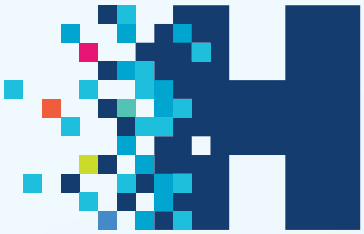

جـامعة حـمـدان بن محـمـد الـذكـيـة
Hamdan Bin Mohammed Smart University

Covid-19: United Arab Emirates' Health Systems Response Compared with Selected OECD Nations

a Scoping Review

Research Report

2020

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EXECUTIVE SUMMARY

An efficient, integrated health system is built on having motivated and skilled health workers. It needs a well-maintained infrastructure and a reliable supply of medicines and technologies that is backed by adequate funding, strong health plans, and evidence-based policies. The United Arab Emirates (UAE) has managed the COVID-19 crisis efficiently owing to its properly funded health system, technological edge, strong commitment to building public trust, and decisive leadership.

The Deep Knowledge Group, which is known as a consortium consisting of commercial and non-profit organizations having an edge for data analytics, ranked UAE 11th in a list of 200 countries with regards to response to Covid-19 by its health system. The review in this report scopes a comparison of the response by the UAE's health systems to Covid-19 as stated by the Organization of Economic Cooperation and Development (OECD) and it was found that there are only two countries ranked above UAE, namely Switzerland (ranked 1st) and Germany (ranked 2nd). Two other OECD countries ranked significantly below UAE: Italy (ranked 53rd) and United States of America (ranked 58th). The analysis reviews and compares legal, clinical and community safety approaches for addressing Covid-19 in four broad areas: detection, containment, treatment, and health security. It is determined that the UAE health system compares favorably with some of the most advanced health systems in the world in the domain of Covid-19 control, apart from excelling in the disaster preparedness as well.

Keywords:

Covid-19, United Arab Emirates, Switzerland, Germany, Italy, United States, Prevention, Detection, Containment, Treatment, Health Security.

ملخص تنفيذي

لا بد لأي نظام صحي يتميز بالكفاءة والتكامل أن يكون قائمًا على وجود التحفيز والمهارات العالية لدى العاملين في الرعاية الصحية. ويحتاج هذا النظام إلى بنية تحتية مستقرة وتوفير إمدادات من الأدوية والتقنيات، كما يحتاج هذا النظام إلى وجود التمويل المناسب، والخطط المحكمة للرعاية الصحية، والسياسات المثبتة بالأدلة. وقد تمكنت دولة الإمارات العربية المتحدة من إدارة أزمة كوفيد 19 بكفاءة، ويعود ذلك إلى ما لديها من نظام صحي حاصل على التمويل المناسب، وتفوقها التقني، والتزامها الراسخ ببناء ثقة شعبها بها، وحزم قيادتها. وقد عملت مجموعة المعرفة العميقة Deep Knowledge Group، وهي ما يعرف بأنها تحالف يضم منظمات تجارية وغير ربحية يجمعها تفوقها في تحليل البيانات، عملت على تصنيف دولة الإمارات العربية المتحدة في المرتبة 11 ضمن قائمة تضم 200 دولة من حيث استجابة نظامها الصحي لجائحة كوفيد 19.

وتشمل الدراسة في هذا المراجعة مقارنة لاستجابة الأنظمة الصحية في دولة الإمارات العربية المتحدة لجائحة كوفيد 19 حسب ما قررته منظمة التعاون الاقتصادي والتنمية، ووجدت الدراسة أن ثمة دولتين فقط تسبق دولة الإمارات العربية المتحدة في الترتيب، وهما سويسرا في المرتبة 1 وألمانيا في المرتبة 2، وأن ثمة دولتين أخريين من دول منظمة التعاون الاقتصادي والتنمية حصلتا على ترتيب أدنى بكثير من ترتيب دولة الإمارات العربية المتحدة، وهما إيطاليا في المرتبة 53، والولايات المتحدة الأمريكية في المرتبة 58.

وسوف تتناول الدارسة بالتحليل والمقارنة المنهجيات القانونية والسريرية ومنهجيات السلامة المجتمعية في مواجهة جائحة كوفيد 19 ضمن أربعة مجالات رئيسية: الكشف والاحتواء والعلاج والأمن الصحي. وقد خلصت الدراسة إلى أن دولة الإمارات العربية المتحدة تتفوق على غيرها من أكثر الأنظمة الصحية تطورًا في العالم من حيث السيطرة على جائحة كوفيد 19، هذا إلى جانب تميزها في الجهوزية للكوارث.

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INTRODUCTION

A sudden coronavirus disease was first reported by the World Health Organization (WHO) as a response by the Chinese authorities who had hitherto addressed it as a case of pneumonia due to an unknown cause on the 31 December 2019. On 11 February 2020, the WHO announced that the disease has been officially named Covid-19. On 12 March 2020, the WHO designated Covid-19 as a pandemic. As of 4 August 2020, there have been about 18.4 million confirmed cases of Covid-19, 11.1 million recoveries, and 703,000 deaths. The term "health systems" describes all the activities whose primary purpose is to promote, restore and/or maintain health; the people, institutions and resources, arranged together in accordance with established policies, to improve the health of the population they serve, while responding to people's legitimate expectations and protecting them against the cost of ill-health" (WHO, 2020a).

This century saw the worst global pandemic ever experienced. Health systems are trying their best to cope with it. Covid-19 exposed major vulnerabilities in the very foundation of the health system (Figure 1), pertaining to its delivery of service, health workforce, health information systems, access to essential medicines, financing, leadership, and governance (Legido-Quigley et al, 2020). Healthcare financing is based on a framework that has five pillars: conducive macroeconomic conditions, reprioritization of health within the government budget, an increase in health sector-specific resources (e.g. earmarked taxation), an increase in the efficiency of existing health expenditure, and health sector-specific grants. The pandemic has also led to a stretch in global economies and many countries are found to be reeling under economic recession in 2020. Economic crisis has further led to the question of health care affordability due to high costs of service or due to unemployment, and also led people to delay seeking treatment or abstaining from obtaining the services they need, making the outbreak harder to control (WHO Europe, 2020).

