Abdullah A. Alhadhira, 2020;1(2):037–044.
https://doi.org/10.24911/SJEMED.72-1589573868

COMMENTARY

"We Are All Responsible" is a Saudi swarm intelligence leadership in the face of COVID-19

Abdullah A. Alhadhira

The Kingdom of Saudi Arabia (SA) is blessed with many assets and holds the admiration of Muslims and non-Muslims across the globe irrespective of their nationality. This admiration also arises from the fact that both, Makkah and Al Madinah, the two holy cities are located here. Before the Kingdom recorded even a single case of coronavirus disease 2019 (COVID-19), the leadership in conjunction with Grand Mufti of SA, to ensure safety, banned all worshippers from performing pilgrimage at the holy city of Makkah and stopped all visits to Al Madinah. This, undoubtedly, halted the advance of the deadly pandemic [1,2]. However, the Kingdom of SA has a unique geopolitical environment and immense cultural diversity, and one-third of its population constitutes of expatriates with strong national social ties, leading to population demographic variance with a majority of the population being young. Furthermore, the country also has certain economic complexities as it is the world's energy supplier. Based on these factors, it was imperative to take strong and early measures to limit the spread of COVID-19 pandemic [3,4].

In Preparedness

The Government of SA has invested in its young generation to be ready for any incidents that may be a threat to its nation's safety, security, health, education, economy, or environment [4,5]. The Saudi government in conjunction with its leadership and healthcare officials established the outbreak, epidemics, and pandemics (OEP) preparedness plan, which has been made a part of the Saudi Central Board for Accreditation of Healthcare Institutions, after the Middle East respiratory syndrome-related coronavirus (MERS-COV) outbreak in 2012. The Ministry of Health (MOH) and the related sectors have invested resources and efforts to build expert teams that are equipped to deal with emergency, disaster, and crisis management [6,7]. A national disaster framework has been built to address the top five risks, such as geopolitical sensitivity or instability (for example, Hajj incidents and Gulf War), OEP risk (malaria, TB, MERS-COV, Ebola as risk, and others), industrial disasters (attack on Saudi Aramco and industrial accidents), technomechanical failure risks (IT cyber attacks), and environmental hazards (for example, Jeddah flood) [8,9]. At the pandemic that the world is dealing with at this point, the COVID-19 is an infectious disease caused by the severe acute respiratory syndrome coronavirus 2. The disease was first identified in December 2019 in Wuhan, China, after multiple outbreak clusters were reported. On January, 2020 [10], the World Health Organization (WHO) formulated the Incident Management Support Team and Emergency Committee under the International Health Regulations (IHR 2005) and declared this as an epidemic and a Public Health Emergency of International Concern. In February 2020, the WHO released the international community's strategic preparedness and response plan to help protect countries with weaker health systems and established the research and innovation forum. Following that, in March 2020, the WHO announced the outbreak of COVID-19 a pandemic and directed all the countries to scale up the response level [11].

In Response to COVID-19 Pandemic

The Custodian of The Two Holy Mosques, King Salman announced a state of national emergency on March 19, 2020. The MOH has been assigned as the lead response agency for the COVID-19 pandemic and has established the National Incident Command System (NICS), and the Minister of Health is to function as the National Incident Commander (NIC). The National Emergency Control Center (NEOC) and the National Health Command and Control Center triggered full scale 13 Regions of Joint Operation Centers with 15 emergency support functions (ESFs) to function under the directions of the NICS as per the National Emergency Framework to report to the Royal Court to limit the spread of the infection [12]. On April 7, 2020, the Saudi NIC announced that the epidemiological studies expect the number of potentially infected cases to range from 10,000 to 200,000 cases which is equivalent to 0.03%–0.6%of the total population of SA, of which 4%–11% may

Correspondence to: Abdullah A.Alhadhira, MD. MBA. Director of Office of Emergency Management at Johns Hopkins Aramco Healthcare, Dhahran, Saudi Arabia.
Email: alhadhira@yahoo.com
Full list of author information is available at the end of the article.
Received: 15 May 2020 | **Accepted:** 16 June 2020

have to be admitted to the intensive care unit (ICU). However, the existing ICU facility space and staff constitute less than 5% of the whole healthcare sector, and the resources are scarce. To address this limitation, the Healthcare Research Committee called in the expert team in critical care, disaster, and crisis management to study the surge capability (staffing and stranded of care) and capacity (space, supplies, services, and pharmacy) of the hospitals. The team also developed a strategy to address the needs and establish and execute an integrated strategy to face the COVID-19 pandemic, ensuring that it is person-centered and focuses on safety and security [11,13,14].

