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THE IMPACT OF PANDEMICS ON PAKISTAN'S HEALTHCARE SYSTEM: LESSONS FROM COVID-19

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Abstract

The COVID-19 pandemic exposed critical strengths and weaknesses in Pakistan's healthcare system, offering valuable lessons for future pandemic preparedness. This study evaluates Pakistan's response to the pandemic, focusing on the healthcare system's capacity, resource allocation, and policy implementation. Despite limited resources, Pakistan demonstrated resilience through rapid mobilization of healthcare workers, establishment of temporary treatment centers, and effective public awareness campaigns. The country's experience with polio eradication and disease surveillance systems provided a foundation for managing COVID-19. However, significant challenges emerged, including inadequate healthcare infrastructure, shortages of medical supplies, and disparities in access to care between urban and rural areas. Weaknesses in data collection and coordination between federal and provincial authorities further hindered the response. The study highlights the importance of investing in healthcare infrastructure, strengthening disease surveillance, and improving intergovernmental coordination to enhance pandemic preparedness. Lessons from COVID-19 underscore the need for equitable healthcare access, robust supply chains, and community engagement to mitigate the impact of future health crises. By addressing these gaps, Pakistan can build a more resilient healthcare system capable of responding effectively to pandemics and other public health emergencies.

Keywords: *COVID-19, Pakistan, healthcare system, pandemic response, public health, healthcare infrastructure, disease surveillance,*

Introduction

Pandemics cast profound impacts over the healthcare system of any country, both developing and developed. Healthcare challenges mount owing to the increase in infected patients, widespread disease prevention needs, medication challenges, equipment procurement needs, and rising medical care costs. Among the plethora of countries, the health policy paradigm in developing country Pakistan is explored. In terms of the severity and impact, the pervasiveness of the COVID-19 pandemic in the country binds to stand out as it illuminates ongoing healthcare

struggles. An attempt is also made to unravel multiple layers of the country's healthcare landscape, indicative of the entwined elements shaping health policies and practices. A deeper view of the broader aspects surrounding the fissures of Pakistan's healthcare system is also sought, with a view that the post-pandemic policymaking process may be better equipped to discern the form and nature of the reforms, changes, and improvements needed. The centrality of these issues is increasingly evident, pointing to the damage aftereffects and dislocations caused by the pandemic, and the urgency to learn from this experience while looking ahead to how health systems can better manage health-related crises. With the corollary that pandemics will become a regular feature of present times, rising to a deeper level of preparedness for and the deleterious effects of diseases. Essentially, while Pakistan's situation is special and unique, many of the same issues and dilemmas experienced during the height of the pandemic in other countries will be recognizable.

The past decade marked a tumultuous period in the annals of global public health with a categorical emphasis on neatly delineated signifies of pandemics. While the tetralogy that commenced with the avian influenza H5N1 during 2011 is conventionally appended with the catastrophic onset and spread of the severe acute respiratory syndrome (SARS) within a spate of six months failed to act on the lessons in respect of the interlink between public health and foreign policy to avert the health and economic crisis (Rasheed et al., 2021). The "swine flu" signifies the first pandemic of the 21st century as declared by the in the month of June 2009 (Falode et al.2021). The prompt response to it in terms of the formulation and importation of anti-viral drugs very handy "vaccine" for pandemic influenza A (H1N1) production, with an anticipated immunization starting in September, was a stupendous success in terms of containment, detection, and management and mitigation roots of transmission (Menéndez-Arias & Delgado, 2022).

Nevertheless, the most significant failure in pandemic healthcare arrangements in the entire history of the World Health Organization (WHO) has highlighted a grave disparity in ethical deliberations and has raised alarms regarding such enterprises. These failures serve as a stark reminder of the critical lessons that remain unlearned, particularly in the face of the impending pandemic threat posed by Ebola. In anticipation of a potential increase in cases due to the frequent cross-border livestock trading

activities with the Pakistan province of Balochistan, the Southern provincial health department, in collaboration with the regional office, meticulously prepared a comprehensive practice schematic geared towards the control of avian flu should such an event arise?
Unfortunately, despite the efforts, the efficacy of the established endemic systems and protocols at the regional borders, combined with the capabilities of the facilitating health department as well as the overall healthcare framework, proved insufficient to avert a crisis. This inadequacy was painfully evident when comparing it to the catastrophic containment failures witnessed during the SARS outbreak. The swift spread of SARS ultimately impacted roughly 32 countries distributed across five continents, leading to a staggering importation of around 5,100 cases. While there were significant containment efforts, it culminated in 54 mortalities, which equated to a fatality rate of 43.1%, primarily affecting healthcare workers who were at the forefront of the epidemic response.

The Healthcare System in Pakistan

To establish a better understanding of the impact of COVID-19 in Pakistan, it is important to discern the areas where the impact of the virus has been the most transformative. This paper focuses on the healthcare system response to the virus and resulting pandemic. It draws from both documentary evidence and interviews conducted among healthcare professionals in Pakistan. The second part of this research begins by reviewing the availability and access of healthcare services in Pakistan. It comprehensively reviews the key issues confronting health policy formation and healthcare provision in the country. Moreover, heavy emphasis is placed on the unique qualities of health professional conduct. This familiarizes the reader with the system's strengths and weaknesses effectively outlining the various constraints on healthcare delivery imposed by the socioeconomic environment of Pakistan.
One of the most complex, interdependent and rapidly evolving issues in modern-day Pakistan is the debate about health care. As a developing country, Pakistan has considerable ground to cover if it is to ensure that its population receives quality healthcare. The healthcare system in Pakistan comprises numerous components including hospitals, smaller clinics, and a broad array of health professionals. In large urban areas such as Lahore, Karachi and Islamabad there are tertiary care hospitals as well as a thriving private sector that caters to the more affluent members of society.

However, for the vast majority of the population living in the rural areas, particularly in the various provinces of the country, access to healthcare services is far from straightforward. For example, the Punjab which is the most heavily populated province in the country, has seen a variety of initiatives to try to improve healthcare provision but a large part of the rural population still largely depends on services provided by the network of basic health units, rural health centers as well as district headquarters hospitals. Such facilities except the latter, often lack a full time doctor, nurse and essential medication.

