Section: Disaster

Original Research Article

CHALLENGES & MITIGATION STRATEGIES DURING THE COVID-19 PANDEMIC IN A STATE IN NORTH INDIA: LEARNING FOR THE FUTURE

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ABSTRACT

The emergence of SARS-CoV-2 (COVID-19) placed unprecedented strain on healthcare systems worldwide, necessitating the consolidation of resources to confront the crisis. Initially reported as an unusual respiratory illness in Wuhan, China, the virus rapidly spread, prompting the World Health Organization (WHO) to declare it a Public Health Emergency of International Concern (PHEIC) on January 30, 2020. Throughout the pandemic, reliable morbidity and mortality statistics have proven essential for informed decision-making. Given their variability over time and across regions, accurately measuring these figures is crucial for planning and executing effective response strategies. This review critically examines the multifaceted challenges posed by COVID-19, evaluates the management and mitigation measures adopted, and assesses the preparedness of the healthcare system in Delhi. It highlights how the pandemic tested existing health infrastructures and underscores the need for adaptive, evidence-based approaches in crisis management. By reflecting on the response in Delhi, this review offers insights into systemic gaps and successful interventions, contributing to the global discourse on pandemic preparedness. Ultimately, the findings aim to inform future strategies to manage better and mitigate the impact of similar public health emergencies.

Keywords: COVID-19, Challenges, Mitigation, Pandemic.

INTRODUCTION

Over the past decade, the world has faced several significant public health emergencies in the form of epidemics and pandemics, including influenza A (H1N1), Middle East Respiratory Syndrome (MERS), Severe Acute Respiratory Syndrome (SARS), Ebola Virus disease, Monkey pox and Coronavirus disease (SARS-CoV-2), underscoring the need for immediate redressal backed by adequate preparedness and mitigation strategies.[1]

The most recent COVID-19 pandemic, caused by, SARS-COV-2 placed unrivalled stress on the global healthcare system, making it imperative to mobilize all available resources. The reporting of unusual cases of pneumonia of unknown origin in Wuhan, China, sparked a risk of transmission of disease across the globe. Later, the World Health Organization (WHO) declared it a Public Health Emergency of International Concern (PHEIC) on 30th January 2020.[1,2]

Accurate and timely data on morbidity and mortality are crucial for informed decision-making during health emergencies. Since these statistics vary across time and geographies, their measurement becomes paramount to planning and implementing effective containment and response strategies.

The review aims to critically analyze the challenges faced during the COVID-19 pandemic in Delhi, India, focusing on the healthcare system preparedness and the strategies adopted for management and mitigation.

1. WHO Global epidemiological update on COVID-19 till 2024

As per WHO epidemiological updates, five variants of concern (VOCs) of SARS-CoV-2 were identified, with the highly transmissible and deadly Delta variant first reported in India in December 2020.[3,4]

The total cumulative global burden of COVID-19 from 2021 to December 2024 is approximately 77.7 crore cases. Weekly surveillance data up to January 2024 reported zero cases from Uzbekistan, while Europe showed an increase of 36,029, and Southeast Asia recorded a decline of 2051 cases.[5-7]

2. COVID-19 Era: Country-wise Situation (2020-2023)

2.1. Situation in China:

China maintained a strict "zero COVID" policy for nearly three years, keeping infections at bay. However, on 7th December 2022, the policy was abruptly abandoned, resulting in the rapid spread of the Omicron variant across the country. By 6th January 2023, nearly 90% of the population was estimated to have been infected, according to provincial health officials. Due to limited official reporting, the actual extent of the outbreak was unclear. Estimates suggest that from November 2022, approximately 1.237 billion (123.7 crore) individuals in China were infected, with an overall infection rate of 87.54%.[7-9]

Data shared by Health Metrics and Evaluation (University of Washington) indicated that one-third of the population in China had been infected with COVID-19 by April 2023. By late November 2022, 86% of those over the age of 60 and 66% of those older than 80, received complete vaccination.[9,10] The pandemic's impact in China included significant peaks in peaks in infection rates, economic slowdown, reduced employment, and a decline in human capital.[8-14]