Flattening the Curve Strategy

The government established a swarm strategy to address the COVID-19 pandemic. King Salman addressed the nation and stated "we rely on the resolve of our citizens and residents, their determination, and sense of responsibility to fight coronavirus," ***We Are All Responsible*** [15,16]. This attempt stems from a strong and focused intent to lessen the impact of COVID-19 in the Kingdom of SA based on science and a realistic approach. Crushing the curve is a hope of a dreamers; however, the aim at this point is to flatten the curve to ensure that the healthcare system is not overwhelmed, and the number of mortalities is lowered. The concept of the swarm leadership strategy has been known since 1981 in complex crisis leadership, and it includes the following features: unity of mission, generosity of spirit and action, stay in lanes, no ego–no blame, and a foundation of trust. The ***We Are All Responsible*** strategy has all five key elements [17]. To execute the ***We Are All Responsible "Saudi swarm strategy in the face of COVID-19 pandemic,"*** a simultaneously well-coordinated response of mobilizing citizens, communities, and cities in conjunction with the country higher authority (Royal Court) to lower demands can be less than resources and can have an endpoint result of mortality rate (MR) less than 1% in 90 days (Figure 1) and lessen the economy negative impact. In an initial situational awareness, a sufficient data were collated from the WHO, Centers for Disease Control (CDC), Chinese health officials, and Italian health delegations, and a communication network was built to identify the pathogen, the pathophysiology of the virus, case definitions, epidemiological facts related to how rapidly is it spreading, high-risk age groups, and what are the vulnerabilities that could have an impact on SA [10,18,19].

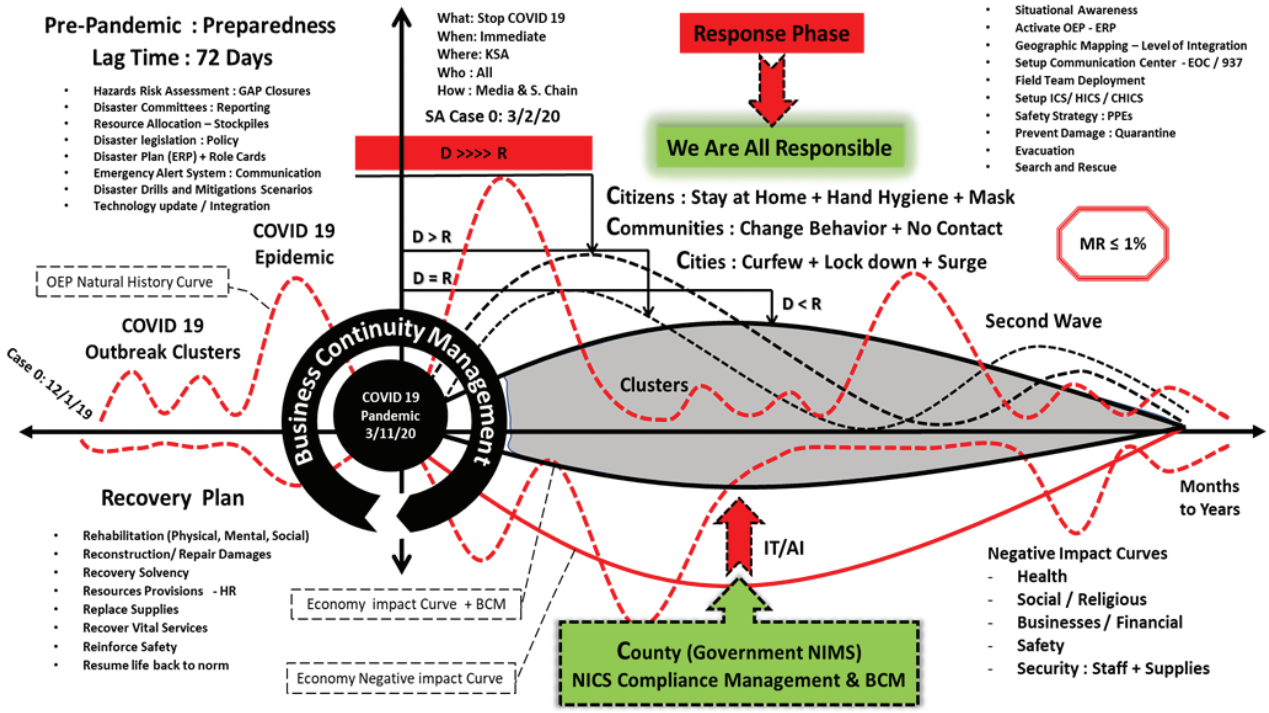

Figure 1. *Observed Saudi Arabia's COVID -19 emergency management cycle, and the natural history of Outbreak, Epidemic, Pandemic (OEP) exhibited on red dotted graph. On Response phase "We Are All Responsible" Swarm Intelligence Strategy extrapolated via mobilizing citizens, communities, cities, and the country simultaneously had lowered demands (D) to be less than resources (R), end result of mortality rate (MR) less than 1% in 60 days. Below the timeline is the negative impact of pandemic, Business Continuity Management (BCM) pledged the negative impact using technology (information technology : IT/artificial intelligence: AI). NICS: National Incident Command System. (© alhadhira @Johns Hopkins Aramco Healthcare, OEM).*