Infrastructure and Resources

Pakistan's population are served by an extensive healthcare system in terms of the physical infrastructure as well as human resources. However, the distribution of health facilities and manpower does not conform to the standard set by the WHO. There are significant disparities of health services in the rural and urban parts of the country. A third of the population is considered as something of a secondary market, availing of the services of both the public and private sector. The public health care delivery system consist of a four tier system, the core of which is made up of tertiary care hospitals, district headquarters hospitals and taluka hospitals, with basic health units (BHU) and rural health centres (RHC) providing the secondary care. The existence of large numbers of BHUs and RHCs, staffed by doctors trained for a three year diploma in general midwifery, means that the most extensive health system in rural areas is the first point of contact for treatment. Modern medical treatment is available at the district headquarters hospitals, with X-ray and laboratory facilities, and larger numbers of doctors including some specialists. DHS are the backup system for tertiary care teaching hospitals (Ali Khan et al., 2022).

The other two tiers of healthcare system are the diagnostic and treatment centers (DTCs) at the tehsil level and the dispensaries and primary health centers (PHCs), which are staffed by lady health visitors (LHVs). There are, in addition, a large number of maternal and child healthcare centers at taluka level. The private sector does not have such an integrated system. It consists of a heterogeneous mix of over seen clinics in urban areas, where qualified doctors consultation with laboratory and x-ray facilities are available, and in-river areas, traditional Hakeems, Homeo and Tib practitioners. At district level, there will be several hospitals (including some more recent clinics and a scattering of small hospitals pre-dominantly run by NFPs) which attract fee-paying

patients including all the doctors in the district. The govt. channel healthcare delivery provide service to the tertiary level in terms of specialization and caters for the patients suffering from major illnesses. Shortage of government hospitals for the poor people and shorter regional distribution of hospitals has pulled the poor masses to depend on the defective public services which has resulted in a heavy load on government resources. Govt. Hospitals do not provide satisfactory medical care.

Healthcare Delivery Models

The existing healthcare delivery framework defines the quality and accessibility of health services provided, which in turn affects the outcomes of patient care and treatment. In Pakistan, there are primarily two modes of healthcare delivery: unfortunately collapsing & unequal public healthcare and the rapid reach and greater outreach into med care of the private sector, addressing over 70-80% of primary care needs. A large proportion of the country's population relies on private healthcare as an individual out-of-pocket fee mode with very poor quality of service. However, public care facilities exhibit a plethora of issues such as shoddy waiting times, low-quality healthcare, medical staff absenteeism or apathy, lack of hygiene, outdated or poor facility infrastructure, lack of essential drugs, insufficient resource allocation, difficulty reaching healthcare centers, paying bribes to receive medical attention, being turned away or referred to higher-tier medical facilities, or lack of proper bedside manners and treatment norms. Moreover, the distribution of health centers and hospitals in the public sector is disproportionate across provinces, catering predominantly to larger cities while the majority of remote or urban areas are medically under-resourced (Fatima et al., 2021).

The community undertakes health interventions of unsatisfactory quality in the top-down cascaded health unit setup. An emergent nationwide network of Lady Health Workers in the bottom-up health unit setup has achieved outcomes that are exceptionally better than those of traditional preventive health services by compounding traditional health service norms, along with culturally appropriate health education. Technological growth improves service distribution, accessibility, and information availability in terms of innovative healthcare delivery methods. Telemedicine, takaful health insurance, and lookup help to spread the use of cell phone 3G data services to check online health conditions. These experienced droplets allow physicians in rural areas to consult patients via text or call. These apps listed nearby

participating physicians, their facility addresses and availability dates to assist in the immediate treatment of specific ailments. Most patients affected by COVID-19 symptoms installed these apps are using them to make clinic diagnosis appointments. Widgets inform the health centers of patient inflow and bed occupancy availability in order to prevent waste dispatch of patients. Utilizing these services, a substantial drop was noticed in the negative care outcomes of training physicians as well as patient inconvenience.

COVID-19 in Pakistan: A Case Study

Across the world, the unanticipated outbreak of COVID-19 in late 2019 marked a significant health crisis. For Pakistan, a developing country, this marked an unprecedented battle for its already overwhelmed healthcare system. This case study outlines Pakistan's experience of COVID-19 to analyze how a fragile yet complex healthcare system responds to a novel pandemic. As of July 18, 2021, Pakistan has recorded more than 963,721 confirmed cases, with a reported 22,560 deaths (Rasheed et al., 2021). The first wave started in mid-2020, followed by subsequent waves, which peaked in the spring of 2021. Despite government narratives following wave-wise lifts and facelifts of restrictions, a high level of community transmission is consecutively observed. The emergent delta variant has been contributing to widely high transmission patterns. The epidemiological profile in Pakistan shows a mixed pattern; whilst the initial part of the pandemic observed an urban-based spread favoring densely populated urban settings, the subsequent waves sharply hit hinterland and rural areas. The outbreak, while majorly addressing the rural parts of the country, was marked by diversified demographic patterns among the urban and rural divide.

The governmental and healthcare response presents a complex mix of panic, misinformation, and resilience among frontline workers, often overshadowed by political pressures. Initial COVID-19 testing was limited, with a scarcity of test kits, inadequate training for laboratory personnel, and irrational testing methods. After strict measures, many sectors reopened quickly, while schools remained closed longer, adversely impacting students. Private hospitals offered some treatment, whereas public hospital admissions were disastrous. Though the government set rates for testing and treatment, hospitals often couldn't comply. Isolation centers proved ineffective, and protective gear was subpar. Still, relief packages and hygiene initiatives were notable successes.

Online systems for consumer complaints and disclosure of COVID-19 cases fostered adherence to protocols. Key changes in hospitals included new wards, additional staff recruitment, and updated emergency facilities. Healthcare guidelines improved patient screening and management, although measures like area lockdowns were ineffective. Overall, COVID-19 has illuminated the struggles and weaknesses of the healthcare system while prompting a necessary re-evaluation.