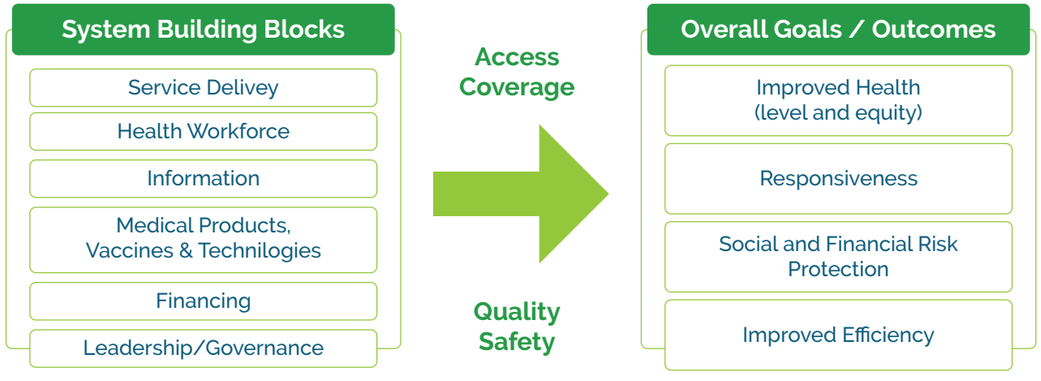

Figure 1: WHO Health Systems Framework

National health authorities are currently implementing policies and practices to balance two competing goals: capacity building to diagnose and treat those affected by Covid-19, and providing services for other associated conditions that are necessary to maintain the health of the population, e.g. those admitted in Covid-19 free hospitals. The World Health Organization's recent survey of 163 national health ministries revealed that prevention and treatment services for non-communicable diseases have been severely disrupted globally since the onset of the Covid-19 pandemic, mainly in low income countries, who have been most affected. For example, the survey found that premature mortality from diabetes increased by 5% between March and May 2020 (WHO, 2020b).

Covid-19 field hospitals usually designated by repurposing hospital buildings or community facilities such as stadiums and convention centers as well as workforce resources to respond to the Covid-19 pandemic have required considerable remodeling of health care systems in most countries (Christen et al, 2020).

Health workers are at the forefront of the response to COVID-19, both as service providers and as high-risk groups for contracting the disease. For example, a value of 5.9 skilled health professionals (midwives, nurses and physicians) per 1000 population was identified as the workforce requirement for the Ending Preventable Maternal Deaths initiative, which entails reducing global maternal deaths to 50 per 100,000

live births by 2035 (WHO, 2015). Covid-19 health workforce-related challenges are so many. They include shortage of staff, misdistribution of resources and misalignment between population health needs and health worker competencies. The acute onset of the epidemic meant that sufficient time could not be allocated for adequate capacity building of health workers and has also resulted in a shortage of infection control and treatment equipment. The increased workload and mostly stressful working environment have often led to long working hours and occupational burnout (Liu, 2020).

Assuring the production, accuracy, dissemination, and timely use of Covid-19 information is a major challenge for the health systems. There was critical information that needed to be disseminated pertaining to Covid-19, which included: how many individuals test positive, how many are symptomatic or are experiencing complications leading to hospitalization, age, gender, occupation, and other demographic attributes of individuals who have tested positive for Covid-19. Figures needed to emerge about these individuals, as to how many people sought care at a health care facility, and within individual hospitals, how many patients required intensive care, received ventilator support, recovered, or died. Such critical information encompassed the length of their stay in the hospital and in the intensive care unit for patients who survived. Such key information is best provided with the help of widespread data collection, aggregation, and analysis, and may entail changes to national, legal, and information technology infrastructure (Sittig and Singh, 2020). Competing sources of health information and emergence of various platforms and sources of health information in the digital age has complicated the work of healthcare researchers and policy makers as well as health promotion staff. The massive "disinfodemic" – misinformation and disinformation spread as rapidly as the virus itself particularly via mobile phones on social media networks, have proven deadly and have been instrumental in creating confusion about life-saving personal and policy choices (UNESCO, 2020).

Medical products useful for controlling Covid-19 include surgical masks and respirators, hand sanitizers, gloves, PCR kits, and ventilators. So far, there appear not to be therapeutics in nature. In June 2020, Covid-19 RECOVERY trial researchers revealed that participants with severe covid-19 (2104) given 6 mg dexamethasone once daily had 8-26% lower mortality than 4,321 participants given standard care (Hornby et al, 2020). Optimizing supplies of quality medical products as well as medicines such as dexamethasone that treat symptoms associated with the Covid-19 entail close partnerships with regulators, manufacturers, and other stakeholders around the world in order to assure accessibility and equity of distribution. In a recent report, the US Food and Drug Administration provided guidelines to chemists, manufacturers and those involved in quality control. These guidelines are related to the nonclinical and clinical data emerging through development and licensure, and for post-licensure safety evaluation of the Covid-19 vaccines (FDA, 2020).

Enhancing frontline services for Covid-19 response requires supportive health financing policies to optimize national fiscal capacity, at a time in which control measures such as lockdowns adversely affects national and international economies. Three key questions that arise in this regard are: What are the immediate spending actions that can be taken with existing budgets? How to secure budget for COVID-19 response through revisions in finance laws? What can be done to accelerate budget execution and fund release to the frontlines? Ensuring an appropriate balance between flexibility and accountability is particularly pertinent. Affected countries such as India have benefited from World Bank loans for Covid-19 emergency response and health systems preparedness (World Bank, 2020). Two overlapping phases of Covid-19 control have important health financing implications. In the emergency response phase, allocative efficiency of funds is crucial. Health systems need to develop the capacity to accommodate supplemental/overtime pay for frontline staff, task shifting, redeployment, and rapid recruitment in health payrolls without being negligent of other critical expenditures. In the containment phase of most countries' health systems, mitigation and suppression policies such as closure of international borders and substantial non-health workforce layoffs exert inadvertent macro-fiscal effects and results in public revenues to shrink. Major investments in epidemiological surveillance including contact tracing are required before strict social controls can safely be wound back.

The Covid-19 pandemic has provided case studies on leaderships in the national, political, and health systems. Leadership is often termed as effective, average and/or dismal. The uncertainty embedded in this situation makes the 'leadership challenge' even more complex. Effective leaders have been successful in demonstrating to employees, customers, communities, and ecosystem that they have best interests of stakeholders at heart and are providing them with psychological safety in addition to protecting everyone from Covid-19 infection or complications. Effective leaders seek to turn the Covid-19 crisis into an opportunity for developing more responsive and resilient health systems. Such leaders have been proactive in filling the information vacuum to combat the spread of misinformation and disinformation. Effective leaders are consistently focused, empower their teams to act courageously, and instill confidence and steadiness across their health systems as well as internationally (Grint, 2020). In times of crisis such as the current COVID-19 pandemic and its economic and social repercussions, effective public governance is essential. Important governance domains include gaining public trust, digital government and effective data analysis, risk and crisis management, government integrity, supply chain logistics as well as evidence-based policy-making and evaluation (United Nations, 2020).