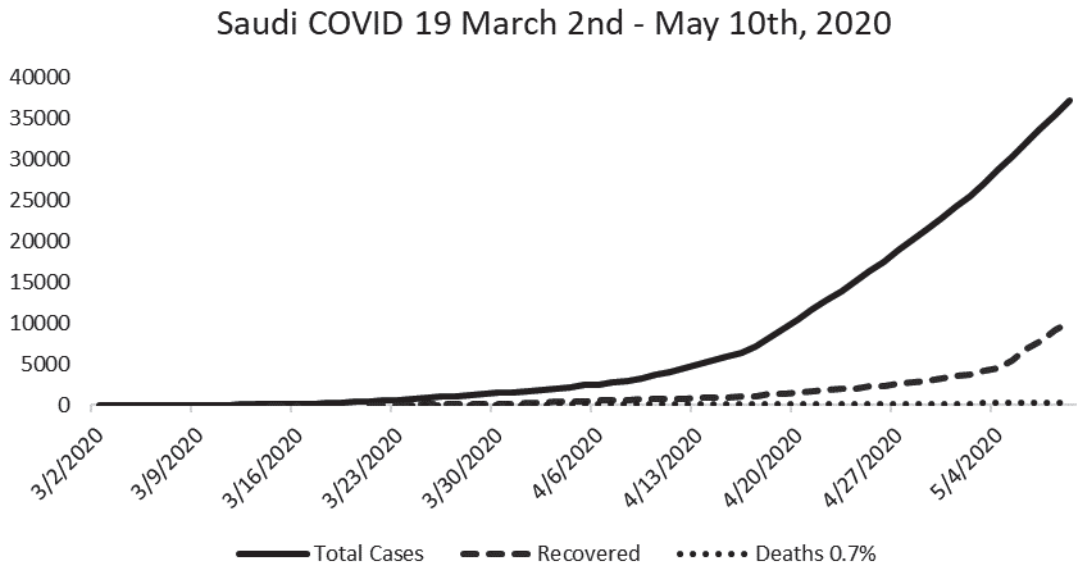

Figure 2. *SA COVID 19 density curve of total cases, recovered cases, and deaths for the period of March 2–May 10, 2020. The MR is 0.7%. For the period, SA COVID 19 curve is increasing with a rate of 19%.*

We Are All Responsible—Citizens and Residents Level (Cold Zone in Crisis Terminology)

The primary focus at this level is to prevent the spread and transmission of COVID-19 with the assistance of mass media that compels people to "Stay at Home – البيت خليك في and by ensuring that the sufficient supplies of sanitizers and masks are available. Staying at home, avoiding crowded places, maintaining distance from others, especially the high-risk elderly, washing hands with soap and water often and for at least 20 seconds, practicing good respiratory hygiene, and avoiding touching the eyes, nose, or mouth with unwashed hands are highly recommended. It is also recommended that one should cover their mouth and nose with a tissue when coughing or sneezing, and if a tissue is not available, the inside of the elbow should be used. For pandemic related panic management and to ensure security, the social media, television channels, and traditional media have been tapped. Furthermore, efforts were made to ensure that basic survival elements and infrastructure including availability of food supplies, water, sanitation, and electricity and attempts have been made to ensure that the cost of these stays stable. A 24-hour help line has been established, and social media channels are being monitored to address any shortage or complaints and firm rules have been established for any violations [9,20].

We Are All Responsible—Community Level (Warm Zone in Crisis Terminology)

Social distancing strategies aimed to reduce the contact of infected persons with large groups are propagated at this level. This is achieved by closing schools, sport centers, malls, and recreational centers and canceling educational activities, large public gatherings, and mosques prayers. This has been achieved by activating the ESFs of the "Ministry of Education, Minster of Human resources, and Ministry of Islamic Affairs, Dawah and Guidance." Social distancing guidelines also state that people should maintain a distance of at least 6 feet (1.8 m) between each other. By following social distancing guidelines and adhering to the stay-at-home orders, many regions have been able to maintain an effective transmission rate of $R_t \leq 1.5$, which indicates that the spread of the pandemic is slow in these areas. A simple model needs on average over to be kept at or below zero to avoid the exponential growth as a key part of managing COVID-19 is trying to decrease and delay the COVID-19 pandemic peak, known as "flattening the curve." This can be achieved by slowing the spread of the infection so as to reduce the pressure on health services, consequently allowing better care and treatment for active cases. This also delays additional cases until effective treatments or a vaccine becomes available [21,22].

We Are All Responsible—Cities' Level (Red Zone in Crisis Terminology)

SA has four cities with more than a million people, 20 cities with between 100,000 and 1 million people, and 45 cities with 10,000–100,000 people. The largest city in SA is Riyadh, with a large density of population. Saudi's COVID-19 National Incident Command implemented the following strategies at this level [23]. ***First, curfew strategy for 24 hours:*** this limited the spread of COVID-19, and hence, the MR was maintained at 1% or less. The span of day-to-day rate of duplication kept

