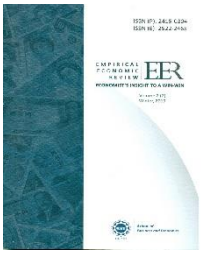

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Article: **Overview of Disaster Preparedness and Response Strategies Regarding COVID-19 Crisis Control for Public Safety and Health Protection**

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Sharafat Ali

Indexing

Overview of Disaster Preparedness and Response Strategies Regarding COVID-19 Crisis Control for Public Safety and Health Protection

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Abstract

The ongoing Coronavirus Disease 2019 (COVID-19) outbreak has incurred tremendous human, social, and economic costs, globally. Major economies across all continents are struggling to contain the COVID-19 pandemic and to flatten the infected curve. This study focuses on critically reviewing the strategies opted globally to control COVID-19. The main objective of this paper is to overview the pandemic conditions, responses of the public, and actions of the governments with the aim to highlight the importance of public health preparedness and risk management strategies. The current study uses an organized method of locating, assembling, summarizing, and evaluating the literature on COVID-19 control strategies adopted in different countries. It overviews the conditions of the COVID-19 pandemic in the countries hardest hit by it. The study uses the systemic literature review method to overview, summarize, and organize the literature regarding COVID-19 spread control strategies. A comprehensive Disaster Management and Response System (DMRS) strategy can be productive in limiting the pandemic spread and may also help to flatten the curve. The current study, based on the experiences of different countries, frames a DMRS strategy to contain COVID-19 which includes immediate

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government intervention, early recognition of the crisis, removal of cognitive and confirmation biases, political and religious biases, consensus development, establishment of a central command and control center, public engagement, integration of institutional functioning using ICT, maintaining the medical supply chain, limiting public mobility and mass gathering, practicing social distancing, quarantining and isolation, clear and effective communication for information dissemination, massive testing, and the use of ICT for information sharing, alerting, contact tracing and surveillance.

Keywords: COVID-19 crisis control, disaster management, infection control, infectious disease, novel coronavirus, public health, safety
JEL Codes: I0, I1, O0, Y1, Z0

Introduction

The world is facing the third outbreak of highly pathogenic coronaviruses (CoVs) after the Severe Acute Respiratory Syndrome Coronavirus (SARS-CoV) outbreak in 2002 (Drosten et al., 2003) and the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) epidemic in 2012 (Al-Abaidani et al., 2014). People infected with the novel Coronavirus 2019 (2019-nCoV) mostly experience mild symptoms such as fever and cough. They recover in a few weeks from this disease. However, in serious cases it can cause severe respiratory illness and may end up causing death, especially among elderly patients. On December 29, 2019 several cases of the novel coronavirus outbreak was reported for the first time in the city of Wuhan in China. The patients were suffering with Viral Pneumonia of Unknown Etymology (VPUE) (Ali et al., 2020; Wang et al., 2020) Later, the China Center of Disease Control (CDC) found that the cause was a novel β-genus coronavirus henceforth named as 2019-nCoV (Ahmed et al., 2020; Li, 2020). On January 30, 2020 the World Health Organization (WHO) declared the 2019-nCoV outbreak in China a public health emergency of international concern due to the high risk it posed to the countries with vulnerable health systems (Di Gennaro et al., 2020; Sohrabi et al., 2020; Spagnuolo et al., 2020). On February 11, 2020 WHO renamed the previously known coronavirus disease (2019-nCoV) as the

Coronavirus Disease of 2019 (COVID-19) and named the virus causing COVID-19 as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (WHO, 2020a).

The outbreak initially hit the Chinese city of Wuhan but spread rapidly to all Chinese provinces (Han et al., 2020) and almost all over the world, afterwards. The COVID-19 outbreak was not limited to China; rather, it alarmingly spread across the continents affecting 118,000 confirmed cases in 114 countries and causing 4,291 deaths by March 11, 2020. The WHO confirmed that COVID-19 should be characterized as a pandemic (WHO, 2020c). According to the WHO Director-General T. A. Ghebreyesus, the novel coronavirus was the first to reach the pandemic level. He also stated that no pandemic has been controlled and reiterated that the situation would worsen. Further, he asserted that "this is not just a public health crisis, it is a crisis that will touch every sector — so every sector and every individual must be involved in the fight" (WHO, 2020c).

The policymakers and governments all over the globe found themselves in unchartered territory and are still struggling to contain the COVID-19 pandemic outbreak (Pisano et al., 2020). Although stories of the successful stifling of the pandemic are echoing across China, Singapore, South Korea, and Taiwan, yet the rest of the world is finding it difficult to control the spread of SARS-CoV-2 infection. The COVID-19 outbreak has spread to more than 185 countries across the world. Major countries across the globe such as Italy, Germany, Spain, France, Belgium, Austria, the UK, Iran, Turkey, Pakistan, India, US, Mexico, Canada, Brazil, Chile, Panama, Egypt, South Africa, Morocco, Algeria, Ghana, Peru, and Ecuador are struggling to contain the pandemic. Policymakers and governments are struggling to halt the spread of the pandemic (Pisano et al., 2020). The early experiences of how China, South Korea, and Italy dealt with the pandemic can serve as a lesson for the rest of the world still struggling to control its spread (JHU, 2021).