Strengthening the six components of health systems described above is essential to control Covid-19 effectively while addressing other activities of health service delivery that promote the health of the population. Strengthening of a country's health system requires both technical and political knowledge and action oriented activities. Importantly, health systems resilience is the ability to prepare for, manage (absorb, adapt and transform) and learn from major health-related crises such as Covid-19. Ideally, resilience is not just about bouncing back to the pre-shock state but about evolving into better prepared health systems for future challenges. In the next section, comparative strengths and weaknesses of four OECD national health systems in Switzerland, Germany, Italy, and United States of America are compared with that of UAE in relation to combating the Covid-19 pandemic.

METHODOLOGICAL APPROACH

Health Systems' Responses to Covid-19 in Switzerland, Germany, UAE, Italy, and USA

The World Health Organization's strategic framework for emergency preparedness (2017) emphasizes health systems' resilience as a core prerequisite for effective response to epidemics and pandemics. It also involves emergency risk management and preparedness towards creating a health system with its key components being more resilient. Specific aspects of health systems that enhance emergency preparedness include:

01 developing, training and equipping an effective workforce for health emergency,

02 maintaining structurally and functionally safe hospitals and other health infrastructure,

03 reliably supplying high-quality medicines and other therapeutics,

04 providing disease surveillance systems and decentralized laboratory services;

05 delivering competent health service to people directly affected by the Covid-19 crisis and other serious health conditions,

06 sustainably financing emergency risk management, including preparedness as an integral part of national health financing, and

07 providing contingency funds for emergency situations.

To help discern why some national health system responses are more effective than others, a four-pronged framework is adopted in this scoping review, which includes:

1 - Detection

2 - Containment

3 - Treatment

4 - Health Security

Without effective vaccines, it is too early to determine if any health system can prevent Covid-19 infections.

In the Detection phase, three useful indicators applied in this review are: number of tests per capita, tests in relation to confirmed deaths, and number of tests per confirmed case.

With regards to containment, we selected three indicators in this review: deaths per capita, deaths doubling time, and cases per capita. Given the limited evidence available on the efficacy of case management measures, we adopted only one treatment indicator, which is case fatality rate.

In relation to Health Security, we examined quarantine efficiency, risk management efficacy, regional resiliency, and government efficiency of risk management, monitoring and detection, as well as healthcare readiness.

We acknowledge the fact that there is a limitation as far as cross-country comparisons is concerned. The reason being that spatial dynamics of the Covid-19 pandemic are different in each country, and are evolving at different rates. However, these five countries are carefully selected because they all recorded their first Covid-19 cases between late January and late February 2020, and they are all high-income countries with well-funded health systems. For the detection, containment, and treatment domains, we relied on the data generously made accessible by the Global Change Data Lab of the University of Oxford (2020). For the Health Security, we extracted relevant data from the Deep Knowledge Group June 2020 rankings of 200 countries and regions (Deep Knowledge Group 2020).

01

DETECTION

It is not feasible to ascertain the actual number of people infected with Covid-19 solely from testing data; only the infectious status of individuals have been tested. The total number of people that have tested positive, the number of confirmed cases, is usually lower than the total number of people who are infected at the same point in time. Nevertheless, testing data can provide a strong indication of the quality of a country's data on the pandemic and an idea of how informative the number of confirmed cases in a country may be.

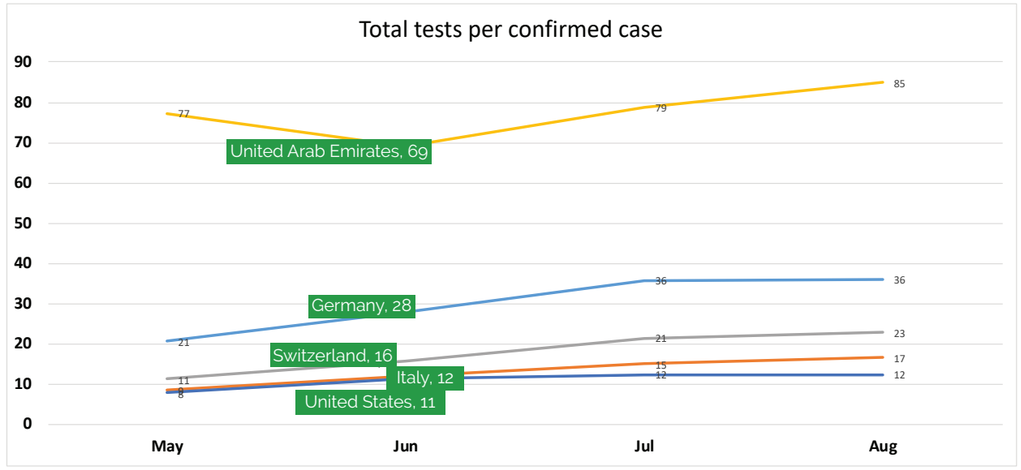

Figure 2: Number of Covid-19 tests for each confirmed case in five selected nations, 2020

Between March and July 2020, the UAE conducted at least double the number of tests for each confirmed case compared with Germany, and triple the number compared to Switzerland, and at least five times the number compared to Italy and USA (Figure 2). This may indicate low caseload or a more diffused testing approach which, for example, the data did not prioritize individuals who are exhibiting symptoms (Figure 2).

Generally, more Covid-19 testing translates to greater reliability in the infection rate, since wide testing coverage provides a larger 'sample' of people for which their infection status is known. In countries where testing capacity is low or tests are rationed for only high-risk, symptomatic individuals skews case detection results since about 40% of detected cases are asymptomatic (Lavezzo et al, 2020). The UAE conducted significantly more Covid-19 tests per capita than any other country in comparison between March and July 2020 (Figure 3).