between 7 and 11 days. In addition, the 24-hour curfew indirectly limited the number of patients admitted to the hospital, and this prevented creating pressure on the available healthcare resources. On March 30, 2020, the confirmed cases in SA were over 22,000, a number of people who have recovered are 3,163 (14%), and deaths are 162 (1%). The number of people infected is over 19,000. The cases have been doubling every 9 days, and the number of people in a critical condition is 125. A total number of people tested are 200,000, whereas the number of confirmed cases in the past 24 hours is more than 1351, recovered is more than 210, and the number of deaths is more than 5. Currently, there are 654 positive cases per million [24–26]. ***Second, lock down of points of entry of inter-cities and inner-cities:*** airports have been identified as major points of entry for people infected with COVID-19. As per the directive issued by the WHO, on February 2020, airports' screening measures were in place for all flights originating from highly infected areas, along with proper case identification, 14 days' self-isolation policy, flights' diversions, self-reporting policy, traveler education, and airline-related measures. The General Authority of Civil Aviation has taken the proactive steps to prevent the spread of COVID-19 in cooperation with the MOH. These preventive and precautionary measures in the aircrafts or inside the airport terminals include training of flight crew to deal with suspected cases during flights by using decontamination tools, conducting isolation procedures, and submitting the necessary reports to the MOH on the arrival of the aircraft. Furthermore, thermal cameras have been installed to ensure the safety of all passengers. Health practitioners and medical teams have been made available. On March 14, 2020, the government NICS suspended international flights in response to the increase in the number of COVID-19 cases across the world [25]. ***Third, quarantine and alternate care sites:*** the NICS implemented this strategic plan with the understanding that the pandemic knows no boarders in an attempt to filter all the potential cases that could be coming from other countries. The government is using hotels, schools, dormitories, field quarantine, and tents for isolating asymptomatic cases. In addition, primary care level hospitals and secondary care level hospitals are being used as quarantine sites for potential cases with mild symptoms. All quarantine sites have independent single unit air conditioners for every room, and primary medical care, nutritional food, COVID-19 testing, masks, sanitizers, educational material, and psychosocial support are provided along with proper security on site to ensure complete compliance. Patients with mild or moderate symptoms, after a completion of 14 days of quarantine and two swab tests that give a negative result, are released and declared as negative or recovered cases. With this precautionary measure, the chances of transmission to other family members is greatly reduced. This process to quarantine is practical unless the pandemic has spread widely in a particular city. To identify the fifth group, which includes those who were previously infected, have recovered, and are adequately immune, the process requires development, validation, and deployment of antibody-based tests that are used for convalescent plasma therapy in severe COVID-19 cases. This would be a game changer in restarting parts of the economy quickly and safely [24,25]. ***Fourth, healthcare:*** the MOH has activated the OEP emergency response plan which is based on the following four pillars: public health, emergency medical services, hospital pandemics incident command system, and activate hospitals' emergency management response plan for surge capacity and surge capability planning [14]. The Saudi healthcare system constitutes of a combination of government owned hospitals and private sector hospitals with a total of 494 hospitals with a total bed capacity of 75,225, and approximately 5% of these are critical care beds [27]. The *Pandemic Tier Triage System* has been implemented to ensure a wide safety net and security for all healthcare workers and hospitals by early recognition of potential cases. This includes the public self-triaging system, car triage system, door triage system, and vital sign-based triage system. The MOH made a media announcement to communicate that all citizens and residents who meet any of the following criteria: recent travel, contract of COVID-19, healthcare workers in COVID risk area, and positive case definitions with "respiratory, GI, and URI" have to report to predefined screening centers for COVID-19 or have to call the hotline "937" for notification and directions [14,28]. Based on the triage system and the "swabbing" screening methodology, the population has been divided into asymptomatic home self-isolation group, asymptomatic or mild symptomatic MOH quarantined group, and symptomatic hospitalized group. The NICS executed a surge capacity and secured across 13 regions of the kingdom, level 1 COVID-19 hospitals that would be equipped with negative pressure rooms, complete C and D personal protective equipment (PPE), supplies, pharmaceuticals, ventilators, continuous renal replacement therapy, and Extra Corporeal Membrane Oxygenation (ECMO) and would also be linked with an electronic dashboard to the NEOC [28–30]. The MOH has assigned medical technical subspecialist team in infectious diseases, personnel from disaster medicine, researchers, and scientists to draft daily updated clinical guidelines for COVID-19 case management which is to be formulated on evidence-based medicine to ensure proper standards of care for all admitted patients. Furthermore, backup overflow level 2,3, and 4 COVID-19 hospitals have been designated to support any potential surge in the number of patients and an increase in the requirement of ICU beds. Field hospitals have been established to test and to support the cities' local health directorates. The NIC ensures that unified accurate data entry is maintained by linking the COVID-19 Centralized Laboratory Center with the Public Health Solutions for Diseases Surveillances and Management— Health Electronic Surveillance Network (HESN) حصن (Figure 2) [30]. All screened patients are being tracked, and follow-up contact tracing information is being collated. Healthcare workers through HESN and Saudi Center for

Disease Prevention and Control (Weqaya—وقاية) [28–30] are being monitored as well. It has been established that everyone does not have to be tested although anyone who falls into the category of high risk (recent travel, contact with a positive COVID-19 case, healthcare workers, and those who meet the positive case definition criteria) has to be tested. Swabbing protocol has been clearly instated. These measures are the key to success in the strategic plan and were adopted based on the example set by South Korea. Decisions related to managing the cases depend on sound clinical evaluation, identifying high-risk patients, and the results of diagnostic tests. Without proper diagnostic tests, it would be impossible to trace the scope of any clusters of infection. It is imperative to use creative ways to mobilize the nation's research laboratories to assist with population screening and to refer persons who screen positive for further evaluation. Currently, polymerase chain reaction assays to detect viral RNA are being employed through preapproved test sites in some hospitals that are geographically away from other care centers. People with the signs and symptoms of COVID-19, those who are at high risk and have not tested or initially test negative, those who have been exposed to COVID-19, those who are not known to have been exposed or infected, and those who have recovered from infection and are adequately immune are considered to be either carrier or recovered immune. We are utilizing Saudi ingenuity to develop new treatments and initiatives that are being taken to develop a vaccine and to provide a greater variety and number of diagnostic tests and are looking at using the power of information technology, social media, artificial intelligence, and high-speed computing to devise novel solutions. It is imperative that everyone works toward reducing the risk of exposure and supports their friends and neighbors in this critical time [28].

