environmental cost. The idea of sanitary landfill is to track layers of solid waste everyday by using heavy machinery and buried under a layer of earth or clean construction debris. By using sanitary landfill the vermin will keep out, the refuse will confine, the odors will reduce and divert leachate from entering the landfill. Once the sanitary landfill full, the land can be used for other purposes, such as use it as a park, sport club, parking lots and any other using and not requiring excavation. (HWSC)

Currant Ajman's landfill is unsanitary landfill such this inadequate waste disposal creates serious environmental problems that may threat public health and cause economic and environmental problems and other life fare losses. (Lulea, 1988)

For instance, the surface and groundwater can be contaminated through leachate, soil contamination through direct waste contact or leachate, air pollution by burning of waste and the spreading of diseases by different vectors like birds, rodents and insects. (Lulea, 1988)

In addition, the public may be affected by the contamination of their drinking water by soil contamination passed on the aquatic and terrestrial food chain through the spreading of diseases by different vectors. The more effected people are people living near the landfill because they are often subject to direct transfer of contamination through inhalation of dangerous volatile compounds and aerosols. There is also a direct physical danger involved deriving from possible collapsing waste landslides. landfills. explosions, fires and waste related transport accidents. (Lulea, 1988)

Such uncontrolled dumps with missing site management directly endanger the health of the people living near to the landfill. It is however to think that the other citizen will not be effected as the chemical and biological contaminates from inadequate disposal will inevitably find their way to them. (Lulea, 1988)

The main challenge in Ajman is that due to the size of the emirates of Ajman it is difficult to find new sites which find public approval and which are located at a reasonable distance from collection area and residential area. (Lulea, 1988)

Ajman Waste Statistics

In order to give a solution to have adequate management for the current Ajman's landfill that present in this study there is need to analysis the quantity of disposed solid waste at least for three years and the contain of disposed solid waste.



Figure 26: The quantity of disposed solid waste in the Emirates of Ajman (2010-2012)

From the graph, there is increase in the quantity of disposed solid waste. The annual increase of the quantity of disposed solid waste is about 11% - 13 % per year. If the rate of increasing of the quantity of disposed solid waste isn't change by 2020 the quantity of disposed solid waste will be huge and the current landfill will not be able to contain the waste.

Quantity of Non-hazardous Wastes by Category and Method of Treatment						
Ν	Waste Treatment method					
0.	Category	Total	Recyc	Com	Dum	
		Quantit	ling	posti	ping	
		y (Ton)		ng		
1	Papers and boards	761	761			
2	Plastic	1521	1521			
3	Metals (all types)	254	254			
4	Organic Materials	11222		1122 2		
5	Dredging and constructio n residues such as soil and rocks	65442			65442	
6	sludge (from wastewater)	6895			6895	
7	Others (mixed and not specified in other categories)	268847			26884 7	
Total		354942	2536	1122 2	34118 4	

The current treatment and disposed methods which are used by Ajman Municipality and Planning Department are three methods, recycling, composting and dumping to the landfill. Onley 3.8% goes to the recycling and composting while 96.2% of waste in Ajman goes to the landfill.

Solutions and Recommendations

One of the key issues when talking the problems of inadequate waste disposal is trying to solve the deficient financial situation of municipalities in respect to solid waste management. (Lulea, 1988)

Finance for solid waste management needs to corer for planning, capital operating and monitoring costs and needs to account for safe disposal wastes. (Lulea, 1988)

There are two options to tackle the problem of landfill in Ajman either to upgrading existing site or either to siting and designing new landfills. Upgrading the existing site will take more time and more costly while there is no way to take the other options due to the difficulty to find suitable sites in Ajman.

There is needed to go for the alternative to solve this problem such as, incineration. Incineration technologies one of the effective means of dealing with wastes. It reduces their harmful and convert the waste to an energy. The advantage of incineration are, reducing the volume and weight of the waste, waste reduction is immediate and not require long time and controlled for minimal impact on environment. the atmospheric But incineration cannot solve all waste problems such as, the capital cost of disposal, skilled operators, not all material are incinerable and it takes time to maintain the incineration process. (Kreith, 2002)

Discussion and Conclusion

The problems of landfills are not only in Ajman. This is an international issue. The main problem of the landfill is the space and location of the landfill. The emirate of Ajman has no adequate space and location for establish new landfills. However, Ajman is the smallest emirates the industrial activities, commercial activities and residential activities are growing rapidly. The growth of such activities means more waste generation which means the need of new landfills with high capacity to cover all wastes.

The current data and information are enough to let as thanking about the future of the landfills in Ajman. The results of this study indicate to the need of more landfills in Ajman. In my point of view, the best way to solve this problem is to go to alternatives to dispose the huge amount of waste in Ajman. Alternatives may need financial tools and it is costly but, the cost of landfills is more than we can predict because we are losing our lands and resources by dump it in the landfills. Incineration is a great way "waste to energy" to solve the problems of the landfill but, thinking about waste minimization, zero waste approach, cleaner products and sustainable development must take its place.

There are needs to minimization the quantity of generation waste. The minimization of generation waste is important due to many things. It will reduce the pressure into the landfill, reduce the cost of disposal and reduce the consumption of our resource. This will achieve environmental objectives as well as economic objectives.

Ajman Municipality and Planning Department in it is way to established incineration station. "At the moment we do not have a sanitary landfill," he said. The incinerator, estimated to cost Dh200 million (US\$54m), will be capable of burning 500 tonnes of waste per day. Mr. Kayed said the decision to proceed with an incinerator was made after a study showed the amount of waste produced in the emirate was to grow rapidly. Ajman's 230,000 residents, as well as industry, hospital and construction sites, generate almost 160,000 tonnes of solid waste per year. *The amount is to grow to 541,873 tonnes in 2013 and more than two million tonnes in 2030*, Mr. Kayed said.

Although the figures do not account for a reduction expected because of the current economic crisis, the overall trend is still up, he said. The incinerator will be capable of producing 15 megawatts of electricity and that enough to provide 250 -500 houses with electricity every day. "We have to go for a waste-to-energy plant to reduce the amounts of waste to the levels we need," he said. Incinerators are controversial methods of dealing with waste because of the harmful emissions released as waste is burned." (Todorova, 2010)

In addition, there is need to establish and developed standards of landfills in Ajman. These standards should be depending on the local and federal environmental laws and legislations. Furthermore, Ajman Municipality and Planning Department has the authority to create local laws and legislations and developed standards of landfills in Ajman.

References

Ajman Municipality & Planning Department, Governmental Statistic Of The Quantity Of Liquid And Solid Waste In Ajman In The Years 2010-2012 And The Quantity Of Solid Waste Segregated Or Compost. Ajman: N.p., 2013. Print.

ALKHALEEJ,. "2.2 Kg/Capita Of Waste In UAE. Retrieved From ALKHALEEJ". 2013: n. pag. Print.

Handbook Of Solid Waste Managment. 2nd ed. McGraw-Hill companies, 2002. Print.

Interview With Mr. Yasser Kayed Head. 2015. in person.

"LANDFILLS: WHERE DOES OUR TRASH GO?". Hobart and William Smith Colleges. N.p., 2017. Web. 16 Jan. 2015.

"Main Problems And Issue Of Municiple Solid Waste Managment In Developing Countries With Emphasis On Problems Related To Disposal By Landfill". Eawag. N.p., 1988. Print.

The National,. "Ajman Fights Back Against A Mountain Of Wast". 2010: n. pag. Print.

The Size. UAEPEDIA, 2017. Web. 11 Dec. 2014.

Integrated Management System of Wadi Wuarayah National Park, Fujairah, UAE

Laila Al Ameri Hamdan Bin Mohammed Smart University

Introduction

UAE hosts two of the "Global 200": the most biologically distinct terrestrial, freshwater and marine eco-regions in the world identified by the World-Wide Fund for Nature (WWF): the Arabian Highlands and Shrublands and the Arabian Gulf and Sea, (WWF, 2016) despite the dry and hot regional climate, Wadi Wurayah (Highlands and Shrublands) reflects the broad array of richness, endemism, taxonomic uniqueness, unique ecological, global rarity of habitats and species, (WWF, 2016)

Wadi Wurayah, in the Fujairah Emirates, United Arab Emirates, located on the north east of the Arabian peninsula within the Al Hajar Mountain range by the Gulf of Oman, covers over 129 km² and the buffer zone surrounding it around 92km², located between the towns of Biddiyah, Dibba and Masafi. (WWF, 2016) See Figure 1.



Figure 1: Location of Wadi Wurayah catchment basin within UAE (Left) and as a protected area zoning dashed in blue (Right)

The climate of the area is influenced by climatic events originating in Africa, Eastern Europe-Siberia, and the Indian and Pacific oceans. Rainfall provides 18.7 hm³ water annually, with an average of 2.24 hm³ as

runoff recharging the mountain ophiolite complex, creating a unique hydrogeological system with lasting freshwater habitats, in the form of springs, pools, streams/ riffles and waterfalls, that support a rich biodiversity of flora and fauna, unique in the country and the world. (Tourenq, et al., 2011)

The presence of the 29 archaeological sites, including uncharted pre-Islamic tombs, shows that Wadi Wurayah has a tremendous potential for further archaeological investigation, exhibition and conservation of national cultural heritage .(Tourenq, 2011). In March 2009, Wadi Wurayah was declared as a protected area (catogery II) according to IUCN, and as a Ramsar Wetland in November 2010. (EWS-WWF, 2016)

This paper highlights Wadi Wurayahs unique natural/ historical culture, analyzing the challenges and threats that it faces, and finally demonstrating a suggested integrated environmental management system plan

Significance

To accomplish Fujairah Emirates vision to conserve its terrestrial areas, in 2006, Fujairah municipality collaborated its efforts with World Wide Fund for Nature WWF through the Emirates wildlife Society EMS. It started with protecting the water reservoir from over usage (Tourenq, et al., 2009), however this project led to unexpected findings, as follows:

Water Characteristics: the area's geology has created a unique hydrogeological system that allows run-off water to emerge between impermeable and permeable rock creating fresh water streams, pools and waterfalls, all of which are uncommon in an arid region. The quality of surface water in the upstream catchment is exceptionally good in terms of hydro-chemical parameters, and meets, from a chemical point of view, most of World Health Organization's standards for drinking water and also for bottled water. It can be classified as magnesium bicarbonate, a type which is indicative of a recently recharged and active water resources regime, slightly alkaline with a mean pH value of 8.3.

Biodiversity: The diversity of fresh water habitats allowes for a diverse spectrum of species- some being rare or unique - of national and international conservation concern with flagship species, such as the Arabian Thar (Hemitrgus jayakari), the wadi fish Garra barreimiae (Cyprinidae) and the orchid (Epipactis veratrifolia), to survive or live in the harsh arid environment of the Arabian Peninsula. In comparison to UAEs flora and fauna, WWNP is known to host about 44% of terrestrial plant species (approximately 300 of 688) and 42% of UAEs terrestrial mammal species (20 of 48), seven in which are included in the IUCN Red List, (Tourenq, et al., 2009). Currently 28% of terrestrial reptile species (15 of 53) are known to live in WWNP, in which 9 of them are restricted to the Hajar Mountains, 25% of bird species (109 of 435) and the only two amphibian species recorded in the country, the Arabian Toad (Scleratophrys arabicus) Dhofar Toad (Duttaphrynus the and dhofarensis) (EWS-WWF, 2016)

<u>Cultural Heritage</u>: WWNPs cultural significance cannot be underestimated, survey teams have discovered 29 heritage sites ranging from pre- Islamic tombs (300 BC to 600 AD) to bedouin settlements of the early 1980s. Artefacts were also identified as being 14th – 18th century AD porcelain and pottery fragments.

Analysis

Few if any protected areas are immune from one type of threat or another and many are vulnerable to a range of them, the type and severity of threats to a protected area are the key in determining how much effort to put in to assessment. Given the biological and cultural wealth of Wadi Wurayah, however, it is not without challenges and threats, the main ones are:

Degradation and Over Exploitation of Water Resources

Currently, the levels of coliform bacteria & E. coli presence mainly from animal and human feces varies according to location and season, since the closing of WWNP in December 2013, E.coli dropped to zero in the waterfall area most of the year, on the contrary downstream E.coli levels are still high all year long except in April floding. As for the coliform, it was present at all sample locations with high concentrations most of the year. The existence and variation of such pathogens in WWNP water bodies has not explained needs been thus further investigation, however, the presence of feral animals and pigeons is a suspected to be one of the sources. (EWS- WWF, 2015-2016). As for the ground waters downstream, its quality is deteriorating due to the intensive pumping to meet the increasing irrigation and domestic water demands of the villages and cities of the coast, which accelerates the intrusion of salt water from the Gulf of Oman into the eastern gravel aquifer, causing the die-off of natural vegetation, and the salinization of groundwater and soils. (Toureng, et al., 2011)

Luckily, due to the topography of the area, the unique quality of surface and groundwater of the mid-upper catchment, with its rich biodiversity are safeguarded from any deterioration of water resources downstream. However, since the freshwater system is the main ecological asset of Wadi Wurayah, which supports a sensitive and fragile biodiversity, urgent investigation are needed to explain the seasonal existence of pathogens, develop monitoring systems for both underground and surface water quantity and quality, and implement regulating mechanisms for groundwater extraction.

Overgrazing

Currently, goat owners prefer to keep their herds in fenced farms for better food and care, thereby reduce the exploitation of Wadi Wurayah natural resources, however, there are abandoned populations of domestic goats and donkeys which have became feral over time. In addition to their defecation and its role in the degradation of water quality, goats in particular graze vegetation indiscriminately, in which they jeopardize the food sources of more selective native herbivore such as Mountain Gazelle and Arabian Tahr that are already endangered, combined with droughts, the disappearance of potential predators (Arabian Leapored, Caracal), and high breeding rate of goats (instantaneous rate of increase, r = 0.43) (Edwards, et al., 1997) threatens the native vegetation and its dependent fauna in the food web, which makes feral pests one of the major threats on WWNP habitat. (Toureng, et al., 2009)

The management of feral pests faces three challenges: the monitoring of populations, the development and implementation of programs effective control and the monitoring of impact reduction as a result of control. (Edwards, et al., 1997) Based on aerial surveys used to monitor the abundance of feral goats, it is estimated that WWNP contains around 663 to 1,193 individuals. (EWS-WWF, 2016), while aerial surveys proved to be one of the effective methods in monitoring (mobile objects in massive areas) (Edwards, et al., 1997) (EWS-WWF, 2016) its also important to be done frequently, in order to have an accurate assessment of the goats population, variation and spatial boundaries, which will dictate the type of feral pest control program, it may include the regular mustering or/and culling a number of them, based on the population demography (age and sex structure, mortality, and reproductive success). (Edwards, et al., 1997) (EWS-WWF, 2016)

other issues have to be further investigated. For example, recolonization rate after a control event, the cost of removal as density is pushed lower and the relationship between goat numbers and their impact all need to be assessed in designing an optimal control program (Edwards, et al., 1997)

The second factor worth considering to address the problem of overgrazing is the quantification of the effects of goats on the vegetation. Which plant species are the most affected? How do they affect plant diversity, abundance, and productivity? These questions may be answered partially through the implementation of experimental exclosures. (EWS-WWF, 2016)

Introduced Alien Species (IAS)

Excluding feral dogs, cats and goats, the framework of the biodiversity inventory, recorded all non- native, alien species observed in the WWNP, (EWS-WWF, 2016) in which some of them were listed by the IUCN as the 100 "World's Worst" invaders, (ISSG, 2013) according to Toureng et al. the Red-eared Slider (2011)and Mozambique Tilapia were introduced as pets, or through food trade and mosquito control respectively (Toureng, et al., 2009), were successfully removed from the pools of Wadi Wurayah in 2007-2008, nevertheless, the presence of Tilapia fish in nearby reservoir of Wadi Shi makes it a constant threat (Tourenq, et al., 2009), in which it reappeared between 2012-2013 and luckily were naturally flushed from water bodies by violent floods. (EWS-WWF, 2016).

In the same period of time (2007-2008), the Green Aloe (Furcraea foetida) - a plant with invasive potential from South America - was removed manually from the wadi. In its 2013-2015 WWNP scientific report, a plant survey revealed that "No exotic species, invasive or otherwise, were encountered at wild sites within WWNP", Few introduced birds have been recorded, they occupy mostly the buffer zone and are encountered in small groups except for the feral rock pigeon, in which their defecation could pollute water bodies under their nests on one hand, but they constitute prey for the rare Barbary falcons on the other hand, in general feral rock pigeons locations and impacts in should investigated WWNP be and monitored. As for mammals, the presence of feral cats, dogs, goats and donkeys, can have a damaging impact on wildlife and its vegetation. In addition, to be a vectors of diseases, feral species such as feral cats for example compete and interbreed with the rare Gordont wildcat to a point that genetically pure wildcats may no longer exists in the wadi. (Tourenq, et al., 2009)

Essential research and monitoring tools to prevent and control IAS in protected areas are:, creating inventories of invasive species in and out of the WWNP, documenting the history of invasions (origin, pathways, and time period), investigating biological traits of the species, its impacts, and the available management alternatives. (SBSTTA, n.d.), conducting meta-analyses of the available data can permit prioritization of pathways of introduction. Also, early warning and rapid response requires effective surveillance to detect emerging incursions, and access to information to correctly identify the new invaders and to screen the associated risks to implement responses (Genovesi et al. 2010)

Hunting and Wildlife Poaching

A social survey was conducted before the designation of Wadi Wurayah as a national park by **EWS-WWF** and Fujairah Municipality in 2006, showed that hunting and poaching still occur in the Wadi (Toureng, et al., 2009). (Toureng, et al., 2011), which played a great role in the local extinction of several species such as (Arabian leopard, Arabian tahr, mountain gazelle, chukar partridge) and to the suspected reduction in population size of other species (Barbary falcon, Bonelli's eagle) (EWS-WWF, 2016)

Currently, hunting is monitored through a network of trapping cameras that was mainly designed to monitor large to medium-size mammals. (EWS-WWF, 2016). However, it's less effective in monitoring the wildlife poaching for several reasons: it didn't cover all access points, especially foot access points, the time gap -4 to 6 months- between the action of breaking the law and

discovering it (recovery of the taken pictures).

To improve the poaching control system, more cameras should be deployed to all access, and the foot access points in particular, the pictures should be transferred in real time through a wireless camera system, then increase in the number and patrolling operations of park rangers. (EWS-WWF, 2016)

Urbanization and Habitat Fragmentation

By the end of the last century, with oil and gas discoveries have discovered in the Peninsula. GCC Arabian countries experienced drastic changes in every aspect of life. Rapid economic development coupled with sharp population increases drove UAE's increasing demand for cement and building materials directed these industries to the mountainous emirates of Sharjah, Ras Al Kahimah and Fujairah for raw materials. Although, the impact on the pristine habitat of the upstream is negligible, urbanization and agriculture land use has been spreading downstream in the eastern part of WWNP, (Tourenq, et al., 2009) while a road and a power line are built south of the catchment basin, in addition to aesthetic impacts on the natural habitats, mining, the construction of dams and infrastructure (buildings, roads, etc.) and the associated pollution. can have irreversible consequences on the hydrology of the wadi ecosystems. (Toureng, et al., 2011) Moreover. Land-use change around protected areas can reduce their effective size limit their ability to conserve and biodiversity, it interferes with the ecological processes, and the movement and safety of species among protected areas (Hamilton, et al., 2013)

Development galvanization will not stop, however, it can be harmonized with the environmental structure, under this concept the WWNP science report 2013-2015 suggested two main points;(1) minimizing its environmental impacts through; creating and maintaining green corridors, conducting cautious EIA studies (2) creation and implementation of; ecological data on population distribution and movement, mapping and quantifying connectivity loss and classifying areas based on required conservation efforts, and nationwide biodiversity database.