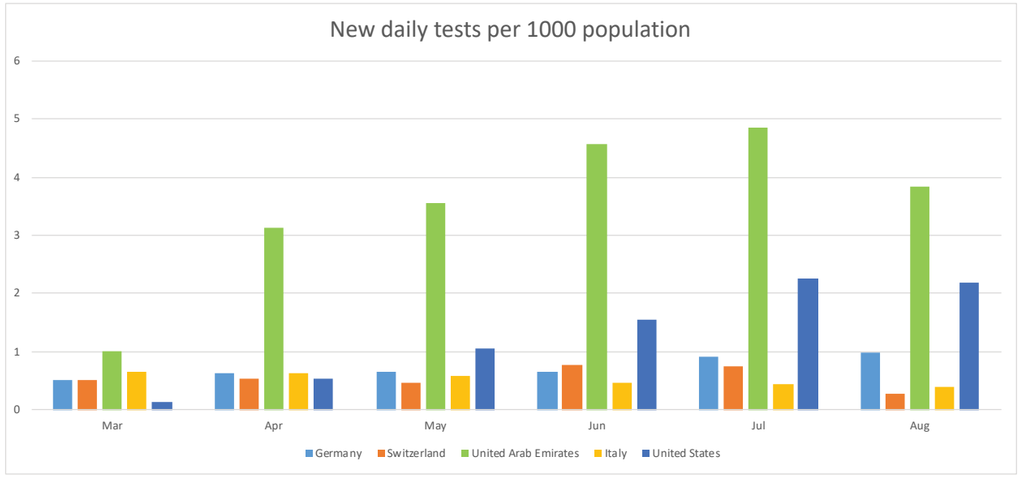

Figure 3: New daily Covid-19 tests per 1000 people

As shown in Figure 4, apart from the United States, all other reviewed countries trended below the world average for total number of confirmed cases per million population during the review period. Given that the percentage of positive tests in the United States is increasing, it is probable that case detection efforts currently still lag behind Covid-19 transmission.

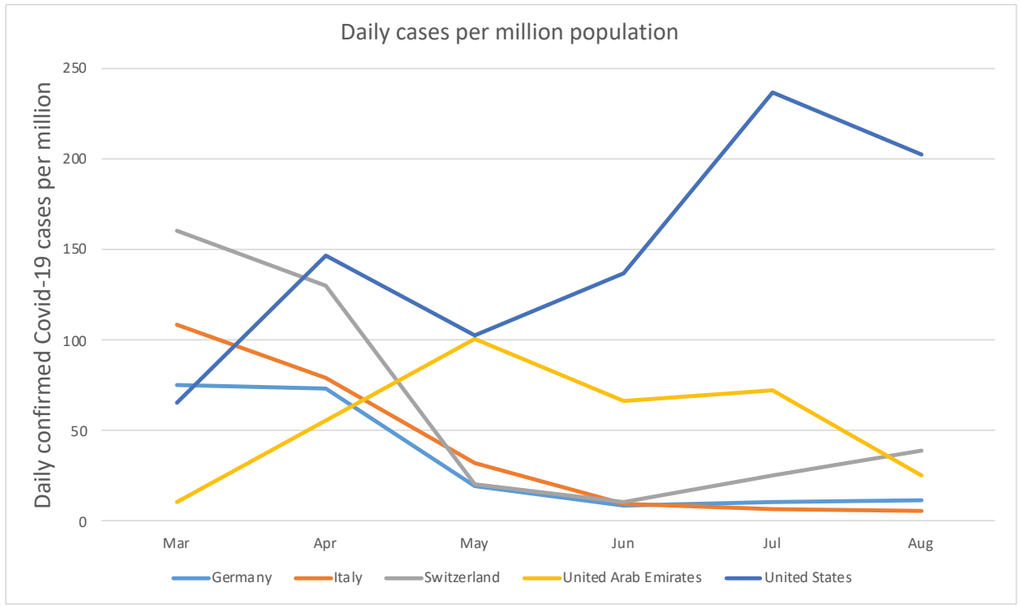

Figure 4: Daily confirmed Covid-19 cases per million population

Figure 5 compares total number of cases with total number of confirmed deaths of Covid-19 per million population. The UAE has a higher number of tests and lower number of deaths than other countries in the cohort. This could be achieved only due to its widespread testing and presumably more accurate assessment of community transmission. The population demographics and age are other factors that indicated lower death rate.

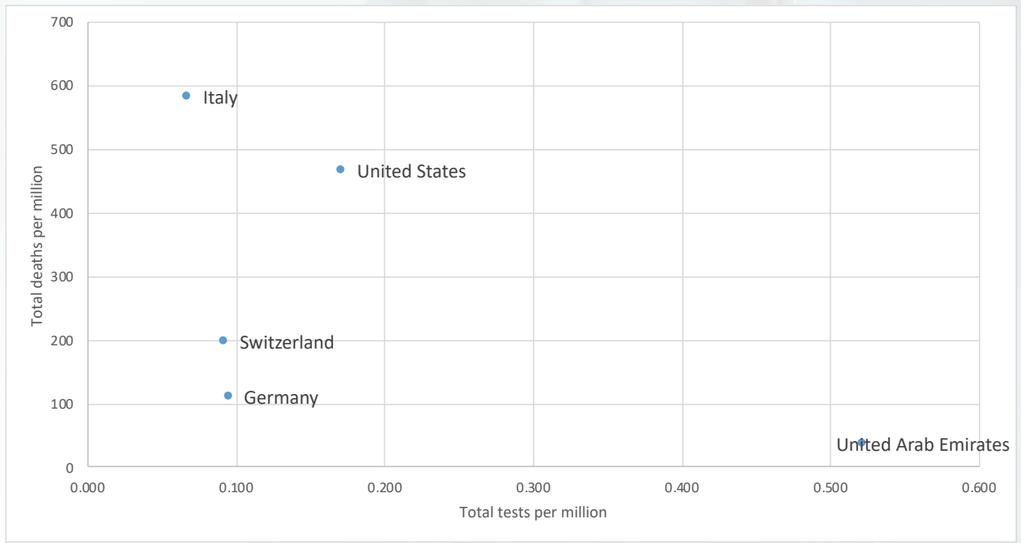

Figure 5: Covid-19 tests in relation to confirmed Covid-19 related deaths

02

CONTAINMENT

As shown in Figure 6, although the number of cases is dependent on testing coverage, the high number of cases in the US is presumed to be the result of poor containment given that the percentage of positive tests is generally increasing nationally.