We Are All Responsible—Country Level (Red Zone in Crisis Terminology)

While taking into consideration SA as a country during the COVID-19 pandemic, the government has focused on two priorities. ***Priority A—compliance and monitoring management of pandemics national incident response plan***: the country's higher authority (Royal Court) has been ensuring that all National Incident Management agencies of COVID-19 follow the directives of the NICS incident Commander (Minister of Health) under a unified command system—command, control, coordinate, and communicate–which is intended to align all the government agencies and ESFs to one goal, which is to fight and flatten the curve of the pandemic. To achieve this, an hourly electronic dashboard has been established for the high authority (Royal Court) to issue informed, accurate, and transparent decisions. The government identified the challenges of COVID-19, which include the prolonged span of the pandemic (duration), the response of multi agencies, and the complexity of its impact. The NICS of MOH gives daily public briefings and holds media meetings, and once a week, the NIC (Minister of Health) attempts to give an update to the nation and the expected outcome based on transparent evidence. The government is also taking security measures that include managing rumor spreaders, religion mongers, curfew violators, and opportunist suppliers. These people are appropriately prosecuted to ensure the safety and security of the nation. The government has been ensuring access to supplies, including PPEs. The healthcare workers are being treated as being the Saudi White Army or the nation's healthcare soldiers as they battle the pandemic. The national stockpile distribution centers, "medical and non-medical," have deployed ventilators and other equipment to hospitals that are in dire need of the same. Despite the best efforts being made by everyone, the crisis standards of care have been issued by islamic bioethicists to ensure that ethically sound decisions are made regarding the use of available equipment and supplies. Financial support is being offered to the healthcare sector through government monetary fund restructuring to meet the demand of healthcare staffing, supplies, system, structural design, and services. The Government of SA and the Government of the People's Republic of China signed a SR 995 million contract to provide 9 million tests to diagnose COVID-19 in the Kingdom and also equipment and supplies. Furthermore, 500 Chinese specialists and technicians would be made available, six regional laboratories would be established, and the genetic map of a number of samples in the Kingdom and the immunity map in the community would be analyzed, covering 1 million samples. Alongside this, China would assist in setting up a mobile laboratory with a capacity of performing 10,000 tests per day, training Saudi cadres, conducting daily tests and comprehensive field tests, and ensuring the quality of service for 8 months. With purchases from several other companies in the United States of America, Switzerland, and South Korea, the number of available tests is at 14.5 million, which covers around 40% of the population of the Kingdom of SA [31].

Priority B—business continuity management (BCM) during COVID-19: At the time, when the pandemic was announced, the higher authority (Royal Court) faced a very complex situation. Frist, it had to address the internal issues including safety, security, maintain vital services, pilgrimages, holy month of Ramadan, oil industry, and other issues. Second, the external factors such as international geopolitical active issues of Yemen safety, G20 meeting, out of kingdom Saudi citizens, and other matters that are beyond the scope of this paper had to be considered. The point to be noted here is that this health concern was a complex threat that had an impact on various factors. Saudi government displayed the ability to continue conducting business regardless of the crisis, and other disruptions affect internal and external business in much the same way even if it is not happening [32].

The BCM risk assessment and impact analysis helped to identify disruptive scenarios for businesses (governmental and private) and to prioritize the order of different business continuity plans (BCPs). Each BCP is a practical

and simple step-by-step document issued to explain how business should be continued during this time to initiate recovery after the pandemic is over. The potential impact analysis of a pandemic and the risk assessment is unique to each Country Business Line—governmental or private. The consequences of the business disruption due to a disruptive scenario include a large portion of workforce being absent due to illness having to temporarily shut down one or more services due to the spread of disease and the inability to travel or access buildings or assets due to quarantine or interruption in the supply chain. To address these scenarios, a Saudi research team of national, international, and local government policy makers was placed, and it executed BCPs based on the capability of each sector and the workforce. The business impact analysis also identifies key services and functions, and this cannot be done without considering the workforce, facilities, technology, suppliers, the minimum number of staff needed to stay open, the industries or other services that the business is dependent on, and the processes that are imperative to ensure that essential supplies are available. It also takes into consideration the impact that would be seen over several days, weeks, or even longer that would include lost or delayed workflow, increased expenses, regulatory fines, dissatisfaction, and damage of reputation. The mitigation strategies to address these impacts have led BCPs to propagate the outsourcing of workforce, expand capability with redundant staffing, or transfer work to other facilities if the employees are absent. This is done by considering the potential impact of the crisis and how long the impact can last for and when is it expected to reach its full destructive potential [33,34].

