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From Crisis To Capacity: A Qualitative Assessment Of Post-Covid-19 Institutional Resilience In Peshawar Based Medical Teaching Institutions

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ABSTRACT

The COVID-19 pandemic represented a transformative global event, inducing systemic shocks that transcended public health to destabilize national economies and social structures. The study provides a comprehensive qualitative deconstruction of institutional resilience within the primary Medical Teaching Institutions (MTIs) of Peshawar, Pakistan, specifically focusing on Lady Reading Hospital (LRH), Hayatabad Medical Complex (HMC), and Khyber Teaching Hospital (KTH). The study utilized a thematic analysis of eighteen in-depth interviews with a diverse cohort of healthcare professionals, including physicians, paramedics, administrative staff, alongside key informants and post-recovery COVID-19 patients. The findings indicate that the initial response in Peshawar was marked by a necessary but drastic suspension of routine care, characterized by a fundamental lack of pandemic preparedness, critical shortages of life-saving oxygen and personal protective equipment (PPE), and extreme psychological trauma among frontline workers. However, the subsequent institutional response demonstrated significant adaptive capacity, facilitated by the permanent establishment of public health laboratories, the establishment of isolation wards, the specialized induction of respiratory therapists, and the implementation of rigorous clinical zoning strategies. By synthesizing these results, the study customized a theoretical framework for healthcare resilience that integrates the "6S" components (Space, Staff, Stuff, System, Strategies, and Services) with the four functional capabilities of Resilient Health Care (Anticipate, Monitor, Respond, and Learn). The study concludes that while qualitative improvements in emergency protocols and triage systems have been achieved, long-term sustainability depends upon transitioning from written policies to applied, simulation-based emergency management frameworks and the remediation of inflexible architectural hospital designs.

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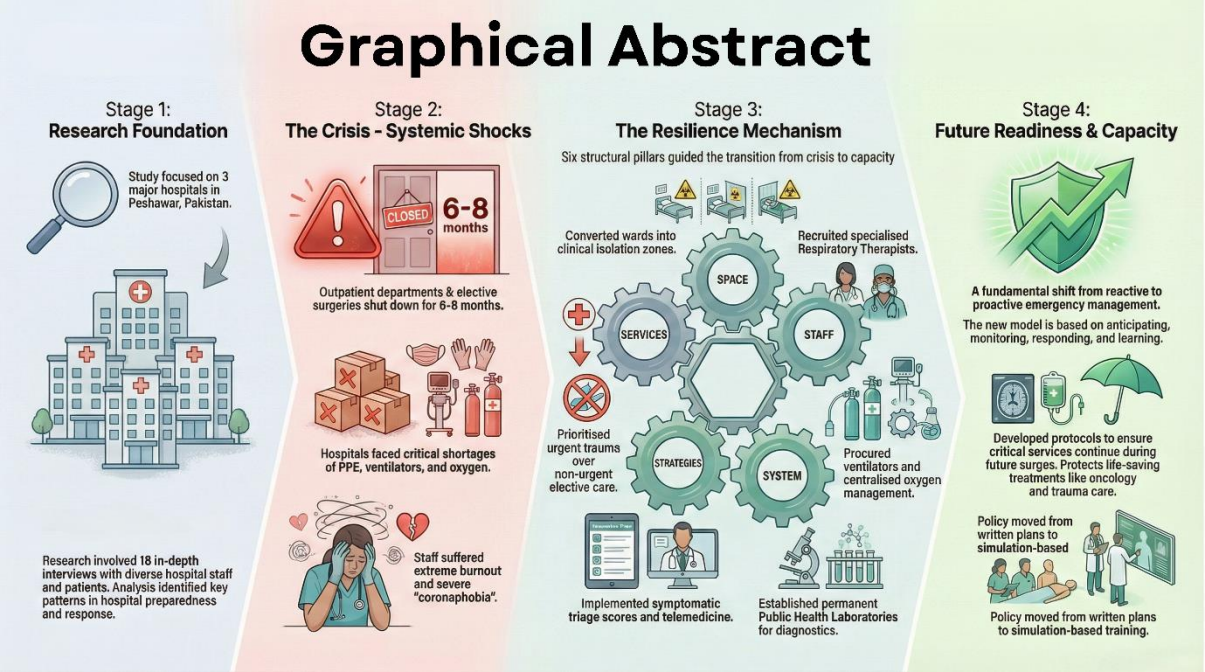

Keywords: Pandemic, Resilience, Covid-19, Hospital, Crises

Introduction:

A pandemic is defined as an epidemic occurring worldwide, or over a very wide area, crossing international boundaries and usually affecting a large number of people (Taylor & Moji, 2021). Many pandemics have occurred throughout human history and seem to be increasing in frequency, especially due to the rising emergence of viral diseases from animals to the human population. Historically, plague, smallpox, cholera, and the Spanish flu are the longest-lasting, most repetitive pandemics and have caused large numbers of human deaths (Piret & Boivin, 2021; Joseph & Susan, 2021; Glatter & Finkelman, 2021). Table 1 provides details of historical pandemics across the globe.