Conclusion and Recommendations

Wadi Wurayah was assigned as the first mountain protected area in 2009 and on November 2010 it was announced as a Ramsar wetland site. It is 227 km2 area located in the Emirate of Fujairah, within the Hajar mountains, between the towns of Masafi, Khor Fakkan and Bidiyah. The fresh water ecosystems found in WWNP provide habitat for a significant diversity of biota (EWS- WWF, 2015-2016), 1146 species were recorded in the biodiversity inventory of the park, it is the home of more than 300 species of plants, including the unique Orchidaceae, (Epipactis veratrifolia), and endangered species found only in the UAE and Oman such as the Arabian leopard and the Arabian Tahr. Due to its permanent water resource the area is serving local communities for thousands of years, 29 heritage sites were found in the area, including old settlements from the 3rd Millennium BC, a 14th – 18th century AD pottery and porcelain fragments

However, the Wadi Wurayah natural culture is under a significant stress, due to several factors, mainly; water degradation exploitation, overgrazing, hunting, urbanization, habitat fragmentation, and introduction of alien species ...etc

The analysis showed a lack of legal enforcement, regulations that need to have

precise guide lines , especially the implementation of theses regulation through park rangers in the area of water resources. overgrazing, hunting and introducing alien species. In addition, being a member of the Biodiversity Convention of CBD. Memorandum of Understanding (MOU) between the neighboring emirates and countries is important in regards to reducing impacts of urbanization, habitat the fragmentation, and introduced alien species. Rapid response requires effective surveillance equipment or networks to detect emerging intrusions (hunters or IAS). Further investigation and studies are needed in which collaboration with universities. institutions specialist are crucial, which lead us to the unconventional ways of awareness. by designing standardized programs that allows individuals, the public to participate in monitoring and recording result of ecological studies.

Recommendations: It is important and useful when planning a management system for a protected area, to consider the following :National objective of the protected area, using IUCN protected area categories as a tool for a solid planning, assessing the current state of the protected area (biological, social and cultural aspects), prioritizing the challenges and threats due to their impacts. forming actions that address both threats and objectives, monitoring, assessing and documenting the implementation of the plan, information resulting and from monitoring/assessing should feedback in to planning.

Table (1) exemplifies a proposed plan for WWNP

Table 1: IEMS Plan for Wadi Wuarayah National Park

Objective

The realization of a restored, protected and sustainably managed freshwater ecosystem that would: support rich biodiversity; provide environmental services and socio-economic opportunities; serve as a replicable example of sustainable freshwater ecosystem management; and build local government capacity in designing and managing protected areas. (WWF)

Operational programs	Outcomes	Activities				
To manage sustainably water resource of the Wadi	Laws, regulation and guide lines to control water exploitation sustainably Implementation of the existing laws and regulations Improvements in water quality and quantity.	 Regulating mechanisms for groundwater extraction Trained rangers for the control and surveillance of designated areas. Conducting EIA studies the surrounding projects. Monitoring surface/ground water quality/quantity Developing water resources database for all water related information Adapting a methodology to estimate the catchment water balance Conducting a Water Research and Learning Programme 				
To protect the ecological integrity ecosystems sustainably	 Improvement of vegetation cover increase in the population of the Arabian leopard maintain the safety and health of ecosystems 	 Monitoring /controlling the number of feral species (goats) Deploying camera traps creating and maintaining green corridors reintroducing the Arabain leopard Assuring the existence of Ecological steppingstone Memorandum of Understanding (MOU) between emirates and countries. For transboundary efforts. Assuring the existence of keystone species 				
Involved parties: federal / local authorities, scientists, Universities, NGOs, international national organization						
parties, stakeholders and environmental authorities in the neighboring countries.						
1 /						

References

Anon., n.d. [Online] Available at: <u>https://www.cbd.int/kb/record/recommendat</u> <u>ion/7021?RecordType=recommendation</u>

Edwards, G., Clancy, T., Lee, J. & Mcdonnell, J., 1997. An Evaluation of Feral Goat Control Methods on Currawinya National Park, South-Western Queensland. *Rangeland Journal*.

EWS- WWF, 2015-2016. Scientific Report Water Research and Learning Programme Wadi Wurayah (2015-2016), Abu Dhabi: EWS- WWF.

EWS-WWF, 2016. Scientific Report Water Research and Learning Programme Wadi Wuravah National Park Field Season 2015-2016 See more at: http://uae.panda.org/?285272/Scientific-Report-Water-Research-and-Learning-Programme-Wadi-Wurayah-National-Park-Field-Season-2015-2016. [Online] Available at: http://uae.panda.org/?285272/Scientific-Report-Water-Research-and-Learning-Programme-Wadi-Wurayah-National-Park-Field-Season-2015-2016 [Accessed 21 Dcember 2016].

EWS-WWF, 2016. *Wadi Wurayah scientific report* 2013-2015. [Online] Available at: <u>http://d2ouvy59p0dg6k.cloudfront.net/down</u> <u>loads/wwnp</u> <u>scientific_research_report_web.pdf</u> [Accessed 22 December 2016].

Hamilton, C. et al., 2013. Current and Future Land Use around a Nationwide Protected Area Network. *PLOSE.One*, 8(1).

ISSG, 2013. 100 of the world's worst invasive alien species : a selection from the Global Invasive Species Database. [Online] Available <u>https://portals.iucn.org/library/node/8565</u> [Accessed 22 December 2016].

at:

SBSTTA, n.d. Alien species: guiding principles for the prevention, introduction and mitigation of impacts. [Online] Available at: <u>https://www.cbd.int/kb/record/recommendat</u> ion/7021?RecordType=recommendation [Accessed 22 October 2016].

Tourenq, C. et al., 2011. Hydrogeology of Wadi Wurayah, United Arab Emirates, and its importance for biodiversity and local communities. *Hydrological Sciences Journal*, 56(8), pp. 1407-1422.

Tourenq, C. et al., 2009. characterisation of the Wadi Wurayah Catchment Basin, the first Mountain Protected Area in the United Arab Emirates. *International Journal of Ecology and Environmental Sciences*, 35(4), pp. 289-311.

WHO, 2006. Guidelines for safe recreational water environments. [Online] Available at: http://www.google.ae/url?sa=t&rct=j&q=& esrc=s&source=web&cd=1&cad=rja&uact= 8&ved=0ahUKEwi446Lh5ZXSAhVFzFQK HawFCWIQFggZMAA&url=http%3A%2F %2Fwww.who.int%2Fwater sanitation hea lth%2Fbathing%2Fsrwe2full.pdf&usg=AF QjCNGy3cXiEUuIR8SmnvKoHJYvnPjYb A&sig2=rt-cPuGA [Accessed December] 2016]. WWF, 2016. List of Ecoregions. [Online] Available at: http://wwf.panda.org/about our earth/ecore gions/ecoregion_list/ [Accessed 30 11 2016]. WWF, 2016. Wadi Wurayah. [Online] Available at: http://uae.panda.org/what_we_do/conservin g_biodiversity/2j/#sthash.yfbhRfaO.dpuf

[Accessed 1 11 2016]

Environmental Laws and Regulation (ERM602_01): Assessment (4) Final Project: UAE and London Convention (International Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter)

Yomna AlKtebi Hamdan Bin Mohammed Smart University

1. Introduction

1.1. How International Agreements Help in Environmental Protection

Environmental issues can be solved at local, regional or international level. The key indicator behind acceleration of management level is the nature of the issue. Ozone depletion, shared resources management and global worming are issues that are impacted by multifactor and can't be solved at local level. The international agreements came as a solution to improve the environmental protection activities. Those agreements provide a clear framework that streamline the processes and define the responsibilities. Also, the international agreements act as a guide on how to respond to specific environmental issue. One more benefit of international agreements that impacts the environmental protection positively is the process of making decisions. In other words, when the countries share their data as part of the agreement, the decision made will be based on scientific research rather than uncertain information. In addition, the reported measures based on the agreements can be used for proactive planning of environmental protection. Moreover, the usual debate between regulators and the industries regarding change in regulations will reduce as a result of having measures at the international level. (Miceli, 1998) (Desombre, 2004)

1.2. Some Applications of International Agreements in UAE

The UAE is part of the following international agreements:

- Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer
- Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and Their Disposal
- United Nations Convention to Combat Desertification,
- Rotterdam Convention on Hazardous Pesticides and Hazardous Chemicals in International Trade
- Convention on Biological Diversity
- Stockholm Convention on Persistent Organic Pollutants
- United Nations Framework Convention on Climate Change and the Kyoto Protocol
- Convention on International Trade in Endangered Species of Wild Fauna and Flora – CITES
- Convention on Wetlands of International Importance Ramsar
- International Convention for the Protection of New Varieties of Plants
- Minamata Convention on Mercury
- Convention on the Conservation of Migratory Species of Wild Animals
- International Convention for the Prevention of Pollution from Ships (1973G.) as amended by Protocol MARPOL (1978G.)
- The "Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972", "London Convention"

The UAE responded to the international agreements in many ways; amendment of

law articles. modification of current regulations, introduction of new regulations and supporting the implementation with the required resources. For example, after being part on the international agreements related to air quality, the Council of Ministers issued a decree concerning air pollution protection system identifies the allowed limits for the ambient air pollutants (Decree No. (12) for 2006). Another example, in the process of protecting the ozone layer, the UAE eliminated the use of any materials or equipment that has chlorofluorocarbons which is considered an ozone depletion substance. (MOEW, 2015)

Note: the selected convention for this report is London Convention and Protocol

1.3. Main Objectives of the Report

The aim of this manuscript is to:

- 1) Explore the London Convention and Protocol.
- 2) Assess the impact of London Convention and Protocol on reducing marine pollution internationally and locally.
- 3) Evaluate the improvement of UAE marine after being part of London Convention and Protocol.
- 4) Propose recommendation for further improvement base on the main finding of this report.

2. Significance

2.1. Background about Marine Pollution

At the global level, the UNEP studied the marine pollution at 12 seas trying to identify the sources of the marine pollution and its impact on the environment. The main source of marine pollution is the waste dumped into the sea, be it from known or unknown sources. The sources can be classified into land source (example: municipal sewerage, tourism and industrial waste) and sea based source (example: fishing industry, offshore mining and shipping including merchant). **Table 1** shows the level of marine pollution in some regions where the pollution levels

ranges from moderate to level. (Ljubomir Jeftic, 2009)

Table1: Level of Marine Litter Pollution in 2005 in the Marine (m) and Coastal (c) environments:

Country	Low	Moderate	Sustainable	High	Very high
Bulgaria	A COMPANY	Yes (M)	Yes (C)		
Georgia		Yes (M & C)			
Romania		Yen (M&C)			
Russia			Yes (M)	Yes (C)	
Turkey	1	Yesi (M)		Yes (C)	
Ukraine			Yes (M)	Yes (C)	
Note: The mediu solid ecrentific de	m acones for me sta about actual	nne environment (% levela	ly probably reflect ge	neral uncertaint	due to a lack of

Source: (Ljubomir Jeftic, 2009)

Marine pollutants can be hazardous waste, plastic bags or medical waste. **Table 2** lists the types of marine pollutants and ranks them according to the risk the pose to the environment.

Table 2: Basic groups of marine litter ingredients ranked according to the experts' scores:

Type of marine littler thems	Bu	Ge	Re	File !	Te	UN	Total
Plantic warne (bottlen, begs, att.)			5		5		38
Pager and carton frichelling various packaging materials and cigaratia hosts)	. +	-	. 4	-	64	+	16
Found measures	2		-		. 6	2	. 9
Mutal objects (thus and came, scrap motal)	- A -		-	4	1.04	1.0	. 7
Mubbler growte (hechoting old tires)	9.	- 2		3		-	
Faatile rege	1.1	-	- 3	. 1	-	-	. 9
Worder objects	1	-4	-		1.4	-	. 9
Glass (Souther, etc.)		-	-	-		3	
Medical wantes					.3	-	. 4
Looseffore (inid advector, one) 2	-	- 3		-	-	-	3
Abanduned linking and sailing gear	-	1	-	3	-		3
Hadaddoor making	-	-	-			-	

Source: (Ljubomir Jeftic, 2009)

The impact of marine pollution is not limited to the economic impact but it expands to impact the human health and the environment as well. At the environmental level, marine pollution may lead to destruction of habitat and reduction in biodiversity where the wildlife is negatively impacted.

2.2. How London Convention will reduce the Marine Pollution

London convention and protocol aim to prevent the marine pollution and protect the marine environment from pollution. The convention and protocol provides a regulatory framework to ensure that its main objective is met. The dumping of waste into the sea is prohibited unless the waste is part of the approved list of materials that can be released to the sea. Even if the waste is within the approved list, the Convention and protocol provide a criteria and guidance on how to dispose it safety into the sea. (UNEP, 2009) Example; as per London Convention and Protocol, when planning for construction of artificial reefs the following shall be considered before construction starts:

- The location should not be used for disposal of waste materials into the sea.
- The location should not be contrary to the aims of the Convention where some areas are considered protected.
- All activity information shall be reported to the Secretariat by Contracting Parties.
- Materials used for placement activities should be assessed in accordance with the relevant Specific Guidelines.

3. Literature Review

3.1. Background about London Convention and Protocol

London convention and protocol was developed in 1972 and came into force in 2006. The main aim of it was to improve the marine environment by defining the responsibilities, providing guidance and framework and ensure the compliance of the involved parties. It consists of 29 articles that cover the following aspects:

- Dumping of waste and other matters.
- Incineration at sea.
- Waste and other maters exporting.
- Granted exception of the convention.
- Process of obtaining permits and reporting of it.
- How to apply the convention and enforce it.
- Compliance procedures.
- Requirements of regional efforts.
- Assistant
- Conducting scientific researches.

- Define responsibilities and liabilities.
- Frequency of meeting with contracting parties.
- Process of withdrawal

Source: (IMO, 2001) (IMO, 2007) (IMO, 2006)

This convention experienced several amendments. In 1978, the incineration of waste at sea was revised and new procedure was introduced for disputes settlement. The same article was amended in 1980 to include the level of care required for the incinerated substances. 1989 amendment aimed to standardization of the permits issuing process. The industrial waste incineration at sea was banned after the amendment of **1993** along with banning the dumping of radioactive waste into the sea. In 1996, London protocol came as replacement for the convention. The protocol replaced the banned (from dumping) waste list by approved (to be dumped) waste list to limit the waste dumping to the sea. Also, it initiated the process of having precautionary measures when harm to the marine is likely to happen. The regulation of CO2 streams sequestration was included after 2006 amendment which form a basis for law establishment on this regards. (IMO, 2008)

3.2. London Convention Implementation Internationally

In industrialized countries, London convention resulted in shifting from disposing the waste to reduction of waste. This opened the door for innovation where those countries reduced the waste using advanced technologies and clean production approach. Also, the waste treatment was another solution when byproducts can't be avoided. In addition, the convention led to transfer of technology among contracting parties (Example: Upgrading the low-level radioactive waste treatment facilities in Russia).





Source: (IMO, 2016)

Ocean Fertilization:

What is it? Ocean fertilization is a potential greenhouse gas mitigation technique that works, in theory, by adding iron or other substances to high nutrient regions of the ocean in order to stimulate phytoplankton blooms that sequester carbon dioxide.

The United States: has consistently tried to balance the concerns about the uncertain efficacy and potential adverse side effects of ocean fertilization with the need for further scientific investigations to explore, among other things, the potential of ocean fertilization as a climate change mitigation strategy.

The fall 2007 annual London Convention and Protocol meetings agreed to a statement that "urged States to use the utmost caution when considering proposals for large-scale ocean fertilization operations" and "took the view that, given the present state of knowledge regarding ocean fertilization, such large-scale operations were currently not justified."
Carbon Sequestration Ongoing Research:

The contracted parties presented their projects about carbon sequestration to meet the convention requirements.

Australia: Otway Basin project,

European Union: "CO2SINK" project in Germany.

Algeria: The "In Salah" industrial-scale CO2 storage project.

US:

- 1- Collaboration efforts between the Department of Energy's (DOE) Regional Carbon Sequestration Partnerships to determine the suitable geological sequestration technologies, regulations, and infrastructure needs for carbon capture, storage, and sequestration in different areas of the country.
- 2- The Weyburn-Midale CO2 Monitoring and Storage Project in the oilfields of Alberta.

Florida- Artificial Reefs:

Guidance on artificial reef placement developed in collaboration with UNEP based on London Protocol. Then it was adopted to establish the reef off the coast at Florida.

Source: (London, 2008)

3.3. UAE Marine Environment before London Convention

The UAE and gulf countries studied the marine pollution level after the occurrence of the gulf war when the water body was impacted by the release of the oil into it. They studied the types of pollutants, their location and concentration. However, the study didn't end by establishment of an emergency management procedure to avoid the recurrence. The article 21-38 in law no 24 of 1999 address the marine pollution prevent but it was not supported by strong regulation to ensure enforcement of the law. This indicates that the system of handling marine pollution was reactive rather than proactive. (I.M. Banat, 1998) (Stephen de Mora, 2004)

4. Analysis

4.1. London Convention and Protocol Impacts in UAE Laws

a) Abu Dhabi:

New law established (Law no. (4) of 2006) to develop a department responsible for transport. One of the main responsibilities of the department is to "control the vessels' compliance with the provisions of the international conventions ratified by the state, regarding the regional and international marine rules, specifically related to guaranteeing the safety in the seas and preventing pollution". (Transport, 2006)

b) Dubai:

Law No. (11) of 2010 concerning Licensing of Maritime Vessels in the Emirate of Dubai (Department, 2014). The law consists of 55 articles that cover the following topics:

- Responsibilities of governmental authorities in marine protection.
- Marine access legibility.
- Vessels licensing requirement.
- Technical inspection if the vessel.
- Environmental requirement during operations.
- Penalties of non- compliance.

(Note: No modification done to Law no. 23 of 1999 and Law no. 24 of 1999 after the adoption of London convention and protocol).

4.2. Organizational Structure Change to Implement the Agreement

a) Abu Dhabi:

In 2006, when the department of transport established they included separate sector in the structure to manage the marine related issues in Abu Dhabi as shown in **Figure 2**.

The department of transport developed regulation for transport. It included the some sections to ensure implementation of the convention like monitoring ships and their waste disposal. (Transport, 2010)



Figure 2: Department of Transport Organizational Structure

Source: (Transport, 2016)

b) Dubai:

Dubai Maritime City Authority was established in 2007. The objective of this authority is to ensure that the industrial activities in marine area are sustainable and promotes the safe environment through safe operations. There is published regulation vet; however the authority established an integrated waste management system based on the regulation from Dubai musicality, Ministry Climate Change of and Environment. (DMCA, 2016) (DMCA, 2013)

c) Ajman:

Ajman municipality didn't advocate a department to handle the marine pollution prevention. Some efforts were done to improve the marine environment in Ajman. One of them is the initiative to clean the bottom of the sea on the Zora beach. Another example of the efforts is fixing water quality monitoring stations. (Ajman, 2011) (Ajman, 2015)

4.3. How Successful was London Convention in UAE

In **2008,** the UAE took the initiative to develop measures related to marine protection. The concerned governmental authorities were involved to ensure that the

responsibility is shared and the noncompliance will have greater impact. By this, the UAE is planning to reach a stage of clean and safe sea. (Basti, 2008) In 2009, there was a reported incident of dumping waste into the Arabian Gulf. The investigations showed that the desalination plants in the gulf region is releasing around 300kgs of copper and 24 tons of chlorine to the sea on daily bases. (Landais, 2009) Moreover, in 2014, a draft of new law related to penalties of harming the environment was presented to the Federal National Council. The draft addressed the marine pollution penalties as well as stronger measures for marine protection. (Salama, 2014) In 2015, Ministry of Climate Change and Environment launched a monitoring program for monitoring and control of marine and coastal environment at the national level. (AMEinfo, 2015)

The situation in 2016 is giving a negative indication on the effectiveness of the implemented regulation after the convention. In February 2016, one of the beaches in Abu Dhabi was closed due to release of waste 'tar balls' from unknown vessel. The incident endangered the aquatics ecosystem and urgent cleaning was done. (Mannan, 2016)

Figure 3: presents the situation in Abu Dhabi in 2015 in terms of marine protection

Marine Water Quality

With approx: 50,000 km² of marine area and 700 km of coastline, marine water quality is an important environmental indicator in Abu Dhabi

Overall marine water quality is good at public beaches

Infrastructure development restricts the flow of water around Abu Dhabi islands



EAD operates a

marine water

Environment impact Assessments for proposed

projects enable identification &

mitigation of impacts on marine

Nutrient levels, which can cause algae blooms, are a concern around Abu Dhabi city & Mussafah



The government adopted a ZERO waste water discharge to sea policy & will reuse all treated water for irrigation

quality monitoring programme

Source: (EAD, 2015)

5. Results and Conclusions

The results are:

- 1. After adoption of London convention and protocol, there were no clear efforts on the federal level where both Law no 23 and law no 24 of 1999 didn't experience any modification to enforce implementation of the convention.
- 2. The owner and responsible department/ sector among all emirates were not defined.
- 3. The framework of implementation was not standardized and the basic was not provided by the concerned authority.
- 4. Fragmented efforts to comply with the convention led gaps on marine protection system.
- 5. There was no consequences of noncompliance from some emirates.
- 6. The monitoring system placed to reactively study the marine pollution.
- 7. Absence of oversight of convention compliance among the 7 emirates.