2.2. Situation in the United States of America (USA):

As of 10th March, 2023, California reported the highest number of COVID-19 cases among U.S. states. By 26th April 2023, the U.S. had recorded over 10.4 crore confirmed and presumptive positive cases, with more than 11 lakh deaths. The number of daily hits reached record highs in early 2022. Co-morbidities and age significantly worsened clinical outcomes; individuals aged 85 and older accounted for over 300,000 deaths.[15]

As per the data provided by the Centers for Disease Control (CDC), by 11th May 2023, almost 81.4% of the U.S. population had been vaccinated. Among those over 65 years, 95% had received the vaccine, along with 85.8% of children aged 5 and above.[16,17]

2.3. Situation in the United Kingdom (UK):

By 20th January 2024, the UK had reported 24.9 million (2.49 crore) COVID-19 cases and 232,000 (2.32 lakh) deaths. During the week of 3rd–9th December 2023, a total of 5,975 new confirmed cases were recorded.[18]

The earliest COVID-19 cases in the UK emerged in late 2019, with confirmed transmission by January 2020. Initially, restrictions were limited but became stringent by the end of March 2020. After a brief easing of restrictions in mid-2020, rising cases led to renewed regulations, including region-specific lockdowns in England, Wales, and Northern Ireland.[19-21]

2.4. Situation in India:

India reported its first COVID-19 case on 30th January 2020 in Kerala. As of 19th January 2024, India recorded 4.5 crore COVID-19 cases with 2331 active cases. The total number of vaccine doses administered reached 220. 68 crores.[22,23]

3. COVID-19 situation in Delhi, National Capital Region (NCR), India:

As of January 2025, Delhi reported 20.17 lakh confirmed cases and 26,701 deaths.[22] The first case of the COVID-19 pandemic in the Indian capital of Delhi was reported on 2nd March 2020. By April 2022, Delhi had already reported 18.68 lakh cases, with 26,158 deaths and 18.40 lakh recoveries.[23]

Following the Janta Curfew on 22nd March 2020, Delhi entered lockdown on 24th March. Gradual unlocking started on 8th June, 2020, with ease of restrictions in a graded manner. A weekend curfew was imposed in April 2021 to control the worsening situation, restricting all but essential services.[26-29]

4. Management and mitigation strategies adopted during the 1st COVID-19 wave in India

A nationwide lockdown was imposed on 24th March 2020 to mitigate the initial outbreak. In parallel, India swiftly implemented strategies including home isolation guidelines, quarantine protocols, and the setting up of dedicated COVID-19 hospitals across the country for inpatient care.[24]

A community-based preventive approach proved helpful during crises. The first control room was established at the National Centre for Disease Control (NCDC), New Delhi, on 23rd January 2020 under the Integrated Disease Surveillance Project (IDSP). Later, control rooms were established nationwide, enabling a coordinated response and addressing public concerns, especially among incoming international travelers.[25]

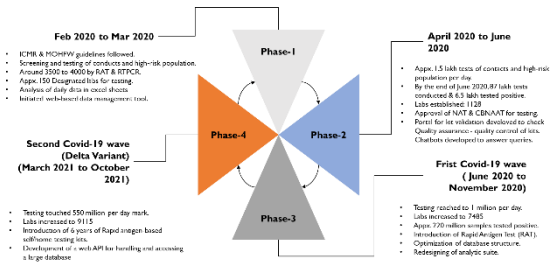

Figure 1: Master plan for Delhi for preparedness to fight COVID-19

5. Challenges and Delhi's Master Plan to fight the 1st COVID-19 Wave

The epidemiology, clinical presentation, and prognosis of COVID-19 in India have been different from those in other countries across the globe. Indian population is unique in the context of vulnerability and associated risk factors, including overcrowding, low socioeconomic status, limited health awareness, living conditions, level of preventive practices, including personal hygiene and respiratory etiquette, and undiagnosed/uncontrolled co-morbid health

conditions. These factors played a major role in response preparedness, resource mobilization, and outbreak prediction in Delhi.[30] To overcome the challenges, various measures were adopted.

