Measures Adopted by National Health Systems against the COVID-19 Pandemic; An Appraisal of Health Systems Functioning

Aysha Zahidie[1]* and Meesha Iqbal[2]

[1]*Independent Researcher and Public Health Consultant, Brooklyn, NY, USA*

[2]*Idaho State University, Pocatello, Idaho, USA*

*Corresponding Author: Aysha Zahidie, Independent Researcher and Public Health Consultant, Brooklyn, NY, USA.

Abstract

Aims: This paper aims to review the policies, strategies, and interventions carried out at the health system, multisectoral and community levels to combat the COVID-19 pandemic.

Subject and Methods: The health systems selected for analysis were China, South Korea, and Taiwan, representing East Asia; Iran and Saudi Arabia, the Middle East; India and Pakistan, South Asia and Italy, Europe. Our framework of analysis for effective mitigation measures at the health system level included the six building blocks of (1) service delivery, (2) health workforce, (3) health information systems, (4) access to essential medicines, (5) financing and (6) governance. Community-level interventions and intersectoral measures were additionally analyzed for proactivity and effectiveness. Data is included since the first case was reported in November 2019 till mid-April 2020. Sources of information are COVID-19 case repositories, official country websites, university research teams' perspectives, official briefings, and available published research articles to date.

Results: It has been found that when much is unknown about an epidemic, resorting to conventional public health practices, such as case isolation, quarantine, social distancing, and lockdown, could be the best practice to control the disease from spreading in the community. An in-place early warning system for diseases and a central policymaking body fully authorized to take mitigation measures at the state level are of utmost importance to combat a pandemic as COVID-19. Meanwhile, the appropriate use of technology can add to the quickness of response.

Conclusion: Countries should be innovative in implementing traditional measures, such as lockdown or quarantine, with consideration for the collective needs and socio-economic structure of society.

***Keywords:** National Health Systems; COVID-19; Building Blocks*

Background

Since its emergence in November 2019, the novel coronavirus (2019-nCoV, later COVID-19) has been one of the most rapidly spreading pandemics of all time, affecting millions of people and taking thousands of lives within weeks of its recognition as a public health emergency of international concern by the World Health organization (WHO) on January 30, 2020 [1,2]. The rapid and high infectivity of COVID-19 has reinforced the need for immediate mitigation efforts at the national and global levels, challenging the effective functioning of the world's most resilient health systems [3]. In the absence of any reliable treatment or immunization options, traditional public health procedures are the only recourse to impede the spread of infection and avert the calamity associated with this disease [4].

Measures Adopted by National Health Systems against the COVID-19 Pandemic; An Appraisal of Health Systems Functioning

18

The implementation of multifaceted prevention approaches, such as social distancing, quarantine, contact tracing, surveillance, rapid and extensive testing, care delivery and raising awareness regarding hygiene, needs an optimally functioning national health system on the one hand and proactive policymaking on the other to ensure timely community-level interventions. The COVID-19 pandemic has brought health systems functioning into sharp focus, highlighting the need for active reforms to improve both the rapidness and effectiveness of the response.

Countries have resorted to innovative strategies to combat the disease in their specific sociocultural and politico-economic contexts. These plans and policies have so far brought about mixed results in containing COVID-19 [5-7].

The geographic distribution of the disease reveals that the Southern Hemisphere has been relatively conserved. However, with rapidly shifting epicenters, the policies adopted by Northern Hemisphere states that have resulted in the successful control or unchecked spread of infection among populations would be important to review. The present study reviewed the policies, strategies, and interventions carried out at the health system, multisectoral, and community levels to combat the COVID-19 pandemic.

Methods

We identified effective public health mitigation strategies required for the prevention and control of COVID-19 pandemic and then assessed how they were incorporated in WHO-identified building blocks of national health system, community and intersectoral levels across countries of Asia and Europe included in this review.