The 2019 novel coronavirus disease (COVID-19) first appeared in December 2019 in Wuhan, China. The disease, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), quickly spread around the world. Since the first case reported on February 26, 2020, in Karachi, Pakistan, the country's confirmed cases have grown dramatically. The virus has killed thousands, sickened tens of thousands more, and states were forcibly closed across the country. By analysing a few key indicators, a full picture of COVID-19 proliferation in Pakistan is provided. Awareness of these key epidemiological factors (i.e., key numbers, transmission routes, incubation periods, and hidden carriers) can effectively prevent further virus transmission.

Pakistan is the world's fifth most populous country, with informal rural economies and densely populated urban areas. Given the country's (1) poor health infrastructure; (2) failure to take early enforcement measures; (3) limited coronavirus testing; and (4) crowded public spaces are the main reasons for such an alarming national situation. Demographically, COVID-19 infections were highest among people aged 31-50 years, and predominantly male. COVID-19 simultaneously exposed the vulnerabilities of developing countries, such as sustainable development and pandemics. In the case of Pakistan, the country faces severe demographic, economic, and public health challenges. The current study will provide a comprehensive impact and response analysis of COVID-19 on the primary healthcare system in Pakistan. This study explores the biomedical, demographic, and healthcare system dimensions of COVID-19. Results showed that COVID-19 infections were predominantly among 20-40 years old, with a higher prevalence in men than women. The outbreak of the disease led to major demographic, economic, and public health challenges for the country. On March 13, 2020, Pakistan's first two cases were reported in Karachi. The country's infected cases increased significantly on March 20, 2020, surpassing those in China. Subsequently, the pandemic state causes containment and

containment measures to take place nationwide. On April 26, 2020, the entire state will be imposed, effectively stopping all viral transmission routes. In addition to widespread personal protection equipment (PPE), all manufacturers were forced to close. At the same time, the government strictly prohibited public gatherings and limited the number of people in public spaces (Rasheed et al., 2021).

Epidemiological Profile

The COVID-19 epidemic, first identified in Wuhan, a city in the Hubei province of China, was declared a global public health emergency on January 30, 2020. Despite the imposition of tight social restrictions in the inception, the pandemic managed to spread to Pakistan by February 26, 2020, with the first two cases being reported. The authorities claimed that the Chinese patients which were identified as the first cases in Pakistan were quarantined, as a result of which further cases were averted. However, the statement proved to be manifestly false when the pandemic fully gripped the country within a month. The total infected cases crossed the hundred mark by March 26, along with the first mortality report. On the 27th of March, the government reacted by imposing countrywide lockdowns in an attempt to thwart the transmission of the virus (Rasheed et al., 2021). Throughout a tumultuous year battling the pandemic, the healthcare system of Pakistan was thoroughly lambasted by citizens, healthcare professionals, journalists, civil rights activists, and politicians. Governments at the provincial and federal level had been slow to grasp the increasing threat, even though it was apparent during the month of February that the pandemic was going to proliferate globally at a rapid pace. The inability of the healthcare sector to comprehend the complexities of the disease along with the weak infrastructure of the health system resulted in lethal pressure being exerted on the healthcare sector. Emergency wards in hospitals of the country were flooded with various cases, raising questions about whether the patients had COVID-19 or dengue. Varied accounts of the pandemic emerged from different sections of society, from fear mongering about it due to religious reasons, to outright denial by the government of the pandemic's severity. Directives issued by the federal government, such as boosting the immunity with hot water, or through eating a particular fruit, failed to address the larger question of testing, promoting confusion and misleading explanations of the novel disease amongst the citizenry. On the contrary, private news

channels took a nefarious stance on the issue, with analysts on the payroll of various political parties and business clans, blaming the lockdowns for economic asphyxiation and not paying heed to the wider ramifications of disease transmission.

To understand COVID-19's implications on Pakistan's fragile healthcare system, it's vital to explore its epidemiological profile, including infection patterns, transmission, and severity. Factors such as infection rates, hospitalization, mortality, demographics, and socioeconomic conditions significantly contribute to grasping the pandemic's overall impact. Testing capacities, healthcare responses, contact tracing, and the role of digital health highlight the broader consequences in a weakened healthcare system. Vulnerabilities, often hidden in lab reports, are also discussed. COVID-19 was first reported in Pakistan on February 26, 2020, leading to widespread infections, totaling 1,499,850 cases by December 7, 2020, with uneven distribution over time and geography. Initial widespread transmission occurred mainly in urban centers like airports, and gendered effects showed a rapid rise in female cases, reflecting distinct social interaction patterns. The virus spread from urban to rural areas, influenced by environmental factors such as temperature, humidity, local income levels, and healthcare spending. The surge in COVID-19 cases placed immense pressure on healthcare resources while reducing workforce availability due to symptomatic staff exits. Utilizing digital health networks for efficient contact tracing and monitoring is crucial for implementing timely intervention strategies. Sindh province pioneered tele-health and home kits to manage the spread effectively.

Healthcare System Response

The COVID-19 pandemic outbreak in Pakistan during winter 2019 challenged the country's health system to respond in unprecedented ways. Previously, the system focused on natural disasters and recurrent disease outbreaks like dengue and polio, but the pandemic required swift public health responses. This section examines Pakistan's health system response across four pandemic waves: emergency, acceleration, peak, and deceleration. Responses are analyzed in four time frames: pre-emergency (before 26th February 2020), emergency (from the first patient until 14th April 2020), acceleration and peak (until 24th June 2020), and deceleration (after 25th June 2020). Evaluations are based on health service provision, public compliance, and resource availability, considering resource allocation and service usage in

relation to the population. Following the emergency response, health system assessment is ongoing, informing strategy evolution. The Health Emergency Operations Centre began preparations in late January 2020, conducting desk reviews and risk assessments of the novel disease's impact across sectors. Anticipated procurement issues for personal protective equipment led to increased transparency in laboratory verification. The Department of Health prioritized rapid disbursal of resources, including the emergency purchase of 1,000 N95 masks, 342 body bags, 8,400 surgical masks, and various protective gear for frontline workers, along with training in critical care management. (Emmanuel et al., 2023)