This paper reviews the policies and actions taken by the policymakers and governments at the national, provincial/state and local levels in the pursuit of pandemic control. Some of the countries started to deal with the pandemic successfully immediately after its onset. Others responded too late to contain the COVID-19 pandemic,

still in its infancy. The study overviews the current condition of the outbreak in the world and among the countries adversely affected by it. The authors overviewed two different models, the Chinese Model of Disaster Management (CMDM) and the South Korean Massive Testing Model (MTM), that successfully flattened the COVID-19 infected curve in those countries. Moreover, the study also pinpoints Italy's response towards the pandemic in the beginning and how it turned into a disaster afterwards (Spagnuolo et al., 2020). The current study outlines the Disaster Management and Response Strategy based on the lessons learnt from the real-time policies opted and actions taken amidst the COVID-19 outbreak. It will help policymakers and governments at all levels to recognize and address the unprecedented challenges that have emerged due to the rapid spread of the COVID-19 outbreak.

Overview of the COVID-19 Outbreak in the World

COVID-19 Outbreak in the World

The world was closely observing China as it grappled with the novel coronavirus at the outset of 2020. The situation seemed to be spiraling out of control as the number of COVID-19 infected cases increased unexpectedly. The pandemic rapidly spread to about 185 countries all over the globe. By July 24, 2020 more than 15 million cases of SARS-CoV-2 (Worldometer, 2020b) had been confirmed since the first case was reported in China in December 2019. More than 636,576 people (about 4 percent of the total infected population) had died and there were more than 5 million (about 35 percent of the total infected population) active cases with about 66,188 (about 0.44 percent of the total infected population) in serious / critical condition (Worldometer, 2020b) (Figure 1).

Major countries of the world including the US, Brazil, India, Russia, South Africa, Peru, Mexico, Chile, Spain, the UK, Iran, Pakistan, Saudi Arabia, Italy, and Turkey, to name a few, have been adversely affected by the pandemic (Table 1). The US, Brazil, and India are the top three countries hardest hit by COVID-19. They make up 26.63 percent, 14.63 percent, and 8.23 percent respectively of the total COVID-19 infected cases, globally.

Figure 1

COVID-19 Cases Worldwide (Worldometer, 2020, on July 24, 2020, 05:14 GMT)

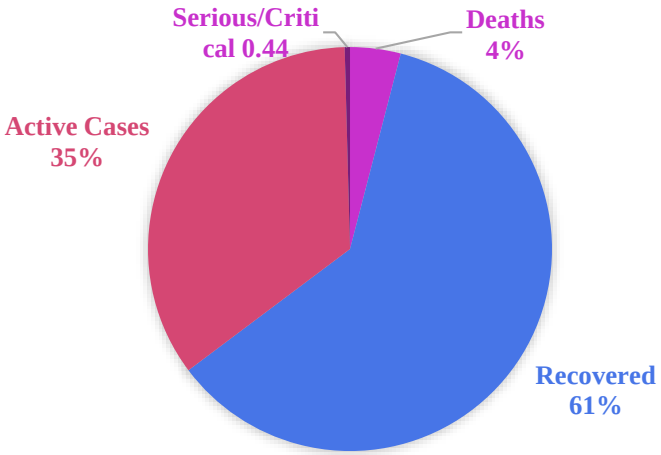


Figure 2

Distribution of COVID-19 Cases (Worldometer, 2020a, Worldometer, 2020b, on July 24, 2020, 05:14 GMT)

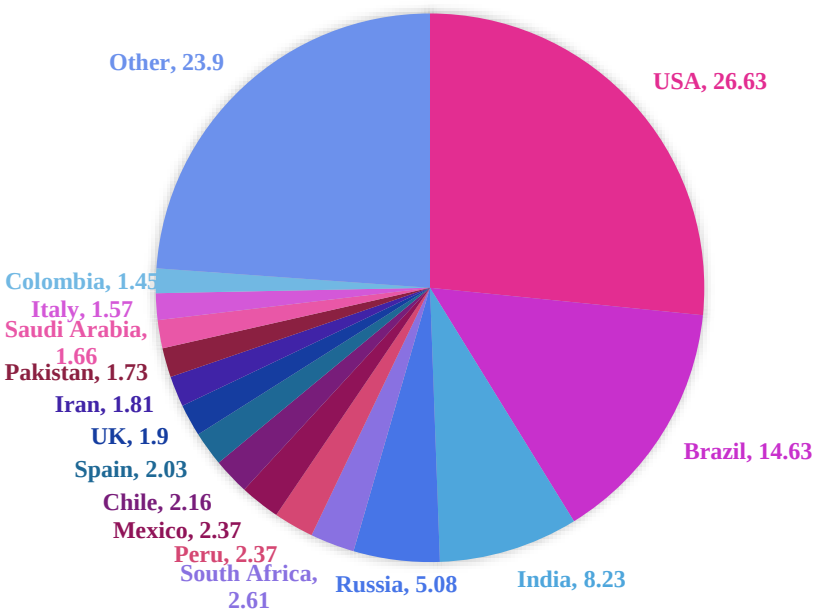


Table 1

Total Number of COVID-19 Cases, Deaths, and Tests Conducted in Major Countries Infected with SARS-CoV-2