Business processes are classified into office-based jobs (non-mobile) and field-based jobs (mobile). On the basis of technology, they are classified as those based on teleconferencing, electronic applications, web-based solutions, e-commerce, digital and electronic banking, telemedicine, telehealth, and other. The use of technology has assisted in limiting the spread of the pandemic and ensured that businesses could continue without the need of commuting and travel during the pandemic. Field-based jobs were further segregated into high-impact services (for example, healthcare, law enforcement, military sectors, electricity, sanitation, water supplies, water treatment, energy, communication, and supply chain services) and low-impact services (recreation, sport, media, locked services, trading services, marketing services, restaurants, shops, and so on). For high-impact services, the daily working hours have been extended and the duty periods have been shortened, and also, the steps have been taken in terms of staffing model modification, policy modifications, emergency contract populated for public allowing infected employees to return to work, and ensuring that everyone follows proper hygiene protocols. In addition, the government is insuring that reliable tested vendors and contractors are available including contact information, and alternate locations are in place for mobility [33,35]. As a part of BCM, the country recovery team has been monitoring the status of the pandemic as reported by the WHO, and official sources such as the CDC to ensure that the disrupted business can start functioning within a healthy environment at the earliest. The higher authority of the country (Royal Court) has acted quickly in a proactive rather than a reactive manner by providing free healthcare to all, covering 60% of private sector salaries, and expanding digital services. Furthermore, treatment is being offered to the millions of foreigners living in the country, and the public support has been mobilized. SA is also donating $500 million to the WHO to support all the countries to fight COVID-19 and combat the spread of the disease [36]. Saudi government has tapped the resources and research centers of the country and is offering grants for new treatments, virus gene sequencing, vaccine trials, providing diagnostic tests, using information technology, social media, artificial intelligence, and high-speed computing to devise novel solutions. The government guided by science is also attempting to revive the businesses of all kinds, using technology and service modification [37]. By protecting small businesses and releasing constraints on credit, the government has positioned the economy to normalize and become functional at the earliest possible once the pandemic has been dealt with [36].

We Are All Responsible "Swarm Strategy in the Face of Pandemic Crisis" Outcomes

A comparative data analysis from March 2 to May 10, 2020 regarding the COVID-19 statistics of SA and the world statistics (WS), is as follows. Pandemic epidemiological indictors: SA Index Case Qatif March 2 (WS is Wuhan December 1, 2019). SA observed lag period is 92 days (WS: 20 days), SA demography of reported cases is 22% Saudis, 78% non-Saudis, 13% females, 87% males, 4% children, 3% more than 60 years old, and 93% less than 60 years old. The reported SA fatality rate is 0.6% (WS: 7%), SA deaths double in 16.93 days (WS: 2.2 days), SA recovery ratio is 26% (WS: 34%), SA containment rate is 26% (WS: 41%), span of duplication is 12 days (WS: 24 days), SA rate of duplication R0 is less than 1% (WS: 2%), SA total critical cases admitted to the ICU is approximately 0.5%, SA ICU average length of stay is 20 days (WS: 6–11 days), and the rate of daily reported tests is 8% of total tests done. As of May 10, 2020, the SA COVID-19 curve is increasing at a rate of 19%, whereas the world curve of pandemic is flattening at a rate of 5%. The SA healthcare surge is 200%, utilization estimated is less than 5%, and surge available capacity is 98%. The estimated pandemic paradigm shift "Second Wave" is expected to be in September 2020 [29,38–41].

Conclusion

It can be seen that this pandemic is causing a worldwide crisis that may happen once or twice every hundred years, and this is considered as a turning point for the whole world and healthcare in particular [42]. The Saudi

National Incident Management Model of COVID-19 top-down and bottom-up integration can be seen as a style of rational, teaching, and a unique style of meta leadership. Based on the observation of the COVID-19 complexity and the Saudi prototype, "We are All Responsible," stem from Saudi's inert culture and the actions of the "individual" **citizen** that "no one is in control yet decisions are made for the benefit of the whole nation including active social distancing, wearing masks, using hand sanitizers, stand for each other, and trust the leadership." ***Communities and cities*** shadow social signals and simple rubrics to coordinate complex activities by staying at home, stop all social gatherings, change faith practices, and limit families visiting behavior to limit the pandemic. ***The higher country authority*** (Royal Court) ensures that the directions are followed and monitored as any desecration of the rules may lead to the collapse of beneficial swarming against COVID 19 pandemic—***We are All Responsible***.

Conflict of interest
The author declares that there is no conflict of interest regarding the publication of this article.

Funding
None.

Consent for publication
Not applicable.

Ethical Approval
Not applicable.

Author details
Abdullah A.Alhadhira
Director of Office of Emergency Management at Johns Hopkins Aramco Healthcare, Dhahran, Saudi Arabia.