The COVID-19 pandemic quickly spread worldwide, affecting almost all countries and territories. The outbreak was first identified in December 2019 in Wuhan, China (Pokhrel & Chhetri, 2021). As of August 16, 2023, the world in total reported 769,774,646 confirmed COVID-19 cases with 6,955,141 deaths **(WHO, 2023).** The global COVID-19 outbreak and its subsequent repercussions and implications, after being declared a pandemic by the World Health Organization, exposed the inherent, lingering, and acute shortcomings of health systems in many developing countries, including Pakistan (Shaikh, 2021). Pakistan reported its first two confirmed cases on 26 February 2020, linked to Iran's travel history (Noreen et al., 2020). **As of August 17, 2023, Pakistan reported a total of 15, 80,631 confirmed cases nationwide, with 30,644 deaths (Government of Pakistan, 2023).** The likelihood of Pakistan getting overwhelmed with COVID-19 exposure was quite strong because of a weak health system, burden of disease, poverty and malnutrition. **The** pandemic has revealed the weak resilience of even those health systems that are classified as high-performing (Shaikh, 2021)**.** Its unpredictable nature, coupled with the far-reaching restrictions it necessitated, induced widespread fear and apprehension among people, transcending geographical boundaries (Salma Zeb, 2023)**.**

Building resilient health systems and hospitals is critical to advance universal health coverage and global health security. Health systems resilience can be defined as the ability to "resist, absorb, accommodate, adapt to, transform and recover in a timely and efficient

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manner" (Khalil et al., 2022). Medical teaching institutions (MTIs) in Peshawar, like other healthcare facilities, had to adapt rapidly to these unprecedented demands. This included establishing dedicated COVID-19 wards and isolation facilities, reallocating staff, and implementing stringent infection prevention and control procedures (Haq et al., 2022). Technological adoption, particularly telemedicine, proved to be a significant strategy for maintaining healthcare delivery and adapting to the pandemic's challenges (Inserm, 2021). Adaptive responses related to the workforce also involved task-shifting, where nurses performed duties typically reserved for doctors, to manage increased demands (Khalil et al., 2022).

Table: Timeline of the pandemics from 1817 to 2019

Years	Pandemics	Pathogens	Vectors
1817–1824	1st cholera pandemic	Vibrio cholerae	Contaminated water
1827–1835	2nd cholera pandemic	Vibrio cholerae	Contaminated water
1839–1856	3rd cholera pandemic	Vibrio cholerae	Contaminated water
1863–1875	4th cholera pandemic	Vibrio cholerae	Contaminated water
1881–1886	5th cholera pandemic	Vibrio cholerae	Contaminated water
1885–ongoing	plague	Yersinia pestis	Fleas associated with wild rodents
1889–1893	Russian flu	Influenza A/H3N8	Avian
1899–1923	6th cholera pandemic	Vibrio cholerae	Contaminated water
1918–1919	Spanish flu	Influenza A/H1N1	Avian
1961-ongoing	7th cholera pandemic	Vibrio cholerae	Contaminated water
1968–1970	Hong Kong flu	Influenza A/H3N2	Avian
2002-2003	SARS	SARS-CoV	Bats, palm civets
2009–2010	Swine flu	Influenza A/H1N1	Pigs
2015-ongoing	MERS	MERS-CoV	Camels, Bats
2019-ongoing	COVID-19	SARS-CoV-2	Bats, pangolins?

Source: (Piret & Boivin, 2021; Joseph & Susan, 2021; Glatter & Finkelman, 2021)

The healthcare system in Peshawar was significantly overwhelmed by the COVID-19 pandemic due to a lack of initial preparedness, resulting in the total closure of essential outpatient services, a shortage of medical supplies, and extreme psychological stress among staff. Despite later adaptations, the institutions faced critical flaws in building design, inadequate training of human resources, and a lack of effective disaster management policies. There is a pressing need to deconstruct these institutional vulnerabilities and the subsequent coping strategies to ensure that the healthcare system can withstand future infectious disease shocks without compromising routine and emergency care. The primary aim of the study is to provide a comprehensive understanding of the challenges created by infectious diseases, specifically COVID-19, while highlighting the measures taken to enhance institutional resilience and preparedness within the MTIs. The specific objectives of the study are to evaluate the impact of the COVID-

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19 pandemic on the functionality of the healthcare system in Peshawar, including short-term disruptions to elective services and long-term structural changes; and to analyze the coping mechanisms and policies implemented by tertiary care hospitals to develop resilience against future pandemic crises and outbreaks. The study answers the following two research questions:

How did the COVID-19 pandemic affect the delivery of healthcare services and the psychological well-being of healthcare workers in Peshawar's MTIs?