The Health Emergency Operations Centre began preparations to respond to the outbreak in late January 2020, with the initial resources made available in early February. A series of meetings with health stakeholders was held in February to develop standard operating procedures for early detection, data entry, sample collection, and transportation. In addition, precautionary measures were undertaken (Emmanuel et al., 2023). District health authorities were oriented on case definitions and associated contact tracing. Testing guidelines, a breakdown of testing kits and reagents, and prevention guidelines were distributed. Regular review meetings were convened, and all suspected cases were honored with person-to-person contact exposure. Personal protective equipment (coveralls, N95 masks, gloves, and goggles) were also distributed. On January 31, 2020, the first COVID-19 case was confirmed in Pakistan; 1) International flights from China were suspended on January 29; 2) Consistent messaging on precautionary measures, testing protocols, and emergency hotline numbers; 3) 12 screening laboratories set up for 2019-nCoV. With some modification to existing public sector facilities, all potential healthcare centers were equipped with workload allocations of severe acute respiratory infection or acute respiratory infection cases. Preventive and precautionary measures were stringently enforced in all health facilities. Infection prevention and control training were held, and the number of high-flow respiratory oxygen units was enhanced. Moreover, coordinated efforts were made with other stakeholders to disseminate information and generate awareness.

Challenges Faced by the Healthcare System

The healthcare system in Pakistan faces numerous challenges and is not prepared to handle health emergencies. The healthcare

system's overall funding is only around 1% of GDP and public health expenditure is a mere 0.8% of GDP. Years of underfunding have left the system in a state of disrepair and unable to handle the large caseload of the pandemic (J Khan et al., 2023). Pakistan has a doctor to patient ratio of 1 for every 963 people (72 percent are in urban centers where only 36 percent of the population lives), a nurse to patient ratio of 1:100 (with over 5 times the number of nurses needed to receive only minimal treatment), and 1 bed for every 1587 people. These numbers highlight that even outside of a crisis situation, Pakistan's healthcare system is not in a condition to help the millions of people who may require assistance simultaneously. During the wider lockdown, healthcare access and utilization decreased by 77% following the spread of public health misinformation. As COVID-19 infections have surged, healthcare systems are unable to support the high increase in the number of cases due to a lack of resources.

The public and private health infrastructure is limited and largely concentrated in urban areas, which have many facilities for preventive and rehabilitative services. In contrast, rural areas are poorly served, with few hospitals and many understaffed basic health units and dispensaries lacking modern technology and skilled personnel. Rural regions and urban slums experience the most significant healthcare gaps, primarily filled by NGOs. There is a lack of collaboration between public and private health sectors, worsening healthcare disparities. Rural healthcare provider training and availability do not meet population needs, leading to insufficient capacity in government facilities due to financial constraints and inadequate resources. Public health facilities miss advanced medical technologies and essential medications, resulting in a shortage of specialist staff. Diagnostic challenges arise from the scarcity of labs and missing standardized health record management systems. The health department's failure to assess land needs obstructs the establishment of primary healthcare units, preferring to focus on manual ambulances and hiring rural doctors. Recently, portable dispensaries for NH&MP staff lack essential equipment and medical supplies. A study of 680 respondents in Balochistan found no significant link between demographics and maternal healthcare knowledge, with cultural and language barriers hindering access. The global trend towards microfinance and entrepreneurship in poverty alleviation has led to the rise of Rural Support Programs in Pakistan, inspired by the Grameen Bank model from Bangladesh. The late 1980s saw the

establishment of mother NGOs and implementing partners aiming to mobilize rural households into Village Organizations, achieving global recognition for blending microfinance with social mobilization to enhance health outcomes, particularly in maternal health.

After the emergence of the COVID-19 pandemic, Pakistan's healthcare system is currently confronting unprecedented challenges. The healthcare system in Pakistan is faced with numerous challenges, which become more pronounced during pandemics and can quickly overwhelm the existence of healthcare institutions. The inadequacy of resources has always been a growing concern in Pakistan's healthcare system which has significantly been worsened since COVID-19 emerged (J Khan et al., 2023). The healthcare system of Pakistan is faced with shortages of medical supplies, personnel, and financial resources. Hospitals have also been overwhelmed with the upsurge in the number of seriously ill patients due to an insufficient number of doctors, and it is far worse in rural regions of Pakistan. The situation was exacerbated with the economic situation due to the global lockdown, due to which Pakistani hospitals are failing to acquire desired medical supplies. Moreover, the inadequate infrastructure of Pakistani hospitals and clinics have also been worsening patient outcomes. Structural problems and bureaucratic inefficiencies in Pakistan's healthcare facilities have become apparent due to the COVID-19 pandemic. The lack of a coordinated testing and consultation system among provinces has hindered timely patient care, making the situation in Pakistan potentially dire. However, the pandemic has opened opportunities for integrating health sectors and improving coordination to prevent future crises. Pakistan's longstanding neglect in public health planning exacerbates current public and policymaker challenges. There is a significant disparity in health resources across regions, affecting access for ethnic groups and increasing the risk of disease outbreaks, particularly among marginalized communities.

Resource Constraints

The healthcare system of Pakistan has long been a topic of fierce debate, with the general consensus being one rooted in disappointment and concern. Tales of overburdened hospitals, under-resourced care centers, and understaffed wards have been spoken of in hushed tones by the ailing population. However, no amount of discussion could have prepared the nation for the trials

set forth by the advent of a pandemic. With the arrival of COVID-19 at the doorstep of the nation, every underlying disparity and fragility within the healthcare system of Pakistan was unearthed. This paper seeks to conduct a comprehensive exploration of said healthcare shortcomings, with specific emphasis on resource constraints. The aim of this analysis is to serve as a testament of the ailments ailing the health sector, but it also serves as a clarion call to stakeholders with the hope that there can be targeted efforts made to mend the cracks, thus creating a healthcare fabric strong enough to weather future pandemics (Ali Khan et al., 2022).

The healthcare system of Pakistan has long been marking below par grades, with the annual assessments pointing towards institutional weaknesses. However, the onset of COVID-19 magnified said deficiencies by revealing an unprepared, unfunded, and highly compromised system. During this ongoing battle of man against virus, and the health system versus pandemic, the resource constraints have been laid bare for public scrutiny. It has been widely acknowledged that without the availability of these resources, coping with any pandemic, let alone a novel virus, is next to impossible. The implications of long term resource constraints translate into poor patient outcomes, hindrance in retaining the public trust, and an unprepared system for future outbreaks (Hammad et al., 2023).