Our framework of analysis for effective mitigation measures at the health system level included the six building blocks (1) service delivery, (2) health workforce, (3) health information systems, (4) access to essential medicines, (5) financing and (6) governance. Community-level interventions and intersectoral measures were additionally analyzed for proactivity and effectiveness.

We included national health systems of the Northern Hemisphere based on a pilot research that was conducted to assess notable strategies in disease prevention before appearance of the cases and mitigation efforts after identification of the first positive case through epidemic growth rate in each of the countries included. The health systems earlier selected were from on WHO regions in the Northern Hemisphere such that geographical balance could be maintained and findings could be generalizable for other states of each geographical region. EMRO (Pakistan, Saudi Arabia and Iran), SEARO (India, China, South Korea and Taiwan), Europe (Italy) and America (USA). We have excluded the USA in America owing to the highly variable responses at the country level, which we deemed to be outside the scope of this work. Our analyses included data up to mid-April 2020.

Results and Discussion

Critical appraisal of the strategies

Health system level

Our analysis revealed that the (a) availability of an early disease warning system and proactive national action plans, (b) local manufacturing of testing kits and personal protective equipment (PPE), and (c) safe testing and minimal exposure of health care workers were among the successful strategies adopted at the health systems level to combat COVID 19.

Taiwan activated its central coordination body after confirming only one case of COVID-19 without waiting for WHO advisory and was able to show desirable results.

The local manufacturing of testing kits and PPE are of paramount importance to ensure the uninterrupted supply to the community and health care workers. Taiwan, South Korea, and China were among the few countries that were self-sufficient in the production of

Measures Adopted by National Health Systems against the COVID-19 Pandemic; An Appraisal of Health Systems Functioning

19

these essential resources against COVID 19 and thus currently have a downward trend of the disease. The safety of front-line health care workers is crucial in controlling COVID 19. South Korea protected its health care staff by introducing drive-through labs. A home testing strategy was adopted in the Veneto region of Italy to minimize exposure of the front-line workers (Table 1).

Service delivery	Health workforce	Health information systems	Access to essential medicines	Financing	Governance
China: Positive cases isolated in designated wards of existing health facilities. Two new hospitals built in Hubei Province in two weeks' time [8]. India: Railways and private shelter homes used as isolation centers [9]. Pakistan: Expo centers in Lahore and Karachi converted to 10,000- and 1,000-bed isolation centers, respectively. Pakistan railways also converted 220 coaches to 2,000 hospital beds for COVID-19 patients. Enhanced capacity of quarantine facilities from 500 to 162,000 beds. Telemedicine services started to cater to the needs of non-COVID-19 patients [10,11].	China: Health personnel from unaffected parts of the country called to reduce the burden on existing health staff [8].	South Korea: Text alerts sent by regional government health authorities: notifying residents of cases in their area and providing links to a central website with more information [12]. Pakistan: Authorities given full access to private labs' data.	China: Testing kits developed in country, along with sufficient PPE, ventilators, and essential medicines [8]. South Korea: Testing made available to all residents Drive-through testing implemented [13]. Iran: The largest mask producing factory built to "produce 4 million masks per month" [14].	China: Announcement of a series of financial support and tax reduction measures by Central Bank [15]. Iran: Twenty percent of the budget allocated to the fight against COVID-19 [16]. India: Aid package of USD 2.1 billion allotted for developing testing facilities; procuring PPE, intensive care units, and ventilators; and training medical workers [17]. Pakistan: Release by federal government of USD 7 billion in funds and by provincial governments of separate funds Prime Minister's Corona Relief Fund was also established [18].	Taiwan: Activation of Central Epidemic Command Centre, given full authority to improvise on the necessary measures needed for the containment of the epidemic [19]. India: Formulation and adoption of a mitigation plan. Pakistan: The National Action Plan for COVID-19 Pakistan developed by a central coordinating body in consultation with provincial governments to develop standard mitigation protocols [18].