What specific institutional capacities and policy frameworks were utilized or established to transition these hospitals from a state of crisis to improved resilience?

Theoretical Framework

To conceptualize the dynamics of institutional resilience within the Peshawar context, the study develops a customized theoretical framework that blends the foundational principles of Resilient Health Care (RHC) with the resource-based view of organizational performance (Emami et al., 2024; Carbonara et al., 2024). Resilience is defined here as the ability of a healthcare system to absorb disturbances, adapt its internal structures, and transform its operations to maintain functional integrity in the face of acute shocks (Tariq, 2023; Tariq et al., 2021 ; Kruk et al., 2015). The framework rests on four core capabilities designed to shift healthcare systems from reactive responses to anticipatory action (Ambrose et al., 2024; Iflaifel et al., 2020). It includes anticipation, monitoring, responding and learning. Anticipation is the ability to monitor the clinical environment and identify potential signals of crisis before they affect hospital functioning (Ambrose et al., 2024). In Peshawar, such a capability was initially low but improved through the establishment of permanent diagnostic labs. Monitoring is the continuous collection of real-time data regarding patient flow, supply chain integrity, and clinical outcomes. It involves assessing the system's status to put forward appropriate coping strategies (Iflaifel et al., 2020). Responding refers to the ability to adapt how performance is enacted during a shock, utilizing both planned and emergent strategies. It was evidenced by the repurposing of orthopaedic wards into isolation zones (Ambrose et al., 2024; Lajber et al., 2024). Learning is the integration of experiences and knowledge gained during a crisis into future crisis management plans. Learning analysis allows institutions to evolve from “Work-as-Imagined” in policy manuals to “Work-as-Done” on the frontline (Iflaifel et al., 2020; Hollnagel & Braithwaite, 2019). The theoretical structure recognizes that resilience is an emergent property of a complex adaptive system rather than a static feature. It posits that institutional capacity-building in Peshawar involves a move toward “smart dependency”, where local hospitals utilize international donations and government funds to build long-term structural reserve capacity.

Methodology

The research was situated in Peshawar, the provincial capital of Khyber Pakhtunkhwa. Peshawar is a densely populated metropolitan area spanning 1518 km^2 with a population of approximately 4.76 million (Pakistan Bureau of Statistics, 2023). Data collection was specifically focused within the city’s three primary MTIs, i.e., LRH, HMC and KTH. The study population comprised a diverse cohort of healthcare professionals, including physicians, paramedics and administrative staff, alongside key informants and post-recovery COVID-19 patients (Figure 1). To identify and recruit these participants, the researchers employed a purposive sampling technique, resulting in a final sample size of n=18. For the patient cohort, inclusion was strictly limited to those patients who had received treatment for COVID-19 at one of the three designated MTIs. Primary data was collected through eighteen in-depth interviews (IDIs), facilitating a comprehensive

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exploration of the participants' experiences and professional insights.

The qualitative data were analyzed using thematic analysis, a systematic framework chosen for its efficacy in identifying and interpreting patterns of meaning across complex datasets. Following the six-phase recursive process outlined by Kiger & Varpio (2020), the analysis commenced with a familiarization stage, involving multiple reviews of audio recordings and interview transcripts to ensure interpretive depth. Data were then meticulously organized into initial codes, serving as the foundational building blocks for broader conceptual patterns. Through an iterative process of comparison and mapping, these codes were synthesized into substantive themes. Each theme was reviewed and refined to ensure internal coherence and evidential support. The final stage involved defining and naming these themes to construct a narrative that transcends mere description, providing a comprehensive interpretation of hospital preparedness and responsiveness within the context of global health crises (Figure 1).