Resource constraints are crucial barriers that compromise the effectiveness of a country's healthcare system in dealing with pandemics, including a lack of critical drugs, essential medical items, particularly Personal Protective Equipment (PPE), and other required equipment to treat COVID-19 patients. Such issues are exacerbated by immense disparities in resource allocations within Pakistan where big cities and urban settings have better resourced health facilities established and maintained by the public and private sectors. So far, the spread of COVID-19 in Pakistan has revealed unpreparedness concerning a massive deficit of necessary resources in its healthcare system, and one of the consequences is that the staff has been striking due to a lack of appropriate PPE. Resource constraints reduce the "surge capacity" of districts, provinces, or countries to respond during an epidemic fallout period by imposing limitations on the existence of an adequate and right mix of personnel, medical supplies, and other required resources. During the first and second wave of Covid-19, Pakistan in general, and the Khyber Pakhtunkhwa province in particular, although tried hard to augment resources, were overwhelmed

because the patients infected by the pandemic and the response from the province or country's health providers got compromised and was unfortunately not fully successful (Ali & Ali, 2020). The constraints on the health workforce to meet the overly increased demand for services arose due to a lack of preparedness, low government investment in the health sector, inappropriate allocation of resources, the inherited, understaffed, inefficient, and largely though not solely privatized public sector, and low wages (Ali Khan et al., 2022). As the number of cases, especially admitted cases, of COVID-19 started increasing, the healthcare facilities faced an extraordinary financial constraint. This led to the reshaping or decrease in the facility management approach of patients suffering merely from the diseases transmitted by the coronavirus. In some cases, the management is reserved only for the patients of COVID-19-like diseases, and all the other common patients are obliged to refer to the far distant hospitals. The restrictions in resources are not only intrinsic; they are there because, historically, they have not been a priority in the resource allocation scheme of the governments of low-incumbent countries (LICs). Overall, resource constraints greatly compromised the healthcare system's operational capabilities to deal with the COVID-19 situation effectively.

Infrastructure Gaps

As underscored by previous research, a critical barrier is the significant infrastructure gaps in Pakistan's healthcare system that need to be well comprehended to understand the challenges faced during a health crisis like the COVID-19 (Ali Khan et al., 2022). The infrastructure gap is increasingly exacerbated with the outbreak of public health emergencies, undermining the resilience of healthcare systems. The inadequacies in healthcare infrastructure reveal the inability to manage the growing volume of patients in a public health emergency. Five types of infrastructure gaps are analyzed: (i) the insufficient quantity of healthcare facilities; (ii) problematic physical condition and technological shortages in healthcare facilities; (iii) weaknesses in the capacity of the medical emergency response infrastructure; (iv) the problematic distribution of infrastructure resources; (v) the patient outcomes pattern and public health statistics related to healthcare infrastructure. Firstly, the insufficient number of medical institutions. Overcrowding of hospitals has been a major problem in Pakistan which deteriorates during health crises such as COVID-19, particularly in rural areas where skilled healthcare

workers are scarce. Hospitals in major cities might be better equipped but cannot meet the needs of patients from rural or economically underdeveloped areas. Secondly, the unsatisfactory physical condition and technology of existing medical facilities. The vast majority of medical facilities are not in optimal physical condition, with neither sufficient resources nor specialization. Healthcare facilities are also substantially lacking in advanced technology and relevant facilities. Thirdly, inadequate emergency medical response infrastructure. Pakistan not only lacks a sufficient number of medical staff but also must deal with the long-lasting public health emergencies such as COVID-19. Fully utilizing existing medical infrastructure as emergency resources during a public health emergency might be practical, whereas this is not possible to do because large tracts of medical facilities do not meet the minimal AA criteria. In addition, established procedures to prevent and control emergency public health hazards are lacking - such as systematic approaches for monitoring, early warning systems, and emergency response contingency plans. The fourth gaps involve the need for a just distribution of health facilities. The highest number of health facilities exist in urban areas, while Chitral and Kohistan have a total of 3 healthcare facilities covering 446,068 residents in 2017. Lastly, there is a discussion of inequities in healthcare infrastructure, which are reinforced by the uncontrolled challenges in the treatment and prevention of diseases under sub-par medical conditions with the spreading and diffusion of COVID-19 and death numbers hitting among the healthcare professionals.

The healthcare infrastructure in Pakistan is inadequate to meet its population's needs and fails to deliver an equitable standard of care. The country's health service delivery is marked by inadequate numbers of healthcare facilities. In addition, the geographic distribution of the already insufficient healthcare facilities is skewed towards urban areas and neglects rural populations (Ali Khan et al., 2022). Public healthcare facilities, especially state-run hospitals, suffer from neglect, with public health spending in Pakistan falling consistently below the recommendation (Ali & Ali, 2020). Outdated or absent medical technology compounds the inadequate healthcare infrastructure. The last National Health Facility survey was conducted in 2016, which makes it difficult to accurately assess the improvement in health indicators since then.

This gap in health infrastructure has led to poor health outcomes. Most disease cases go undiagnosed, leading to increased morbidity

and mortality rates. Adding to these problems are the inadequate sanitation facilities contrary to the guidelines during the fulfillment of health and hospital services. Due to a lack of testing facilities, it is harder to diagnose the diseases which in turn means that less than required numbers of patients meet the desirable treatment plan. It is important to scale up existing health infrastructure as well as to invest broadly in health infrastructure. By re-energizing investment in hospital infrastructure, the capacity of the healthcare system can be greatly improved. Potential infrastructure solutions and innovative ideas that could revolutionize the field are also discussed. Partnerships between the public and private sectors can support equitable public healthcare service delivery. The role of the healthcare system's infrastructure in the effective provision of healthcare is undeniable, so advocacy for holistic infrastructure reform in the healthcare system must be amplified.

Lessons Learned and Best Practices

A critical review of epidemics management provides a synthesis of best practices. A focus is placed on COVID-19 within Pakistan, and an emphasis is placed on critical adaptations that lead to health service resilience during successive waves of COVID-19.