References

1. Ebrahim SH, Memish ZA. COVID-19: preparing for superspreader potential among Umrah pilgrims to Saudi Arabia. Lancet. 2020;395:e48. https://doi.org/10.1016/S0140-6736(20)30466-9
2. Saudi officials urge Muslims to postpone hajj amid COVID-19. The time of Israel [cited 2020 Apr 18]. Available from: https://www.timesofisrael.com/saudi-official-urges-muslims-to-delay-hajj-plans-amid-virus-pandemic/
3. Al-Tokhais A, Thapa B. Management issues and challenges of UNESCO world heritage sites in Saudi Arabia. J Heritage Tourism. 2020;15:103–10. https://doi.org/10.1080/1743873X.2019.1594836
4. AlQahtany AM, Abubakar IR. Public perception and attitudes to disaster risks in a coastal metropolis of Saudi Arabia. Int J Disast Risk Reduct. 2020;44:101422. https://doi.org/10.1016/j.ijdrr.2019.101422
5. Algaissi A, Alharbi N, Hassanain M, Hashem A. Preparedness and response to COVID-19 in Saudi Arabia: building on MERS experience. J Infection Health. 2020;13:834–8. https://doi.org/10.1016/j.jiph.2020.04.016
6. Almasabi, Mohammed.Thomas, Shane. The Impact of Saudi (CBAHI) Accreditation on Enhancing Patient Safety and Improving the Quality of Care Indicators. The International Journal of Health Planning and Management. Volume32, Issue4 October-December 2017 Pages e261-e278.ISSN 07496753. 19/7/2016. https://doi.org/10.1002/hpm.2373.
7. Alkhenizan A, Shaw C. Assessment of the accreditation standards of the Central Board for Accreditation of Healthcare Institutions in Saudi Arabia against the principles of the International Society for Quality in Health Care (ISQua) [Internet]. Ann Saudi Med. 2010;30:386–9. https://doi.org/10.4103/0256-4947.67082
8. Alazmy W, Samarkandi O, Williams B. The history of emergency medical services response to mass casualty incidents in disasters, Saudi Arabia. J Emerg Med Trauma Acute Care. 2020;2020(1):3. https://doi.org/10.5339/jemtac.2020.3
9. Abosuliman SS, Kumar A, Alam F. Disaster preparedness and management in Saudi Arabia: an empirical investigation; 2014 [cited 2020 Mar]. Available from: https://zenodo.org/record/1091130#.XuifckUzbIU
10. World Health Organization. WHO timeline—COVID-19; 2020 [cited 2020 Apr]. Available from: https://www.who.int/news-room/detail/08-04-2020-who-timeline---covid-19
11. Bar-On YM, Flamholz AI, Phillips R, Milo R. SARS-CoV-2 (COVID-19) by the numbers. Cornell University; 2020 [cited 2020]. Available from: http://arxiv.org/abs/2003.12886. https://doi.org/10.7554/eLife.57309.sa2
12. Ministry of Health. MOH news—news list [Internet] [cited 2020 Apr]. Available from: https://www.moh.gov.sa/en/Ministry/MediaCenter/News/Pages/default.aspx
13. Farmer JC, Wax R, Baldisseri MR. Preparing your ICU for disaster response. Mount Prospect, IL: Society of Critical Care Medicine; 2016. 270 p.
14. Ministry of Health. Media center [Internet]; 2018 [cited 2020 Jan]. pp 1–58. Available from: https://www.moh.gov.sa/en/Pages/default.aspx
15. Court R. Saudi king's speech "reflects his desire to ensure safety of all" [Internet]. Saudi Press Agency [cited 2020 May]. Available from: www.spa.gov.sa/2049452.
16. Arab news. King Salman says Saudi Arabia "taking all measures" to fight coronavirus in speech to nation [Internet]. Arab News. 2020 [cited 2020 May]. Available from: https://www.arabnews.com/node/1643926/saudi-arabia
17. Marcus LJ, Mcnulty E, Dorn BC, Goralnick E, Kennedy H. Crisis meta-leadership lessons from the boston marathon bombings response: the ingenuity of swarm intelligence [Internet]; 2014 [cited 2020 May]. Available from: https://www.semanticscholar.org/paper/CRISIS-META-LEADERSHIP-LESSONS-FROM-THE-BOSTON-THE-Marcus-McNulty/f9b8d318e6bd7e3e0d5be29302b7f6fc06a66b45
18. Porter S. COVID-19: "Collaboration between countries has been key in Kingdom of Saudi Arabia" | healthcare IT

news [Internet]. HIMSS digital [cited 2020 May]. Available from: https://www.healthcareitnews.com/news/europe/covid-19-collaboration-between-countries-has-been-key-kingdom-saudi-arabia