In conclusion, achieving the aim of London convention and protocol of protecting the marine environment from dumping of waste varies from one country to another. The UAE compared to the other countries lack the consistency in practices related to London Convention.

6. Recommendations

1) At the national level, the main environmental law (no 24 of 1999) shall be amended to include the following:

- The prevention on marine pollution based on the international conventions and agreements.
- Define the responsible authority to establish the framework at national level.
- Penalties of non-compliance with international convention shall be added to the law.
- Mandate the change in organizational structure to accommodate the international conventions if the current structure doesn't support the same.
- The defined leading authority shall develop the regulation related to ships/vessels licensing, marine transport regulation, recreational activity regulation, industrial activity regulation and waste disposal permits.
- 3) The defined leading authority shall set the performance measures for monitoring compliance with the convention.
- 4) At the local level, the department/ sector strategic goals shall reflect the commitment towards the convention.
- 5) Operational plan should be reviewed more frequent to ensure that the adopted activities help in achieving the strategic goals of marine protection.
- 6) When performance measures shows drop in implementation or gap, the local authority shall submit mitigation plan to the leading authority for their further recommendation, review and approval.

7. Citation and References

Ajman, M. a. P. D. -., 2011. *The launch of the largest environmental campaign in the State to clean the bottom of the sea on the Zora beach on Saturday.* [Online] Available at: <u>http://www.am.gov.ae/en/News/Pages/news</u> 1002.aspx [Accessed 07 05 2016].

Ajman, M. a. P. D. -., 2015. The Municipality and Planning Department in Ajman is installing six fixed stations to monitor the quality of seawater and Al Khor. [Online] Available at: <u>http://www.am.gov.ae/en/News/Pages/news</u> 297-2015.aspx [Accessed 05 05 2016].

AMEinfo,2015.UAEMoEWlaunchesnational program to monitor and controlmarineenvironment.[Online]Availableat:

http://ameinfo.com/money/economy/uae-

moew-launches-national-program-to-

monitor-and-control-marine-environment/ [Accessed 08 05 2016].

Basti, A. K. A., 2008. *UAE to step up measures to protect marine environment*. [Online]

Available

http://www.emirates247.com/eb247/compan ies-markets/aviation/uae-to-step-up-

at:

measures-to-protect-marine-environment-

<u>2008-11-13-1.227280</u> [Accessed 08 05 2016].

Department, G. o. D. L. A., 2014. *Law No.* (11) of 2010 concerning Licensing, Dubai: Government of Dubai Legal Affairs Department.

Desombre, E. R., 2004. The Evolution of International Environmental Cooperation. *Journal of International Law & International Relations*, 1(1), pp. 75-88.

DMCA, 2013. Integrated Waste Management. [Online] Available at: http://www.dmca.ae/en/Environment/Enviro nmentalServices.aspx?GenericContent=iwm [Accessed 07 05 2016]. DMCA, 2016. About Dubai Maritime City Authority. [Online] Available at: <u>http://www.dmca.ae/en/AboutDMCA.aspx?</u> <u>GenericContent=dmca.introduction</u> [Accessed 07 05 2016].

EAD, 2015. Environmental Snapshot Abu Dhabi, Abu Dhabi : EAD.

I.M. Banat, E. H. M. E.-S. a. A. A.-H., 1998. POST -GULF-WAR ASSESSMENT OF NUTRIENTS, HEAVY METAL IONS, HYDROCARBONS, AND BACTERIAL POLLUTION LEVELS IN THE UNITED ARAB EMIRATES COASTAL WATERS. *Environment International*, 24(1), pp. 109-116.

IMO, 2001. GUIDANCE ON THE NATIONAL IMPLEMENTATION OF THE 1996 PROTOCOL TO THE LONDON CONVENTION 1972, UN: International Maritime Organization.

IMO, 2006. 1996 PROTOCOL TO THE CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER, 1972, UN: International Maritime Organization.

IMO, 2007. COMPLIANCE PROCEDURES AND MECHANISMS PURSUANT TO ARTICLE 11 OF THE 1996 PROTOCOL TO THE LONDON CONVENTION 1972, UN: International Maritime Organization.

IMO, 2008. *B-3:INTERNATIONAL CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER*, UN: International Maritime Organization.

IMO, 2016. Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter. [Online] Available at: <u>http://www.imo.org/en/OurWork/Environm</u> <u>ent/LCLP/Pages/default.aspx</u> [Accessed 7 May 2016].

Landais, E., 2009. *Waste dump threatens Arabian Gulf.* [Online] Available at: http://gulfnews.com/news/uae/environment/ waste-dump-threatens-arabian-gulf-1.72058 [Accessed 08 05 2016].

Ljubomir Jeftic, S. S. a. E. A., 2009. *Marine Litter: A global Challenge*, Nairobi: UNEP.

London. Е., 2008. IMO: LONDON CONVENTION REPORT ON MARINE **ENVIRONMENT** ISSUES. [Online] Available at: http://www.telegraph.co.uk/news/wikileaksfiles/london-wikileaks/8304827/IMO-LONDON-CONVENTION-REPORT-ON-MARINE-ENVIRONMENT-ISSUES-1..html [Accessed 07 05 2016].

Mannan, M., 2016. Vessel dump closes popular Abu Dhabi beach. [Online] Available at: <u>http://7days.ae/vessel-dumpcloses-popular-abu%E2%80%88dhabibeach [Accessed 08 05 2016].</u>

Miceli, K. S. a. T. J., 1998. Voluntary Environmental Agreements: Good or Bad News for Environmental Protection. *Journal* of Environmental Economics and Management, 36(1), pp. 109-130.

MOEW, 2015. State of Environment Report (United Arab Emirates), Dubai: MOEW.

Salama, S., 2014. UAE gets tough on environmental crimes. [Online] Available at: http://gulfnews.com/news/uae/environment/ uae-gets-tough-on-environmental-crimes-1.1308702 [Accessed 08 05 2016].

Stephen de Mora, S. W. F. E. W. a. S. A., 2004. Distribution of heavy metals in marine bivalves, fish and coastal sediments in the Gulf and Gulf of Oman. *Marine Pollution Bulletin*, 49(1), p. 410–424.

Transport, D. o., 2010. *Maritime Sector Transport Regulations (General and Port Operations)*, Abu Dhabi : Department of Transport.

Transport, D. o., 2016. *Department of Transport- Organizational Stucture*. [Online]

Available

http://dot.abudhabi.ae/en/info/Organization_ Structure [Accessed 07 05 2016].

Transport, T. D. o. M. A. a., 2006. *Law number (4) of 2006 Regarding the creation of the Department of Transport*, Abu Dhabi: The Department of Municipal Affairs and Transport.

UNEP, 2009. London Convention and Protocol- Guidelines for the Placement of Artificial Reefs, London : International Maritime Organization.

at:

United Nations Convention on Climate Change and UAE's Efforts Towards it

Jawaher Al Mehairi Hamdan Bin Mohammed Smart University

1. Introduction

An environmental treaty is a type of international law, an intergovernmental document which is legally binding and mentioned purpose having the of preventing and protecting the natural resources and the environment (Mitchell, 2014). Treaties have polices which show the commitment of one nation to the laws and regulations for the environment and sustainability protection (Ohliger, 2015). The international conventions can be grouped to the following topics (Güner-Özbek, 2011)



9 Globally, there are environmental protection categories for which treats, conventions are established. Which are as the following: Atmosphere with 6 conventions, freshwater resources with 11, environment with 10 marine global conventions and 13 regional conventions, marine living resources with 7 conventions, nature conservation and terrestrial living resources with 10, noise with one convention and nuclear safety with 6 conventions. These Environmental laws are the standards for governments to establish and manage environmental natural resources and quality.

International environmental treaties are important because they allow countries to work together and address main transboundary or global environmental issues such as air pollution, climate change, or protection of the ozone layer (Anon., 2001). Sometimes domestic actions alone are not sufficient to protect the environment, or resources in one country. That's why there is a need to work with other countries to develop joint solutions to international environmental issues that impact us.

UAE is one these countries that has globally agreed and ratified multiple conventions. It has ratified 19 conventions, accessed 2 conventions and approved one (National Bureau of Statistics, 2016). The main conventions accepted and ratified by UAE are Convention on international Trade in Endangered Species of wild Fauna and Flora (CITES), United Nation Framework convention on Climate Change, Kyoto Protocol, Montreal Convention, Convention on Biological Biodiversity, The Basel Convention and Regional Organization for the Protection of the Marine Environment (National Bureau of Statistics. 2016). These conventions have affected the country and lead to the introduction of many environmental laws. Federal Law No. (24) Of 1999 Protection and Development of the Environment have incorporated many aspects of the signed conventions.

2. Significance of the topic

One of the most important environmental issues is climate change. It is the long term change in average weather conditions that include temperature, precipitation and wind (Environmental Protection Agency, 2014). Our climate is experiencing dramatic changes because of the greenhouse gas (GHG) emissions as a result of the human activity. GHG are gases released in the atmosphere which later trap in heat. Carbon dioxide (CO2) is the most critical GHG released as a result of human activities and emissions from burning of coal, oil or natural gas (Reilly, et al., 2003). Other GHG are as the following:

• methane (CH4)

- nitrous oxide (N2O)
- hydrofluorocarbons (HFCs)
- perfluorocarbons (PFCs)
- sulphur hexafluoride (SF6).
- nitrogen trifluoride (NF3).
- Chlorofluorocarbons (CFCs)



United Nation Framework Convention on Climate change (UNFCCC) is addressing this environmental issue. UAE has agreed to UNFCCC on 1992, and ratified it on November 1995 (National Bureau of Statistics, 2016). Along with UNFCCC, the timeline below shows other international actions taken globally to combat and highlight the issue of climate change (UNFCCC, 2016).

3. Importance of the UNFCCC

The international climate system is built on clear understanding of the threats caused by climate change. Industrialization, cutting down forests has increased the greenhouse gas levels in the air. The objective of the UNFCCC is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system" (UNFCCC, 2015). It establishes a framework of principles and associations, and sets up a process in which governments of different countries meet consistently to discuss climate change action.

UNFCCC is important because it gather countries to collect and share GHG emissions information, polices and what is being practiced by the member countries. It assists the countries in launching national strategies and actions to reduce the GHGs. UNFCCC also cooperates and aids in preparing the mitigation measures and adaption actions.

4. Literature review

1980's concern was about the global impact of the Greenhouse Gases (GHGs), and this lead to the creation of the Intergovernmental Panel on Climate Change (IPCC) by the world Metrological organization and UN Environmental both program; are UN agencies. Emissions led to Climate change which has negative and serious impact on the Earth, physical and biological systems are affected. Flooding, spread of infection, poor air quality, crop productivity will be affected, and ecosystem will be damaged, all these are examples of the impact of the climate change on the planet earth.

In 1992, Rio conference which was a declaration on environment and development which's key principle was or states to ensure that their economic developments are environmentally sustainable. and the environmental concerns should be an integral part of development policy and unsustainable practices should be eradicated. It represented a mandate for ICAO to further its work on global air pollution and climate change. Its outcome was the United Nation Framework Conference

on Climate Change UNFCCC (United Nation Environment Program, 2000).

UNFCCC is international an environmental treaty negotiated at UN environmental conference on and development known as Earth summit. Its main objective is to stabilize greenhouse gas concentration in the atmosphere at a level that would prevent dangerous interference with anthropogenic the climate system. It has no binding limits, thus it's legally nonbinding. However, it provides a framework for negotiating specific protocol which may set binding limits on the greenhouse gases emissions. This treaty was effective from 1994, having 196 parties who meet annually during Conference of Parties (COP) to assess the progress in dealing with climate change. Yet, because of the increasing importance and the adverse impact of the climate change it became evident to the policy makers that further actions are necessary which lead to delegate in Kyoto at COP 3 to agree to a protocol to UNFCCC which makes the developed countries and developing ones to commit a quantified emission reduction targets. These countries called Annex 1 parties, who agreed to reduce GHG emissions 5% below 1990 levels during 2008 -2012 (United Nations, 2008). Kyoto protocol also established fixable mechanisms such as:

- Emission trading system
- Joint implementation of emissions
- Clean Development Mechanisms

Later after COP 3, country members began discussing and negotiating the rules and governing factors and how to implement these reduction measures. Kyoto protocol is now ratified by 190 countries post its enforcement since 2005.

At COP 21 in Paris, members of UNFCCC reached to an agreement to face climate change and to accelerate its actions to reach sustainable low carbon. The Paris Agreement is built upon the UNFCCC. The convention was adopted by many countries around the world, many of them have showed a successful adaptation of UNFCCC and good records. They showed how their reliance on the Green Economy, Green Technology and projects created new opportunities and edges for them. Germany's efforts to face climate change can be seen through the Energyiwende which means energy transition. It was adopted in 2011 with the aim of transforming Germany to one of the most of the greenest economy and energy efficient country around the world. This will be done by 60% of its energy generating from renewable sources energy bv 2050. According to reports published in 2014, Germany has already driven 12.3% of its energy from the renewable sources (Ministry of Environment and Water, 2014).

Republic of Korea has also shown its commitment to the UNFCCC. It has established the Green Growth strategy in 2008, and in 2009 it enacted the Framework on the low carbon Green Growth. The strategy committed spending 2% of GDP each year on promoting the shift to greener technologies, and to increasing its share of green technologies by 10% of the global market in 2020 (Ministry of Environment and Water, 2014). China has achieved incredible progress in tackling its environmental issues and transforming to green and renewable energy. In 2013, it was ranked the first worldwide becoming the world leader in renewable technology investment. Its new renewable energy investment accounted for USD 56.3 billion. Whereas Chile, in 2008 adopted the National Action Plan on Climate Change and set its reduction target of 20% of GHG emission in 2020 compared to 2007 levels (Ministry of Environment and Water, 2014).

UAE before ratifying the UNFCCC, was depending on the fossil fuel such as oil and natural gas as its energy sources, hence contributing to GHG emissions, it didn't have any clean energy strategy or plans until it ratified the UNFCCC and changed its development goals and recognized the potential consequences of the climate change.

5. Analysis

UAE is playing a major role in the face of the implications of the climate change. By signing the convention, it incorporated its commitment towards climate change in many aspects. Green energy policies, clean energy strategies, green technology, etc. are a good example how UNFCCC convention has impacted the country. The country does not have a direct law which mitigate or call for actions to compact climate change, however. UAE has a cabinet Decree 12 of 2006 regarding Regulation the Concerning the Protection of Air from Pollution (EAD, 2010). Climate change and air pollution are closely coupled. Having regulations to protect the air from pollution can indirectly reduce the potential adverse impact of climate change. Out of its 16 articles, article 3 sets limits to the cars and vehicle emissions and what type of fuel to be used. Article 4 specifies limits for emissions emitted from different industries for power generation, commercial purposes, etc. whereas article 9 sets the regulation regarding the usage of the pesticides and chemical compounds (EAD, 2010).

The Climate Change Executive Committee coordinates the climate change activities in UAE. It is chaired by the Federal Ministry of Energy and representatives from different institutions. The committee has different activities which include promoting public awareness on climate coordinating change, data for the development of updated GHG inventories, and implementing initiatives related to the technical capacity building (Ministry of Energy, 2013).

The UAE taken and continuing to take key steps to implement the UNFCCC, efforts includes the followings:

• Development of an expansive environmental vision

- Actions for improved understanding of vulnerability to climate change o Launching the Eye on Earth international information access initiative
- Taking proactive steps to promote alternative sustainable investments for GHG reduction

In April 2014 UAE was praised by the United Nations for its efforts to face climate change. UAE has featured its role as a true energy leader; it is diversifying its energy mix. UAE believes that the key strategy for climate change mitigation is the adoption of the clean and renewable energy (Gulf News, 2014).

UAE is very concerned about the climate change. It has shown its involvement into it in various events. UAE is fully aware of the potential effects of the climate change. Long term change in temperature, even a small change in it can have adverse results on productivity because of the instable nature of the natural resources of the country. UAE has been working hard to study the impact of climate change at different levels. According to the UAE's national communication, there are five areas that are vulnerable to climate change. Priority areas are reginal climate change. environment. coastal zones and socioeconomic sectors (Ministry of Energy, 2013).

Determining the Regional Climate change is still in its preliminary planning stage. The planned projects are Water Research and Forecasting (WRF) and Reginal Ocean Modeling systems (ROMS). WRF is used for the atmosphere and regional climate modeling and it shows the climate change on a smaller scale and considering local topography, coastlines and land use factors. Whereas ROMS will be used to determine how climate change and Green House Gases will impact the water of Arabian Gulf, it will reflect sea temperature and evaporation rates. This study will be very beneficial for the country (Ministry of Energy, 2013). Another major concern for UAE is the potential loss of the maritime and terrestrial biodiversity as a result of climate change. However, UAE has planned two projects which are, Species Distribution Model (SDM) along with different climate change scenarios can be referred to study the species and terrestrial environment vulnerability. Dynamic **Bioclimate** Envelope Model (DBEM) will be used to used the marine ecosystem vulnerability to changes in the physical, biological and chemical properties of the Arabian Gulf.

Availability of adequate water for future to match the rapid growth of the country poses a concern too. Yet UAE has planned 3 projects to assess the water resources supplies. By using the Water Evaluation and Planning WEAP model will be used to assess water resources vulnerability to long term reginal climate change and UAE's socioeconomic growth. Vulnerability of the renewable groundwater supplies will be assessed by the NOAH land surface model (Ministry of Energy, 2013). The third model will be used to assess Arabian Peninsula's groundwater vulnerability as a result of rise in the sea levels relating it with long term climate change and social and economic growth.

According to the UAE's Climate Action Tracker report, 90% of UAE's coastal zones are at the risk of the climate change (Climate Action Tracker, 2015), which poses a concern for the country because of the concentration of industries, infrastructure and the population throughout the UAE is around these areas. Planned are two studies, both at national and regional levels. A coastal vulnerability index for all UAE's coastline segments so that it will offer information which is actionable applicable to the near term planning. This index is going to be at the national level. Whereas at the regional level. GIS modeling techniques will be used to measure the inundation (flood, wave, etc) extent related to the probable rise in the sea level scenarios (Ministry of Energy, 2013).

Accompanying its commitment to the UNFCCC, UAE announced the Green Growth Strategy in 2012. The strategy puts the greenhouse gas mitigation as its core by reaffirming its existing green growth programmes and suggested measures for energy decarbonization. The rollout of the clean technologies driven by new policies investments is being and spread throughout the country, and affecting the key sectors that emit GHGs. UAE also been developing a program called has Carbon Capture and Storage which is an intellectual property as one of the clean energy options (Ministry of Environment and Water, 2014)

The country has communicated some strategies to show its implementation of the convention. As part of UAE's Vision 2021 agenda, the country is planning to set a process to develop a full systematic national GHG inventory considering several indicators for the country's development. The country also has plans to set policies, institutions that account for climatic risk (EAD, 2014).