Adaptive strategies: COVID-19 pandemic strikes, a review is provided on the key adaptations in the health service delivery and the community-based care system, critically assessing these in the context of the evolving TB burden and broader health system. The standard care cascades, recruitment to TB care and treatment outcomes are characterised in the context of COVID-19 waves and the sector-wide medical adaptations taken. In the wake of the pandemic aftermath, a two-year health systems thinking process has eagerly mentioned the best available evidence and debated adequate adaptations to build back a better TB care sector. The Tuberculosis Response Plan aims to avoid the excess mortality and morbidity due to reduce COVID-19 related public health measures, preserve the healthcare capacities and professional workforces, and bring the TB care services as close as possible to where patients live. Key additional adaptations are made that build stronger primary healthcare systems and proactively address the social stigma and fear surrounding COVID-19 and lungs health services (Fatima et al., 2021).

Communication and collaboration: Pakistan, a country of 220 million, after summarising the times series epidemic curves and other key COVID-19 related statistics, a narrative review provides a critical appraisal of the epidemiological and the public health

adaptations to COVID-19 waves. The health sector capacity adaptations and the backlash on the non-pharmaceutical interventions including both countrywide and citywide public health measures are also described. A critical discussion is provided of the extent the Pakistan's COVID-19 public policy and health systems adaptations during country waves correspond to WHO's KgERI of epidemic response interventions for respiratory transmissible pathogens and respond to typology. According to the assessment, it is argued that several policy and system failures compounded the system's inability to flatten the COVID-19 curve. In light of a series of effectively planned, implemented, and evaluated adaptations, it is claimed that newly derived experiences, and effective practices are nationally and now widely generalised that could benefit other health systems fighting the COVID-19 and future pandemics (Emmanuel et al., 2023).

The most rapid way the world has ever changed in modern history is the COVID-19 pandemic. By infecting millions of people around the globe, the novel coronavirus exposed mankind to such a degree of physical, psychological, economic changes, from which it is believed that at least for a generation to recover would be difficult. The COVID-19 is a one-in-a-century event that has significantly affected global public health protection, early warning systems, containment, and response mechanisms. From architecture to operation, for understandable reasons, the pandemic caught several nations off guard and relied on infrastructure designed for other catastrophes. Pakistan is no unusual nation in this matter. For the mid-level public health emergency, its healthcare system has been preparing at most. Nonetheless, the COVID-19 is an unprecedented public health catastrophe that has shown critical flaws in the present set-up. Reviewed from December 2019 onwards, this research sheds light on the effect of the COVID-19 pandemic on Pakistan's healthcare system. More importantly, it enlightens the lessons to be learned in shaping public health practices from COVID-19, and last but not least, it sheds light on the adaptive strategies that have emerged from these trying times in Pakistan in response to the pandemic. These assessments would benefit both public healthcare professionals and policymakers and offer noteworthy cases that can be implemented globally (Emmanuel et al., 2023).

It is argued that a. increasing the ratio of community health centers and family health centers to hospitals in urban areas, where the ratio is significantly lower, b. establishing an integrated city-

wide electronic reporting and information system and providing immediate access to all healthcare institutions (public and private) via this system to the necessary online resources, c. conducting infrastructure and human resources improvements for healthcare institutions, especially by ensuring that infectious patient care areas, environmental isolation standards, and SARS-CoV-2 testing and treatment infrastructure are established in critical care settings. d. expansion of telehealth services, especially in fragile, separated, or remote districts, is a vital practice in the ongoing and post-COVID-19 world. And e. restructuring vocational training in medical schools and the development of pandemic management and emergency preparatory courses that are fundamental for ensuring that healthcare personnel comply fully with infection protection rules, have open access to the most up-to-date information, and are sufficiently trained in case-intensive care patient admission is projected to boost public healthcare capacity. In parallel with the abovementioned forecasts, the COVID-19 pandemic was confronted with interim public health emergency interventions in Pakistan and reflected on the healthcare structure, providing different views on how to remodel for a healthier environment (Fatima et al., 2021).

Adaptive Strategies

The COVID-19 pandemic imposed a significant burden on global health, affecting both developed and developing countries like Pakistan. The adaptive strategies implemented during the pandemic in Pakistan exemplify mechanisms that should be integrated into the healthcare structure for effective future responses. Health institutions needed to adopt these strategies rapidly, akin to chameleons, to address the challenges posed by the crisis. Lessons learned from COVID-19 must be retained in policy and operational frameworks, as these strategies not only address current issues but can also prepare for emerging pandemics and healthcare concerns post-COVID-19. The healthcare system in Pakistan faced an unforeseen toll, prompting immediate adoption of swift adaptive measures. Establishing testing centers quickly and using methods like drive-through sample collection exemplifies effective responses to ensure efficient supply chain management and testing capacity utilization. Quality assurance measures were put in place to ensure reliable test results. The healthcare system embraced digital health innovations, launching mobile apps for real-time data on COVID-19 testing prevalence and impact on morbidity and mortality. Telemedicine practices were introduced

to provide healthcare remotely while adhering to social distancing guidelines. The system also flexibly identified supply chains, ensuring the procurement of essential resources such as ventilators, oxygen cylinders, and PPE. The ability to manufacture these resources at speed and scale illustrates a commendable adaptive strategy to meet urgent needs during the pandemic. (Emmanuel et al., 2023) .

Given the evolving nature of COVID-19, as a novel strain of coronavirus, preventive and treatment strategies have rapidly evolved across the globe over the past two years. Therefore, an open-ended analysis of adaptive healthcare strategies would be critical to comprehend how different healthcare system stakeholders adjusted their strategies over time. This component, switching responses, is often overlooked in discussions of health during COVID-19. The importance of flexibility at each step of the policy process, starting from orientation to implementation, is too often overlooked. Public interventions must be readily adjustable to suit the reality of a situation as it evolves. This is why it is so crucial to consider how community surveys can feed into policy decisions right down to implementation; being able to pivot and adjust based on new information is just as important as the initial strategic choices. As countries across the world brace for the next pandemic, understanding where efforts might have lagged in concert with lessons learned about what can be done in the future is just as vital as understanding the sustenance of ongoing, successful policies. Pakistan's highly decentralized, non-uniform healthcare system and the increasing engagement of local governments has installed such critical understanding (Fatima et al., 2021). Drawing from extensive rounds of research conducted over the past year, ongoing discussions across more than half of all Pakistani districts, these considerations might encourage the collective building of a more responsive, inclusive and resilient healthcare system, capable of combating future pandemics. Four community surveys were conducted across heavily populated districts of Pakistan; findings have been presented at health conferences and seminars held by the government of Pakistan (Emmanuel et al., 2023).