19. Alsherebi M. Saudi Arabia's clear response to the coronavirus outbreak is in stark contrast to the west | view | Euronews [Internet] [cited 2020 Apr]. Available from: https://www.euronews.com/2020/03/27/saudi-arabia-clear-response-to-the-coronavirus-outbreak-is-in-stark-contrast-to-west-view
20. Mahmud L, Al-Mohaimeed A. COVID-19: Utilizing local experience to suggest optimal global strategies to prevent and control the pandemic. Int J of Health Sci. 2020 [cited 2020 May];14. Available from: https://ijhs.org.sa/index.php/journal/article/view/5008
21. Alhajji M, Al Khalifah A, Aljubran M, Alkhalifah M. Sentiment analysis of tweets in Saudi Arabia regarding governmental preventive measures to contain COVID-19. Preprints [Internet]; 2020. 16 p. https://doi.org/10.20944/preprints202004.0031.v1
22. Ebrahim SH, Ahmed QA, Gozzer E, Schlagenhauf P, Memish ZA. Covid-19 and community mitigation strategies in a pandemic. BMJ. 2020;368. https://doi.org/10.1136/bmj.m1066
23. 2020 GA for statistics©. Cities of Saudi Arabia data| [Internet]. General authority for statistics [cited 2020 May]. Available from: https://www.stats.gov.sa/en
24. Barry M, Ghonem L, Alsharidi A, Alanazi A, Alotaibi NH, Alshahrani F, et al. Coronavirus disease 2019 pandemic in the Kingdom of Saudi Arabia: mitigation measures and hospital preparedness [cited 2020 May 8]. Available from: https://www.academia.edu/42609482/Coronavirus_Disease_2019_COVID-19_Pandemic_in_the_Kingdom_of_Saudi_Arabia_Mitigation_Measures_and_Hospitals_Preparedness [cited 2020 May 8]. https://doi.org/10.4103/JNSM.JNSM_29_20
25. Occupational Medicine. COVID-19 lockdowns throughout the world [cited 2020 May]. Available from: https://academic.oup.com/occmed/advance-article/doi/10.1093/occmed/kqaa073/5828239
26. Saudi Arabia coronavirus stats tracker map—COVID-19 latest cases update in 2020 [cited 2020 May 8]. Available from: https://visalist.io/emergency/coronavirus/saudi-arabia-country
27. Ministry of Health. Statistical yearbook [Internet]; 2018 [cited 2020 Feb]. Available from: https://www.moh.gov.sa/en/Ministry/Statistics/book/Documents/book-Statistics.pdf
28. Arabia RC of S. Kingdom of Saudi Arabia—Ministry of Health portal [Internet] [cited 2020 May]. Available from: https://www.moh.gov.sa/en/Pages/default.aspx
29. MOH. Saudi center of disease prevention and control المـركز الوطـني للوقايـة مـن الأمـراض ومكافحتهـا [Internet] [cited 2020 May]. Available from: https://covid19.cdc.gov.sa/contact-us/
30. Health M of. home—HESN portal [Internet] [cited 2020 May]. Available from: https://hesn.moh.gov.sa/webportal/
31. Saudi Press Agency. Saudi Arabia signs SR955 million contract with China for testing coronavirus the official Saudi press agency [Internet] [cited 2020 May]. Available from: https://www.spa.gov.sa/viewfullstory.php?lang=en&newsid=2079249
32. Saudi Arabian Monetary Authority (SAMA). saudi-arabian-monetary-authority-sama-business.pdf/PDF4PRO [Internet] [cited 2020 May]. Available from: https://pdf4pro.com/view/saudi-arabian-monetary-authority-sama-business-4e8856.html
33. Al Hamed T, Alenezi M. Business continuity management & disaster recovery capabilities in Saudi Arabia ICT businesses. Int J Hybrid Inform Technol. 2016;9(11):99–126. https://doi.org/10.14257/ijhit.2016.9.11.10
34. Khalil KM, Abdel-Aziz M, Nazmy TT, Salem AB. Multi-agent crisis response systems—design requirements and analysis of current systems. Ithaca, NY: Cornell University; 2009 [cited 2020 May]. Available from: http://arxiv.org/abs/0903.2543
35. Communications and information technology commission. Guidelines on disaster recovery planning for the ICT industry Kingdom of Saudi Arabia [cited 2020 Feb]. Available from: https://www.citc.gov.sa/ar/Decisionsoffers/Decisions/Documents/DRP_Guidelines_Final.pdf
36. World Health Organization. WHO, Saudi Arabia join forces to fight COVID-19 nationally, regionally and globally [Internet] [cited 2020 May]. Available from: http://www.emro.who.int/media/news/who-saudi-arabia-join-forces-to-fight-covid-19-nationally-regionally-and-globally.html
37. Custodian of the two holy mosques delivers speech to citizens and residents in the Kingdom. Saudi Arabia must continue to work hard to overcome crisis, says King Salman [Internet] [cited 2020 May]. Available from: www.spa.gov.sa/2049452
38. Li C, Chen LJ, Chen X, Zhang M, Pang CP, Chen H. Retrospective analysis of the possibility of predicting the COVID-19 outbreak from Internet searches and social media data, China, 2020. Euro Surveill. 2020;25:2000199. https://doi.org/10.2807/1560-7917.ES.2020.25.10.2000199
39. Verity R, Okell LC, Dorigatti I, Winskill P, Whittaker C, Imai N, et al. Estimates of the severity of coronavirus disease 2019: a model-based analysis. Lancet Infect Dis. 2020;20:669–77. https://doi.org/10.1016/S1473-3099(20)30243-7
40. COVID-19 #CoronaVirus Infographic Datapack - information is beautiful [Internet] [cited 2020 May]. Available from: https://informationisbeautiful.net/visualizations/covid-19-coronavirus-infographic-datapack/
41. Morgan Stanley timeline of coronavirus outbreak return to work-BI. Morgan Stanley CEO [Internet]; 2020 [cited 2020 Apr]. Available from: https://www.businessinsider.com/morgan-stanley-timeline-of-coronavirus-outbreak-return-to-work-2020-4
42. World Health Organization. The WHO pandemic phases - pandemic influenza preparedness and response—NCBI bookshelf [Internet] [cited 2020 May]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK143061/