	Countries	Tot Cases/1M pop	Deaths/1M pop	Total Tests	Tests/1M pop
1	USA	12593	445	51552175	155688
2	Brazil	10768	396	4911063	23094
3	India	933	22	15428170	11173
4	Russia	5448	88	26000908	178163
5	South Africa	6875	103	2632106	44347
6	Peru	11246	535	2158770	65420
7	Mexico	2873	325	879608	6818
8	Chile	17712	462	1464640	76578
9	Spain	6785	608	6320836	135188
10	UK	4376	671	13974097	205779
11	Iran	3379	179	2254123	26817
12	Pakistan	1223	26	1821296	8236
13	Saudi Arabia	7473	76	2894426	83065
14	Italy	4058	580	6415041	106111
15	Colombia	4446	151	1320935	25944
16	Turkey	2646	66	4446374	52686
17	Bangladesh	1311	17	1079007	6548
18	Germany	2448	110	7418812	88529
19	France	2748	462	2982302	45683
20	Argentina	3273	60	593044	13114
21	Canada	2984	235	3697322	97910
22	Qatar	38551	58	455798	162332
23	Iraq	2538	102	861165	21384
24	Indonesia	342	17	1310924	4790
25	Egypt	883	44	135000	1318
26	China	58	3	90410000	62814
27	Sweden	7796	562	751213	74354
28	Kazakhstan	4177	31	1867907	99409
29	Ecuador	4425	308	216974	12287
30	Philippines	678	17	1243246	11337

Source: (Worldometer, 2020a) (on July 24, 2020, 05:14 GMT)

Table 1 summarizes the total number of COVID-19 infected cases per million population, deaths per million population, and the number of total tests conducted per million population in the top 30 countries infected with COVID-19. The US is the most affected country by the COVID-19 pandemic with the highest number of infections. The UK has led the world in testing with the highest number of tests (205,779) conducted per million population followed by Russia, Qatar, USA, Spain, and Italy. The UK also has the highest number of deaths per million population (671), followed by Spain (608), Italy (580), Sweden (562), Peru (535), and France (462). On the contrary, China has the lowest number of deaths per million population (3).

Successful Response Strategies to Contain the COVID-19 Outbreak

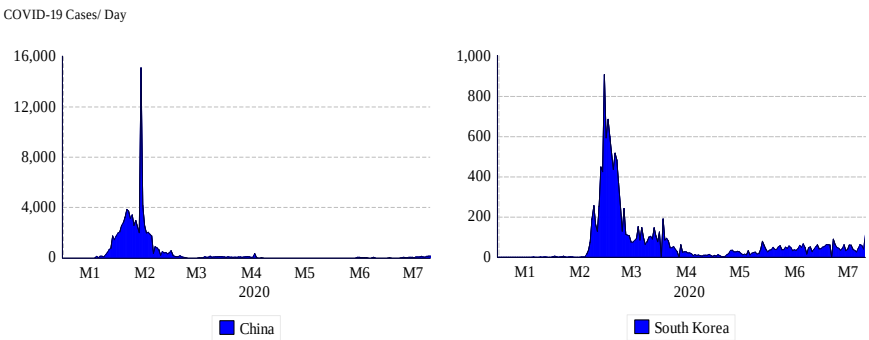
Efforts are underway at the global, national, regional, and local levels to flatten the COVID-19 infected curve. Major economies of the world are struggling to contain the pandemic. Public health experts and physicians have repeatedly referred to the importance of flattening the curve to keep the COVID-19 outbreak manageable (Ahmed et al., 2021). However, some countries such as China and South Korea are heralded as success stories because they were successfully able to flatten the COVID-19 infected curve (Spagnuolo et al., 2020) (see Figure 3). Although their disaster management systems, response strategies and approaches to deal with the novel pandemic varied greatly, yet they were successful in flattening the curve. China pursued a multipronged disaster management system and response strategy consisting of lockdowns, quarantining, social distancing, closure of schools and other institutions, online teaching and study, work from home, and hard limits on the size of public gatherings (WHO, 2020b).

The Chinese government took difficult decisions with trade-offs between their socioeconomic consequences and health effects and outcomes. The Chinese response strategies and actions aimed to flatten the infected curve proved to be productive in the containment of the COVID-19 outbreak, although the Chinese economy and people had to incur high socioeconomic costs. The Chinese government opted for a multipronged strategy including a complete

lockdown of cities, surveillance of active cases, timely and rapid investment into increasing the testing capacity, creation of the isolation centers, treatment of the infected individuals, quarantining of the infected individuals with high-risk, and the utilization of risk reduction strategies such as the compulsory use of face masks in the public. Despite the high socioeconomic costs, the Chinese DMRS provides lessons for other countries trying to flatten the infected curve (Azman & Luquero, 2020). However, these countries must also consider their domestic and local socioeconomic dynamics.

Figure 3

COVID-19 Infected Curve in China and South Korea



In contrast to China, South Korea did not opt for the draconian policies of restrictions on movement, speech, and lockdowns causing huge socioeconomic disruption (Fisher & Sang-Hun, 2020). Outside China, the outbreak of COVID-19 was the most severe in South Korea. However, it managed to contain the COVID-19 outbreak without closing the economy or restricting the movement of the people. The Korean government responded quickly and suitably (ROK, 2020). The South Korean Massive Testing Model (MTM) proved to be an exemplary response aimed to contain the pandemic. It proved that asymptomatic diseases such as COVID-19 can be beaten with smart and competitive public health practices of massive testing, breaking the chains of transmission through contact tracing, isolation, and quarantining (Wilson, 2020). The authorities in South Korea made an extensive use of the Internet and Information and Communication Technologies (ICTs) to maintain extensive social distancing, free smartphone apps flagging infection hotspots coupled with text alerts on testing and cases identified

locally, dissemination of valid and updated information regarding COVID-19 testing results through e-government, and contact tracing through mobile phone tracking.