UAE has green growth development strategy which promotes green energy, green investment, green cities. green technologies, and green buildings. Abu Dhabi has established a policy which states that target for renewable energy will account for 7% of electricity generation capacity by 2020 (EAD, 2014). To support it, the emirate is concentrating on solar power by having Shams 1 power plant, Noor 1 solar photovoltaics, and having the Sir Bani Yas wind power project (Ministry of Energy, 2013). Dubai Also has set its target of producing 1% of the electricity from renewable source of energy by 2020 and 5% by 2030 (Supreme Council of Enegry, 2014). UAE is also moving towards the nuclear plants for energy generation. Contracting with the Korea Electric Power Corporation, the station can provide 20% power supply in the country hence resulting in 20% reduction of carbon footprint of the power sector (Ministry of Energy, 2013).

UAE has a Green Building Council called The Emirates Green Building Council formed in 2006, with the goal of promoting green buildings and sustainability. In 2010, Building Regulations Green for new construction were introduced in Dubai (Supreme Council of Enegry, 2014). The emirates has also published a mandate stating that new buildings in the city have to have solar hot systems capable of meeting 75 percent of the need of hot water (Supreme Council of Enegry, 2014). The Aviation sector of the country has also contribution shown its to country's commitment towards UNFCCC. In 2012, General Civil Aviation Authority (GCAA) approved an Action Plan for a sustainable aviation in UAE. The plan includes the sector efforts for efficiency, researches and

assessment of alternative fuel possibility (General Civil Aviation Authority, 2013). Moreover, institutions in UAE are investing in clean energy projects outside the country to promote renewable energy and efficiency. A good example can be Masdar.

The impact of the convention was not only in term of policies and measures establishment in the country, but the structure of the Environmental Mistry of the country also has changed. Renaming the Ministry of Environment and Water to the Ministry of Climate Change and Environment and restructuring it shows UAE's commitment the new green economy to and sustainability and it will make the country focus on the issue.



Trend of the GHG emissions in UAE

Finally, the treaty is successfully integrated in UAE system and efforts to face climate change, however, GHG emissions are not yet reduced and are counting to rise. The figure below from the Climate Action Tracker shows the trend of the GHG emissions in UAE.

It estimates that the GHG emissions would reach around 450 MtCO₂e excl. LULUCF by 2030, which around 65% increase to 2010 levels, and 600% compared to 1990 levels (Climate Action Tracker, 2015).

5. Results and Conclusion

Climate Change has rapidly risen compared to the recent years and is creating a big challenge for the global community. Its impact can be felt around the world. UAE is already a low lying coastal country and it faces an increase in the temperature. It also plays a central role in the worlds energy economy because of being major fuel supplier, this makes it important for the country to seek for solutions and cut emissions and be one of the energy provider to the world.

UAE's investment in clean energy has shown some real opportunities to fight against climate change. These investments lead to the introduction of new concepts such as Green Bus. Dubai introduced the Green Bus which operates on Biofuel that is from recycled cooking oil combined with Ultra low sulfur diesel. It used the solar energy to power its interior. In addition to applying different technologies and policy 294 solutions, the country is investing in innovation for the climate and energy solutions (Supreme Council of Enegry, 2014).

Creation of an Energy and Climate Change Directorate (ECC) under the Ministry of Foreign Affairs was as the solution to build UAE's climate change agenda. UAE's efforts to mitigate the consequences of climate change can be seen both at National and local levels, its commitment to face the issue can also be noticed from its involvements in alternative energy and climate change matter such as:

- International Renewable Energy Agency
- World Energy Council
- UNFCCC Conference on sustainable Development

Its involvement, considering the convention that it signed in its laws, regulations, and policies shows how committed the country is. Throughout the paper its in noticeable that the country used to have a dedicated team for the climate change file and issues related to it. The country also published three National Communications to the United Nations describing its efforts and engagement to fight. United Nation has recognized UAEs effort too, which adds that what the country is doing is what is actually needed. Later the paper showed different studies that the country is having to assess the vulnerability of its different resources to the climate change, these studies will add to the country's knowledge and make it aware about where it is standing in facing the issue and how successful it is in combating climate change.

Having a clear strategy set up is helping the country to be focused and maintain to seek better options for the development and clean energy. Shifting from the traditional energy sources to the renewable ones, using the Nuclear for the power generation, setting up new standards for appliances, encouraging investment in the mass transit systems, having new standards for buildings such as Estidama label and having the Carbon Capture and Storage programme, all are examples that show that UAE is putting the climate change issue and how to mitigate it as a core for its development.

One thing to to notice in the paper that All the efforts being done to face the climate change are being done by Emirates such as Dubai, Abu Dhabi and Sharjah. This raises a question about the role of the other emirates in the country, and their contributions towards meeting country's commitment to the convention.

The way UAE is engaging its self towards its commitment is notable. Yet it is too soon to judge or conclude whether what the country is doing is more than enough and it will lead to the desired changes or no, but compared to other countries, what UAE is doing is sufficient.

6. Recommendations

The transition towards clean energy to mitigate the consequences of the climate change is a long term process, but UAE can be a good example or reference to other countries. Yet some improvements can be considered as the recommended below:

- Increased level of political support and commitment and the dedicated team is needed: relocating the climate change file under the new ministry and renaming it may not be the ideal solution for the issue, because even though the Ministry is being renamed as the Climate change and Environment, it has other environmental issues to tackle too which may distribute the focus.
- Increase the coordination at various levels of the government and the environmental institutions, and increase the communication between emirates regarding their efforts to face climate change.
- Invest in building green infrastructure in other emirates, other than Abu Dhabi.

- Development of companies that only deliver green R&D service on the state level with focusing sufficiently on each emirates.
- Increase the awareness level in the country so that everyone is aware of the importance of the issue and how seriously the country is working towards it.

7. Bibliography

Anon., 2001. *The Environment Encyclopedia and Directory*. London: Europa Publications. Climate Action Tracker, 2015. *UAE's Climate Action Tracker*. [Online] Available at:

http://climateactiontracker.org/countries/uae .html [Accessed 08 May 2016].

EAD, 2010. *Regulation Concerning Protection of Air from Pollution*, Abu Dhbai: EAD.

EAD, 2014. CLIMATE CHANGE Impacts, Vulnerability & Adaptation, Abu Dhabi: EAD. Environmental Protection Agency, 2014. Climate Change Science Overview, U.S: EPA.

Güner-Özbek, M. D., 2011. The United Nations Convention on Contracts for the International Carriage of Goods Wholly or Partly by Sea. Istanbul : Springer.

General Civil Aviation Authority, 2013. GEGCAA STATE ACTION Plan, Dubai: GCAA. Gulf News, 2014. Ban Ki-moon praises UAE efforts on climate change. [Online] Available at: http://gulfnews.com/news/uae/environment/ ban-ki-moon-praises-uae-efforts-on-climatechange-1.1325839 [Accessed 07 May 2016].

Ministry of Energy, 2013. 3. *Ational Communication under the United Nations Framework Convention on Climate Change*, Abu Dhabi: Ministry of Energy,.

Ministry of Environment and Water, 2014. *UAE State of Green Economy*, Dubai: UAE's Ministry of Environment and Water.

Mitchell, R. B., 2014. International Environmental Agreements Database *Project.* [Online] Available at: <u>http://iea.uoregon.edu/</u> [Accessed 08 May 2016].

National Bureau of Statistics, 2016. International Conventions Related to the Environment Issue in the UAE until 2015, Dubai: UAE National Bureau of Statistics.

Ohliger, T., 2015. Environment policy: general principles and basic framework. [Online] Available at: http://www.europarl.europa.eu/atyourservic e/en/displayFtu.html?ftuId=FTU_5.4.1.html [Accessed 07 May 2016].

Reilly, J. M., Jacoby, H. D. & Prinn, R. G., 2003. *Multi Gas contributors to global climate change*, Cambridge: MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Supreme Council of Enegry, 2014. *STATE OF Energy REPORT Dubai 2014*, Dubai: Supreme Council of Enegry.

UNFCCC, 2015. *Climate Get the Big Pictur*. [Online] Available at: <u>http://bigpicture.unfccc.int</u> [Accessed 09 May 2016].

UNFCCC, 2016. Background on the UNFCCC: The international response to climate change. [Online] Available at: <u>http://unfccc.int/essential_background/items</u>/6031.php [Accessed 08 May 2016].

United Nation Environment Program, 2000. *Rio Declaration on Environment and Development*, s.l.: UNEP.

United Nations, 2008. Analysis of possible means to reach emission reduction targets and of relevant methodological issues, s.l.: UNFCCC.

Assessment of the Environmental Management Practices to Combat Overfishing in the UAE

Halima Aljasmi Hamdan Bin Mohammed Smart University

Abstract

Studies have shown that the main fish stocks in the United Arab Emirates (UAE) are overfished, with assessment surveys showing an 88% decline in stocks in the Arabian Gulf and a 94% decline in stocks in the Sea of Oman between 1975 and 2011. This drop was caused by various factors, including extensive development and rapid urbanization of coastal areas, marine pollution, climate change, and overfishing, which is the main cause of these declines. Overfishing can be proactively combated legislation through and regulation, education and awareness, and economic tools, in addition to investments in research and development. The main UAE legislation regulating fisheries is Federal Law No. 23, which went into effect in 1999. In addition, several decrees aim to reduce overfishing by capping the number of boat licenses, banning fishing in spawning season, and defining the minimum length of fish that can be legally kept. However, without better enforcement of these regulations, the effects of overfishing cannot be reduced. Advisory tools, including social media and paper leaflets, aim to increase awareness among both UAE fishermen and the crew members of fishing boats from other nations. Furthermore, economic tools define penalties and provide fishing boats with environmentally friendly engines and other benefits. Although these measures work quite well in the UAE, there is still room for improved regulations and advisory tools, and a socioeconomic study of those who fish could provide a good indication of how management tools affect them. There is also need for alternative *methods, including aquaculture, of providing* local fish for the market. Finally, research

and technology, especially trap technology, could improve the methods used in the UAE.

Keywords: UAE, Fisheries, Overfishing

1. Introduction

The United Arab Emirates (UAE) is located on the Arabian Gulf with the northeastern coasts on the Gulf of Oman. The total coastal length of the country is 734 km which corresponds to a marine area of 27,624 km² (Ministry of Environment and Water, 2015a). From 1975 to 2011, most of fish stocks in this area sharply declined to the point that officials were concerned that they would not be able to recover. This drop was a result of different factors, including extensive costal development and rapid urbanization, marine pollution, climate change, and overfishing. The latter practice now threatens most the UAE fisheries with extinction (Ministry of Environment and Water, 2015b).

Fisheries management in the UAE is carried out at the federal level by the Ministry of Environment Climate Change and (MOCCAE) in cooperation with local authorities that include municipalities in some emirates, such as Dubai Municipality, and environmental agencies, such as the Abu Dhabi Environmental Agency (EAD). The Critical Infrastructure and Coastal Protection Authority (CICPA) is responsible for regulatory enforcement within territorial waters and the exclusive economic zone (Young, 2006).

Fishing in the UAE is basically artisanal, with no industrial operations. There two types of fishing activities, which are commercial fishing and recreational fishing. Commercial fishermen have two types of vessels owned by the UAE nationals. The first is the lansh, which is a traditional wooden dhow up to 15 m in length and powered by inboard engines. The second is the tarad, a fiberglass dory powered by outboard engines and approximately 8 to 10 m in length. The lansh can generally undertake four- to five-day fishing trips, while the tarad usually operates only on a daily basis. The fishing gear allows fishermen to use nets, traps (locally known as gargoor) and hook-and-line techniques. The net methods vary depending on how fishermen use the net for example, as a halaq (surrounding net) (Al-Abed, 2006).

emirate's fishermen Each can ioin cooperatives known fishermen as cooperative societies. Currently, UAE has 13 fishermen cooperative societies. These societies not only arrange for fish catch sales, but they also represent the fishermen as their voice in the community (Ministry of Environment and Water, 2015b). In the UAE, 12 of the 13 cooperatives have formed a union. The Dubai Fishermen Cooperative Society is the only exception (Federal Competitiveness and Statistics Authority, 2014).

2. The Importance of Fisheries in the UAE

The need for fishery management in the UAE has arisen for several reasons. Fish are considered a good protein source. Fish also have small amounts of essential nutrients, including minerals (iron, iodine, zinc, and calcium) and vitamins (A and B). Additionally, fish are a source of the fatty acids necessary for healthy brain and body development (Béné & Heck, 2005).

The government has become increasingly concerned with food security due to the country's growing population, which reached 8.26 million in 2010 and is still increasing (Ministry of Environment and Water, 2015a). Three sectors—agriculture, animal husbandry, and fisheries—are involved in food security, but, with the

UAE's arid climate and water shortage, the growing population cannot depend solely on agriculture and animal husbandry. Thus, fisheries are thought to be the most potential to address these food security concerns, though not in their current state. In 2013, only 35% of the fish consumed in the UAE was from local fish catches (73,203 tons) and aquaculture (717 tones), while a full 65% was imported from other countries (136.450 tons) (Ministry of Environment and Water, 2015c). People in the UAE enjoyed consuming fish at a per capita rate of 24 kg in 2013, which was higher than the global average rate of 19 kg (Food and Agriculture Organization of the United Nations, 2014).

The fisheries of the UAE have social importance because of their cultural heritage. The people in the UAE were originally fishermen depending on fishing as their primary livelihood source in the pre-oil periods (Young, 2006). Fisheries are an important income source for fishermen and those holding fishing-related jobs. In 2015, the estimated number of fishermen reached 5.115. while the number of boat crew members was at least two times that. Nevertheless, the contribution of fisheries, agriculture, livestock, and forestry sectors in the national GDP was less than 0.1% in 2013 (Ministry of Environment and Water, 2015b).

Fish is an important renewable resource, but with overfishing and other activities leading to fish stock depletion, fish risks losing this potential. This resource needs to be protected or used in a sustainable way that ensures that future generations can meet their needs, while at the same time not negatively affecting the people who currently work in the fisheries.

3. The Status of Fisheries in the UAE

Three main stock assessments were carried out in the Arabian Gulf and the Gulf of Oman, including one by the Gulf Cooperation Council (GCC) countries in 1975–1979, one by the EAD in 2001–2002, and another by GCC countries again in 2011. The results show in Figure 1that fish stocks have declined by 88% between the periods of 1975 to 2011in the Arabian Gulf and by 94% in the Gulf of Oman (Ministry of Environment and Water, 2015b).

In 2003, new commercial fishing boat registrations started to be controlled by Ministerial Decree No. 261. This decree capped the number of allowed commercial fishing boats at 5,985, which was reached in 2015 (Federal Competitiveness and Statistics Authority, 2014). Most UAE demersal fish species are fully exploited or overexploited beyond sustainability, including the *Siganus canaliculatus* and the *Lethrinus nebulosus*, known locally as Safi and Sheri, respectively (Ministry of Environment and Water, 2015a).

Figure 1: Fish biomass density estimated in territorial waters of the UAE from 1975 to 2011



Sources: Ministry of the Environment and water, 2015b

The main fishery legislation, Federal Law No. 23, came into effect in 1999 and deals with living aquatic resources' exploitation, protection, and development. In 2016, some of this law's articles were modified in Law No. 7. Executive Order 302 of 2001 is regarded as part of Law No. 23, but the executive order regarding Law No. 7 has not been issued yet. In addition, the ministry of the climate change and environment as issued ministerial decrees regulating fishing gear and use methods, as well as instituting species bans.

The UAE has 11 protected marine areas in

five emirates. They collectively have a total area of 6,404.58 km² which represents 23.2% of the total marine area. Accordingly, the UAE has the highest ranking on the Environmental Performance Index (EPI) for its protected marine areas (Yale University, 2016). Fishing in these areas is not allowed, according to Law No. 23 (Ministry of Environment and Water, 2015a).

The Marine Environment Research Department (MERD) belongs to the MOCCA and carries out studies and research promoting the best fishery management practices. Studies have included determining the spawning seasons of commercial fish including species. the Gerres longirostris(Badah) and the Siganus canaliculatus (Safi); fishing gear's impact on fisheries; and restocking programs that release small, nursery-reared fish into lagoons and protected areas (Ministry of Environment and Water, 2015c).

Most of the landed catch is sold as a fresh product at 48 landing sites. These landing sites are administered by fishermen cooperative societies and the respective emirate authorities. The most important landing sites are those near the major cities of Dubai, Abu Dhabi, Sharjah, Fujairah, Umm al Quwain, Ajman, and Ras Al-Khaimah. The landing site markets operate both wholesale auctions and retail stalls. In the Abu Dhabi, fish is auctioned by weight at most landing sites. In the other six emirates, fish is auctioned by lot without being weighed (Ministry of Environment and Water, 2015b).

The UAE is a member of the regional fisheries management body for the two gulfs. The Regional Commission for Fisheries (RECOFI), which has eight coastal gulf country members, discuss and act on key fishery sector issues, including shared stock management and collaborative research (Food and Agriculture Organization of the United Nations, 2015). The UAE is also a member of the GCC Fisheries Committee, which, among other recent initiatives, carried out a joint stock assessment survey. In2013, the committee members agreed on a

minimum catch size for narrow-barred Spanish mackerel (*Scomberomorus commerson*). These measures are subject to implementation by member states.

4. Management Tools

4.1. Advisory Tools

In 2006, the MOCCAE formed the Environmental Education and Awareness department. which handles fishermen awareness programs. In addition, they communicate through the media using channels such as newspapers, text messages, social media, radio, and television programs. Moreover, the MOCCAE gives advice by publishing guidelines, leaflets on topics like sharks and turtles, and posters on the minimum fish species length allowed to be caught or sold (Ministry of Climate Change and Environment, 2016b).

4.2. Economic Tools

Articles 42 and 43 of 1999's Law No. 23 states that the ministry needs to give fishermen grants and loans that can then be repaid in kind. However, despite this law, the ministry has not given fishermen any financial aid; instead, the MOCCAE provides them with maintenance workshop and engine (Ministry for boat of Environment and Water, 2015c). In addition, subsidizes the MOCCAE fishermen's environmentally friendly engine purchases under certain conditions, depending on the fisherman's salary, full-time work, number of fishing fines, time of last subsidy, and number of fishing trips in a year (MOCCAE, 2016c) The MOCCAE just recently launched Mawroothna (which means "our the heritage" in Arabic) card in 2016, which offers discounts and privileges to fishermen and farmer. This initiative includes 80 companies, but only five are related to professional fishermen's activities (MOCCAE, 2016a).

According to Law No. 23, the penalties for fishing regulation infringements are fines and imprisonment. However, the 2012 Cabinet Resolution No. 18 on Sanctions for Violators of Regulatory Decrees Related to Living Aquatic Resources and Fisheries also defined the penalties for the same violations, including reduced penalties. These include fines and boat license revocations for a set period.

4.3. Regulatory Tools

Law No. 23 manages the fishery registration processes and states that, to be allowed to fish, individuals should have a permit from both local authorities and the ministry, as well as specify the registration requirements. In 2013, Ministerial Decree No. 372 temporarily banned any new commercial boat registrations and put a ceiling on the number of boats allowed to fish. The existing laws also state that either the owner or the vice-captain should be physically present on the boat on all fishing trips. The laws also establish specific conditions for naming a vice captain, such as medical conditions. According to UAE federal law, local fish cannot be exported except with ministry permission, and only for six months, so as to protect the local species.

Existing laws and executive orders define forbidden gear and methods, such as drift, trawling, nylon, and bottom setting nets. Additionally, the legislation defines the UAE's allowed gear, namely, nets, gargoor hook-and-line traps. and materials. Fishermen are only allowed to use one type of gear, either traps or nets, at a time, and this gear has to used according to be specifications. For example, the 2013 Ministerial Decree No. 706 defines gargoor trap mesh size specifications.