5.1. Capacity building and coordination:

All cadres of healthcare workers (HCWs) were capacitated to inform about the prevailing literature on COVID-19, frequently asked questions on COVID-19 (epidemiology, mode of transmission, contact tracing, steps for prevention and control, associated risks) and do's and don'ts IEC citing information for international travel, etc. Updated contact directories of officials from MoHFW, NCDC, WHO, and various surveillance officers were circulated. Unresolved queries were escalated to the appropriate authorities, with clinical queries referred to the Assistant Director of Epidemiology, NCDC, and movement-related queries referred to the respective district/state helplines and District/State Surveillance Officer.[31,32]

5.2. Control Rooms and Multi-Level Engagement:

Both state and national control rooms were tasked with risk alerts, stakeholder coordination, and query resolution.[33,34] Primary health care centers (PHCs), especially under the Ayushman Bharat Scheme, played a crucial role in combating the pandemic. Trained health service providers at the PHC or community health center (CHC) level played a crucial role in doorstep care, contact tracing, defining containment zones, and non-COVID service continuity.

5.3. Primary Care Involvement:

Primary care physicians ensured continuity of other essential healthcare services, including those for chronic conditions such as diabetes, hypertension, and those on palliative care. Thus, the leadership, effective communication and coordination skills demonstrated by the primary care physicians were vital in crisis response.[34,35]

5.4. Surveillance, screening, isolation and referral:

Early preparedness included contacting WHO through the International Health Regulations (IHR) mechanism from the National Centre for Disease Control (NCDC) on 3rd January 2020. Following that, sequential meetings at the NCDC and with the Joint Monitoring Group were held. The meetings reviewed the COVID-19 outbreak in China, assessed its international spread, and evaluated the potential public health implications for India. As a result, several key decisions were made, including:[34-38]

- Surveillance & thermal screening at international airports.
- Community surveillance and contact tracing via Integrated Disease Surveillance Project (IDSP).
- Activation of Viral Research and Diagnostic Laboratories (VRDLs) for sample testing.
- Establishment of COVID-19 dedicated Hospitals, including Dr Ram Manohar Lohia (RML) Hospital, New Delhi.
- Visa suspensions and quarantine protocols (for 14 days) for international travelers from countries with rising cases. Nationwide Education, Information and communication (IEC) campaigns to promote hand hygiene, cough etiquette, and social distancing (2 feet distance) at all times.
- Roster for the control room staffing across disciplines, including technical staff, deputy directors, assistant directors, and additional directors from various departments such as microbiology, epidemiology, public health personnel, virology, etc., for a real-time response was maintained.

Hospital protocol for COVID-19 patients as per the ICMR guidelines (17th March 2020) has been detailed in [Figure 2].[40]

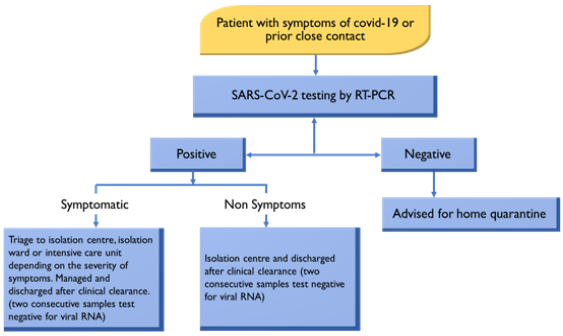

Figure 2: Hospital protocol for COVID-19 patients as per the ICMR guidelines (17th March 2020)

5.5. Containment Guidelines and Helplines in Delhi:

- Following the Lockdown,[34] the Delhi Disaster Management Authority (DDMA) implemented several public-facing initiatives:[35-49]
- Setting COVID-19 Helpline Number 1031 during lockdown.
- Mandatory use of face masks in public places, with legal penalties imposed for non-compliance.
- Establishing COVID-19 testing centres & providing Rapid Antigen Testing (RAT) kits for the public.
- Hospital Protocols and guidelines for patients and close contacts.
- An advisory was issued for using Aarogya Setu (MoHFW) for contact tracing and the Delhi Corona app for real-time ICU and oxygen bed updates.
- Hunger helplines and food centers in schools and community halls.
- Maintaining a nationwide supply chain of essentials and goods.
- Establishing Telemedicine consultations with Delhi Medical Council approval.
- Provision of shelter homes for the immigrant and stranded population in Delhi.
- Advisory for the safety and protection of Senior Citizens and pregnant females.
- Strict Prohibition of any kind of social/religious gathering/procession, etc.