In addition to mainland China and South Korea, Taiwan also managed to limit its confirmed infected cases (Wang et al., 2020). It acted quickly and started screening travelers from Wuhan, China on December 31, 2019 and also set up a tracking system for self-quarantine. The first case of human-to-human transmission of COVID-19 in Taiwan appeared on January 20, 2020. Taiwanese government established a Central Command Center (CCC) for the epidemic as it did back in 2003 following SARS. It swiftly mobilized to allocate resources for the protection of public health and introduced specific approaches of identification and containment. Moreover, the government created big data for analytics by leveraging its national health insurance database and integrating it with the immigration and customs database. It helped in generating real-time alerts based on travel history and clinical symptoms which, in turn, proved to be useful in tracing the infected individuals. QR code scanning, online reporting of travel history and flight origin have been used to classify the risk of infections. The individuals with higher risks were quarantined at home and mobile phone tracking was used to ensure their stay at home during the incubation period of the virus (Wang et al., 2020). Immediate measures were taken to maintain the supply chain of medical equipment. For this purpose, the government ramped-up the production of medical equipment and banned the export of supplies including face masks (Wilson, 2020).

Methodology

The current study utilizes the systematic review method to provide comprehensive knowledge about the recognition and realization of the severity of the public health challenges posed by COVID-19 along with the responses and strategies adopted to control the COVID-19 pandemic in different countries. It overviews and summarizes the data from primary studies, newspapers, magazine articles, and reports published by various governments and WHO to increase the awareness about COVID-19 and for the dissemination of related information. There are multiple methods such as

systematic review, scoping review, and meta-analysis for the collection and analysis of data. However, synthesis procedures such as scoping review, systematic review, and meta-analysis should be unbiased, clearly organized, and reproducible (Heyn et al., 2019; Ketcham & Crawford, 2007). A properly conducted literature review which is logically summarized can be useful, may lead to the best practices and improves the quality of further research (Hampton & Parker, 2011; Heyn et al., 2019). If an article is organized, designed and assembled in a rigorous and reproducible manner, it would be valuable (Heyn et al., 2019; Higgins & Green, 2008).

Disaster Management and Response System (DMRS) to Contain COVID-19

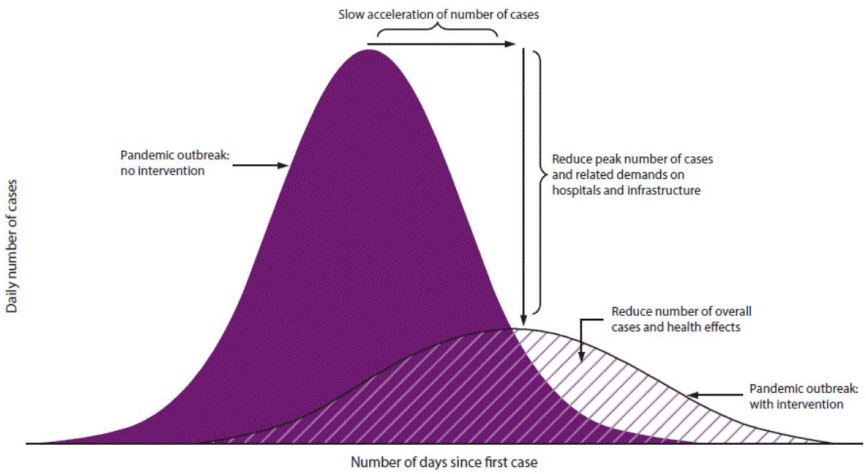
Immediate medical resource availability coupled with a responsive Disaster Management and Response System (DMRS) is warranted to contain the disease and limit widespread cross-infection in patients and health staff. An effective and productive DMRS requires immediate mobilization, allocation of resources, and the management and monitoring of the pandemic for outstanding results. Two curves in Figure 4 depict two different scenarios of the infection curve, one with intervention and the other without it. The peaked curve shows that the number of cases increase rapidly in a few days if no intervention is made to deal with the pandemic outbreak. Consequently, it will choke the healthcare system with an unimaginable number of infected cases and an increase in the demand for beds and facilities. The number of infected cases can be reduced with timely and swift intervention by the government and competent authorities aimed to control the pandemic outbreak.

Decision-making while preparing and fighting against a pandemic such as COVID-19 affects the consequences and outcomes during the pandemic and in the post-pandemic scenario as well. The impact of the pandemic/epidemic can be lessened through careful and dynamic planning along with clear communication. It warrants multiple control and prevention measures from its inception(WEF, 2020). Policymakers, government authorities, institutions and departments, and the public need to respond quickly but correctly to cope with the outbreak. The experiences, measures, contingency plans and their implementation in the countries who

have successfully flattened the curve can be instructive to other countries still struggling to control the pandemic.