The laws also specify the seasons and species banned, such as turtles and dugongs. The legislation states that fishermen can arrange for marine species' export, import, and reexport. Furthermore, ministerial decrees like the 2015 No. 501 decree regulate two local species, known as Safi and Sheri in Arabia, prohibiting any catching, selling, exporting, or importing in their spawning season. In 2015, Ministerial Decree No. 580 defined the length allowed for catching and market sale of 21 commercially exploited species.

In 2014, Ministerial Decree No. 500 specified guidelines for the shark fishing season, including for fishing methods and export and import practices, especially for the species on the Convention on International Trade's Endangered Species List. The Federal Transport Authority Land and Maritime (FTA) issued in 2016 Decree No. 90 regarding recreational boat regulation. This decree defines the quota and gear allowed and restricts their use to the people who are licensed to do so.

5. Management Tools Assessment

The decline of fish biomass has reached 88% of the Arabian Gulf's total fish stocks, and this figure is even higher in the Gulf of Oman. Therefore, the government must take serious steps to protect and regulate UAE fisheries. The management tools applied by the government have some strengths, but they also have weaknesses.

Most UAE fishermen are elderly, and most of them have not completed a high school education. Therefore, they can have difficulty understanding the relevant laws' articles. The awareness programs could explain the laws to them. The MOCCAE has also used the media to send messages to fishermen, which, while a good way to inform fishermen of management tool updates, are alone still not enough.

Some media, such as social media, are not popular among fishermen. This media could increase public awareness but still fail to most fishermen. Leaflets reach and guidelines are also inadequate, as they only give fishermen orders without offering concrete explanations to increase their awareness. Hence, the fishermen can start to think that the government is against them. Communication is also primarily in Arabic and English, because the ministry is targeting fishermen. However, the ministry has started to publish awareness materials in the other languages, such as Bengali and Urdu because boat crew members are two times as numerous as the fishermen. They represent the main workforce on the fishing vessels (Young, 2006). The government has taken steps to educate these people about fishery management and the impacts of illegal fishing practices.

The MOCCAE supports fishermen in their fishing activities by providing them with engines to increase the use environmentally friendly engines. However, it is important to look at this sector not only from the environmental aspect, but also from the social aspect. Accordingly, the Mawroothna cards initiative was launched to provide the fishermen with privileges that do not enhance their fishing activities, since the program only includes five fishing profession-related companies.

Other measures for the fishing sector's environmental impact reduction include bans on new commercial boats registrations with a ceiling on the number of boats allowed, which ensure a fixed fishing boat number that can only decrease—in the case that some boat registrations are not renewed-but never increase. Additionally, requiring the vice-captain's captain's and physical presence further reduces the number of active boats that actually go out fishing (Young, 2006). Beyond this, banning local fish exporting also helps reduce fishing activities.

Most of the fishing gear allowed in the UAE, such as traps and nets, are artisanal and nonselective gear that catches many fish simultaneously. However, in order to reduce impact, the MOCCAE has set gear specifications in order to reduce their harmful impacts.

Banning specific species and creating length limits is not truly effective, however, as some fish die after they come out of the sea. Even if fishermen are successfully retrained to return live fish to the sea, with no proper procedures taken by fishermen, the fish survival rate is low. As a result, these methods fail to generate a significant positive impact, although the government has in place some good regulations for protected area species banning.

6. Results and Conclusions

There has been a clear fish catch reeducation effort between 1999 and the last few years, as Figure 2 shows a grown from approximately 120,000 tons to 70 tons. Even though the fish catch fell following the 1999 Law No. 23, marine biomass has continued to decline. In addition, the UAE catch did not fall between 2010 and 2013, with the catch remaining in the 70,000-80,000 fish range (Federal Competitiveness and Statistics Authority, 2014). The advisory and financial aid management tools have not been helpful. significantly While the laws themselves are quite good, without real consequences implemented, they will not reduce the UAE catch.

The present management tools focus on fishermen without little considering boat crews. The number of recreational fishermen is at least twice that of commercial fishermen, and they are subject to no real management. The new FTA decree has defined the quota to 20kg and five big fish, and it has allowed them to fish using hookand-line methods only in order to regulate activity; otherwise, they are allowed to fish freely. As a result, they catch fish to near commercial levels, which impacts the fisheries and creates competition for the commercial fishermen, given the currently dwindling resources.

Statistics on UAE fisheries are only available for 2013 or earlier. Without government programs tracking the catch and the most heavily fished species, the MOCCAE cannot effectively measure its management tools' impact. However, the EAD emirates have their own statistics programs and data collection processes (Environment agency, Abu Dhabi, 2016).

Figure 2: Trend in total fish catches in the UAE, 1987-2012



Sources: Ministry of the Environment and water, 2015b

The MERD of MOCCAE is conducting a study on how to develop laws based on researching and restocking fisheries, and it has begun measuring the effectiveness of specific decrees, such as the one that bans Safi and Sheri fishing. The fisheries share fish stocks with other gulf countries, so regional-level cooperation is crucial to effective management.

7. Recommendations

Before any management or regulatory tools are applied, studies are needed on the UAE's approximately 5,115 fishermen in order to better understand their socioeconomic situations. The government needs to know how strongly they depend on fishing activities, including whether fishermen consider this to be their primary income, how much they depend on it, the fishing process's costs and profits, and what the situation is in the fishermen cooperation societies. This information will help the MOCCAE understand how far they can go with regulations like one-month bans, since this could significantly affect fisheries or how fishery management should be handled.

The government needs to develop fishery statistics programs for all of the emirates and other important include research on spawning patterns and high biodiversity habitats, such as coral reefs. Researchers can seek alternative methods. such as aquaculture, for providing markets with fish. Researchers can also encourage fishermen to do this similarly on a small scale with sea cages. This could enable them to continue fishing as well as provide them with other income sources.

One solution would be to provide fishermen with another income source without impacting or even reducing their catch amount. For example, the government could add value to fishery processes by building factories that use their catch-but only a specific amount-in order to ensure that the fisheries do not increase their fishing activities. However, this could prove difficult, as consumers prefer freshly caught fish. Taste changes can be achieved by raising consumer awareness or introducing campaigns to change consumer behavior, though this could require some time to be successful.

The government needs to enhance the awareness program, as well as explain the reasons behind regulations, such as banning specific species in spawning seasons. This could be explained as necessary because these species are below a sustainable level; they should be at 30% but are currently only at 7% of original stock levels. In addition, the MOCCAE can teach fishermen best practices, such as what the steps to follow in order to return unwanted fish to the sea without reducing survivals rates.

The government also needs to develop further legislation in order to define commercial fishermen quotas. However, this could make enforcement more difficult, as CICPA employees could not easily monitor where the fishermen enter and practice their activities on the sea. The laws should define the areas with seasonal bans during major fish species' spawning seasons. In addition, the laws and ministerial decrees must be enforced in order for them to have significant impacts.

Gear regulations need to be more selective or require less harmful methods, such as those used in Abu Dhabi, in which the trap door's material dissolves if it stays in the water for days, allowing the fish to get out still alive. This could be implemented throughout all the emirates. Smart gargoor traps could have cameras and global positioning systems (GPS) in order to monitor the catch and pinpoint the traps' exact locations. This is still in the pilot phase, however, and might not be feasible due to the expense involved, despite GPS being a good way to avoid trap loss. In addition, the idea of developing traps that can dissolve entirely may prove harmful to marine environments, and the fishermen may not accept these traps due to high costs associated with frequently replacing them. Finally, regulations can reduce fishing activities by reducing the number of crewmembers per boat, as well as limiting the amount of specific equipment, such as traps.

References

Al-Abed, I. 2006. United Arab Emirates Book. Abu Dhabi: Trident Press Ltd.

Béné, C. & Heck, S. 2005. Fish and food security in Africa. Naga, WorldFish Center Quarterly. 28 (3). pp.8–13.

Federal Competitiveness and Statistics Authority Federal Competitiveness and Statistics Authority. 2014. Cooperative Societies 2014. [Online]. Available from: http://www.fcsa.gov.ae/EnglishHome/Depar tmentsEnglish/tabid/104/Default.aspx?Men uId=1[Accessed 9th December 2016].

Food and Agriculture Organization of the United Nations. 2014b. The State of the World Fisheries and Aquaculture Opportunities and Challenges. [Online] Available from: <u>http://www.fao.org/3/a-i3720e.pdf</u>. [Accessed 9th December 2016].

Food and Agriculture Organization of the United Nations. 2015. Report of the Ninth Meeting of the RECOFI Working Group on Fisheries Management. [Online] Available from: <u>http://www.fao.org/3/a-i3720e.pdf</u>. [Accessed 9th December 2016].

Environment agency- Abu Dhabi 2016. Annual fisheries statistic report for Abu Dhabi emirates 2015. Environment agency-Abu Dhabi, UAE.

Ministry of Climate Change and Environment 2016a. Mawroothna Initiative. Ministry of Environment and Climate Change, UAE.

Ministry of Climate Change and Environment. 2016b. MOCCAE News. [Online] Available from: http://www.moccae.gov.ae/en/media-

<u>centre/moew-news.aspx</u> [Accessed 9th December 2016].

Ministry of Climate Change and Environment. 2016c. Request for Support Materials for Fishermen. [Online] Available from: <u>http://www.moccae.gov.ae/en/our-</u> <u>services/fisheries/licensing/fishermen-</u> <u>society-development.aspx.</u> [Accessed 9th

December 2016].

Ministry of Environment and Water. 2015 a. State of Environment Report - UAE - 2015. Ministry of Environment and Water (now known as Ministry of Environment and Climate Change), UAE.

Ministry of Environment and Water. 2015 b. United Arab Emirates State of the Green Economy. Ministry of Environment and Water (now known as Ministry of Environment and Climate Change), UAE.

Ministry of Environment and Water. 2015c. Aquaculture Guide to the United Arab Emirates. Ministry of Environment and Water (now known as Ministry of Environment and Climate Change), UAE.

Yale University. 2016. United Arab Emirates. [Online] Available from: <u>http://epi.yale.edu/country/united-arab-</u> <u>emirates</u>. [Accessed: 9th December 2016].

Young, C.D. 2006. Review of the State of the World Marine Capture Fisheries Management: Indian Ocean (Food and Agriculture Organization Fisheries and Aquaculture Technical Paper #488). Rome: Food and Agriculture Organization of the United Nations.

The Amount of Waste Produced By Family Households Living in Dubai

Nourah Al Takarli and Mayada Moussa Hamdan Bin Mohammed Smart University

Abstract

Background: Dubai has undergone rapid urbanization since the discovery of oil in 1966. Khaleej Times newspaper has listed UAE as one of the most developed countries in the world in 2014. One of the main problems caused by urbanization is Solid waste production. Municipal solid wastes are considered one of the main challenges in UAE, which has several impacts on our health and require global and immediate The impacts on health and action. environments, in addition to the amount of money spent by government to get rid of the wastes are some of the consequences that results from solid waste production. There are numbers of studies published in different countries that issued the problem of waste, recycling and its best management. In fact, most of these studies were concentrating on the management and treatment part rather than the waste amount that is produced from different sectors on daily basis. By knowing the amount of waste produced by each individual daily, this will help governments to start sorting solutions based on priorities like increasing population awareness, which is one of the first and major step that should be taken to solve any problem. The aim of this study is to know the daily amount of waste produced by household's in Dubai and compare it with other statistics from different countries worldwide. Also, to check wither there is a relationship between income and number of family members in relation to the amount of waste produced in addition to the efforts taken by UAE to solve the problem of MSW.

Methods: A study was conducted covering 30 household's families from Dubai municipality building in Dubai Al Tawar1 area. Data were obtained by using simple constructed questionnaire form that consists of four questions. The amount of waste levels were estimated using an international Volume-to-Weight Conversion Factors published by U.S. Environmental Protection Agency and graphs will be used to see wither there is any relations between the income, number of family members and the amount of waste produced.

Results: The results showed that the amount of waste by each individual is equal to 1.66 kg. This amount is almost the same the international estimated amount of waste production estimated for UAE, but still considered very large as compared to other countries. Also, the graph analysis showed that people with high incomes and more family members are producing higher amount of wastes compared with people with low incomes and less family members

Key words*: Solid waste, Waste amount, waste management, Individual production

Introduction

Every day you throw your trash into the trash container and that is probably the last time you think about it, because after that it goes away. Well, it is not as simple as that. Haven't it you ever thought were all these amounts of waste go? How much the country is paying to get rid of these wastes? What would happen if there were no place to put all these wastes? Are there any impacts on our health or on our environment? These are all important questions that could give us an overview about the amount of waste produced and which people should be aware of. UAE is one of the rapidly developing countries worldwide that is witnessing an unprecedented economic and urban growth. This increase in the development in all sectors and the vast increase in population number lead to the increase in the amount of Municipal solid wastes and all types of wastes produced. Every day, tones of waste including papers, cartoons, glasses, plastics, aluminum and general unwanted household waste are accumulating in UAEs landfills. Another problem is that only a small amount of this waste is recycled while most of them go to the landfill stations.

Some steps needs to be followed in order to solve this problem. Each community should take a sample from the waste, and check what are the components? , how much they are generating? then they can begin to look at what are the existing facilities the community has and start to figure out what would be the best mix of approaches for the community to address, how much it will cost, how much the community is willing to step up and do and what kind of facilities you need to get this accomplished. But the problem is that most of the researches are only concerned with waste management and how to find solutions like waste handling practices and the treatment of disposal wastes instead of focusing on the reason of this generated waste. We have to know the amount of waste produced so that we can take the appropriate measure in order to reduce it.

In this research paper, Iam going to measure the amount of municipal solid waste produced by each individual and compare it to the previous statistics to know wither the amount of waste has been increased or not. In addition, to check wither there is a relationship between income and number of family members in relation to the amount of waste produced.

Literature Review

The word "waste" can be categorized in many different ways. In general when we say waste, it indicates the waste produced at home (household wastes), as well as office and retail wastes, with an exclusion to hazardous, construction and industrial wastes. (Center for Sustainable Systems, 2016). Municipal solid waste (MSW) consists of everyday items that are commonly generated from homes. This includes papers, containers (glasses and plastic), food leftovers, packaging, durable goods, street sweeping and litter and yard trimming.

The amount of municipal solid waste generating around the world has been increasing rapidly in the past few years because of the increased in population number and the developments in all branches and fields. According to (Giller & Roberts, 2006), today's global population is 7 billion and it is expected to reach 9.2 billion by 2050.This means tons and tons of waste if no control or global action was taken.

"Globally, solid waste management costs will increase from today's annual \$205.4 billion to about \$375.5 billion in 2025" (Bhada-Tata, 2012, P.9). Poor low income countries who can't afford to pay these tremendous amounts will be the most affecyed by costs increase than the other countries. Most of their budgets will be spent on waste collection while only little will be used for disposal.

In the early 80s, the method of waste handling was simply to landfill waste. Land filling is an old method that is done simply buy burying the waste disposal. The Environmental Protection Authority defined solid waste landfills as "Any landfill that accepts solid wastes" (1996.P.54). There was not much concern at that time about the designs of landfills. Many of them were unlined; very few have Leachate collecting systems and they were in fact old holes in the ground into which waste was put. There a lot of disadvantages associated with land filling. These includes the risk of damaging areas for an area of significant environmental value, o, the risk of polluting drinking Sites and ground water within and toxic gas emissions into the atmosphere. (EPA.1996.P8) "By the mid of 80s, there was huge increase in the

amount of disposed waste which raised the concern to stop land filling waste as a major method of waste disposal and try to find other methods". (Watson, et al., 1994).

According to Mariam Al Shansi, Deputy Minister of Environment and Water mentioned in Emirat alyoum newspaper citing from study by the Centre for Waste Management Abu Dhabi that "UAEs national economy is losing around 1.5 billion dirham's yearly as a result of lack of waste recycling and reprocessing" (Shansi, 2012). This huge amount of can be used in fields and areas if an appropriate majors are taken to reduce waste production.

Furthermore, These amounts of wastes will cause an emission of GHG. "Landfills are responsible for almost half of the methane emissions attributed to the municipal waste sector in 2010" (Bhada-Tata, 2012, P.30). The amount of Methan produced into the atmoosphere depend on waste disposal practices and waste compostion It is considered one of the dangerous gases if it is emitted in large quantites more than the permitted.

Methods

Study Population

The study population involved in this study was easily accessible and no permission was needed in order to access them. Participation in this research was completely voluntary. Dubai Municipality building in Al Tawar area in Dubai was chosen because most of the flats there are equipped by families of work for those who the Dubai municipality and because of the easy accessibility. The present study adopted a non-experimental (single variable) research in which the amount solid waste produced daily is a study variable. Data were obtained directly from the wives by face-to-face interview. The inclusion

criteria for the participant were: (1) Families Dubai Municipality Building residents (2) Families with more than two members. While the incomplete answers (some refused to say the monthly income) and answers that are based on estimation were excluded.

Data Collection Methods

Data collection was conducted between November 2016 and December 2016. A questionnaire form was designed and used to collect information from the participants. It included four questions about the monthly total income, number of family members, size of waste bag (in Gallons) and the number of times the waste bag is thrown into the trash container. The amount of estimated waste calculated in Gallon will be converted to kg by using an international "Volume-to-Weight Conversion Factors" made by U.S. Environmental Protection Agency and updated on April 2016.

Category	Recyclable Materials	Volume	Estimated Weight (lbs)	Source
Municipal	MSW+Commercial	-	1	
Solid Waste	Commercial - dry waste	cubic yard	56-73	15,8
	Commercial - all waste, uncompacted	cubic yard	138	21
	Mixed MSW - Residential, Institutional, Comme	ercial		
	Uncompacted	cubic yard	250-300	14
	Compacted	cubic yard	400-700	14
	Mixed MSW - Multifamily uncompacted	cubic yard	95	21
	MSW - Landfill			
	Compacted - MSW Small Landfill with Best Management Practices	cubic yard	1,200-1,700	17
3	Compacted - MSW Large Landfill with Best Management Practices	cubic vard	1.700-2.000	17

Then the daily amount of waste produced by each individual in kg will be compared to the amount of waste produced in UAE from last years and to other countries as well. Figure "1" shows the estimation of Mixed Municipal Solid Waste – Multifamily Uncompacted, which is the one chosen for this study and is equal to (1cubic meter = 95 Gallons).