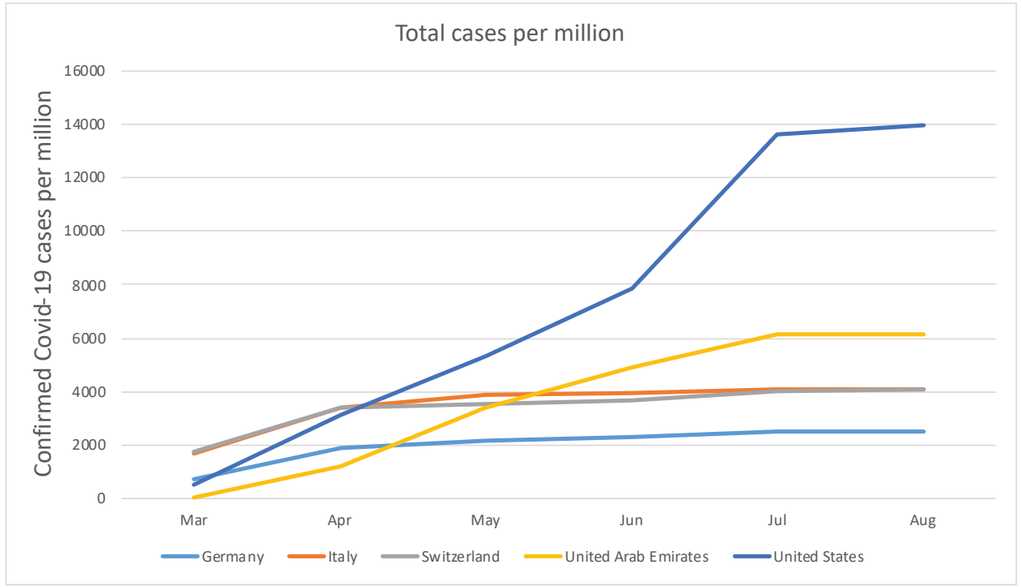

Figure 6: Confirmed Covid-19 cases per million people

The steep Covid-19 cases slope in the US could indicate high levels of transmission, a rapid increase in testing capacity, or a change in testing strategy to include, for example, asymptomatic or mildly ill people. The WHO has stated that in countries that have conducted extensive testing for Covid-19, percentage of positive tests should remain at 5% or lower for at least 14 days. In spite of the different authorities that provide healthcare in UAE, all seven Emirates followed a clear plan. Policies regarding testing of cases were unified and the screening test centers were provided for all Emirates.

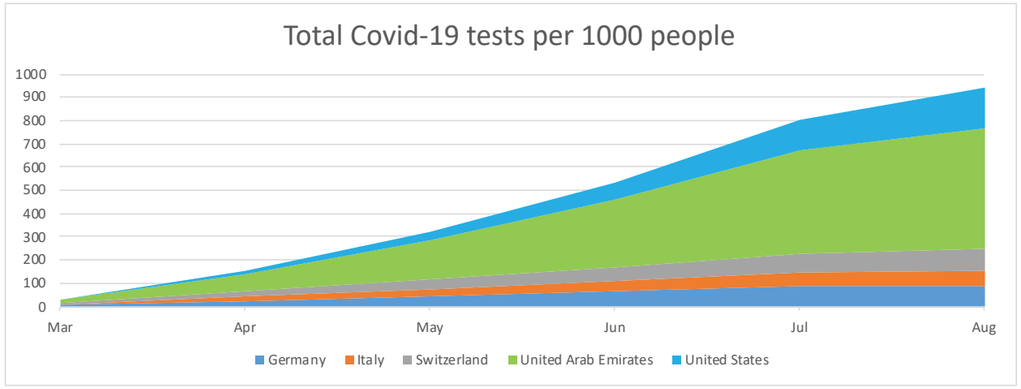

Figure 7: Covid-19 tests per 1000 people

As the date indicate, least half of the United States exhibited 8% or greater spike of the disease during the review period and 7.4% nationally as at July 2020. Despite increased testing since April 2020, the US still trails behind UAE in the number of tests per million population (Figure 7 and Figure 8).

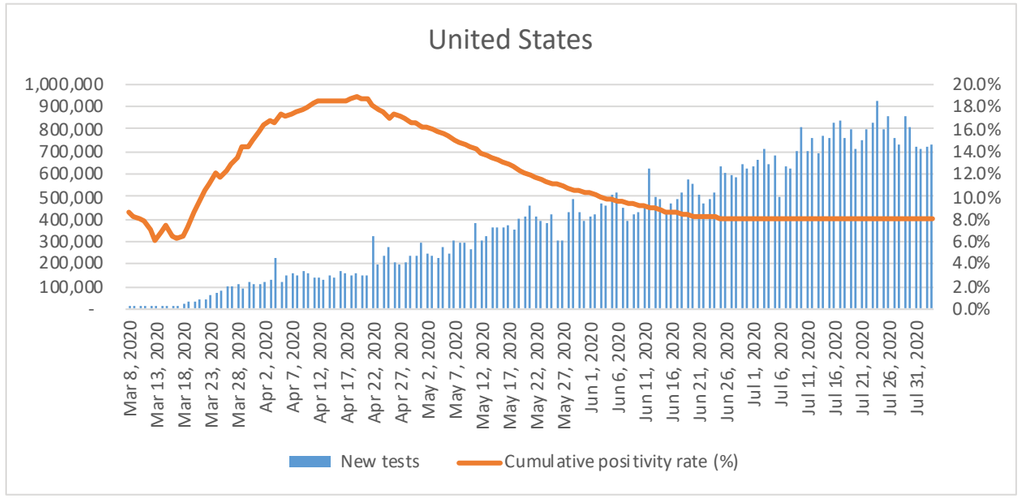

Figure 8: Rates of positive Covid-1 tests in the US between April and August 2020

Figure 9 reveals that the United Stated and Italy both had high Covid-19 death rate and high doubling time of confirmed deaths during the review period. Evidence from the data exhibits a strong indication of inadequately controlled Covid-19 infections. The UAE exhibits the most favorable trend of relatively low death rates and low doubling time of confirmed deaths, indicating adequate containment. It is noteworthy that, unlike the UAE, countries with high elderly populations (e.g. Italy) tend to have higher death rates from Covid-19 deaths.

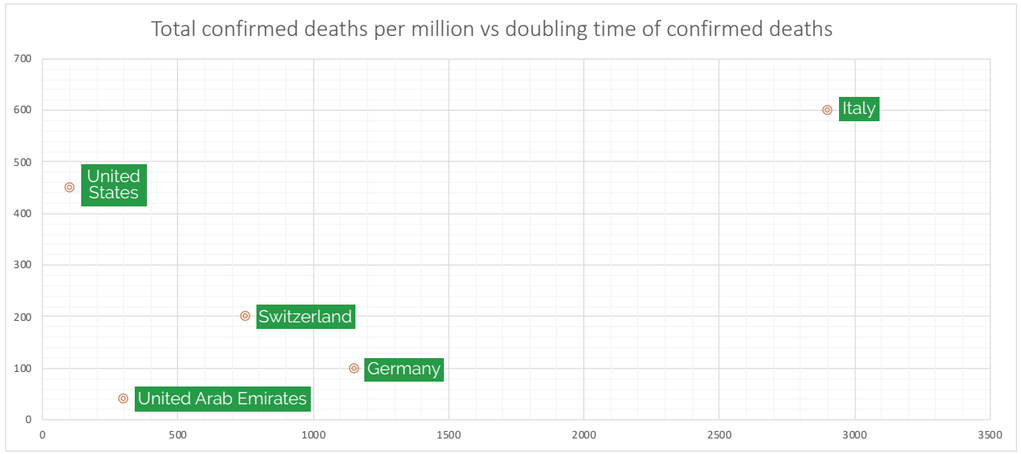

Figure 9: Doubling time of confirmed Covid-19 cases

Figure 10 reveals an apparent positive correlation between the case fatality rate and median age of death among the five countries. However, the direction of this correlation is not statistically significant (regression p-value > 0.1). UAE has the lowest case fatality rate and youngest median age of death of all five nations. UAE's case fatality ratio is 0.6%, compared with 4.72% for Germany, 5.4% for Switzerland, 5.5% for the United States and 14.2% for Italy (JHU, 2020).