Figure 4

Flattening the COVID-19 Case Curve[1]



Immediate Government Intervention

The most successful way to contain the pandemic is to "respond aggressively from the outset" (Barron, 2020). The fundamental lesson learned from the countries which successfully fought against the menace of the COVID-19 pandemic is the realization of the gravity of the problem from the very beginning, removal of cognitive biases, developing a central command and control center, setting goals and strategizing. The decision to respond quickly and aggressively has been the key factor behind the success of China (WHO, 2020b; Azman & Luquero, 2020), South Korea (Fisher & Sang-Hun, (2020) Taiwan, Hong Kong, and Singapore (Barron, 2020).

Recognition of the Crisis and Emergency Declaration

The best way to contain an epidemic or pandemic is to recognize the emergence of the crisis in its infancy and to identify the risks it

[1] https://www.path.org/articles/making-sense-covid-19-models/

poses. In involves the assessment of potential risks in multiple scenarios, risk analysis, risk monitoring, and the devising of viable alternative contingency plans to deal with the epidemiological situation (Yue et al., 2020). The government and the public both need to realize that the pandemic is no longer a hoax. It is not only the government but also the public that needs to realize the gravity of the situation to come. The sooner they recognize the crisis the higher the chances to deal with it successfully (Wang et al., 2020). There is evidence that shows that the most effective time to act is when the threat appears to be small. Threats such as the COVID-19 pandemic start small but intensify exponentially in a nonlinear fashion (Guardian, 2020).

The practices and policies implemented in China, South Korea, Singapore, and Taiwan serve as an example that the pandemic can be stifled only if responded to with quick decisions about implementing multiple control and prevention measures to contain it in its infancy. In an emergency, especially early in a pandemic, it becomes important to rapidly generate the risk management response (Wu et al., 2020). The experience of Italy, Spain and the US shows that if the pandemic is not stifled in the beginning, it becomes hard to contain it later on and it turns into a disaster (Pisano et al., 2020). The government is supposed to declare a national emergency in the wake of an epidemic / pandemic such as COVID-19. Timely decision-making and immediate actions coupled with a scientific, risk-informed, and phased approach provide a clear recognition and realization of the evolving conditions during the pandemic (Wu et al., 2020).

Building of Consensus and Coordination by Recognizing and Removing Cognitive Biases

Psychological biases determine decision-making and its outcomes (Scott, 1993). Cognitive biases are ubiquitous in the real world and distort decision-making which, in turn, leads to undesirable outcomes. So, it is necessary to eliminate cognitive biases to prevent disaster from occurring (Murata et al., 2015). Another psychological bias is the confirmation bias. It refers to "a tendency to seize upon information that confirms our preferred position or initial hypothesis" (Pisano et al., 2020). Consensus

development and confidence building measures bring all stakeholders on board for immediate actions to be taken. Coordination and consensus must be developed among the national, provincial / state, and local governments, other relevant departments, government agencies, and the public.

All biases can be eliminated, and serious contingency plans can be prepared and executed successfully if the scientists and public health experts are listened to during the changing and evolving conditions of a pandemic. The Chinese did this successfully (Wu et al., 2020). The Chinese experience unveils that a systematic and proactive pandemic risk management based on collaboration between the government authorities and health experts have been productive in containing COVID-19 in China. Timely acquisition and dissemination of disease-related data to the public, experts, researchers, and the WHO helped to analyze about 40,000 COVID-19 infected cases in China. The analysis revealed that about 20 percent of those infected with SARS-CoV-19 needed medical care and treatment, while 80 percent of patients did not need any medical intervention (Wu et al., 2020).

Formation of a Central Command and Control Office (CCCO) to Contain the Pandemic

The establishment of a central command and control office is imperative to streamline and monitor the implementation of contingency plans through an integrated system, downwards from the national to the provincial / state and local levels. The goal(s) may be to strengthen the pandemic preparedness and to minimize the risk of disease transmission. This calls for the detection and reporting of disease transmission immediately along with swift and rapid decision-making to deal with the epidemic / pandemic. Strategic goals need to be defined as well. It needs to be decided whether to pursue a preventive policy (massive testing) or curative policy (complete lockdown). It must be realized that the level of uncertainty is very high amidst a pandemic. It calls for an evolving planning and demands short-term contingency plans. This provides flexibility in the plans, making them adaptable according to the changing conditions.

Community-centered Approach to Contain the Pandemic

In most countries, healthcare systems are decentralized and function on a patient-centered model. However, in the wake of a pandemic such as COVID-19, patient-centered models of healthcare need to be adapted to the Community-System Approach (CSA) (Pisano et al., 2020). CSA provides solutions for the entire population. It was used during the Ebola outbreaks in West Africa and Congo. This approach helps in preventing, preparing for, and responding to the needs of the affected communities, especially when difficult measures such as quarantining are put in place. The experiences from Africa revealed that mere emergency medical care is not enough to end the pandemic. The support of the community is also needed to respond to the outbreak successfully (Thomas & Dennis, 2020).