- Trainings of medical/paramedical/ambulance staff/sanitation staff at various health facilities for handling COVID-19 suspects and cases.
- Maintenance of swab transport, rumor control web portals, and law enforcement at hospitals.
- Regular sanitization of containment zones and areas with verified COVID-19 cases.
- Engagement of civil society members and NGOs.
- Establishing Surveillance and Corona foot warriors' containment teams.
- Permission to all kind of employees to work from home except for those in essential services like health, sanitation, transportation of essential goods & medical items, etc.
- Guidelines and facilitation of Board Exams for class 10 and 12 in Delhi.
- Maintaining coordination of State and District Level Nodal Officers with CSOs/NGO.
- Coordinating movements of migrant workers, pilgrims, tourists, students, etc., by deploying a Nodal Officer.
- Standard operating procedures & guidelines SOPs for airports, trains, and disposal of COVID-19 deceased.

5.6. Graded Relaxation post lockdown:

No relaxation was permitted in containment zones, except for essential services, per DDMA's 30th May 2020 guidelines. The color-coded zone system- red, orange, amber, and yellow was based on positivity rates and hospital occupancy levels. Restrictions were adjusted accordingly.[51,52]

Easing down of activities was done in a phased manner outside the containment zones with an instruction to follow SOPs and guidelines.[50,52]

Table 1: Unlock 1.0 Guidelines & restrictions

Mandatory thermal screening at all public places, corporate, and government organizations.
Restaurants, shopping malls, and religious places/places of worship to run for the Public with caution and at half capacity in June 2020.
Instructions to display the availability of beds and charges, by Hospitals/Clinics/Nursing Homes.
House-to-house Survey in the Containment Zone to Identify suspected COVID-19 cases.
Development of a Web-based Portal and Dashboard, maintained by NIC for registration of NGOs, CSOs & Individual Volunteers.
Opening Delhi Metro rail, Bars, and weekly market (with restrictions).
Opening of Gyms in Delhi, theatres, multiplexes, malls, restaurants, salons, and Banquet halls.
Order regarding Inter-State Movement of buses (DTC as well as Cluster) with full seating capacity continued further up to 30-11-2020
The students, teachers, and non-teaching staff living in Covid containment zones were not permitted to come to schools and colleges physically but were allowed to work from home. [49,50]
Night curfew continued to remain in force, on the movement of individuals for all non-essential activities, with a revised timing from 9 pm to 5 am. [49,50, 53]

6. Emergence of the Delta variant (2nd Wave) of COVID-19 in India

The Delta variant (B.1.617.2) of SARS-CoV-2 was first identified in Maharashtra in October 2020 and quickly became the dominant variant worldwide. Known for its high transmissibility and severity, the Delta wave in India presented with alarming clinical symptoms such as breathlessness, sudden drop in oxygen saturation (SpO2), extensive lung damage, gastrointestinal discomfort, appetite loss, and sudden death within one week of onset. By mid-2021, India had become the second-most affected country worldwide with over 3 crores confirmed cases, trailing only the U.S. (3.4 crores). The estimated mortality during the Delta wave, from April to July 2021, stood at around 27 lakh deaths.[54]

6.1. Delta Variant in Delhi: Impact and Response:

Delhi's delta COVID-19 pandemic consequences were bad. Following a surge in cases after March 2021, all districts in Delhi were declared red zones, with lockdown extended until 17th May 2020. Delta re-infected even those who had recovered from prior COVID-19 infections, undermining hopes of herd immunity.[54]

By July 2020, Delhi recorded approximately 2,000 confirmed COVID-19 cases per day, reflecting a significant caseload during that period. Between 31st March to 16th April 2021, the city saw daily spikes of up to 20,000 cases. Hospitalizations and ICU admissions soared, with the death rate tripling compared to earlier waves. Every day, almost 30,000 positive COVID-19 tests and over 250 deaths were reported, with every third person tested being positive. In some areas, there were shortages of personal protective devices (PPEs), face shields, gloves, sanitizers, pulse oximeters, thermometers, oxygen concentrators, oxygen cylinders, etc. Infection control, medical waste disposal, and handling of the deceased posed additional challenges.[54-57] Despite such challenges, the state Government scaled up community surveillance, quarantine infrastructure, PPE stockpiles, trained manpower, and rapid response teams to manage the crisis.