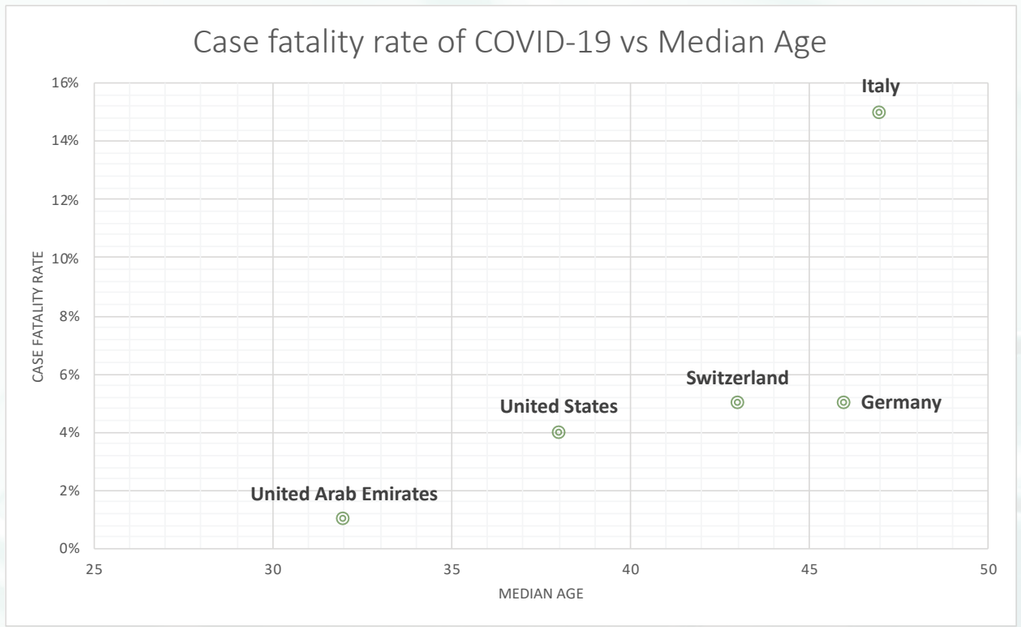

Figure 10: Covid-19 case fatality rate Vs. Median age at death

03 TREATMENT

Approximation of infection and mortality rate of case fatality rate are mediated primarily by testing coverage. A less biased indicator is excess mortality, which measures how many more people died in a given country over a given period than was expected. The number of confirmed COVID-19 deaths may differ from the total death toll due to the pandemic for several reasons, such as:

- differences in reporting of hospital and non-hospital deaths,
- Covid-19 confirmed and unconfirmed tests,
- changes in deaths from other causes,
- mobility restrictions may reduce road traffic fatalities as well as pollution-related diseases such as heart attacks, and
- increasing deaths from poverty and limited access to health services due to lockdowns (Mafham et al, 2020).

The August 2020 review of impact of Covid-19 on health systems based on data collected between March and June illustrate that 90% of countries experienced significant disruptions to provision of basic health services (WHO, 2020). The UAE has managed to keep basic health services provision ongoing with minimal disruptions through the use of telehealth services, centralization of Covid-19 treatment in the early phases of the epidemic, establishment of Covid-19 field hospitals, provision of adequate personal protective equipment for health staff, public education on access to treatment facilities for both Covid-19 and other ailments, and capacity building of regular health workforce as well as volunteers. These initiatives have largely kept UAE's health system resilient while drastically reducing the risk of nosocomial infections among staff and patients.

Figure 11 provides an indication of treatment efficacy for the five countries. The UAE has consistently shown the lowest fatality rate among all five countries. Case fatality rates may be skewed by testing programs focused mainly on the sickest people, or in countries like Germany and Switzerland with high proportions of older people.

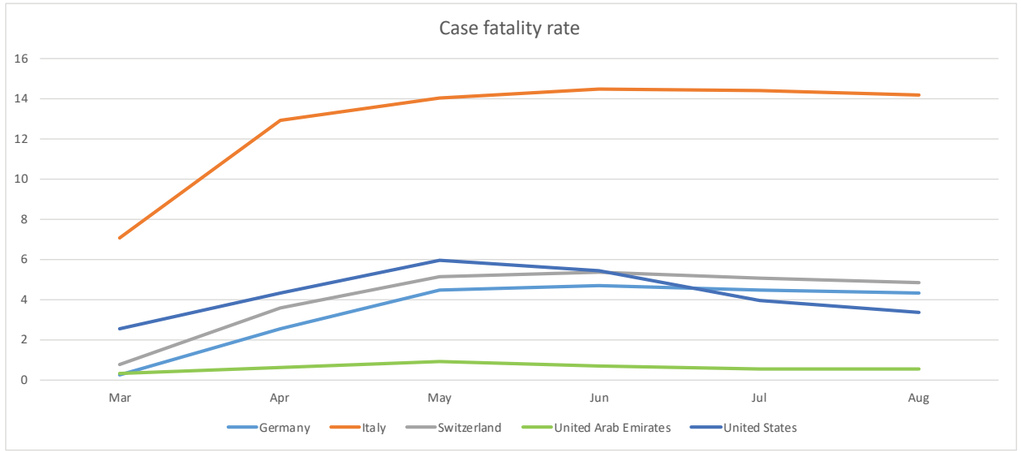

Figure 11: Covid-19 case fatality rates

As shown in Figure 12, the UAE has the lowest number of deaths and the second lowest number of confirmed cases among the five countries. This comparison helps provide more context about the drivers of case fatality rates. In all countries reviewed, the number of cases and number of deaths are directly proportional.