Outbreak Prevention Mechanism

Public Engagement

In the wake of any pandemic, public engagement is indispensable. The government needs to share reliable information to make the public understand and realize the severity and consequences of the pandemic. A pandemic is a common risk that everyone is exposed to and consequently, everyone shares the same responsibility. COVID-19 is contagious, and it can spread asymptomatically, hence it puts the burden of responsibility on everyone's shoulder to get involved in the collective efforts to successfully implement measures to prevent and control the pandemic. The Chinese experience reveals that person-to-person contact and large gatherings need to be avoided during the epidemic. However, this is not possible without public engagement which, in turn, is not possible without continuous and clear information dissemination to the public about the latest updates regarding the outbreak (Pisano et al., 2020; Wu et al., 2020). The authorities in Zhejiang, China provided daily updates on the number of cases infected with SARS-COV-19, their clinical treatment outcomes, plans to be executed, and the procedures and guidelines to be followed (Wu et al., 2020).

Assessment and Maintenance of the Medical Resources Supply Chain

Supply and demand assessment, demand projection, and resource allocation for prevention and protection measures are the initiatives needed to be taken to deal with the COVID-19. It is indispensable to assess the required information and knowledge about the pandemic and the available medical resources such as healthcare personnel, paramedical staff, essential medicines, testing kits, face masks, and Personal Protective Equipment (PPE). Failure to do so results in a weak disaster control management response mechanism which, in turn, leads to poor disease containment, extensive cross-infection in the community and among health workers in the hospitals (Spagnuolo et al., 2020). Cases appeared in Wuhan owing to the lack of knowledge about COVID-19 as well as due to the shortage of medical supplies and protective equipment in the early weeks of the outbreak in Wuhan (Wu et al., 2020). In contrast to Wuhan, the authorities in the Zhejiang province of China were prepared, mobilized, and acted proactively. The allocation of resources as well as the management and monitoring of the pandemic was proactive and impressive during the evolving epidemic conditions in Zhejiang (Wu et al., 2020).

Maintaining the medical resource supply chain is fundamentally important for an effective response using the disaster management mechanism (Yue et al., 2020). This entails immediate coordination between the government officials, medical experts, physicians, and pharmaceutical companies for the mass production of medical equipment and medicines with a guarantee of urgent approval. In case of a shortage, communication with international agencies, friendly countries, and the local industry for procurement is essential.

Limiting Public Mobility by Banning Mass Gathering and Maintaining Social Distancing

Government should reduce public mobility and congregations to avoid the transmission of the virus. Emergency measures need to be taken to close the places of congregation such as temples, churches, and mosques. The government should enforce lockdown in the areas believed to be the epicenters of the pandemic to reduce the spread by limiting public movement. These lockdowns may be intra-city,

intercity, intrastate, interstate, or international depending on the gravity of the situation. The implementation of the measures to successfully contain the pandemic is possible only if everyone takes responsibility and every official is held accountable for the execution of the contingency plan (Bennhold, 2020; Wu et al., 2020).

Lockdowns and Traveler Management. It is important to manage the traveling of citizens in the wake of a closure or lockdown imposed due to the pandemic. As the people receive the closure notice, the asymptomatic citizens may travel to their hometowns, other cities, and some may even travel abroad causing the transmission of the pandemic to other countries. This is among the main reasons behind the spread of the coronavirus outside Wuhan to the other parts of China and beyond its borders (Yue et al., 2020).

Lockdown and travel bans imposed either nationally or internationally have their consequences in terms of the loss of billions of dollars because of the loss of economic activities and employment, causing social unrest in the society. In the wake of lockdown and travel bans, the closure of government offices, educational institutions, and other services comprise a huge loss. However, at the end, it will help to win the war against the pandemic. During the lockdown, the losses can be reduced with the use of computer-based online work. Educational institutions can provide their students with online learning opportunities while they stay at home. These practices started in China during the lockdown (Azman & Luquero, 2020; WHO, 2020b; Wu et al., 2020).

Test centers should be installed at the entry-exit points of the city, bus stations, railway stations, and airports. Smartphone apps should be launched to self-check for symptoms and to keep track of the travelers (Fisher & Sang-Hun, 2020).

The governments of most states in the USA have shut down businesses and people have been asked to stay at home. The authorities have ordered the closure of all non-essential businesses such as fitness centers, salons, nail parlors, gym and entertainment venues (Gershman, 2020).

Government of Pakistan (GOP) also opted for the policy of lockdown to reduce public mobility and people-to-people (P2P) contact by banning intercity, intra-city, intra-province, and inter-province transport, along with the restriction and closure of all non-essential business activities except for the industries manufacturing the necessities of life such as food, medicine, and power (The News, 2020).

Closure of Religious Sites and Ban on Religious Gatherings. Religious gatherings and congregations are the major sources of P2P contact and can be a major source of the spread of the pandemic, putting a huge strain on medical services. For instance, more than 60 percent of cases were reported in a branch of the Shincheonji Church of Jesus, in the south-eastern city of Daegu in South Korea. It put huge pressure on health services in Daegu as the authorities had to test more than 210,000 Shincheonji followers (Fisher & Sang-Hun, 2020; Guardian, 2020). Similarly, in Iran, the first few cases of SARS-CoV-19 were reported to be sourced from Fatima Masumeh Shrine in Qom and the Imam Reza Shrine in Mashhad. The Iranian government closed the shrines due to the pandemic (Sherwood, 2020). Earlier on, the Kingdom of Saudi Arabia closed the two Holy Shrines of Islam in the holy cities of Mecca and Medina to foreign pilgrims and banned their entry into the country in the last week of February 2020, due to the fear of COVID-19 outbreak in the Middle East (Chulov, 2020). Despite resistance from Muslim clerics, the government in Pakistan also banned the congregational prayers as a measure to reduce P2P contact (Tunio & Mandhro, 2020). The global Holy Week celebrations and services of 1.2 billion Roman Catholics took place without the physical presence of followers at the Vatican. Following the ban on gatherings by the Italian government, the square in front of St Peter's has also been closed (Sherwood, 2020).