Table 1: Interventions at the health system level.

Community level

Table 2 shows a myriad of strategies adopted at the community level. Our analysis revealed that the (a) utilization of already available resources and (b) use of digital technology were successful strategies at the community level. The former is crucial to achieving effica-

Measures Adopted by National Health Systems against the COVID-19 Pandemic; An Appraisal of Health Systems Functioning

20

cious results. Pakistan used its community-based philanthropic structures and electronic National Data Base and Registration Authority to maintain the supply chain for people in need during lockdown. It also tapped existing resources of its polio program to penetrate the communities for contact tracing and creating awareness. Meanwhile, the use of digital technology played a significant role in China, Taiwan, and South Korea. This strategy resulted in quick and reliable contact tracing and stringent implementations of quarantine and social distancing. However, digital technology use remains of limited value in countries with a low literacy level.

Raising public awareness	Contact tracing	Quarantine enforcement	Supply chain maintenance
Digital, electronic, print, and social media widely used by all countries South Korea: Massive warning signs erected for public awareness. Hand sanitizers were placed at public transport stops and doorways of residential buildings [20].	China: Clinical and imaging-based diagnoses were made available in Hubei Province. Teams of municipal workers and volunteers were formed to conduct contact tracing and suspect isolation. The National Health Commission launched a Close Contact Detector App that allowed people to identify if they were at an increased risk of being infected. People were required to log their names before leaving public transport using a QR code [8,12]. South Korea: Private companies developed mobile apps to supplement government efforts. An example was "Corona 100m," which collected data from government sources and alerted users of any patient diagnosed with COVID-19 within a 100-meter radius of their location. "Corona Map" similarly plotted the locations of diagnosed patients to help those who want to avoid these areas [12]. Taiwan: Through an already established disaster management system, relevant institutions integrated infected patients' past 14-day travel history with their identification data, which then facilitated ongoing mobile tracking. In other countries, the traditional backward tracing system was used involving a team of physicians and infection control experts notifying people at risk [12,19]. India: The government launched "Aarogya Setu," a digital app that used a phone's location data and Bluetooth technology to identify people who have come in contact with a patient under quarantine [21]. Pakistan: Rapid response polio teams were deployed for contact tracing at the district level. A find-and-trace strategy was also piloted, tracing mobile phone callers of confirmed patients who had some physical contact with patients [22]. Italy: In the Veneto region, the government conducted rigorous contact tracing at home, including asymptomatic neighbors, using traditional tracing methods [23].	China: Bright yellow and blue plastic sealed walls indicated the shelter of self-quarantine patients. At checkpoints throughout Wuhan City, anyone seeking to enter or leave was asked to present a QR code on their mobile phones. Green codes granted unrestricted movement. A yellow code required seven days of quarantine. Red meant 14 days of quarantine [12]. Taiwan: Mobile tracking was carried out by government officials; they called those in quarantine twice a day to ensure they do not evade tracking by leaving their phones at home. Later, Taiwan launched the Entry Quarantine System that sought to expedite entry by providing passengers with a health declaration pass via SMS, with all hospitals, clinics, and pharmacies gaining access to patients' travel histories. A neighborhood warden system was also used to enforce quarantine [12,19].	China: Most of the industrial manufacturing was diverted to medical supplies manufacturing and distribution. Taiwan: A law for rationing face masks was introduced to avert hoarding. A neighborhood warden system was used for the distribution of goods to those in need under quarantine [19]. Pakistan: Civic groups and NGOs were involved in providing grocery supplies to the needy. Government funds were allocated for families of daily-wage and poor laborers under the already in place *Ehsaas* program. Volunteer Tiger force program was launched, deploying youth in mitigation and relief efforts across the country [24].