Results: (Daily amount of waste produced by individuals)

Study Sample	Number of family	Size of waste bag in gallons	Number of bags thrown daily	Estimated waste amount produced	Estimated waste amount produced
F	members	·····g g·······		by family in kg	by each individual in kg
1	6	50 gallon	1 daily	10.77 kg	10.773/6 = 1.79kg
2	6	50 gallon	1 daily	10.77 kg	10.773/6 = 1.79kg
3	3	11 gallon	3 daily	2.37 kg	2.370/3 = 0.8kg
4	5	60 gallon	1 daily	12.93 kg	2.59 kg
5	6	30 gallon	1 daily	6.46 kg	1.08 kg
6	5	30 gallon	1 daily	6.46 kg	1.29kg
7	8	60 gallon	1 daily	12.93 kg	1.62 kg
8	7	60 gallon	1 daily	12.93 kg	1.85 kg
9	6	50 gallon	1 daily	10.77 kg	1.79 kg
10	4	22 gallon	1 daily	4.74 kg	1.19 kg
11	7	50 gallon	1 daily	10.77 kg	1.54 kg
12	3	22 gallon	1 daily	4.74 kg	1.58 kg
13	4	22 gallon	1 daily	4.74 kg	1.19 kg
14	4	50 gallon	1 daily	10.77 kg	2.69 kg
15	5	50 gallon	1 daily	10.77 kg	2.15 kg
16	4	60 gallon	1 daily	12.93 kg	3.23 kg
17	3	11 gallon	1 daily	2.37 kg	0.79 kg
18	4	30 gallon	1 daily	6.46 kg	1.62 kg
19	4	30 gallon	1 daily	6.46 kg	1.62 kg
20	3	11 gallon	1 daily	2.37 kg	0.79 kg
21	3	11 gallon	1 daily	2.37 kg	0.79 kg
22	3	11 gallon	1 daily	2.37 kg	0.79 kg
23	6	50 gallon	1 daily	10.77 kg	1.80 kg
24	7	65 gallon	1 daily	14.00 kg	2.00 kg
25	7	65 gallon	1 daily	14.00 kg	2.00 kg
26	5	50 gallon	1 daily	10.77 kg	2.15 kg
27	5	50 gallon	1 daily	10.77 kg	2.15 kg
28	7	60 gallon	1 daily	12.93 kg	1.84 kg
29	5	60 gallon	1 daily	12.93 kg	2.59 kg
30	3	11 gallon	1 daily	2.37 kg	0.79 kg





Discussion

From the "Daily amount of waste produced by individuals "Table, the daily estimated amount of waste from a total of 30 family households ranges from 0.79 kg (Min) to 3.23 kg (Max). The gallon sizes were chosen in accordance with UAE standard waste bag sizes after checking them from different stores. After calculating the waste produced by family, this number will be divided by the total family members in order to find the estimated amount produced bv each individual. The results showed that the mean estimated amount of waste produced by each individual is equal to 1.66 kg of waste daily. The per capita production of waste in the UAE has reached up to 650 kg per year in 2015, which made the UAE highest in the world in terms of high waste production rate"(Awad, 2015). The data provided by (Bhada-Tata, 2012, P83) shown in the table below classify UAE as one of the High Income Countries that generates 4,192 tons of waste per day that is 1.66 kg/day per capita. They estimated that this amount will increase and reach up 2 kg/day per capita with a total generated waste of 10,184 tonnes/ day because of the increase in the total and urban population number.

		Current Available Data			2025				
Country	Income Level	Region	Total Urban Population	MSW Gen- eration Per Capita (kg/ capita/day)	Total MSW Generation (tonnes/ day)	Total Population	Urban Population	MSW Gen- eration Per Capita (kg/ capita/day)	Total MSW Generation (tonnes/day)
Uganda	u	AFR	3,450,140	0.34	1,179	54,011,000	9,713,000	0.65	6,313
United Arab Emirates	HIC	MENA	2,526,336	1.66	4,192	6,268,000	5,092,000	2	10,184
United Kingdom	HIC	OECD	54,411,080	1.79	97,342	65,190,000	59,738,000	1.85	110,515
United States	HIC	OECD	241,972,393	2.58	624,700	354,930,000	305,091,000	2.3	701,709
Uruquay	UMI	LCR	3,025,161	0.11	329	3,548,000	3,333,000	0.6	2,000
Vanuatu	LMI	EAP	33,430	3.28	110	328,000	113,000	3	339

Although the number is the same like the number estimated by (Bhada-Tata, 2012, P83), but it is still considered as one of the highest in comparison to other countries.

The "Waste produced \times Income graph" shows the relationship between the amount of waste produced and income. It shows that people with high income (Yellow and grey lines) equal to 20000dh & more per month, produce higher amount of waste compared to people with low income (Blue and Red lines) less than 20000dh per month. To conclude, we can say that the amount of waste produced families with high income is higher than the amount of waste produced by families with low incomes.

The "Waste produced × Family Members graph" shows the relationship between the

amount of waste produced and income. It shows that people with high income (Yellow and grey lines) equal to 20000dh & more per month, produce higher amount of waste compared to people with low income (Blue and Red lines) less than 20000dh per month. To conclude, we can say that the amount of waste produced families with high income is higher than the amount of waste produced by families with low incomes.

The actual amount per capita however will be different. In order to find the real gallons for a waste bag, we should take each bag separately; classify the types of waste inside the bag(Cans , Papers, Food leftovers) and then measure each of the components separately. The numbers in these tables are based on estimations but they could provide enough evidence to proof that people who live in Dubai produce a huge amount of waste and point to the need of more solutions in order to reduce the amount of waste produce.

Limitations

There are two limitations that faced me while doing this study. The first one is the small sample size (n=30) due to time constraints. Another limitation is that the final results are based on estimation for the daily amount of waste produced not the actual amount. In order to find the real weight for the plastic bag, we have to go under a process called "waste sorting". Each bag will be separated according to its components (Cans, Papers, organics) and then measuring each one separately.

UAE's Efforts

UAE has noticed this increased amount of waste and started to working on finding solutions. The government is aware of the importance of waste recycling and aims at reducing the volume of waste and the protection of natural resources bv encouraging investment in this area in particular. Dubai Municipality (DM) has developed and adopted an Integrated Waste Management Master Plan (WMMP) for the Emirate of Dubai. The WMMP provides the roadmap and approach required to efficiently manage wastes generated from the Emirates. These include policies about waste management practices, imposing fees & product charges and the demand for recyclable products in markets.

One of the methods to encourage waste practices management by Dubai Municipality is to ensure that recycling trash containers are being placed all over the country in an effort to decrease the amount of waste. These containers are divided depending on the type of waste (Plastic, Cans, papers), and this will help to easily recycle depend on the type of material. In addition, if you checked the labels for any of the products in Dubai stores, most of them produced nowadays are being are environmental friendly. UAE is always organizing educational and awareness programs and conferences in order to inform the population about the importance and their options to reduce waste and to encourage recycling and composting.

Conclusion

No question that it is more expensive to handle the waste once you produced it. The aim should be by all governments is not to produce waste from the first place. Anything we can do to reduce the amount of waste we generate is a valuable effort. Waste production has become a serious issue especially in a rich country like UAE that is rapidly developing and witnessing an unprecedented economic and urban growth. Further educating the public on the importance of reducing the amount of waste they are throwing away and encouraging recycling is an important issue and should be the first step to be taken by any government in order to reduce the amount of waste produced. Every individual should remember that for every ton less they are throwing away means one ton less need to be collected, one ton less that has to be processed and its one ton less that has to be disposed of.

Recommendations

Waste prevention is an area where individuals have a big impact, but it is the least well developed waste management component. To change this, municipalities have a variety of strategies to choose from. Public environmental education is a good first step. Other strategies include charging by the can or bag for trash collection, providing incentives to product repair, rental and resale businesses. Also, encouraging industries to increase products durability and minimize disposable products, packaging and its use of toxic compounds.

In addition to that, governments also can have a direct impact on reducing waste through their own purchasing and product maintenance decisions. The governments' needs to improve the analysis of what they are purchasing and what happens to it by reviewing an each major purchasing decision and the content of the material being purchased. If for example it contains any toxic contents, then it will require a special handling at the point of disposal. Furthermore, governments should ensure Resources

Authority, E. P. (Jan 1996). Environmental Guidlins : Solid Waste Landfills. Chatswood.

http://www.epa.nsw.gov.au/resources/waste/ 950085-solid-waste-landfill.pdf

Awad, S. (2015, April 26). Waste from environmental problem into an economic resource. Al Ittihad newspaper • http://www.alittihad.ae/details.php?id=4023 5&v=2015

Bhada-Tata, D. H. (March 2012, No. 15). WHAT A WASTE "A Global Review of Solid". Washington: World Bank's Urban Development and Local Government Unit of the Sustainable.

Center for Sustainable Systems, U. o. (2016). "Municipal Solid Waste Factsheet.". Michigan: Pub. No. CSS04-15.

Giller. C., Roberts, D., (2006). Green gets Going, Fast Company, 103, pp. 72-78, Business Source Complete, EBSCOhost, [Accessed 18th October 2011]

Shansi, M. A. (2012, Feb 29). Environment: Non-waste recycling costs the state 1.5 billion dirhams a year. Emaratalyoum.

U.S. Environmental Protection Agency Volume-to-Weight (2016)Conversion that the products they are buying like fabric, roofing or siding includes a percentage recycled contents. They should look at the life cycle, costs and methods of handling of that product whatever it is.

Factors

https://www.epa.gov/sites/production/files/2 016-

04/documents/volume_to_weight_conversio n factors memorandum 04192016 508fnl. pdf

WAM. (December 6, 2014). UAE among most developed countries in the world. Khaleej Times .

Watson, J. G., Berglund, R. L., Biswas, P., Blaney, B. L., Butler, J. P., Englund, H. M., et al. (1994). The Air and Waste Management Association : Critical Review Program. Introduction. Journal of the Air and Waste Management Association, Vol. 44, No. 5.

Websites

- http://css.snre.umich.edu/sites/default/fil es/Municipal_Solid_Waste_Factsheet_C SS04-15.pdf (Center for Sustainable Systems, 2016)
- http://www.alittihad.ae/details.php?id=4 • 0235&y=2015 (Itihad news)
- http://www.emaratalyoum.com/localsection/other/2012-02-29-1.464673
- http://www.khaleejtimes.com/nation/gen • eral/uae-among-most-developedcountries-in-the-world

Evaluation of the Environmental Status of the M-35 Industrial Zone in the Musaffah Industrial Area in Abu Dhabi

Mark Turner, Ahmed Rady, Samer Akl, Mohammad Al Ashram, and Senathipathi Kalimuthu RTI International-Abu Dhabi, United Arab Emirates

Khalid Al Hajeri and Faisal Al Hammadi Environment Agency-Abu Dhabi, United Arab Emirates

Jennifer Lloyd RTI International, North Carolina, USA

Abstract

The Environment Agency – Abu Dhabi (EAD), supported by its strategic partner RTI International, utilizes a combination of programs to evaluate industrial facilities' operations in Abu Dhabi. The Inspection and Compliance tool (ICT) is a hand-held, computer-based tool that EAD inspectors use to conduct environmental inspections and to evaluate the compliance of industrial facilities with EAD environmental requirements. The Data Collection Tool (DCT) is a hand-held, computer-based tool that is part of the Risk Characterization and Hazard Evaluation System (RiCHES) and is used to conduct hazard evaluations to industrial and commercial facilities to characterize facility risks in four dimensions: first responder, process hazard, ecological risk, and public health risk. The data collected using these two tools are stored in a single database called the Onsite Assessment Compliance and Inspection System (OACIS). Recently, EAD requested an environmental assessment of the Musaffah Industrial Area - Zone M-35 (Mussafah M35 due to concerns about particulate matter (PM) emissions from facilities in this zone. This paper presents the results of the environmental assessment for Mussafah M35. Based on data extracted from the OACIS database, 27 industrial facilities are currently operational in Mussafah-M-35. Of the 27 plants, 25

facilities are concrete products or ready-mix concrete facilities. Because the ready-mix and concrete products facilities represent more than 90% of the industrial facilities located in Mussafah-M35, the environmental issues associated with this zone are more concentrated around this industrial sector and are associated with the release of PM emissions.

This paper will provide an analysis of the types of violations categories that were found during the inspections conducted to M-35 facilities along with the primary risk drivers' data extracted from RiCHES are provided. The analysis associated with compliance data showed that more than 40% of the violations identified are related to Material Transfer, Storage and Handling activities and more than 26% of the violations are related to Recordkeeping and Training requirements. Overall, the Concrete Products Manufacturing Sector scored relatively low for a majority of RiCHES risk scenarios and the sector scored below the average compared to other industrial sectors.

Key Words: Risk Assessment, Concrete Products, Environmental Inspections

1. Introduction

EAD requested an environmental assessment of the Musaffah Industrial Area - Zone M-35 (Mussafah M35_due to concerns about particulate matter (PM) emissions from facilities in this zone. This paper presents the results of the environmental assessment for Mussafah M35. Based on data extracted from the OACIS database, 27 industrial facilities are currently operational in Mussafah-M-35. Of the 27 plants, 25 facilities are concrete products or ready-mix concrete facilities. Because the ready-mix and concrete products facilities represent more than 90% of the industrial facilities located in MussafahM35, the environmental issues associated with this zone are more concentrated around this industrial sector and are associated with the release of PM emissions.

Figure 1 shows the geographic location of M-35 with respect to the Musaffah industrial area. **Figure 2** presents the locations of the facilities within M-35.



Figure 1: Location of M-35 in the Musaffah Area



Figure 2: Facility Locations in M-35

Table 1 lists the facilities located in M-35 along with the EAD Environmental Management System identification number and the sector to which each facility belongs. Most of the industrial facilities located in M-35 belong to the cement and cement products industrial sector. Based on data extracted from the OACIS database, 27 industrial

facilities are located in M-35 (only two facilities in M-35 belong to different industrial sectors). Only the Saif Bin Darwish Wood Factory and the Dome General Contracting Company belong to sectors other than the cement and cement products industrial sector.

Table 1. List of All Facilities Located in M-55 Holli the OACIS Data Das	Table	1: List	of All	Facilities	Located	in M-35	5 from the	OACIS	Data Base
--	-------	---------	--------	------------	---------	---------	------------	-------	-----------

No.	EMS ID	Facility Name	Sector
1	IND-	SAIF BIN DARWISH WOOD FACTORY	Weed Francishings Manufacturing
1	2460		wood Furnishings Manufacturing
2	IND-292	ADVANCED PIPES AND CAST COMPANY	Cement and Cement Products
3	IND-718	READYMIX ABU DHABI LLC	Cement and Cement Products
4	IND-659	INTERNATIONAL READYMIX CONCRETE EST	Cement and Cement Products
5	IND-254	AL FALAH READY-MIX FACTORY L L C	Cement and Cement Products
6	IND-679	FUTURE READY MIX CONCRETE L L C	Cement and Cement Products
7	IND-182	NATIONAL READY MIX CONCRETE COMPANY LLC	Cement and Cement Products
8	IND-	BAINOONA READY MIX FACTORY	Cement and Cement Products
-	1514		
9	IND- 2263	QUICK MIX BETON L.L.C	Cement and Cement Products
10	IND-940	NEW MIX READY MIX INDUSTRY	Cement and Cement Products
11	IND-703	AL GHAFLY CEMENT PRODUCTS FACTORY	Cement and Cement Products
12	IND-276	ALGHAFLI READY MIX (RMC ALGHAFLI)	Cement and Cement Products
13	IND-748	AL FARA'A PRECAST FACTORY	Cement and Cement Products
14	IND-232	GULF READY MIX	Cement and Cement Products
15	IND-464	READY BATCH CONCRETE EST.	Cement and Cement Products
16	IND-139	ROCK CEMENT INDUSTRIES	Cement and Cement Products
17	IND-214	BILDCO CEMENT PRODUCTS LLC	Cement and Cement Products
18	IND-	XTRAMIX CONCRETE SOLUTIONS L.L.C. MUSSAFAH	Cement and Cement Products
10	1849	BRANCH	Centent and Centent Floddets
19	IND- 1730	BIN MEHRAN READYMIX CONCRETE - BRANCH	Cement and Cement Products
20	IND- 2498	UNIBETON READY MIX-ABU DHABI BRANCH 2	Cement and Cement Products
21	IND-765	CEMEX SUPER MIX LLC	Cement and Cement Products
22	IND-88	BIN MEHRAN READY MIX CONCRETE	Cement and Cement Products
23	IND-504	TRANSGULF READY MIX CONCRETE CO.LLC	Cement and Cement Products
24	IND-327	DOME GENERAL CONTRACTING L.L.C	Metal Fabrication
25	IND-548	TATCO TILES FACTORY	Cement and Cement Products
26	IND- 1383	SYNAXIS READYMIX L L C	Cement and Cement Products
27	IND-717	UNITED PRECAST CONCRETE ABU DHABI LLC	Cement and Cement Products

2. Assessment Criteria

The criteria used for the environmental assessment of M-35 are based on a combination of parameters, algorithms, and programs that the Environment Agency–Abu Dhabi (EAD) utilizes to evaluate industrial facilities' operations in Abu Dhabi. Because cement and cement products facilities are the predominant type of facility in M-35, only the data for this sector has been compiled.

The information presented in this report was collected from the environmental compliance inspections conducted at the cement and cement products facilities, from the Sector Assessment Report (SAR) prepared for this sector dated December 2014. and from the on-site hazard evaluations conducted at facilities in this sector as part of the SAR.

- Facility Inspections. EAD conducts inspections individual at industrial facilities using the Inspection and Compliance Tool (ICT) to verify that the facility owner and operator are complying with the conditions and Best Management Practices specified in the facility's environmental permit. EAD makes every effort to conduct inspections at each facility on a routine basis. These inspections include random (unannounced) and targeted inspections for cases of special interest. The inspection reports provide a significant amount of data about the degree to which these facilities are in compliance and the types of violations identified. The inspections data for the cement and concrete products facilities are compiled in this environmental assessment report.
- Facility Hazard Evaluations. EAD performs hazard evaluations for individual industrial facilities using the RiCHES to prioritize specific industrial sector categories and individual facilities within a sector on the basis of potential risk or hazard to support EAD's national-level risk development of management strategies, and EAD's facility inspection, auditing, monitoring, and compliance activities. The data from the hazard evaluations conducted to the cement and concrete products facilities are compiled and analyzed in this environmental assessment report.

1.1. Inspections and Compliance Tool

The Inspection and Compliance Tool (ICT) inspectors allows to conduct onsite inspections using portable Windows-based devices, such as laptops and tablets, and upload the inspection data back to the On-site Assessment, Compliance, and Inspection System (OACIS) (Rady et al, 2014), and automatically send the inspection report to the facilities. The ICT is a smart tool for field inspectors to conduct facility site-specific compliance inspections. Before 2008, EAD inspections were hand written. While these reports documented the inspection, there was no mechanism to retrieve and analyze inspection data, and inspection reports were inconsistent and primarily based on the experience of individual inspectors. Currently through the ICT, comprehensive, detailed, and consistent inspection reports are created.

8		10 at 10
ANY marked	سرابية فعدامت الباريلية	
مرد منا (ما مراقعا (ما مراقع) مراقع مراقع	يديد في ملك في ميلية (مريد من الملك) و محمد الله من حق الجام - اليونين (202) من المحمد الروبية الجام اليونين وقام مريك حك الم المحمد أو الأمكان - الم	به ۸ از بریه آیا ۵۵۵ والسا در شد مود میرد و ۵ از داده استان و آشریه ۱۰ از بار میرا ایمان ایمان و آشریه ۱۰ از بار ایمان ایمان و آشیه ایمان ایمان ۱۰ از بار ایمان محک ایمان مکان ۱۰ از بارز ایمان محک ایمان محک ۱۰ از بارز ایمان محک ایمان محک ۱۰ از بارز ایمان محک ایمان محک ۱۰ از بارز ایمان محک
8.44 9.44	مر معین انهایی: مرد میز استان مرد معین از انهاییم د میاند (این انهایی) در انهایی از ا	ی و به منظر و عن افرد وا و هر اور گران و به مراد افتا کان ها اور مرو مرو اور و به مند است برای سایه و ایر اسر ان و به استان است برای سایه و ایر اسر ا
5.00 8.40 • •	ער שבור - לשעלי אלע מעליי ייין האשרי היו לא אלי היוני איני אוני איני איני איני איני איני	میں استان میں میں اور این مار میں اور این ماری میں کی اور استان این میں اور این میں کی اور استان اور این میں کا اور این اور این میں کی میں اور این میں اور این میں کی اور این کی میں میں کی میں اور این اور این میں میں میں اور این کی میں اور این کی میں میں کی
		الا من المراجع العرار من الدر ما المراجع من المراجع من المراجع من المراجع من المراجع من المراجع من المراجع من المراجع المراجع من المراجع من مراجع من المراجع م من من م

1.2. Risk Characterizations and Hazards Evaluation System (RiCHES

The Risk Characterization and Hazard Evaluation System (RiCHES) and Data Collection Tool (DCT) are designed to automate the use of hazard evaluation checklists and to evaluate hazards at facilities. RiCHES is designed to address four risk dimensions: first responder addresses the potential risk to the teams that respond to an accident or emergency; process hazard addresses the potential risks to facility operators; ecological impact addresses the potential risks to ecological areas; and public health addresses potential risks to the public. The tool evaluates facility operations and identifies factors that could pose potential harm to the environment (Akl et al, 2014). Unlike other risk assessment tools that require experienced staff and substantial resources, RiCHES provides an easy-to-use, screening tool to evaluate and rank industrial facilities which pose risks to health and the environment. Accordingly, the tool calculates relative risk rankings that allows EAD to identify those facilities with the highest risk in the four risk dimensions and overall. RiCHES assesses facility operations to identify factors that could pose potential harm under a prescribed set of conditions that could lead to unintended consequences. The system is capable of evaluating different types of hazards, different facility areas, and different industrial sectors (EAD, 2011) in order to prioritize EAD resources for inspectors; higher risk facilities are inspected more frequently while lower risk facilities are inspected less frequently.