Exploring ways to move care closer to homes for those unwell, particularly for COVID and tuberculosis, holds great potential, as policy changes during COVID succeeded. While COVID-19 caused devastation worldwide, the most severe outcomes were in advanced, centralized healthcare systems. Low- and middle-

income nations faced even greater fears. Amid preparations and desperation, surprising resilience emerged: local adaptations of international guidelines, patients accessing unavailable prescriptions via WhatsApp, and states borrowing policy proposals from global discussions. The key was that this robustness stemmed from policy changes. If effectively implemented and sustained, there's a chance to improve health systems and reshape healthcare resources post-COVID. The shifts in vaccination policy might also lead to relevant analysis for resource reallocation. The proposals acted upon during the COVID crisis remain important: time has allowed for evaluating their success, despite persistent confusion in vaccination strategies. The policy adaptations in Pakistan regarding COVID could provide insights for building a more adaptable health system overall.

Technological Innovations

The COVID-19 pandemic has severely disrupted global health systems, prompting countries to adopt strategies like social distancing, lockdowns, and vaccination campaigns. In Pakistan, as in many low- and middle-income countries, health infrastructure proved insufficient to manage the pandemic's extensive challenges. However, government measures combined with support from philanthropic individuals, non-profits, and foreign NGOs effectively reduced infection rates and prevented the extreme scenarios seen elsewhere. The pandemic triggered significant social and economic crises, with lockdowns heavily impacting labor-dependent sectors. The healthcare sector was particularly affected, scaling back services to focus on COVID-19 cases, which led to a restoration of patient beds and emergency facilities to manage the surge in patients. New constructions and temporary hospitals helped to alleviate the burden on existing healthcare resources. Front-line health workers like nurses and doctors faced overwhelming demands and safety risks, compounded by the cancellation of surgeries and the exit of migrant healthcare workers contributing to staffing shortages. Amid these challenges, technological advancements facilitated patient care, exemplified by the growth of telemedicine, E-health services, and systems for managing quarantine and tracking virus spread, thereby ensuring continuity of care during lockdowns. (Irfan & Yaqoob, 2024) .

The return of mutated coronavirus strains after a brief respite sparked two waves that severely challenged Pakistan. Efforts to contain the pandemic devastated the national economy and healthcare sector. With a surge in COVID-19 cases, the healthcare

system was overwhelmed, leading to the death of at least 700 health practitioners. The lockdown exacerbated the situation for daily wage earners, revealing the vulnerabilities of a health system weakened by inadequate investment and reliance on private care. The outbreak highlighted the need for countries to establish resilient health systems to manage infectious disease outbreaks. Public health must become central to addressing the failures in existing healthcare. A positive outcome of the COVID-19 crisis is the rapid acceptance of technological innovations, such as the gig economy and online education. This section explores health-oriented innovations spurred by the pandemic, including increased funding and digital health infrastructure. Key developments include telemedicine, mobile appointment registration, and health monitoring for quarantined individuals. The surge in digital healthcare solutions may lead to lasting improvements in access and reduced financial barriers, fostering a culture of seeking prompt consultation for illnesses and enabling quicker identification and isolation of contagious individuals. (Irfan & Yaqoob, 2024)

Policy Implications and Recommendations

Pakistan's healthcare system was impacted significantly as a result of the ongoing COVID-19 pandemic. The country began swiftly taking measures to combat the virus once COVID-19 cases started becoming visible in Pakistan around March 2020, leading to an increase in the use of resources and an increased burden on the healthcare delivery system. Despite this, COVID-19 cases surged, leading to a lock-down. This resulted in economic hardship for the population, particularly those struggling to get a regular wage because of the lock-down. Overall, Pakistan's healthcare system faced some understated challenges surrounding the ongoing COVID-19 outbreak.

The COVID-19 outbreak in Pakistan has highlighted urgent needs for resilience in its healthcare system, exposing overlooked vulnerabilities. This overview identifies key areas for policy reform based on lessons learned from the pandemic's impact. These areas are categorized into five: resource allocation, infrastructure, health workforce, health delivery, and evident inequalities. Community involvement in health policy-making is emphasized for equitable healthcare access across demographics. Recommendations propose a framework for sustainable interventions to combat future pandemics, stressing the importance of co-designing policies with affected communities. Ensuring healthcare resilience, particularly

in resource allocation, is vital, with significant variances noted across responses and regions. Over the past year, resource distribution has changed among healthcare levels and sectors, revealing systemic inefficiencies. Historical insights underline the need for improved resilience to manage the frequent misalignment between supply and demand, leading to inadequate vaccination centers and disrupted health services. Coordination between public and private sectors remains a persistent challenge despite governance reforms. To counter these issues, four interventions aim to enhance flexibility in healthcare response, supported by evidence-based policymaking and stakeholder engagement, backed by data on effectiveness. Implementing these interventions will demand substantial investments in healthcare infrastructure and workforce development, requiring coordinated policy initiatives between government and private sectors while addressing the complex political economy surrounding healthcare policies.

Healthcare Policy Reforms

Health sector reform in Pakistan is essential for improving service delivery and outcomes. The pandemic exposed weaknesses in the public healthcare system, prompting the need for resilient policies to handle future emergencies. Key reforms should focus on expanding health service coverage, particularly in community healthcare, as inadequate primary care resources impact pandemic management. Strategies for resource allocation must prioritize underserved areas and ensure adequate funding for protective equipment and medical supplies for health workers, who require fair compensation. Establishing public-private partnership medical centers and incorporating community health into policies is crucial for addressing local needs. Utilizing technology for training disadvantaged health workers is vital amid automation threats in healthcare. Innovations like telehealth and AI can improve patient care and increase access. Policies must be evidence-based and structured by healthcare experts to monitor impacts. Simulation exercises can provide insight into the effects of changes. Learning from successful healthcare models globally can enhance policy development. Continuous monitoring and assessment are necessary to maintain adaptive health systems, ensuring coherent and consistent implementation of health reforms.