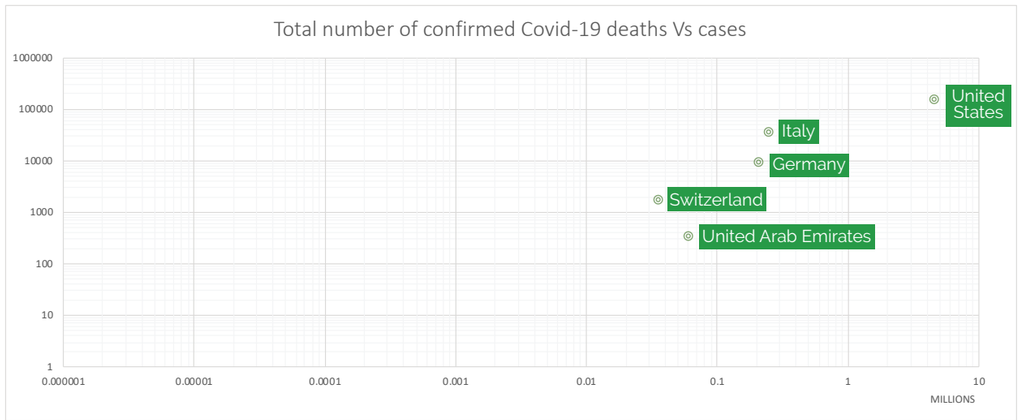

Figure 12: Total number of confirmed Covid-19 deaths Vs total confirmed cases

04

HEALTH SECURITY

The UAE is ranked among the top 3 countries for monitoring and detection, regional resiliency, and emergency preparedness. Only Germany is ranked among the top 3 countries on any three of the six measures. UAE's lowest ranking of 46 is however, in relation to the healthcare readiness measure. This measure is assessed based on factors such as availability of Covid-19 management facilities, health workforce availability in sufficient numbers and with the appropriate qualifications, level of healthcare technology advancement, and mobilization of healthcare resources.

Table 1:

Covid-19 comparative health security indicators. Rankings out of 200 countries/regions. Data source: http://analytics.dkv.global/covid-regional-assessment-200-regions/full-report.pdf

Country (overall ranking)	Ranking on Quarantine Efficiency	Ranking on Government Efficiency of Risk Management	Ranking on Healthcare Readiness	Ranking on Emergency Preparedness	Ranking on Regional Resiliency	Ranking on Monitoring and Detection
Switzerland (1)	3	4	3	21	9	10
Germany (2)	7	1	2	30	2	5
United Arab Emirates (11)	20	26	46	2	3	3
Italy (53)	54	58	45	38	55	58
United States of America (58)	71	97	62	13	54	86

DISCUSSION

Although Covid-19 was first officially reported to the WHO on 31 December 2019, it took at least 8 weeks for most health systems to respond to contain its rapid spread. By the end of April 2020, the virus had spread to almost all countries in the world. Italy's health system revealed major fissures in its health system in its response to Covid-19. In Lombardy and other severely affected Italian regions, the surge in Covid-19 cases almost overwhelmed its national health service, which has years of fragmentation and decades of finance cuts, privatization, and deprivation of human and technical resources. Lack of strategic leadership in Italy's healthcare system is a major factor in its lackluster response (Armocida et al, 2020).

In the United States, gross allocative inefficiency, e.g. simple but effective public health measures such as wearing face masks (Lyu and Wehby, 2020) are accorded lower priority than unproven therapies such as hydroxychloroquine (Cavalcanti et al, 2020), inadequate political will, and sub-optimal national health leadership all created a situation in which the country currently records a third of total global cases and a quarter of global deaths. Being the only OECD country with no universal health coverage, the United States exemplifies fatality ratio playing an important role of social and structural determinants of health in the epidemiology of Covid-19. Empirical evidence has shown that Covid-19 infection rate is three times higher in predominantly Hispanic and African American locales than in predominantly white counties, and the case fatality ratio is about six times higher (Abrams and Szefler, 2020).

Germany's health system's response to Covid-19 is impressive and illustrative of how well structured health systems combat health crises. With regards to testing, for example, as on 15 March 2020, 167,000 Covid-19 tests (2,023 tests per 1,000,000 population) were performed, compared with 18 tests per million population in the United States, and 990 tests per million population in UAE. Agility is evidenced in the manner in which German laboratories adapted quickly by doubling staff in order to at least prevent human resource shortages, and at the same time, repurposing public health offices into temporary Covid-19 testing centers. Germany has the highest number of hospital beds per population in Europe (8.0 hospital beds per 1,000 population, including 34 ICU beds per 100,000 population). The German hospital sector is highly decentralized resulting in a very good accessibility.

These facilities, adequate workforce and treatment infrastructure, coupled with a remarkable strong political leadership of the Chancellor, Angela Merkel, whose reflective, motivational and science-led style facilitated commendable efforts at Covid-19 control in Germany. A doctoral degree holder in quantum chemistry, she was the first leader to speak up and provide unfiltered facts about the threat posed by Covid-19 in Germany and globally. She activated stereotypes of female leaders as trustworthy and competent public health champions. Chancellor Merkel's government relied on experts from well-funded scientific research organizations, including public-health agencies such as the Robert Koch Institute and the country's network of public universities to guide the formulation of evidence-based policies and programs. Germany operates a federal system based on subsidiarity with cooperative political decision makers, which allows for a consensual policy approach while providing flexibility for states and counties. It is well entrenched in enhancing the acceptance of evidence-based measures and regulations related to Covid-19 such as wearing masks and social distancing. (Deutsche Bank Research, 2020).

Switzerland has an extremely well developed health care system which upholds the principles of universality and equality through means such as compulsory health insurance. The first Covid-19 case in Switzerland was identified on 24 February 2020 in the Southern/Italian-speaking canton of Ticino, and the virus was considered to be of moderate danger to the Swiss population. On 27 February, the Swiss Federal Office of Public Health launched an information campaign, containing three key messages on rules of hygiene and conduct:

01	02	03
Wash your hands thoroughly	**Cough and sneeze into a handkerchief or on your elbow**	**Stay home in case of fever and cough**

Flyers were distributed at border crossings of Italy as well as in major train stations and motorway service areas. Posters informed border crossers and travelers about important rules of conduct. Wide public acceptance and adherence to the safety measures and other health communication campaigns undoubtedly contributed to successful efforts to contain Covid-19 in Switzerland. Since 25 June, the SwissCovid mobile contact tracing app, based on decentralized privacy-preserving proximity tracing concept is being used (FOPH, 2020). As Covid-19 cases and deaths (138 cases between 1-4 August and zero deaths on 2 August) become steady to low levels despite high levels of Covid-19 testing, most restrictive measures have been lifted. Only the ban on large-scale events remains in place until the end of August 2020.