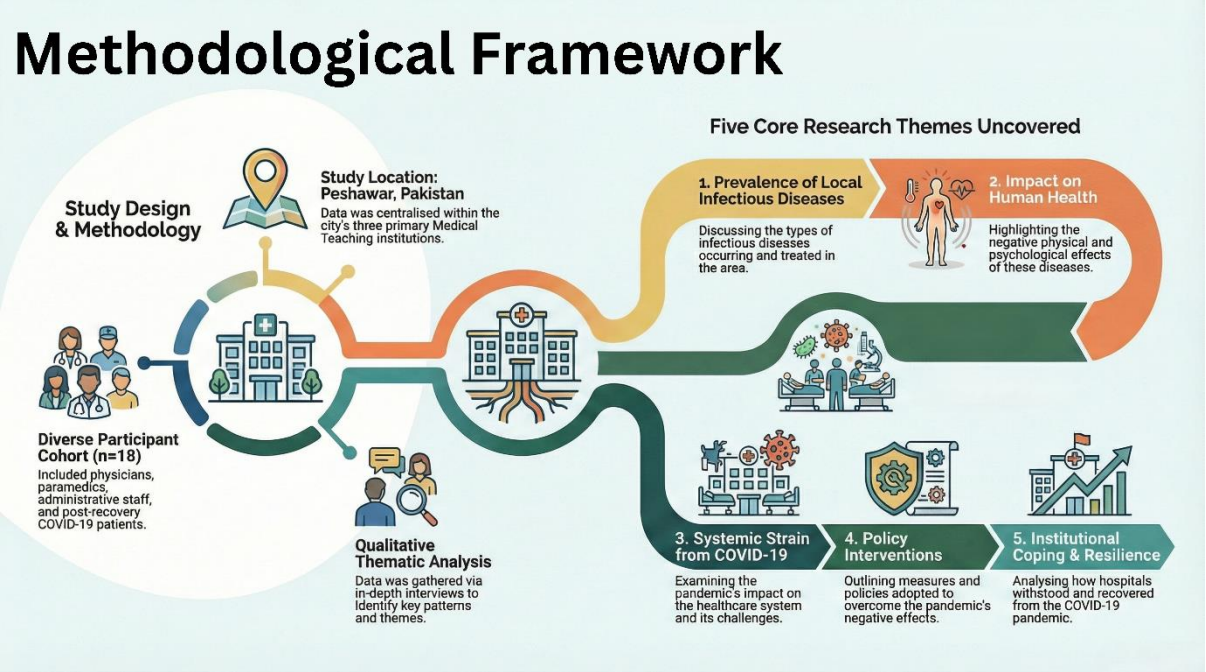

Figure 1 Methodological Framework and Core themes of the study

Results

Global health data indicate that infectious diseases are the second leading cause of mortality, surpassed only by cardiovascular conditions (Lee & Nguyen, 2015). Within the global context, Peshawar stands out as a critical center for disease transmission. As the primary metropolitan hub of Khyber Pakhtunkhwa, the city faces a high population density of individuals per square kilometer. The overcrowding, combined with socio-economic hurdles, is specific to its geographic positioning (Khan et al., 2022), and issues regarding public health (Israr et al., 2022), creates an environment for the rapid spread of the pathogens. The clinical burden in the region is heavy and diverse. A 49-year-old ICU Manager at LRH noted that, “the facility manages a vast spectrum of conditions, ranging from chronic viral hepatitis (HBV, HCV) and Tuberculosis to acute outbreaks of Dengue, COVID-19, and H1N1 influenza. The facility also handles high-risk cases of MRSA and Crimean–Congo hemorrhagic fever.” Furthermore, the Head of the Infection Control Committee at LRH (Aged 55 Years) reports that “MTIs across the Peshawar district provide treatment for an extensive list of ailments, including Vaccine-Preventable Diseases (Polio/AFP, Measles, Diphtheria, Pertussis, and Rubella), Vector-Borne &

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Zoonotic Illnesses (Malaria, Leishmaniasis, Rabies, and Anthrax), Waterborne & Gastrointestinal Infections (Cholera, Acute Diarrhea, and Enteric fever) and Respiratory & Systemic Infections (SARI, Bacterial Pneumonia, Meningitis, and HIV/AIDS)". Figure 2 provides the details of disease prevalence statistics derived from previous research studies on Peshawar.