Quarantine, Isolation Centers, Penalties on Violations of Guidelines. Until recently, there was no vaccine available for SARS-CoV-2, hence the best cure for the pandemic was prevention. The best option for those infected with COVID-19 is to quarantine themselves. It is "the separation and restriction of movements of people who have potentially been exposed to contagious disease" (Brooks et al., 2020). This is the best way to reduce the risk of

infected patients infecting others, although it is different from quarantine. Isolation is "the separation of people who have been diagnosed with a contagious disease from people who are not sick" (Brooks et al., 2020). Recently, quarantine was imposed in China and Canada during the Severe Acute Respiratory Syndrome (SARS) outbreak in 2003 and during the Ebola outbreak in 2014 in the West African countries (Brooks et al., 2020). During the COVID-19 outbreak in China, quarantine was used. China effectively placed entire cities under mass quarantine (Brooks et al., 2020; Shah & Farrow, 2020).

The establishment of quarantine centers and makeshift isolation units is a prerequisite to containing the pandemic. Patient(s) are kept in isolation whether it is self-isolation or quarantine for their care and it prevents others to be infected by them. Strict monitoring of self-quarantine or public quarantine is required. Further, heavy fines should be charged, or strict legal actions should be taken if patients(s) venture out of isolation. Singapore enforced a strict home quarantine system and an effective contact-tracing system. The authorities in Singapore repetitively accentuated the need for Collective Social Responsibility (CSR). The Singapore government introduced harsh penalties such as a fine up to $10,000 or up to 6-month imprisonment for those who violate the guidelines promulgated by the government (Guardian, 2020).

Protection of Health Staff

Physicians, health staff, paramedical and medical professionals, and caregivers in nursing homes are frontline soldiers in the fight to contain the pandemic (Chughtai & Khan, 2020; Wang et al., 2020). The safety of these personnel is of prime importance in such emergencies, as these professionals are the ones most exposed to asymptomatic diseases. Necessary PPE, face masks, and other safety requirements must be readily available to deal with the pandemic in an effective manner (Chughtai & Khan, 2020). It has been observed that it puts heavy pressure on the existing healthcare system and hospitals are overwhelmed if the gravity of the pandemic is ignored at its outset. An exponential increase in the number of patients infected with SARS-CoV-2 caused infections in frontline workers due to the lack of PPEs. The root cause was the lack of

guidelines and Standard Operating Procedures (SOPs), erratic policies and practices, low compliance, as well as the non-availability, shortage, and reuse of PPEs. Consequently, it caused infections in frontline soldiers which further exacerbated the severity of the damage done by the pandemic (Chughtai & Khan, 2020).

Information Dissemination and Public Engagement

Dissemination of Clear Information and Effective Communication

The dissemination and sharing of clear information and authenticated data along with predictive research supports the decision-making of agencies and authorities involved in the process of pandemic control (ROK, 2020). The government needs to ensure the dissemination of clear and comprehensive information to the public and concerned departments. Public health experts and scientists should take the responsibility to provide factual and scientific information, leading the way to fight the pandemic. It was experienced in Hangzhou, Zhejiang that careful planning and clear communication among different stakeholders lessened the impacts of COVID-19 as compared to Wuhan, Hubei (Wu et al., 2020). It is very important to clamp down on fake news and critical opinion online (Guardian, 2020). The government should have a tight grip on the media during the pandemic outbreak.

Awareness through the Dissemination of Reliable Information

The lack of transparency or misinformation creates rumors, speculations, and panic amidst a pandemic. It can be avoided through the dissemination of transparent, clear, open access, and authentic information (Sohrabi et al., 2020) which is the key to public engagement. The government should inform and educate the public about the spread of the pandemic through social, print, and electronic media. However, the said measures should be taken to avoid chaos and fake news and rumors circulating via social media and messenger apps should be curbed. Relentless public messaging can be used to urge the public to take a test if someone develops symptoms. The government should establish an online platform(s) and develop smartphone apps to keep the public well-informed. Announcements on public places, subways, bus and railway stations,

markets, television broadcasts and radio transmission should be made, endlessly reminding people to wear masks and gloves, practice social distancing, and sanitize their hands.

Massive Messaging and Mobile Alerts

Emergency alerts through messages should be sent on mobile phones whenever a newly infected case is discovered. Websites, smartphone apps, and popup messages should be sent explaining the hour-by-hour details. These mediums should be used to inform and educate the people to wear masks, wash hands frequently, and stay at home. Massive messaging was efficiently and impressively used in South Korea (Fisher & Sang-Hun, 2020), China, Taiwan, Hong Kong, and Singapore (Barron, 2020; Guardian, 2020) to contain the spread.