The UAE has demonstrated exceptional competence in addressing Covid-19 related to issues at national, local, and municipal levels. At the national level, the government coordinated remarkable health systems with agility; it exhibited the ability of an organization to react to a rapidly changing environment. Core pillars of agile government such as gracefulness and foresight, collaboration and resilience, as well as harmony and legitimacy were the hallmark of the UAE government (Tolf et al, 2015). The UAE central government also implemented performance intelligence approaches, incarnated in the structured approach to acting on health policies, using knowledge and information generated by applying scientific methods and comparable healthcare data to systematically measured indicators of health systems and its performance (Kringos et al, 2020). At the local and municipal levels, a joined up approach was utilized in formulating and effectively implementing regulations contained in the schedule attached to the UAE Federal Law No. 14 of 2014 on communicable diseases. In addition, the UAE cabinet resolution 17 of 2020 regulates the implementation and violations of precautionary measures designed to address Covid-19 (UAE Cabinet, 2020). All aspects of the health system were strengthened to address Covid-19 with impressive outcomes. However, one area in which UAE scored relatively low ratings (46 out of 200 countries and regions) is in relation to healthcare readiness for emergencies. This aspect was assessed using parameters: COVID-19 equipment availability; mobilization of new healthcare resources; quantity and quality of medical staff, level of healthcare progressiveness; level of technological advancement; and epidemiological system level of development. The result indicates that while the UAE has overall above average quality and quantity of medical staff, there are insufficient numbers of psychiatrists, respiratory physicians, and intensive care nurses and doctors.

FUTURE RESEARCH

This report emphasizes on the importance of collaborative research involving all healthcare stakeholders managing Covid-19 in the UAE to ensure a larger sample size and significant research results. This report calls for the need for Covid-19-related research in general, and more specifically research that will enable:

- Better understanding the nature of transmission of and exposure to the virus, including quantifying the infectious dose, and transmission from asymptomatic cases and children.
- Better understanding susceptibility of different populations in terms of age, sex, ethnicity, and demographics.
- Understanding social distancing measures that are most effective at preventing or reducing spread of SARS-CoV2, and how such social distancing and isolation measures may be most effectively relaxed.
- Examining the role of environmental exposures in impacting individual susceptibility to SARS-Cov-2 infection, or the development and severity of COVID-19 disease.
- Investigating the role of lifestyle factors (diet, physical activity) as modifiers of the effects of environmental exposures on the development or severity of COVID-19 disease.
- Leveraging existing biological samples or data from human or animal research studies to test hypotheses examining the impact of environmental exposures on susceptibility to SARS-Cov-2 infection and COVID-19 disease severity or progression (e.g. detection of SARS-Cov-2 infection in an existing environmental epidemiology study).
- Utilizing previously developed research tools or technology platforms that can be applied in order to understand how environmental exposures affect COVID-19 spread or progression and severity of the disease (e.g. personal exposure monitoring, geospatial mapping, risk modeling tools, biomarkers to detect infection).

- Understanding the role of exposure-induced perturbations in respiratory microbiome and its contributions to COVID-19 susceptibility and disease progression.
- Assessing the impact of COVID-19-related interventions (including social or physical distancing or public health messaging) on changes in the spread of COVID-19 as well as environmental exposures and related human health outcomes.
- Determining the potential health effects of increased personal/community use of disinfection products for COVID-19 control.
- Developing or applying educational, community-based, or other public health strategies that address the intersection between environmental exposures and COVID-19.
- Identifying climate or weather-related factors that influence population susceptibility to SARS-Cov-2 infection and COVID-19 disease.
- Realizing the need for properly designed multi-center randomized clinical trials to assess the effectiveness of some biological agents used in UAE to treat COVID-19 infected patients.
- Realizing the need for prospective studies to assess the clinical long-term effect of COVID-19 on certain populations, such as children born to infected mothers, and patients with cardiac or respiratory disease.

CONCLUSION

The Covid-19 pandemic has underscored the prime importance of a well-functioning health care system. Countries that ensure affordable, efficient, and equitable access to quality care (such as Germany and UAE) are at a clear advantage when it comes to mitigating adverse effects of Covid-19. Fighting COVID-19 requires a comprehensive approach, including health systems well prepared with adequate equipment and trained staff. Strong health systems are one of the six elements, along with contact tracing and testing, that WHO officials have identified as essential for managing the virus' spread regardless of its transmission phase in its February 2020 Covid-19 Strategic Response and Preparedness Plan. A defining feature of Covid 19 is the considerable stress placed on health systems and health workers by the large proportion of Covid-19 patients who may require quality and intensive clinical care. Furthermore, Covid-19 impacts have led to an acute substantial shortage of essential supplies, including personal protective equipment, diagnostics, and supplies for clinical management. This has made the procurement and delivery of resources on the basis of need extremely challenging. An effective and sustainable Covid-19 supply chain system is essential. Apart from the United States, which is among 17% of countries globally yet to develop Covid-19 national preparedness and response plan, the other four counties in this scoping review have developed and effectively implemented such plans.

The Covid-19 pandemic is a complex global public health crisis presenting clinical, organizational, and system-wide challenges. Health systems research is very important in Covid-19 response, which forms an integral part of the leadership and governance functions of health systems of the country. Research on the adequacy of health systems as well as research that provides an evidence base for biological (vaccination) public health (use of face masks) and case management (use of dexamethasone) initiatives are urgently required. The WHO global research roadmap comprises three core principles: speed, scale, and access (WHO, 2020c). Performance intelligence as indicated by the data highlights the need for different research perspectives in support of decision-makers in health systems to determine policies based on well-informed choices.

The coronavirus pandemic has tested health care systems and their capacities around the world in their efforts to care for patients and protect their health workers in a time of crisis. Some countries, such as Switzerland, quickly implemented pandemic-response plans, helping them to promptly halt the spread of Covid-19. Others, such as the United States, failed to act early, and their health systems have been overwhelmed with patients. In some cases, such as UAE, decisions by federal and local leaders aimed at halting community spread, such as travel bans and lockdowns, have made the difference in keeping outbreaks manageable. This review is the first study to compare the UAE health system with global leading health systems with regards to Covid-19 response, using key performance indicators related to detection, containment, case management and health security. Despite having the lowest expenditure both per capita and as a percentage of GDP, the UAE health system's response to control Covid-19 is commendable.

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