Table 2: *Interventions at the community level.*

Measures Adopted by National Health Systems against the COVID-19 Pandemic; An Appraisal of Health Systems Functioning

21

Multisectoral level

Our analysis determined that an autocratic system of government (e.g. China) was more beneficial in tackling the pandemic compared with democratic systems, primarily because such a government type could strictly ensure alignment and adherence to lockdown procedures. Thus far, China has been the only country with successful results achieved through a complete and stringent lockdown. However, imposing a lockdown requires the presence of a functioning system to cater to the needs of the populace, or else it could lead to havoc, as in India. The abrupt lockdown by the Indian government put millions of daily-wage workers at risk, leading to excessive migration of such workers back to their hometowns and creating an alarming situation of facilitating the accelerated spread of the virus in far-flung regions (Table 3).

Lockdown	Border management and travel	Schools, workplaces and areas of worship	Gathering cancellation	Public transport restrictions
China: Complete lockdown of Wuhan City and neighboring areas for more than six weeks. South Korea: Southern cities of Daegu and Cheongdo declared as "special care zones" [8,20]. Saudi Arabia: Curfew imposed in province bordering the Persian Gulf and major cities of religious pilgrimage [8]. India: Complete 21-day curfew imposed. Pakistan: Partial incremental lockdown approach. Italy: Partial incremental lockdown approach, followed by complete lockdown [23].	Immediate measures were taken for travel bans to and from China and screening of incoming travelers for fever in most of the countries Taiwan: Travel restriction to almost all foreign nationals without Taiwanese residence certification who were also required to complete two weeks of self-quarantine on return from abroad [19]. Iran: Travel ban imposed on China in early February. Some private airlines allowed to continue passenger flights [25]. Saudi Arabia: Prohibition of all international flights and domestic travel in early March [26]. India: Suspended issuing of new visas in early March. Pakistan: Isolation for Wuhan-based Pakistani students within China Established quarantine center at Pakistan–Iran border.	Early closure of schools enforced in all countries except Iran. Iran: Partial closure of religious pilgrimage centers. Saudi Arabia: Complete closure of all religious centers and mosques. India: Complete closure. Pakistan: Partial closure.	China: Public holiday and New Year's celebrations cancelled to restrict mass transit [8]. All except Iran: Marriage halls, cinemas, and malls closed. Sports events cancelled. Iran: Decisions delayed and taken only after considerable transmission of the virus had already happened. No attempt to stop mass transit during beginning of the Iranian new year and holidays No social distancing during elections, which proceeded per earlier announced schedules [25].	China: Only "safe" passengers allowed to board determined through digital mobile codes [12].

Table 3: *Interventions at the inter-sectoral level.*

Measures Adopted by National Health Systems against the COVID-19 Pandemic; An Appraisal of Health Systems Functioning

22

Recommendations and Conclusion

The Chinese experience shows that when much is unknown about an epidemic, resorting to conventional public health practices, such as case isolation, quarantine, social distancing, and lockdown, could be the best practice to control the disease from spreading in the community. Simultaneous relevant measures, such as enhancing care delivery capacity and hypothesis testing for innovative treatment strategies, are useful approaches.

An in-place early warning system for diseases and a central policymaking body fully authorized to take mitigation measures at the state level are of utmost importance to combat a pandemic such as COVID-19. Meanwhile, the appropriate use of technology can add to the quickness of response. Any use of technology must be based on expert advice and a country's own manufacturing and maintenance capacity.

Countries should be innovative in implementing traditional measures, such as lockdown or quarantine, with consideration for the collective needs and socio-economic structure of society. Moreover, health policy must never be politicized, especially in terms of emergency medical response.

Implications for Policy and Practice

COVID-19 has led to grave health outcomes and compromised economic wellbeing across the globe. High disease transmissibility with serious consequences for susceptible population groups has challenged effective functioning of health systems all over the world.

This review is first of its kind which comprehensively appraise effectiveness of strategies adopted by different countries to combat COVID-19 pandemic across using the framework of health systems building blocks to identify what particular innovations can be sought for effective mitigation of the pandemic at health systems level.