3. Data Outputs

1.3. M-35 Compliance Profile

compliance During environmental inspections, violations are recorded by the ICT and are grouped into the following categories: Combustion Units and Process Operations; Material Transfer, Storage and Handling; Noise; Permit-Specific Conditions (e.g., conditions that are unique to a particular facility); Recordkeeping and Training; Safety and Emergency Response; and Solid Waste and Wastewater Management. Figure 3 presents, by violation category. the percentage of violations categories found during the inspections Violations conducted to M-35. were primarily found in the Material Transfer. Storage and Handling and account for 40% of the violations recorded in an inspection visit; this is followed by the Recordkeeping and Training category with a percentage of 26.8%, and the Solid Waste and Wastewater Management category that accounts for 15.8% of the total number of violations.



Figure 3: Percentage of Violations Found per Inspection Category During Inspection Visits to Cement and Concrete Products Manufacturing Facilities in Mussafah-M35

Table 2 presents the compliance data for the facilities located in M-35 as of 2016. Out of 27 industrial facilities permitted by EAD in M-35, only 8 facilities are in compliance based on the current ICT inspections criteria. **Figure 4** is a graphical representation of the compliance data.

Table 2: Total Number of Existing Facilities in M-
35 and their Compliance Status as of 2016

Total Number of Existing Facilities	27
Total Number of Existing Facilities that are In-Compliance	8
Total Number of Existing Facilities that are Out-of-Compliance	19
Compliance Rate (%)	30%

Environmental Action Plans requested from non-compliant facility	(EAP) ies	6
Action Plans (MP) requested from compliant facilities	non-	4

1.4. M-35 Risk Profile

3.2.1 Risk Scores for M-35 Facilities

OACIS database houses all the data associated with inspections and hazard evaluation visits. This data helps EAD to analyze the risk trends for each facility and for each sector. Table 3 represents the risk scores for each risk dimension, the Total Facility risk Score (TFRS is the addition of the risk score for the four risk dimensions), and the risk rank for each facility.

Table 3. Risk Scores	for the Concrete Produ	ets Manufacturing Sector	facilities located in M-35
Table 5. Misk beeres	ioi me concrete i rouu	cis Manufactul ing Sector	racing socarcu in MI-55

EMS ID	Name	Sector	Process	First Responder	Ecological	Public Health	Total
			Hazard Score	Score	Risk Score	Score	Score
IND-1514	BAINOOAN READAN MIX FACTORY	Cement and Cement Products	56.66	26.05	14.68	10.03	107.42
IND-940	NEW MIX READY MIX INDUSTRY	Cement and Cement Products	47.12	26.85	14.05	8.49	96.51
IND-1383	SYNAXIS READYMIX L L C	Cement and Cement Products; Oil And Gas	48.24	29.57	7.04	6.74	91.59
IND-276	ALGHAFLI READY MIX (RMC ALGHAFLI)	Cement and Cement Products	39.78	21.61	15.09	8.47	84.95
IND-139	Rock Cement Industries	Oil And Gas; Cement and Cement Products	41.30	25.91	10.75	6.62	84.58
IND-765	CEMEX SUPER MIX LLC	Cement and Cement Products; Oil And Gas	34.36	21.48	10.42	7.27	73.53
IND-504	TRANSGULF READY MIX CONCRETE CO.LLC	Oil And Gas; Cement and Cement Products	33.50	21.48	10.43	7.19	72.6
IND-182	NATIONAL READY MIX CONCRETE COMPANY LLC	Cement and Cement Products	33.18	17.24	9.60	8.07	68.09
IND-1730	BIN MEHRAN READYMIX CONCRETE - BRANCH	Cement and Cement Products	34.74	17.28	8.36	7.11	67.49
IND-717	UNITED PRECAST CONCRETE ABU DHABI LLC	Cement and Cement Products; Oil And Gas	29.31	19.87	9.43	6.81	65.42
IND-254	AL FALAH READY-MIX FACTORY L L C	Cement and Cement Products; Oil And Gas	29.58	11.99	10.18	8.53	60.28
IND-748	Al Fara'a Precast Factory	Cement and Cement Products; Oil And Gas	26.30	22.81	1.76	1.55	52.42
IND-88	BIN MEHRAN READY MIX CONCRETE	Cement and Cement Products	22.36	14.23	6.80	7.47	50.86
IND-1849	xtramix concrete solutions L.L.C. Mussafah branch	Cement and Cement Products	22.98	11.75	7.46	7.27	49.46
IND-679	FUTURE READY MIX CONCRETE L L C	Cement and Cement Products	20.42	6.83	11.24	6.56	45.05
IND-2498	UNIBETON READY MIX-ABU DHABI BRANCH 2	Cement and Cement Products	15.95	11.09	3.42	0.89	31.35
IND-703	AL GHAFLY CEMENT PRODUCTS FACTORY	Cement and Cement Products	9.38	2.17	6.24	6.29	24.08
IND-214	BILDCO CEMENT PRODUCTS LLC	Cement and Cement Products	2.50	2.50	0.25		5.25
IND-940	NEW MIX READY MIX INDUSTRY	Cement and Cement Products	59.09	32.12	16.49	9.93	117.63
IND-1730	BIN MEHRAN READYMIX CONCRETE - BRANCH	Cement and Cement Products	46.07	25.75	12.66	9.46	93.94
IND-1383	SYNAXIS READYMIX L L C	Cement and Cement Products; Oil And Gas	36.53	23.75	11.72	7.49	79.49
IND-214	BILDCO CEMENT PRODUCTS LLC	Cement and Cement Products	33.37	13.84	10.49	8.54	66.24
IND-254	AL FALAH READY-MIX FACTORY L L C	Cement and Cement Products; Oil And Gas	19.34	5.50	9.07	7.12	41.03
IND-765	CEMEX SUPER MIX LLC	Cement and Cement Products; Oil And Gas	8.61	4.00	9.12	6.49	28.22

3.2.2 First Responder

The first responder risk dimension evaluates information relevant to first responders (e.g., fire fighters, medical personnel, police officers). Risks include limited or restricted access to the facility, physical hazards on facility grounds, poor condition of the buildings, amounts facility large of and inadequacy HAZMAT onsite. of emergency management systems. It should be noted that this risk dimension does not evaluate risks to the facility workers. The first responder risk dimension can be used to inform Risk Managers of potential risks to first responders so that mitigation options can be developed to reduce those risks.

Table 4 summarizes the first responder risk drivers and proposed mitigation strategies that can reduce the overall risk posed by the facilities in this sector. This finding suggests that the primary risks across the sector are relatively low and spread across a variety of scenarios with no single scenario ranking

highly across a majority of concrete products manufacturing facilities.
First Responder Scenario	Questions ("High Risk" Responses) Associated with the Scenario	Percent of Responses Scoring "High" ^a	Proposed Mitigation
2.b) Condition of evacuation stairwells and escape routes in the facility poses a risk	How high are the stairwells in the emergency evacuation routes? (>3 m)	44%	Restrict unnecessary access to high elevation and install guardrails, barriers, and/or warning signs surrounding elevated work platforms and other changes in elevation
(Average scenario score = 1.03) What is the average distance to the nearest exit in the facility buildings (or evaluation area)? (More than 50 m to the nearest exit)		25%	Increase the number of emergency exits available to workers to reduce the distance to the nearest exit
	Are all building emergency exit doors identified with signs, unobstructed, and easily accessible by workers at the facility (or evaluation area)? (No)	24%	Adequatelyidentifyallemergencyfireexitswithsignageandclearanyobstructiontoensureaccessibility at all times
	Are there sufficient building emergency exits to allow prompt and convenient escape of all workers during an emergency at the facility (or evaluation area)? (No)	6%	Increase the number of emergency exits available to workers to reduce the distance to the nearest exit

 Table 4: Highest Scoring First Responder Risk Scenario(s) and Proposed Mitigation Strategies for the Concrete Products Manufacturing Sector

^a To identify "high risk" responses, original (not averaged) responses from those facilities scoring above the sector average were used. These percentages are only meant to provide a general sense of frequency of response.

3.2.3 Process Hazard

Information on chemical and physical processes at a plant, including materials handling procedures, chemical processing, cleaning, and other operations, are collected in the process hazard risk dimension to assess the risks to plant personnel during the plant's operation. This module measures the risks within a plant's boundaries during normal operations, maintenance, emergency situations, normal shutdown, and decommissioning. These risks include worker exposure to toxic chemicals, slick surfaces, hot pipes, leaks, elevated surfaces, high-speed equipment, and other potentially dangerous situations. Hazards identified in the process hazard module may provide data that are used by other modules. Potential process hazards at concrete products plants include fine particulate (fugitive dust) emissions, vehicular traffic, moving equipment, excessive noise, slick surfaces, and overhead hazards or falling objects. Nearly all operations at concrete products plants release fine particulate matter. The most significant sources are vehicular traffic, particularly on unpaved areas of plants, and cement and aggregate transfer operations.

Vehicular traffic occurs throughout the work day. Much of the vehicular traffic consists of large trucks either bringing raw materials to the plant site or hauling products off site. In addition, front-end loaders and other types of heavy equipment move continuously around the plant.

The moving equipment at most plants includes conveyors, bucket elevators, and concrete mixers. At plants that produce concrete blocks or precast shapes, other types of moving equipment can be found, including vibration and compaction machines, stacking equipment, and binding equipment.

One of the most significant sources of noise at concrete products plants come from the inuse vehicles. Other significant noise hazards include concrete vibration and compaction machines found at concrete block and precast concrete plants. Concrete mixers also generate high levels of noise.

Overhead hazards are associated with conveyors and elevated storage bins, which increase the risk of falling objects.

The primary risk drivers for the process hazard risk dimension include (1) the

potential for poor evacuation stairwells and escape routes, and (2) improper operation practices and procedures in the facility. Error! Reference source not found.5 summarizes the process hazard risk drivers and proposed mitigation strategies that can reduce the overall risk posed by the facilities in this sector.

 Table 5: Highest-Scoring Process Hazard Risk Scenarios and Proposed Mitigation Strategies for the Concrete Products Manufacturing Sector

Process Hazard	Questions (Responses) Associated with the Scenario	Percent of Responses	Proposed Mitigation Measures
Scenario		Scoring "High" ^a	
2.f) Condition of evacuation stairwells and	How high are the stairwells in the emergency evacuation routes? (>3 m)	38%	Restrict unnecessary access to high elevation and install guardrails, barriers, and/or warning signs surrounding elevated work platforms and other changes in elevation
in the facility pose a risk	What is the average distance to the nearest exit in the facility buildings (or evaluation area)? (More than 50 m to	23%	Increase the number of emergency exits available to workers to reduce the distance to the nearest exit.
(Average scenario score = 1.03)	the nearest exit) Are all building emergency exit doors identified with signs, unobstructed, and easily accessible by workers at the facility (or evaluation area)? (No)	21%	Adequately identify all emergency fire exits with signage and clear any obstruction to ensure accessibility at all times.
	Are there sufficient building emergency exits to allow prompt and convenient escape of all workers during an emergency at the facility (or evaluation area)? (No)	5%	Increase the number of emergency exits available to workers to reduce the distance to the nearest exit.
5.a) Improper operation practices and procedures in the facility	Approximately how much gaseous HAZMAT (including materials that are stored, processed, or produced) are currently at this evaluation area? (>25 cylinders)	63%	Minimize the storage of unnecessary compressed gases if possible, and implement an integrated HAZMAT management system to ensure that HAZMAT are properly handled at all times.
pose a risk (Average scenario score	Are written Standard Operating Procedures (SOPs), including checklists and safe operating limits, available to personnel at point of use? (No)	56%	Ensure that SOPs for all machines and equipment are available to all process operators. The SOPs should include checklists and safe operating limits for all machines.
= 0.98)	Approximately how much liquid HAZMAT (including materials that are stored, processed, or produced) are currently at the facility? (>50 55-gallon drums)	54%	This type of industry requires the bulk storage of quantities of concrete additives. The facility should ensure tank integrity through periodic tank integrity testing, conducted by a certified third-party consultant, and the construction of secondary containments, if possible.
	Are there eye-wash stations and emergency showers available near storage areas for HAZMAT at the facility (or evaluation area)? (No)	54%	Install eye-wash stations and emergency showers near storage areas for HAZMAT at the facility.
	Are emergency response drills (for fire, toxic release) conducted regularly at the facility? (No)	52%	To ensure the readiness of the emergency response personnel, conduct regular emergency response drills at the facility.
	What is the most representative flammability or combustibility score of gases stored, processed, or produced at the facility (or evaluation area)? (High)	44%	Because of the intrinsic severity of the used gas, the facility should adopt and implement an integrated HAZMAT management system to ensure that HAZMAT are properly handled at all times.

Process Hazard Scenario	Questions (Responses) Associated with the Scenario	Percent of Responses Scoring "High" ^a	Proposed Mitigation Measures
	Are workers properly trained to respond to accidental emergency events such as fire, explosion, or toxic release? (No)	40%	Ensure that a team has been trained at the facility to respond to any emergency events (e.g., fire, explosion, toxic release).
	Is there emergency equipment in place to detect and/or respond to accidental toxic release at the facility (or evaluation area)? (No)	30%	Install emergency response equipment and ensure that the facility's Emergency Response Team been trained at the facility.
	Is the emergency response system (fire, toxic release) at the facility regularly inspected, tested, and maintained? (No)	28%	Ensure that the emergency response system is regularly tested and maintained. A maintenance schedule logbook should be updated accordingly.
	Approximately how much liquid HAZMAT (including materials that are stored, processed, or produced) are currently at this evaluation area? (>50 55-gallon drums)	25%	Minimize the storage of unnecessary HAZMAT if possible, and implement an integrated HAZMAT management system to ensure that HAZMAT are properly handled at all times.
	What is the most representative corrosivity score of liquids stored, processed, or produced at the facility (or evaluation area)? (High)	25%	Try to replace highly corrosive materials with less corrosive or non-corrosive materials if possible.
	Do facility personnel use proper Personal Protective Equipment (PPE) when needed? (No)	22%	Ensure that facility personnel use proper PPE applicable for the job requirements.
	What is the most representative flammability or combustibility score of liquids stored, processed, or produced at the facility (or evaluation area)? (High)	19%	This type of industry requires the bulk storage of quantities of concrete additives. The facility should ensure tank integrity through periodic tank integrity testing, conducted by a certified third-party consultant, and the construction of secondary containments, if possible.
	Approximately how much gaseous HAZMAT (including materials that are stored, processed, or produced) are currently at the facility? (>25 cylinders)	16%	Minimize the storage of large quantities of compressed gases because such materials are not part of the production process.
	Are there proper and adequate fire- detection and suppression systems in place at the facility (or evaluation area)? (No)	14%	Install emergency response equipment and ensure that the facility's Emergency Response Team been trained at the facility.
	Are workers trained on procedures to safely operate the machines, equipment, and processes operated at the facility? (No)	8%	Ensure that process operators are trained on the machines and equipment. Training should include safe work practices and operational limitations of the machines.
	Approximately how much solid HAZMAT (including materials that are stored, processed, or produced) are currently at the facility? (> 5,000 kg)	4%	Minimize the storage of unnecessary solid HAZMAT if possible, and implement an integrated HAZMAT management system to ensure that HAZMAT are properly handled at all times.
	What is the most representative flammability or combustibility score of solids stored, processed, or produced at the facility (or evaluation area)? (High)	4%	This type of industry requires the bulk storage of quantities of diesel fuel to be used for vehicles. The facility should ensure tank integrity through periodic tank integrity testing, conducted by a certified third-party consultant, and the construction of secondary containments, if possible.

^a To identify "high risk" responses, original (not averaged) responses from those facilities scoring above the sector average were used. These percentages are only meant to provide a general sense of frequency of response.

3.2.4 Public Health

The public health risk dimension is evaluated based on potential adverse public health impacts associated with facilities. The impacts could be from daily operational activities (e.g., dust emissions), accidental releases (e.g., spills, fires), or routine emissions (e.g., air pollutant emissions, wastewater effluent). The approach considers the potential for exposures to human receptors in the vicinity of the plant other than on-site workers. Pathways considered include transport within air, surface water, groundwater, and hazardous solid waste, as well as potential on-site environmental exposures (e.g., animals living on site). The most significant public health risk associated with concrete products plants result from release of toxic pollutants, exceedances of air pollutant emission limits, and release of "criteria" pollutants to ambient air, which can be readily carried by the wind to nearby residential areas and other areas frequented by the public. Concrete products plants generate solid waste in the form of concrete spillage, product rejects, and waste concrete, material and supply packaging, cleaning materials (rags), and vehicle maintenance supplies and waste, such as engine oil, lubricants, transmission or brake fluid; all of which carry a potential to impact local public health.

Table 6 summarizes the public health risk drivers and proposed mitigation strategies that can reduce the overall risk posed by the facilities in this sector. This finding suggests that the primary risks across the sector are relatively low and spread across a variety of scenarios, with no single scenario ranking highly across a majority of concrete products manufacturing facilities.

 Table 6: Highest Scoring Public Health Risk Scenario(s) and Proposed Mitigation Strategies for the Concrete Products Manufacturing Sector

Public Health	Questions ("High Risk" Responses) Associated with the Scenario	Percent of Responses Scoring "High"a	Proposed Mitigation
1 b) Palansa of toxic	How far is it to the closest high	65%	No mitigation masures are
nollutants into the air	density structure? (<300)	0370	proposed
poses a risk	Are emission control equipment and/or systems in place to reduce the release of air toyics? (No)	25%	Install emission control equipment (e.g., cartridge filters, bag filters) to prevent the release of air toxics
score = 0.92)	Are pollution control equipment and systems for air toxics routinely inspected and properly maintained? (No)	25%	Ensure that all air pollution control equipment are regularly tested and maintained. The maintenance schedule logbook should be updated accordingly.
	How far is it to the closest intermittent high-density structure? (< 300 m)	24%	No mitigation measures are proposed.
	What is the total amount of concrete products produced each year at the facility? (>600,000 m ³)	14%	No mitigation measures are proposed.
	What is the total amount of concrete products produced each year at the facility? (>400,000 tons per year)	8%	No mitigation measures are proposed.
	How far is it to the closest sensitive-population structure? (<300 m)	4%	No mitigation measures are proposed.
	What is the amount of air toxics emitted under normal operations? (High)	3%	Install emission control equipment (e.g., cartridge filters, bag filters) to prevent the release of air toxics.
	What is the toxicity (to humans) of air toxics emitted by the facility based on relevant standards? (High)	2%	No mitigation measures are proposed.

^a To identify "high risk" responses, data from those facilities scoring above the sector average were used. These percentages are only meant to provide a general sense of frequency of response.