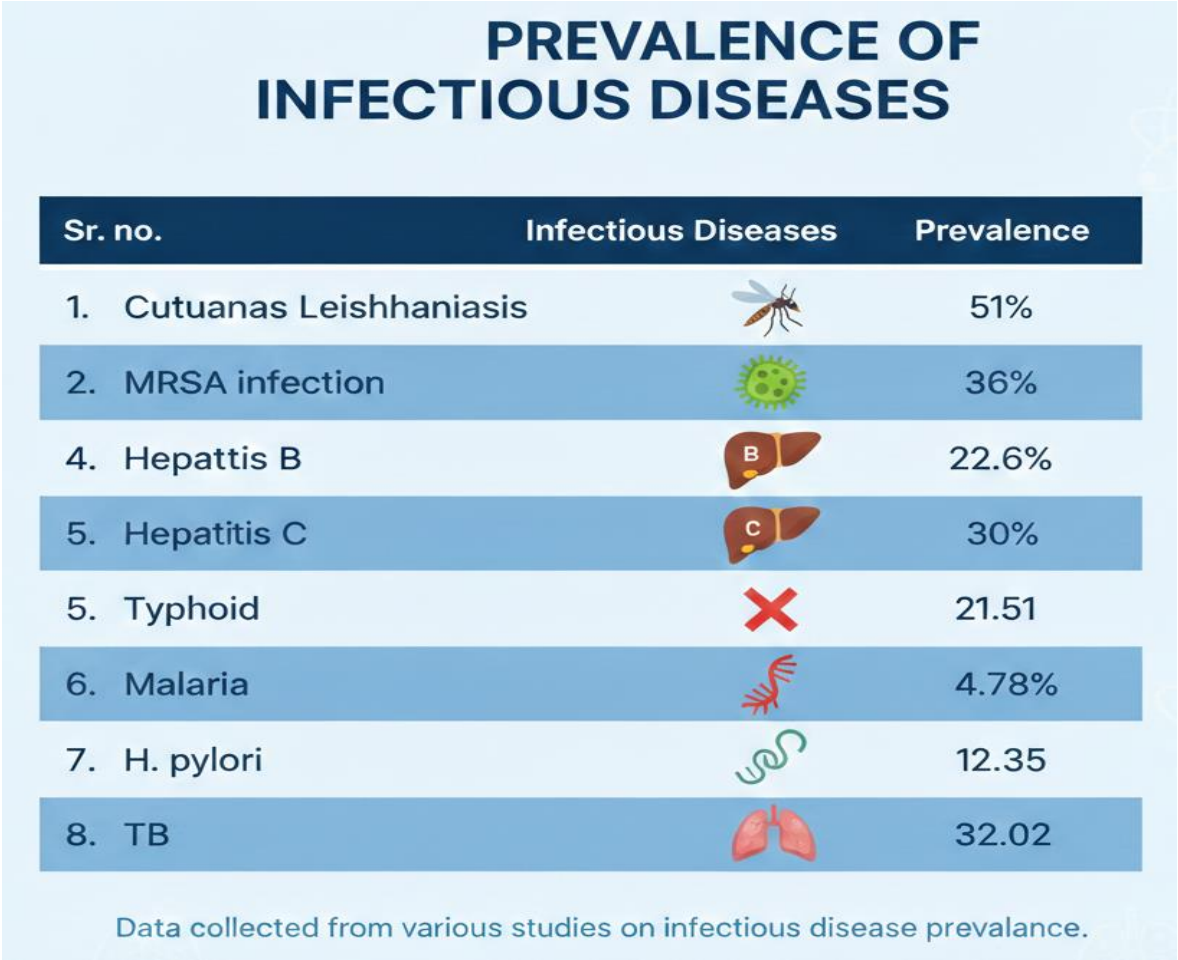

Figure 2 Prevalence of Infectious Diseases Treated in MTIs in Peshawar (Khan et al., 2022 Ullah et al., 2021; Ullah et al., 2017; Ahmad, 2014; Ayaz et al., 2012)

Regarding the Covid-10 progression, a respiratory therapist (age 37) at KTH Peshawar provided a localized perspective revealing that, "the actual morbidity rate was lower than initial projections, and the prognosis for many was generally positive. While rumors suggested widespread complications among all demographics, we found that young, healthy individuals typically recovered well, often only experiencing a loss of taste and smell. Severe outcomes were largely confined to comorbid patients, specifically those with hypertension, diabetes, or hepatic, and cardiovascular issues".

In Peshawar, the initial response was marked by a necessary but drastic suspension of routine care. A medical officer working at KTH (Aged 39) recalled that "outpatient departments remained closed for up to eight months. During the first wave, a critical shortage of PPE, the absence of vaccines, and inconsistent oxygen supplies created a climate of acute distress for both patients and clinicians". Tertiary and private facilities across Khyber Pakhtunkhwa were mandated to cease elective surgeries and outpatient

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consultations to mitigate viral transmission. However, the shift revealed a fundamental lack of pandemic preparedness. At HMC, a physician (age 51 years) reported that "even urgent cases, including trauma and infectious diseases, received diminished attention as resources were diverted and health personnel coped with the fear of infection". Beyond administrative closures, public perception played a significant role in declining health outcomes. Patients in the Peshawar district avoided emergency departments for life-threatening conditions, such as cardiovascular events or oncology needs, due to a pervasive fear of hospital-acquired COVID-19.

The strain on hospital operations extended to the administrative and quality assurance sectors. A KTH respiratory therapist (Age 38) noted that "despite rapid attempts to adapt, the lack of specialized facilities resulted in high mortality rates, with nearly 650 fatalities occurring in their immediate vicinity". Such disruption is a hallmark of resource-limited healthcare systems, where the sudden surge in demand quickly overwhelms available capacity (Haileamlak, 2021). The pandemic inflicted a psychological and physical toll on medical personnel. An ICU Manager (Aged 41) at LRH described the "indescribable" stress of managing unprecedented patient volumes while performing extended shifts under constant anxiety. At HMC, doctors highlighted that the "sudden need for specialized contagious staff led to a reliance on less experienced personnel, further complicating the response. The physical and professional strain not only impacted the standard of patient care but also contributed to widespread burnout and long-term exhaustion among the workforce."