Health care providers have responded to health risks attributed to the climate crisis. People in South Asian, and other low- and middle-income countries are facing some of the most severe health impacts due to the climate disaster (Muzzamil et al., 2023). After

the monsoon flooding in 2022, the call for healthcare providers to take action to avert far-reaching health adversities was disseminated. In this regard, a comprehensive reformation of Pakistan's healthcare system is recommended. As the COVID-19 pandemic highlighted, Pakistan's healthcare system is incapable of effectively responding to the growing health risks that have emerged in the wake of ongoing world health crises. In light of COVID-19, seven areas of healthcare policy reform and their implementation are discussed to mitigate risks and enhance defence abilities in the face of future pandemics. In order to effectively respond to health risks posed by pandemics, further healthcare policy reform is warranted in Pakistan. Second, in order to reduce the health risks that arise during the COVID-19 pandemic, healthcare policy in Pakistan should be reformed to facilitate the health system's re-enforcement. Third, should be reformed to meaningfully address health risks that may emerge in Pakistan during current or future pandemics. Following the COVID-19 pandemic, Pakistan should reform its healthcare policy in seven areas as a comprehensive defense strategy of health risks that can occur during future pandemics.

Capacity Building Initiatives

In an environment characterized by health challenges and a tendency toward global health crises, it is essential to move forward with capacity building initiatives. These initiatives should aim to strengthen the healthcare system for effective response now and better management of health issues in the future. Training and professional development opportunities for healthcare providers should be targeted. Giving improved competencies, healthcare providers would be better prepared to manage crises during the most critical period. When investments are made in nursing education as well as in public health and infectious disease management, this would lessen the need for drastic measures in future events. There currently are numerous opportunities and programs focused on the health sector, which invest in capacity building and knowledge transfer, as well as for resources and support for preparedness. Building up of continuous learning culture would improve effectiveness, promote better innovation, and encourage care improvement. This refers to a range of topics and activities that include safety protocols, patient management, signs of illness, infection prevention measures, and preventive measures. Equally important is the development and sharing of more and more informative materials and resources on public

health awareness. Finally, support for healthcare service provision from the public sector helps provider institutions to ensure the sustainability and availability of services and focuses on caring delivery in arduous times (Ali Khan et al., 2022). By building the capacities of community health workers (CHW), healthcare workers can be reduced by giving special attention to the "last mile" to continue service effectively and timely. Likewise, health activities taken by CHWs in places where access to information is limited has the ability to supplement facilitation and intervention, thereby advancing the provision of last-mile service.

Until the COVID-19 pandemic found its way to Pakistan, not much attention was given to the country's healthcare system capabilities for response to a large scale infectious disease outbreak (Ali Khan et al., 2022). With an understaff constant of barely 0.6 doctors per 1000 population, and a marginal greater number of nurses – the pandemic exposed the already limited healthcare system capacity in the country. However, a wider appreciation of the situation was ensured by the pandemic's landing on the globe. In brief, the country's healthcare system found itself bumping along in the wake of the virus' outbreak.

"The hospital infrastructure is in tatters, the staff are over-worked, over-exposed and under-protected and the policies are changing as rapidly as the surge in COVID-19 cases.

Conclusion and Future Directions

COVID-19 severely impacted global healthcare, with Pakistan facing extraordinary challenges due to its historically neglected health systems. The pandemic prompted adaptive strategies and technological innovations, allowing for valuable lessons to be learned. The fear surrounding COVID-19 led to stigma against positive cases. In response, the healthcare system quickly adapted, using telemedicine effectively for COVID-19 testing and management of mild to moderate symptoms at home, thereby reducing pressure on health facilities. Public-private partnerships facilitated accessible and affordable testing through drive-through services. Online platforms provided free COVID knowledge resources and consultations with doctors. Vaccination centers were established, efficiently administering vaccines and garnering public support. Policymakers are urged to continually reformulate policies to address future health challenges and collaborate with international networks for resource capacity. Collaborative strategies involving local stakeholders and community health workers (CHWs) are essential for prompt services and effective

care. Emphasis on improving general health outcomes and instituting medical legislation for healthcare products is critical. Strengthening the healthcare system's foundation through infrastructure investment is necessary for future resilience.

The COVID-19 pandemic has placed immense, unprecedented pressure on healthcare systems worldwide, exposing critical vulnerabilities within the public health infrastructure of developing nations like Pakistan. In light of recent warnings concerning Pakistan's healthcare system preparedness, the necessity to address the country's fragile health response mechanisms is more immediate than ever. This paper offers an evidenced critique of Pakistan's healthcare system resiliency during the COVID-19 crisis and beyond, suggesting policy recommendations to align best practices in the face of emerging shortfalls. Drawing on diphtheria and COVID-19 as compounding threats to Pakistan's public health, the crisis highlights the government's inaction toward advancing healthcare industries as well as its misplaced salience on pathogens only. After synthesizing critical lessons and policy cross-comparisons with Malaysia, the essay concludes by underlining the value behind this potential dialogue in health policy development while providing future-oriented questions for ongoing research.

Synthesizing the global conversation around Pakistan's evolving health policy, there is importance to amplify and support those voices calling for the improvement in the healthcare infrastructure, resource management, and intersectoral collaboration. The first wave of COVID-19 in Pakistan uncovered a range of inconsistencies in hospitals' abilities to treat standard or complex health conditions. The more recent diphtheria revelation also sharply exposed the underinvestment in hospitals and care facilities outside COVID-19 responses. Thus, the remaining focus makes an empirical contribution reflective of the vast public need to unpack these complexities. In light of the disease outbreaks like COVID-19 or the threat of new viral strains in addition to extant diphtheria strains in the region surrounding Pakistan, the significance of forward-looking health policy is self-evident. So, the health policy dialog between academia and practitioners should be seen in the light of strengthening healthcare industries and management capabilities as well.

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