3.2.5 Ecological Risk

The ecological risk dimension assesses the risk to ecological receptors (i.e., flora and fauna) and considers the potential for environmental exposures to ecological receptors living within nearby habitats. Pathways considered will include transport within air, surface water, groundwater, solid and hazardous wastes, and potential on-site environmental exposures. The most significant ecological and environmental risks associated with concrete products plants result from emissions of fine particulate matter. Fuel spills and/or fuel storage tank leakage also present potential risks to groundwater. The major risk drivers associated with the sector within M-35 were the potential to release toxic pollutants into the air

 Table 7: Highest Scoring Ecological Risk Scenario(s) and Proposed Mitigation Strategies for the Concrete Products Manufacturing Sector

Ecological Risk Scenario	Questions ("High Risk" Responses) Associated with the Scenario	Percent of Responses Scoring "High" ^a	Proposed Mitigation
1.b) Release of	Are emission control equipment and/or	33%	Install emission control equipment
toxic pollutants	systems in place to reduce the release of		(e.g., cartridge filters, bag filters) to
into the air poses a	air toxics? (No)		prevent the release of air toxics.
risk	Are pollution control equipment and	33%	Ensure that all air pollution control
	systems for air toxics routinely inspected		equipment are regularly tested and
(Average scenario	and properly maintained? (No)		maintained. The maintenance schedule
score = 0.87)			logbook should be updated
			accordingly.
	What is the total amount of concrete	18%	No mitigation measures are proposed.
	products produced each year at the		
	facility? (>600,000 m ³)		
	What is the total amount of concrete	9%	No mitigation measures are proposed.
	products produced each year at the		
	facility? (>400K tons per year)		
	How far is it to the closest ecologically	2%	No mitigation measures are proposed.
	sensitive marine area? (<300 m)		
	What is the amount of air toxics emitted	2%	No mitigation measures are proposed.
	under normal operations? (High)		
	What is the toxicity (to ecology) of air	2%	No mitigation measures are proposed.
	toxics emitted by the facility based on the		
	relevant standards? (High)		

^a To identify "high risk" responses, data from those facilities scoring above the sector average were used. These percentages are only meant to provide a general sense of frequency of response.

4. Conclusions

The inspections database for the concrete products manufacturing facilities located in M-35 identified that violations were primarily found in the Material Transfer, Storage and Handling and account for 40% the violations followed of by the Recordkeeping and Training category with a percentage of 26.8%. The Best Management Practice (BMP) for the mitigation of the violations related to Materials Transfer, Storage and Handling require having proper enclosure of the aggregates storage bays, proper housekeeping practices to reduce the accumulation of track out dust. The Best Management Practice (BMP) for the mitigation of the violations related to Recordkeeping and Training category requires implementation of rigorous capacity building training for the facility personnel, and associated documentation of training records.

The Concrete Products Manufacturing Sector scored relatively low for a majority of risk scenarios across all of the facilities in the sector; however, individual facilities within the sector did score highly compared to all facilities across one or more risk dimensions (refer to Table 3). Some facilities within the Concrete Products Manufacturing Sector have high total facility risk score compared with facilities in other industrial sectors. However, with few high scoring scenarios across the sector, the implementation of relatively simple and cost-effective mitigation strategies can reduce the sector's overall risk. For the first responder and the process hazard risks, the mitigation strategies can include providing adequate warnings and signage to inform first responders and personnel of the locations of any potential hazards associated with unguarded platforms, unexpected changes in elevation, or other unprotected areas of the facility. For public health and ecological risks, the mitigation strategies can include reducing PM emissions from the facility, reducing the track out of PM from the facilities, and minimizing the risk of environmental releases to the storm water system. Although the risk scores for the public health and ecological risk dimensions were low

compared to the scores for other industrial sectors, it is expected that the main public health and ecological risks are associated with the emissions of PM from facilities in this sector.

By addressing these risk drivers through the implementation of efficient and costeffective mitigation strategies, the risk scores for individual facilities within the Concrete Products Manufacturing Sector would be lowered, subsequently lowering the overall risk posed by the sector. Figure 5 compares the average TFRS for each of the sectors with at least 10 completed hazard evaluations. The average TFRS across all sectors and facilities with a current hazard evaluation was 60.32. The Concrete Products Manufacturing Sector's TFRS of 54.92 was below the average across all facilities and similar to the Wastewater Treatment Sector.



Figure 5. The sector average TFRSs across sectors with at least 10 completed hazard evaluations within each sector

References

EAD (Environment Agency–Abu Dhabi). **2010**. *Facility Assessment Report*. 2014.

Rady A, Turner M.B., Akl S., Ibrahim M.I., Abdallah H.G., Alayyan F., Al Hajeri K., Al Qudah A., Ali H.H., Baskir J.N., Tulloch M.L., *Inspections and Compliance Tool (ICT) for Industrial Facilities and Development Projects in Abu Dhabi Emirate;* A&WMA Annual Conference 107, Long Beach, CA; 2014.

Lloyd J.M., Mokhtari A., Beaulieu S.M., Phelan J.N, Money E.S, Turner M.B., Akl S., Gelle K., Al Muhairi A.R., Al Hajeri K., Al Qudah A., *RiCHES tool for risk assessment* of industrial sectors in Abu Dhabi Emirate; A&WMA Annual Conference 107, Long Beach, CA; 2014.

Mokhtari A., Beaulieu S.M., Lloyd J.M., Akl S., Money E.S, Turner M.B., Al Hajeri K., Al Mehairi A.R.,, Al Qudah A., Gelle K.; *Development of a Practical Approach to Rank the Relative Health and Environmental Risks of Industrial Facilities in Abu Dhabi;* SRA Annual Meeting, Baltimore, MD; 2013.

Risk Characterization and Hazard Evaluation System as a Decision Making Tool in Evaluation of Risks of Hazardous Materials Storage Facilities in Musaffah, Abu Dhabi

Mark Turner, Ahmed Rady, Samer Akl, Mohammad Al Ashram, and Senathipathi Kalimuthu RTI International-Abu Dhabi, United Arab Emirates

Khalid Al Hajeri and Faisal Al Hammadi Environment Agency-Abu Dhabi, United Arab Emirates

Jennifer Lloyd RTI International, North Carolina, USA

Abstract

In 2011, RTI International, in partnership with the Environment Agency-Abu Dhabi (EAD), deployed the Data Collection Tool (DCT), a hand-held computer-based tool that is part of the Risk Characterization and Hazard Evaluation System (RiCHES). The DCT is used to conduct onsite hazard evaluations at industrial and commercial facilities to characterize risk in four dimensions: first responder, process hazard, ecological, and public health risk. RiCHES functions as a decision making tool that helps EAD to identify the high risk facilities and to propose necessary measures to reduce risk. Since 2011, over 1,000 hazard evaluations have been conducted to industrial and commercial facilities and EAD has been able to conduct analyses of the data to understand the types of scenarios that drive risk at these Recently, EAD was asked to facilities. evaluate the risk at hazardous materials (HazMat) storage facilities in operation in the Musaffah industrial area, Abu Dhabi. Primarily, these facilities are inherently high risk facilities because of the wide variety of chemicals that are stored and handled. In order to evaluate risk at all of these facilities, RTI and EAD inspectors collected primary data from the HazMat facilities permitted by EAD using the DCT. RiCHES allowed the team to analyze the risk data for all of these facilities, including the evaluation of primary

risk drivers, and describe the risks attributed to HazMat facilities in Musaffah.

The purpose of this paper is to describe the risk evaluation approach, the initial analysis of specific high-risk scenarios that were identified using RiCHES, and the use of the drill down analysis techniques into the risk scenarios that pinpoint the particular risk factors that trigger high risk scores. This paper will demonstrate RiCHES as a decision-making tool capable of identifying the primary risk drivers and proposing mitigation measures.

Background

In collaboration with RTI International, EAD developed the Data Collection Tool (DCT), part of the Risk Characterization and Hazard Evaluation System (RiCHES), as a screening tool to evaluate risk at industrial and commercial facilities. The DCT evaluates risk in four risk dimensions: first responder. process hazard, ecological, and public health. Inspectors use the DCT in the field on handheld tablet or laptop computers to collect the hazard evaluation data; the inspectors simply answer questions in the tool by selecting the low-, medium-, or high-risk responses based on visual observations at the facilities. Each of the questions is linked to one or more risk scenarios in the tool. RiCHES maps and scores the responses to questions through the risk scenarios and the system generates risk

scores for each risk dimension and an overall risk score which is simply the sum of the four risk dimension scores. The total facility risk scores (TFRS) for all of the facilities comprise a relative risk ranking that allows EAD to identify those facilities that are high risk (high scoring facilities) and those that are low risk (low scoring facilities). RTI in collaboration with EAD has developed a statistical approach to identify the high-, medium-, and low-risk facilities that is currently being used to develop a risk-based inspection schedule where high-risk facilities are inspected more frequently than mediumrisk facilities and the medium-risk facilities are inspected more frequently than the lowrisk facilities. This approach will allow EAD to focus inspection resources on those facilities with high risk.

Same .	Matte	Sec.0	factors.	Engenne .
fotomers.				
//64/8511	h-seat .		2	encomer unelle de l'het Nacional Nacional 19 august - Anno 19 august - Anno
Permit	Anner :		1-1944-1850-5 12-140 12-140	alang al-Markanin, pad
Promote la	6-8001	Ψ.		dha (Isaach nà ghliannag faoilte, franc 194 hadite, gragade, 1947) . - 18 m
Passis	sere .	14		provide and an item for the state of
Parine 1			Second fait	in generation in this wanted rangements (e.g., if go, angle is and have the
(forting is	hanni (Enclineerin Constant Constant Constant Constant	- Anne married Patriget Marriel (e and Patriel Ref. Society, annual Nacional a Annell Other patrimonia menu per vendo
-	a Mitmanie			naterioli storel, prosocial, registilicad et the facility.?





In the fourth quarter of 2016, the EAD inspections team was tasked with conducting an evaluation of the risks associated with the operation of hazardous materials (HazMat) facilities in Musaffah, Abu Dhabi. Musaffah is the industrial area located near Abu Dhabi and contains a wide variety of industrial and commercial facilities. During November and December, the EAD and RTI inspections team conducted 31 hazard evaluations at HazMat facilities using the DCT in order to quantify risk. This paper provides an analysis of the results of this effort and provides some conclusions that can be drawn from the data.

Risk Scores for HazMat Facilities

The list of facilities in this paper includes facility-specific information for the 31 facilities that are located in Musaffah Industrial area. Information presented in this paper includes the names and locations of the facilities, the quantities of chemicals processed and/or stored by hazard class, Flammable substances, corrosive materials, and compressed gases are the most widely used and stored hazard classes of materials in this sector. EAD sector assessment report compiled in 2009 reported approximately 6.300 tonnes of flammable chemicals and 2,400 tonnes of corrosive chemicals were handled Chemicals and stored. and hazardous materials are typically stored in drums, totes, and small tanks in separate

rooms or buildings specifically designed to store the particular chemical hazard. Larger industrial facilities, particularly industrial gas facilities, store hazardous materials in large above-ground storage tanks located outdoors in tank farms. The use of secondary containment structures or equipment is widely adopted throughout the sector. Table 1 provides a list of these facilities along with the dates when the hazard evaluations were conducted, the risk dimension scores, and the overall total facility risk score (TFRS) for each facility. Figure 1 illustrates the total facility risk scores for each facility. The TFRS ranges from 1.92 to 81.98 with a median score of 38.9

EMS ID	Sector	Hazard Evaluation Date	Process Hazard Score	First Responder Score	Ecological Risk Score	Public Health Score	TFRS
HAZ- 5061	Chemical Trading	06/12/2016	39.36	27.81	8.16	6.65	81.98
HAZ-483	Hazardous Materials Trading	29/11/2016	36.29	27.99	2.25	1.94	68.47
HAZ- 1600	Hazardous Materials Trading	28/06/2016	33.32	23.67	5.21	5.97	68.17
HAZ- 5074	Hazardous Materials Trading	29/11/2016	35.03	24.73	2.37	2.14	64.27
HAZ-103	Hazardous Materials Trading	27/11/2016	33.55	22.62	2.17	1.89	60.23
HAZ- 5048	Hazardous Materials Trading	06/12/2016	29.33	18.30	6.04	5.25	58.92
HAZ- 5017	Hazardous Materials Trading	06/12/2016	27.93	23.51	4.40	1.64	57.48
HAZ- 5018	Industrial Gases Trading	27/11/2016	27.78	17.32	2.96	1.52	49.58
HAZ- 1794	Hazardous Materials Trading	06/12/2016	26.27	17.26	2.00	1.69	47.22
HAZ- 2351	Hazardous Materials Trading	06/12/2016	23.75	18.88	2.67	1.41	46.71
HAZ- 3123	Hazardous Materials Trading	06/12/2016	21.71	12.68	5.52	6.41	46.32
HAZ- 2753	Hazardous Materials Trading	29/11/2016	23.87	18.12	1.77	1.49	45.25
HAZ-100	Hazardous Materials Trading	07/12/2016	20.54	12.46	6.47	4.96	44.43
HAZ- 5149	Hazardous Materials Trading	06/12/2016	25.30	15.42	1.66	1.66	44.04
HAZ-113	Hazardous Materials Trading	27/11/2016	21.75	17.72	2.91	1.11	43.49
HAZ- 5190	Hazardous Materials Trading	19/05/2016	19.86	11.93	5.04	4.86	41.69
HAZ- 5158	Hazardous Materials Trading	07/12/2016	24.28	9.79	1.96	1.78	37.81
HAZ-96	Hazardous Materials Trading; Chemical Trading	27/11/2016	18.60	13.28	1.43	1.43	34.74
HAZ- 5011	Hazardous Materials Trading	05/12/2016	18.94	11.81	1.57	1.10	33.42
HAZ- 1867	Hazardous Materials Trading	30/11/2016	18.21	10.93	1.97	1.90	33.01
HAZ- 5137	Hazardous Materials Trading	12/12/2016	16.33	12.68	2.02	1.65	32.68
HAZ- 5195	Hazardous Materials Trading	15/11/2016	16.10	11.99	2.88	1.22	32.19
HAZ- 5288	Hazardous Materials Trading	30/11/2016	15.68	9.95	1.52	1.69	28.84

HAZ- 1994	Hazardous Materials Trading	29/11/2016	15.24	9.48	1.98	1.36	28.06
HAZ- 5004	Hazardous Materials Trading	06/12/2016	11.10	7.51	1.43	1.41	21.45
HAZ-138	Chemical Trading; Hazardous Materials Trading	28/11/2016	10.85	7.17	1.18	1.31	20.51
HAZ- 4259	Hazardous Materials Trading	12/12/2016	10.29	7.90	1.05	1.22	20.46
HAZ- 5183	Hazardous Materials Trading	07/12/2016	3.67	3.67	0.50	0.00	7.84
HAZ- 1824	Hazardous Materials Trading; Chemical Trading	29/11/2016	1.17	1.17	0.50	0.00	2.84
HAZ- 5037	Hazardous Materials Trading	05/12/2016	0.83	0.83	0.25	0.00	1.91
HAZ- 5179	Industrial Gases Trading	12/12/2016	0.83	0.83	0.25	0.00	1.91

HazMat Facilities Risk Profile

For each dimension, a RiCHES module has been developed to support the characterisation of risk and the development of risk profiles specific to the nature of risk that the module considers. These modules share some common data elements (e.g., data about chemical and physical properties) and use certain data that are unique to a specific module (e.g., data about threatened and endangered species). Although the four RiCHES modules focus on different types of risk, the Risk Assessment Matrix approach is an integral part of each module because it allows for the development of comprehensive risk profiles *across* risk dimensions and the creation of dimensionspecific profiles.

Figure 4 compares the average TFRS for each of the HazMat facilities across the four risk dimensions.



Figure 4: Average TFRS for each of the HazMat facilities across the four risk dimensions

First Responder

The first responder risk dimension evaluates information relevant to first responders (e.g., fire fighters, medical personnel, police officers). Risks include limited or restricted access to the facility, physical hazards on facility grounds, poor condition of the facility buildings. large amounts of HAZMAT onsite, and inadequacy of emergency management systems. It should be noted that this risk dimension does not evaluate risks to the facility workers. The first responder risk dimension can be used to inform Risk Managers of potential risks to first responders so that mitigation options can be developed to reduce those risks.

Figure 5 compares the first responder risk posed by the facilities in this sector. This finding suggests that 13 HazMat facilities out of 31 have exceeded the average risk score of the first responder. The average risk score for the first responder was 13.85.



Figure 5: Average risk score for the first responder risk dimension

Process Hazard

Information on chemical and physical processes at a facility, including materials handling procedures, chemical processing, cleaning, and other operations will be compiled in the process hazard module to assess the risk to facility personnel during phases of the facility's operation. These phases include normal operations, maintenance. emergency procedures.. Therefore, this module measures the risks within a facility's boundaries of processes that occur at the facility. These risks include worker exposure to toxic chemicals and HAZMAT. Hazards identified in the process hazard module provide data that are used by other modules. For example, excessive releases of chemicals and HAZMAT may affect workers at the facility, but may also affect people living downwind of the release. This risk is reflected in the public health risk module.

Figure 6 compares the process hazards risks posed by the facilities on the workers. The average risk score for the first responder was 20.25. This finding suggests that 15 HazMat facilities out of 31 has exceeded the average risl score of the process hazard risk dimension.



Figure 6: Average risk score for the process hazard risk dimension

Public Health

The public health risk module is evaluated based on potential adverse public health impacts associated with facilities. The impacts could be from construction activities (e.g., dust), accidental releases (e.g., spills, fires), or routine emissions (e.g., air pollutant wastewater effluent). emissions. The approach considers the potential for exposures to human receptors in the vicinity of the facility other than on-site workers. Pathways considered include transport within air, surface water, groundwater, and hazardous solid waste, as well as potential on-site environmental exposures (e.g., animals living onsite).

Figure 7 compares the process public health hazards posed by the facilities on the surrounding public. The average risk score for the first responder was 2.15. This finding suggests that 15 HazMat facilities out of 31 has exceeded the average risk score of the process hazard risk dimension.



Figure 7: Average risk score for the process hazard risk dimension

Ecological Risk

The ecological risk dimension assesses the risk to ecological receptors (i.e., flora and fauna) and considers the potential for environmental exposures to ecological receptors living within nearby habitats. Pathways considered will include transport within air, surface water, groundwater, solid and hazardous wastes, and potential on-site environmental exposures.

Figure 8 compares the process public health hazards posed by the facilities on the surrounding public. The average risk score for the first responder was 2.15. This finding suggests that 15 HazMat facilities out of 31 has exceeded the average risk score of the process hazard risk dimension.



Figure 8: Average risk score for the process hazard risk dimension

Conclusions

The TFRS for all the evaluated HazMat stores are plotted in figure 9. The average TFRS across all the risk dimensions was 38.9. This finding suggests that 11 HazMat facilities out of 31 have exceeded the average TFRS.

Figure 9 compares the process TFRS posed by the facilities on the surrounding public. The average TFRS across all the risk dimensions was 38.9. This finding suggests that 11 HazMat facilities out of 31 has exceeded the average TFRS. The results of the TFRS illustrated in figure 9 were then compared to a study results that EAD conducted on 694 evaluated facilities using the quartile analysis. Based on the quartile analysis, the classification of the high-, medium-, and low-risk facilities is relatively straightforward. The facilities that fall below Q1 (equal to or lower than RiCHES score of 27) are classified as low-risk. The facilities with a RiCHES score greater than 27 (Q1) and less than or equal to 62 (Q3) are classified as medium-risk facilities. Lastly, the facilities with a RiCHES score greater than 62 (Q3) are classified as high-risk facilities.



Figure 9: The average TFRSs across all the hazard evaluations for all HazMat facilities

Table 2 shows the risk quartile results for the 694 facilities where hazard evaluations have been conducted.

Table 2: Risk Quartile Analysis Results for
Facilities Where Hazard Evaluations Have Been
Conducted

Risk Quartile	Total Facility Risk Score
High Risk (>Q3)	>62
Medium Risk (from Q1 to	From 27 to 64
Q3)	
Low Risk (<q1)< td=""><td><27</td></q1)<>	<27

Only 4 HazMat facilities score higher than 62 making only 13% of the facilities within the high-risk facilities. 20 of the evaluated facilities scored higher than 27 accounting for 64.5 of the facilities to be categorized in the medium-risk facilities, the remaining 7 facilities scored less than 27 making 22.5% of the facilities in the low-risk category.