Frontline healthcare workers faced significant barriers to maintaining safety standards. High patient volumes, coupled with a chronic shortage of PPE, rendered standard precautions nearly impossible to sustain. Data indicate that hospital infrastructure during this period fell significantly below the clinical requirements necessary to manage a high-pathogen outbreak. An Isolation Ward In-charge (age 49) at KTH Peshawar highlighted these systemic failures as, "resource scarcity remains our primary hurdle. During the peak of the pandemic, and even now, PPE remains insufficient. We continue to rely heavily on the central health department for basic reagents. Beyond supplies, there are administrative flaws and a lack of specialized training; we lack the 'refresher' courses needed to maintain staff competency. Even the physical design of our hospitals is a barrier; the buildings were not engineered with dedicated infectious disease wards in mind. Although it was a global challenge, it exposed our specific technical and structural flaws". A COVID-19 patient who was admitted to HMC during the first wave of COVID-19 noted, "isolation was the hardest part. The staff was so overwhelmed. They were out of N95 masks, so the doctors were double-masking with surgical ones. It made you feel guilty for being sick. I watched the man next to me get moved to the ICU, a spot only opened because someone else died. It was a 'one-in, one-out' system. The shortage of ventilators and life-saving medicine was a grim reality we faced every day."

The aftermath of the COVID-19 pandemic in the study area is characterized by a dual legacy of loss and systemic advancement. On the negative side, the most devastating impact was the permanent loss of both community members and highly skilled medical professionals. The death of seasoned healthcare providers has created a significant gap in clinical expertise and mentorship within Peshawar's hospitals, a gap that remains difficult to bridge despite ongoing recruitment efforts. Conversely, the crisis catalyzed institutional growth. Significant progress was made in refining emergency response protocols and strengthening the healthcare system's resilience against future biological threats. While post-pandemic preparedness has improved, experts suggest that current infectious disease protocols require further standardization to meet international benchmarks. A physician at

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HMC highlighted these structural improvements, “post-pandemic, we have established isolated units dedicated to communicable diseases. Unlike previous years, where disparate wards for conditions like Tuberculosis were often clustered, we now have dedicated spaces, personnel, and resources separated from general care. While international donations significantly increased our inventory of ventilators and medical supplies, improving our readiness to an extent, there remains a critical need for further development”.

In an effort to mitigate the socio-economic and clinical impacts of the pandemic, the Pakistan government launched a COVID-19 Relief Fund to mobilize public and private donations. These funds supported the creation of specialized isolation facilities within major tertiary care hospitals (Waris et al., 2020). Another critical support to the social protection fund was the "National Action Plan for the Coronavirus Disease," a strategic framework developed by the federal government and the Ministry of Health. The plan provided a standardized policy roadmap to assist provincial authorities in implementing localized containment and management strategies (Javed et al., 2020). Furthermore, the state introduced a fiscal stimulus, announcing a PKR 1.2 trillion ($8 billion) economic relief package designed to buffer the country against the pandemic’s financial fallout (Ashfaq & Bashir, 2021). Local medical institutions in Peshawar underwent significant structural and human resource transformations to meet the crisis. An Emergency Manager at KTH (Age 41) reported that, “the response included the establishment of permanent public health laboratories and dedicated COVID-19 ICUs. The human capital was enhanced by the recruitment of Medical Officers and the specialized induction of Respiratory Therapists. The long-term policy shifts ensure that these isolation units remain active and prepared for future surges even as case numbers fluctuate”. Similarly, HMC adopted a rigorous "zoning" strategy to prevent cross-contamination. An ICU Nurse (Age 51) noted that “the facility was bifurcated into distinct zones for COVID and non-COVID care before the arrival of the first patient. This included five separate isolation units with a total capacity of approximately 150–180 beds, ranging from specialized 9-bed units to a 64-bed primary ward”. A patient recovered from COVID during the third wave and was admitted at the KTH isolation ward noted, “It was different from what I’d heard about the COVID ward. When I arrived at KTH, they didn't keep me in a general hallway; they had a dedicated triage area. The triage officer checked bed availability in real-time. I was moved straight to the new COVID block. There was a real sense of a 'system' in place. The PPE looked standardized; everyone was in full suits with proper face shields. They even had a separate entrance for supplies so the clean areas stayed clean”.