6.2. Delhi Unlock 2.0:

Post-peak, Unlock 2.0 was implemented with continued lockdowns in containment zones and phased reopening elsewhere. Measures included: Metro services and private offices operating at 50% Capacity, markets to open on an odd-even basis, and night curfew adjusted to 10 pm - 5 am.[57]

6.3. Challenges and mitigation strategies during the Delta Wave:

Despite the initial challenges, the Delhi Government undertook proactive steps to scale up preparedness.[56]

A holistic range of measures was taken for prevention, early diagnosis, and treatment, including telemedicine and awareness campaigns using various

social media and government-run mobile applications.[54,55] Contact tracing and testing of suspected cases were done aggressively compared to other states.[57]

The government prioritized strengthening logistics, medical personnel, oxygen supply, and ICU infrastructure, tripling ICU beds in Delhi's state hospitals from 136 to 366. Convalescent plasma was briefly used for moderate cases but was withdrawn post-May 2021, while Remdesivir and Tocilizumab were advised for moderate to severe cases.[56]

6.3.1. Oxygen supplies and crisis management:

During the Delta wave, hospitals faced challenges in oxygen supply. Misinformation spread through social media, causing panic in some areas. The Supreme Court intervened, directing the Union Government to supply 700 MT of oxygen daily to Delhi, which had demanded 1,140 MT as cases surpassed 28,000 per day. Regulatory measures were introduced to curb hoarding and unauthorized sales, with some states invoking the National Security and Gangster Acts.[58]

7. Omicron 3rd COVID-19 Wave & its impact

The Omicron variant (B.1.1.529), first reported in South Africa in November 2021, spread to 108 countries within a month. India detected its first Omicron case in Nagpur in December 2021. The impact of the Omicron variant is seen relatively less than the delta variant, with a difference in highly transmissibility and low virulence.

Most patients (>70%) recovered within 3–6 days of contracting the infection, with only very mild symptoms or no symptoms but positive tests.[59] Most patients recovered in home isolation, with symptomatic treatment. The MoHFW recommended isolation for one week, marking a shift from earlier prolonged care.

7.1. Vaccination as a part of mitigation:

The world's largest vaccination drive was initiated on January 16, 2021. By March 2022, almost 80% of the total Indian population had been fully vaccinated, and 97% of the Indian population had received at least a single dose.[60]

Recommendations for COVID-19 Preparedness

Delhi is vulnerable to a rapid surge of infectious variants than other states due to its dense population. Health facilities must have essential infrastructure, including oxygen supply for COVID and non-COVID care. A robust system for forecasting, procurement, and resource distribution is necessary. Increasing ICU and HDU beds, promoting teleconsultation, and maintaining a central pool of healthcare workers for triage are critical. States should recruit additional personnel, including students, volunteers, retirees, and ex-servicemen. Coordination among all stakeholders—public and private—is vital. Functional helplines, real-time apps, and standardized treatment protocols must be widely implemented. Public masking, physical distancing, and medicine availability must be strictly enforced. Efforts should also focus on testing, home isolation, quarantining travelers, vaccinating marginalized populations, and enabling staggered work and shopping schedules. Mobile vaccination vans and temporary sites like Anganwadi centers can ensure last-mile vaccine coverage.

CONCLUSION

The COVID-19 pandemic exposed critical vulnerabilities in global and national health systems. India's experience in tackling with the COVID-19 pandemic, particularly in Delhi, has been marked by a series of challenges and evolving mitigation strategies. The crisis prompted rapid adaptation from managing oxygen supply issues during the Delta wave to supporting home isolation during Omicron. The combination of containment, surveillance, vaccination, public awareness, and multi-sectoral coordination helped stabilize the situation.

The country and the state must continue investing in the healthcare infrastructure, data systems, and communication to manage future public health threats. Cross-sector collaboration between government, civil society, and the private sector and clear, consistent health messaging will be vital in creating a resilient, inclusive, and equitable health system.

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