Acknowledgements

Bibliography

1. Worldometer. Coronavirus cases (2020).

2. CDC. Provisional death counts for Corona Virus Disease (COVID-19).

3. Garg S., *et al*. "Hospitalization Rates and Characteristics of Patients Hospitalized with Laboratory-Confirmed Coronavirus Disease 2019 - COVID-NET, 14 States, March 1-30, 2020". *Morbidity and Mortality Weekly Report* 69 (2020): 458-464.

4. Schuchat A. "Public Health Response to the Initiation and Spread of Pandemic COVID-19 in the United States, February 24–April 21, 2020". *Morbidity and Mortality Weekly Report* 69 (2020): 551-556.

5. King JS. "Covid-19 and the Need for Health Care Reform". *The New England Journal of Medicine* (2020).

6. MSH. Staccy Lu in Health Systems Strengthening. COVID-19: A "testing ground" for health system resilience (2020).

7. WHO. "Rolling updates on coronavirus disease (COVID-19)" (2020).

8. Wu Z and McGoogan JM. "Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention". *The Journal of the American Medical Association* 323.13 (2020): 1239-1242.

Measures Adopted by National Health Systems against the COVID-19 Pandemic; An Appraisal of Health Systems Functioning

23

9.   Ramaprasad H. "India has closed its railways for the first time in 167 years. Now trains are being turned into hospitals". *CNN* (2020).

10. Warraich FA. "24 Digital. First phase of 1,000-bed field hospital at Lahore's Expo Centre completed (2020).

11. The News International. Coronavirus: Pakistan Army helps set up field hospital at Karachi's Expo Centre (2020).

12. Huang Y., *et al*. "How Digital Contact Tracing Slowed Covid-19 in East Asia". *Havard Business Review* (2020).

13. Lee D and Lee J. "Testing on the Move South Korea's rapid response to the COVID-19 pandemic". *Transportation Research Interdisciplinary Perspectives* (2020).

14. Tasnim News agency. Iran Opens Largest Mask Factory in Southwest Asia (2020).

15. Zhang Z. "China's Support Policies for Businesses Under COVID-19: A Comprehensive List". *China Breifing* (2020).

16. Takian A., *et al*. "COVID-19 battle during the toughest sanctions against Iran". *Lancet* (2020).

17. Chandrashekhar V. 1.3 billion people. A 21-day lockdown. Can India curb the coronavirus? Science (2020).

18. Geo News. "PM Imran sets up coronavirus relief fund, urges Pakistanis to donate" (2020).

19. Lin C., *et al*. "Policy decisions and use of information technology to fight 2019 novel coronavirus disease, Taiwan". *Emerging Infectious Diseases* (2020).

20. COVID-19 National Emergency Response Center, Epidemiology and Case Management Team, Korea Centers for Disease Control and Prevention. "Contact Transmission of COVID 19 in South Korea: Novel Investigation Techniques for Tracing Contacts". *Osong Public Health and Research Perspectives* 11.1 (2020): 60-63.

21. Andrew C. "Aarogya Setu: Why India's Covid-19 contact tracing app is controversial". *BBC India* (2020).

22. Pakistan Polio Eradication Program. Pakistan Polio Eradication Initiative support to COVID 19 response". National Emergency Operations Center. Islamabad (2020).

23. Gary P Pisano. "Raffaella Sadun and Michele Zanini. Lessons from Italy's Response to Coronavirus". *Harvard Business Review* (2020).

24. The News International. Over 300,000 apply for Corona Relief Tiger Force (2020).

25. Georgy M and Bryan-Low C. "Elections, ties with China shaped Iran's coronavirus response". Reuters World News. APRIL 2 (2020).

26. Barry M., *et al*. "Coronavirus Disease 2019 (COVID-19) Pandemic in the Kingdom of Saudi Arabia: Mitigation Measures and Hospitals Preparedness 3 (2020).