The mitigation of COVID-19 required a multi-pronged approach involving pharmaceutical interventions, rigorous diagnostic surveillance, and large-scale public health measures such as the disinfection of educational and commercial hubs (Ebrahimi Rigi et al., 2023). In Pakistan, despite resource constraints, the state implemented significant measures, including the designation of specialized treatment centers, expanded laboratory capacities, and nationwide awareness initiatives (Waris et al., 2020). Local hospitals in Peshawar responded by reconfiguring existing infrastructure. An Isolation Ward Manager (Age 55) at KTH noted that “the facility successfully repurposed orthopedic wards and outpatient spaces into dedicated pandemic zones. Key elements of this response included utilizing all tiers of staff, from clinicians to paramedics and support personnel; implementing strict PPE adherence and social distancing within clinical environments; and establishing a foundation for rapid-response teams and dedicated administrative oversight”. While initial measures were comprehensive, a consensus among healthcare workers suggests that current infrastructure still lacks the resilience required for future outbreaks. A respiratory

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therapist at LRH emphasized the "need for convertible spaces/hospital areas that can be transformed into isolation wards within hours and the necessity of a permanent disaster management framework". Furthermore, a critical lack of simulation-based training and sustainable policy remains a concern. A physician at HMC observed that "without regular simulation exercises and easily adaptable policies known to all staff, the hospital remains vulnerable to the next crisis". Table 2 provides a summary of Impact Dimension, Challenges Faced, and Long-Term Resilience Outcome.

Table 2 Impact Dimension, Challenges Faced and Long-Term Resilience Outcome

Impact Dimension	**Short-Term Crisis (Challenges)**	**Long-Term Resilience (Outcomes)**
Service Delivery	Complete closure of OPDs and elective surgeries for 6–8 months.	Improved emergency protocols and triage systems.
Human Resources	High infectivity among staff, extreme psychological stress, and burnout.	Induction of specialized staff (Respiratory Therapists) and improved training.
Infrastructure	Inadequate building designs and a lack of dedicated isolation spaces.	Permanent establishment of isolation units and public health labs.
Supply Chain	Critical shortages of PPE and interrupted oxygen supplies.	Increased ventilator capacity and ensured continuous oxygen supply chains.

Discussion

The qualitative data from the frontline health workers in Peshawar demonstrate that the COVID-19 pandemic served as a watershed moment for Pakistan's healthcare sector, exposing a system that struggled to absorb the shock of exponential case growth during the initial wave. The impact of the virus extended beyond clinical health to destabilize national economies and social structures (Moosavi et al., 2022). While mortality and severe illness risks were significantly higher for high-risk populations, specifically the elderly and those with pre-existing comorbidities like diabetes and heart disease (Clark et al., 2024; Moon et al., 2024) the systemic disruption in Peshawar was unique due to its status as a provincial epicentre. The initial vulnerabilities of Peshawar's MTIs were intensified by a combination of insufficient medical facilities and pre-existing administrative decisions that had reduced public health funding (Shehzad & Majeed, 2025; Khalid & Ali, 2020). These structural gaps were exacerbated by a lack of pandemic preparedness and inflexible architectural hospital designs, which made existing facilities difficult to adapt during a crisis. The resource-based view of resilience identifies that organizational performance is contingent upon the synergistic combination of property-based resources (hardware) and knowledge-based resources (human capital) (Khalil et al., 2022). In Peshawar, it was evident that high-value medical equipment provided during the crisis remained unutilized due to a lack of specialized technical training for medical staff (Khalid & Ali, 2020). Future resilience requires that hospital facilities be upgraded not only in terms of bed capacity but in the technical competency of the personnel required to operate complex respiratory equipment. While substantial capital investments led to a national isolation capacity of 23,557 beds, the qualitative feedback from clinicians

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emphasizes that institutional resilience is more dependent on the "software" elements of healthcare, such as governance processes and staff experience, than the "hardware" of physical bed numbers.

The pandemic inflicted a psychological toll on medical personnel, with many facing social isolation, separation from families, and a pervasive fear of transmitting the virus to loved ones. Research consistently indicates that frontline workers experience higher levels of anxiety, depression, and post-traumatic stress disorder compared to administrative staff (Ahmed et al., 2024; Mousavi et al., 2021; Abed Alah et al., 2021; Sun et al., 2021; Riaz et al., 2021; Wang et al., 2021; Lasalvia et al., 2021). In the local context, healthcare workers in Peshawar experienced moderate to severe "coronaphobia," which significantly impacted work efficiency and job performance (Javid et al., 2025). These findings highlight that clinical recovery from COVID-19 does not guarantee functional recovery for healthcare professionals, emphasizing the need for enhanced social support in the workplace. To build a resilient healthcare team, organizations must address the predictive role of psychosocial risks and create environments characterized by team cohesion and altruistic behaviour. Institutionalizing regular psychological screening and peer support mechanisms is urgently needed to protect the primary drivers of the healthcare resilience workforce.