Detection and Management

Testing

Testing is a prerequisite to detect and isolate the infected individuals from those that are not infected yet (WSJ, 2020; Weaver & Ballhaus, 2020; Bennhold, 2020). Massive testing for COVID-19 enables the identification, isolation and treatment of the infected individuals, immediately after they get infected. Testing is a critical tool to control asymptomatic diseases such as COVID-19 but it warrants a specific, reliable, accurate, and fast detection method to screen the infected and separate them from the uninfected. It became the ultimate challenge in Wuhan during the early days of the outbreak due to the unavailability of testing kits. Screening was dependent on laboratory nucleic acid sequencing analysis. It was a labor-intensive, time taking, and costly method. The first kit was introduced on January 13, 2020, with the help of immediate actions taken by the Chinese government authorities and biotech companies to develop testing kits. A sufficient number of test kits were available only after two weeks (Wu et al., 2020). Extensive or massive testing is considered the single most important and effective tool used to contain the pandemic in the case of South Korea. The South Korean experience revealed testing as central to minimize the further spread of the virus and also allowed for the quick treatment of the infected individuals (Fisher & Sang-Hun, 2020).

Epidemiological Test Centers (ETCs). The government should establish ETCs designed to screen as many people as possible. Setting up separate ETCs would help to spare hospitals and clinics from being overwhelmed and could be time saving. ETCs would help to keep health workers safe by minimizing contact. Drive-Through Test Centers (DTTCs) can be established in the cities to test the people without having them leave their cars, bikes, rickshaws, and other vehicles. They may be given a questionnaire, a remote temperature scan, and a throat swab. The results of the test can be conveyed through messages sent on cell phones. Moreover, Drive-Through Test Centers (DTTCs) should be developed to make it easy for the patients to be tested. Thermal Image Cameras (TICs) should be installed on large buildings, offices, hotels, or at entry-exit points of residential areas to identify the people with fever. South Korea developed ETCs, DTTCs, and TICs for mass testing to detect those infected with SARS-CoV-19 (Fisher & Sang-Hun, 2020; Guardian, 2020).

Contact Tracing. The infected and potentially infected are quarantined or isolated from the uninfected. In addition to isolation or quarantining the infected, the next step is contact tracing. It refers to retracing the patient's recent movements by health workers or volunteers to find and test the individuals that came into contact with the infected person. Tracings can be done through security camera footage, use of AI, Facial Recognition Technology (FRT), credit/debit card records, and GPS data collected from people's vehicles and cell phones. However, this may be a breach of individual privacy and may not be possible without proper legislation, which may be carried out for social security during the times of the pandemic. The most effective and efficient instance of contact tracing was observed in South Korea (Fisher & Sang-Hun, 2020; Guardian, 2020).

Conclusion

This study was focused on giving an overview of the COVID-19 response strategies used to contain the spread of the pandemic. The study critically summarized the experience of multiple actions and inactions of various governments in dealing with the pandemic. The overview of DMRS opted by the authorities and institutions in

different countries unveiled multiple issues with pandemic response strategies which included a lack of transparency, public disinformation, delay in travel restrictions, delay in quarantine, and self-isolation practices, and inadequate research and development. However, delays in information release about the cases of infected with SARS-CoV-19 resulted in COVID-19 outbreak. It is likely that the travelers freely passed through bus and railway stations and large airports in high-risk or hotspot areas, highly infected with SARS-CoV-19, to uninfected areas causing a potential spread of the infection locally, nationally, and internationally. Delayed and untimely actions cause the emergence of social issues such as prejudice, racism, religious biases, and an unprecedented fear of the pandemic among communities and societies, leading to incorrect public precautions. The gravity of an outbreak, if not acknowledged or broadcasted widely, results in delayed containment measures, especially in the wake of an asymptomatic pandemic such as COVID-19. The best strategy is the immediate recognition and realization of the problem and its severity. Policymakers and government authorities struggle to keep up with the pandemic spread without taking immediate and swift actions. Immediate response is needed to ensure social distancing, speedy and massive testing, quick tracing of COVID-19 and contact tracing, as well as the provision of facilities for the treatment of the infected with asymptomatic disease. Otherwise, the objective of flattening the curve cannot be achieved.

The study has some implications regarding the DMRS strategies that may be opted to contain the COVID-19 pandemic. Effective and productive outbreak containment warrants a clear and immediate whistleblowing policy for possible local, national, and global health catastrophes. High-risk and hotspot areas need to be quarantined as soon as any asymptomatic pandemic is identified. An integrated and centralized emergency announcement and public information mechanism should be developed, ensuring continuous updates providing timely, clear, authentic, and reliable information about emergent and evolving conditions. Moreover, the dissemination of authentic and reliable information coupled with inclusive and evolving contingency planning creates public trust in the

government. The increased public trust strengthens the collective effort through increased civic awareness and voluntary cooperation.

The government should mobilize the concerned health departments, authorities, academia, research centers, and bio-medic companies to make it possible to produce ventilators, PPEs, facemasks, and other protective equipment required to fight the pandemic. Scientific and technological progress made the discovery of the COVID-vaccine possible in a very short time. Various governments are now facing challenges in vaccinating the population of their respective countries. An equitable access to safer and effective vaccination facilities to control COVID-19 and its variants has become critical. The government should strategize the vaccination process to make sure the maximum vaccination of the population. Indeed, the government should introduce bailouts, remedies for the economic losses endured due to business closure, price control, availability and affordability of necessities, loan waivers, and relaxation as the measures that need to be taken to combat the pandemic and its consequences. This process should be continued not only during the pandemic but also in the post-pandemic scenario to mitigate the negative socioeconomic impacts of the pandemic.

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