Pakistan's ability to navigate the early health system response was largely driven by a collaborative governance model that unified federal and provincial authorities through the National Command and Operation Centre (Zaidi et al., 2025; Khalid & Ali, 2020). The imperative for national survival helped mobilize an agile response across a previously fragmented health security context, utilizing domestic resources like pre-existing health networks for viral tracking. However, the overriding focus on clinical surge capacity often resulted in the disruption of essential health services, creating uneven outcomes for patients with non-COVID conditions. Future preparedness must transition from short-term strategic measures to long-term investment in primary healthcare and transformative stewardship. It involves standardizing essential service packages for emergencies and ensuring that both private and public primary care providers are integrated into national pandemic planning. Ultimately, a health system is considered resilient only if it maintains its objectives in the face of challenges while preserving life and achieving positive medical outcomes for all demographics (Kruk et al., 2015). For the Medical Teaching Institutions of Peshawar, pandemic management capabilities must be operationalized through six critical structural dimensions, presented in Table 3.

Table 3 Six critical structural dimensions of Resilience

Dimension	**Definition in MTI Context**	**Customization Based on Peshawar Results**
Space	The availability and flexibility of physical infrastructure.	Repurposing of OPDs and orthopaedic wards; zoning strategies to prevent cross-contamination.
Staff	Human capital includes preparedness, experience, and specialization.	Induction of Respiratory Therapists; recruitment of Medical Officers with 15-day staff rotations.
Stuff	Material resources, medical equipment, and clinical supplies.	Procurement of mechanical ventilators and NIVs; management of central oxygen tanks; PPE stockpiling.

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System	Governance processes, information management, and coordination.	Centralized coordination via NCOC; SOPs; localized Rapid Response Teams; permanent Public Health Laboratories.
Strategies	Adherence to protocols and the implementation of adaptive plans.	Symptomatic triage scores, mandatory vaccination policies for staff, and telemedicine measures.
Services	The continuation of medical treatments and essential care delivery.	Scaling back of non-urgent elective care; prioritizing urgent trauma and infectious disease management.

(Zaidi et al., 2025; Ahmed et al., 2024; Lajber et al., 2024; Khalil et al., 2022)

Despite the depth of qualitative insight provided, several limitations must be acknowledged. First, the study's sample size (n=18) and its specific focus on tertiary Medical Teaching Institutions in Peshawar limit the generalizability of the findings to rural healthcare settings or private primary clinics across Pakistan. The qualitative nature of the research, while offering interpretive depth, is inherently subjective and based on the lived experiences of a purposively sampled cohort, which may not represent the views of the entire healthcare workforce across different medical specialties. Additionally, because data were collected retrospectively regarding the initial pandemic waves, the results may be subject to recall bias, where subsequent experiences influence participants' memories of specific events or clinical protocols. Finally, while the study evaluates "Work-as-Done" through frontline interviews, it lacks direct longitudinal quantitative performance metrics to correlate institutional resilience scores with specific medical outcomes over the entire pandemic timeline.

Conclusion

The COVID-19 pandemic served as a critical point for the MTIs, exposing profound initial vulnerabilities while simultaneously catalyzing a significant transition toward institutional resilience. Initially, the healthcare system was characterized by a fundamental lack of pandemic preparedness, as evidenced by the suspension of essential services, critical shortages of life-saving equipment, and severe psychological distress among frontline personnel. However, the subsequent institutional evolution demonstrated a substantial adaptive capacity, shifting the MTIs from reactive crisis management to a more structured and resilient operational state. The study's findings underscore that resilience in Peshawar's healthcare context is an emergent property driven by a synergistic combination of structural "hardware" such as the permanent establishment of public health laboratories, isolation wards, and improved oxygen supply chains and human "software," including the specialized induction of respiratory therapists and the implementation of rigorous clinical zoning strategies. The development of a customized theoretical framework integrating the "6S" components (Space, Staff, Stuff, System, Strategies, and Services) with the four functional capabilities of Resilient Health Care (Anticipate, Monitor, Respond, and Learn) provides a roadmap for future disaster management. To enhance the resilience of MTIs, the healthcare system must shift from theoretical policies to applied, institutionalized protocols. The transition requires mandatory disaster management drills to ensure staff readiness and the development of convertible hospital zones engineered to switch to negative-pressure isolation wards within 24 hours. Furthermore, establishing a crisis monitoring hub in each MTI is essential for real-time visibility of oxygen and PPE supplies to prevent stockouts. Finally, the implementation of "Dual-Track" service protocols supported by institutionalized telemedicine will ensure that while non-urgent care scales

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back during a surge, life-saving treatments for oncology, trauma, and cardiovascular patients remain uninterrupted.

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