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COVID-19 as the New Normal: Evolution, Endemicity, and Public Health Strategies

Aniket V Inamdar[1^], S K Gupta[2], Umesh Sharma[3]

ABSTRACT

As COVID-19 transitions from a pandemic to an endemic disease, public health efforts must increasingly focus on sustainable surveillance systems, adaptive prevention strategies, and long-term health system preparedness to mitigate ongoing population-level impact. The emergence of new Omicron subvariants such as LF.7 and NB.1.8 in Southeast Asia—often an early indicator of global SARS-CoV-2 transmission trends—highlights the virus's continued evolution and its capacity for periodic surges. Waning population immunity and the limited effectiveness of current vaccines in preventing transmission have altered the epidemiological profile of COVID-19. As a result, its transmission dynamics now resemble those of other seasonal respiratory viruses such as influenza and respiratory syncytial virus (RSV).This communication outlines the public health implications of COVID-19's endemic nature and proposes long-term preparedness strategies for policymakers, health systems, and public health professionals.

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1*Corresponding author: Aniket V Inamdar, Consultant Physician, Email: haripath@gmail.com, **Phone:** 9604131455, **ORCID:** 0000-0001-9013-5934, **Institute:** Samarpan Clinic, **Department:** Internal Medicine **City:** Omerga, **State:** Maharashtra, **Country:** INDIA, **2. S K Gupta Associate Professor, Email:** drskgupta@gmail.com, **Institute:** G S Medical College, **Department:** General Medicine, **City:** New Delhi, **State: Country:** INDIA, **Author Type :** Co-Author; **3. Umesh Sharma, Consultant Physician) Email:** sharma.umesh@mayo.edu **ORCID:** Not Available **Institute:** Mayo Clinic **Department:** Internal Medicine **City:** Arizona **State: Country:** UNITED STATES **Author Type :** Co-Author

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INTRODUCTION

After more than four years since its initial emergence, SARS-CoV-2 continues to challenge global health systems with its persistent evolution. While the acute phase of the pandemic has subsided, recent epidemiological trends suggest that COVID-19 has transitioned into an endemic phase characterised by intermittent surges linked to variant evolution and fluctuating population immunity (1). The latest wave in Southeast Asia, driven by Omicron subvariants LF.7 and NB.1.8 (descendants of JN.1), underscores the need to redefine our public health response in this "new normal" (2).

Ongoing Evolution of SARS-CoV-2

SARS-CoV-2 has displayed a dynamic evolutionary trajectory since its emergence in late 2019. The virus has accumulated mutations primarily in the spike protein, particularly the receptor-binding domain (RBD), facilitating immune escape and increased transmissibility (3).The transition from early lineages to Alpha, Delta, and then Omicron variants has been marked by episodic waves of increased infectivity and, in some cases, altered clinical presentations (3). Omicron, first identified in November 2021, gave rise to multiple subvariants, including BA.1, BA.2, BA.4, BA.5, and subsequently XBB, BQ, and JN lineages (3,4). The current subvariants LF.7 and NB.1.8 are offshoots of JN.1 and have demonstrated increased transmissibility in the Southeast Asian region, notably in Singapore, Hong Kong, and Bangkok (2,3). Although not yet labelled as variants of concern by the World Health Organization (WHO), their rapid spread calls for close monitoring and robust public health preparedness (3). These variants have also been associated with mild to moderate symptoms, particularly in vaccinated individuals, yet the sheer volume of cases can overwhelm health systems (3). Additionally, repeated waves contribute to cumulative morbidity and economic burden. These emerging waves highlight a central truth: SARS-CoV-2 is not static—it is adapting continuously, fueled by immune escape and waning immunity.

The Immunological Challenge

.A major challenge in managing COVID-19 as an endemic disease is the limited duration of protective immunity. Neither natural infection nor currently available vaccine formulations confer sterilising immunity, and protection against symptomatic infection wanes substantially within months (4,5). Although memory B-cell and T-cell responses provide meaningful protection against severe disease, reinfections and breakthrough infections have become increasingly common (4,6). Booster vaccinations—particularly updated bivalent or variant-adapted formulations—restore protection; however, their effectiveness depends on sustained public engagement and robust vaccine delivery infrastructure (6). Waning immunity, combined with ongoing viral evolution, suggests that annual or biannual COVID-19 booster doses may be required for high-risk populations (6). An additional immunological concern is the uncertainty surrounding the long-term sequelae of repeated SARS-CoV-2 infections. This limitation undermines eradication efforts and necessitates a strategic shift from containment to mitigation, as illustrated in Figure 1. While subsequent infections are often clinically milder, the cumulative effects of repeated exposure on cardiovascular, neurological, and metabolic systems remain under active investigation.

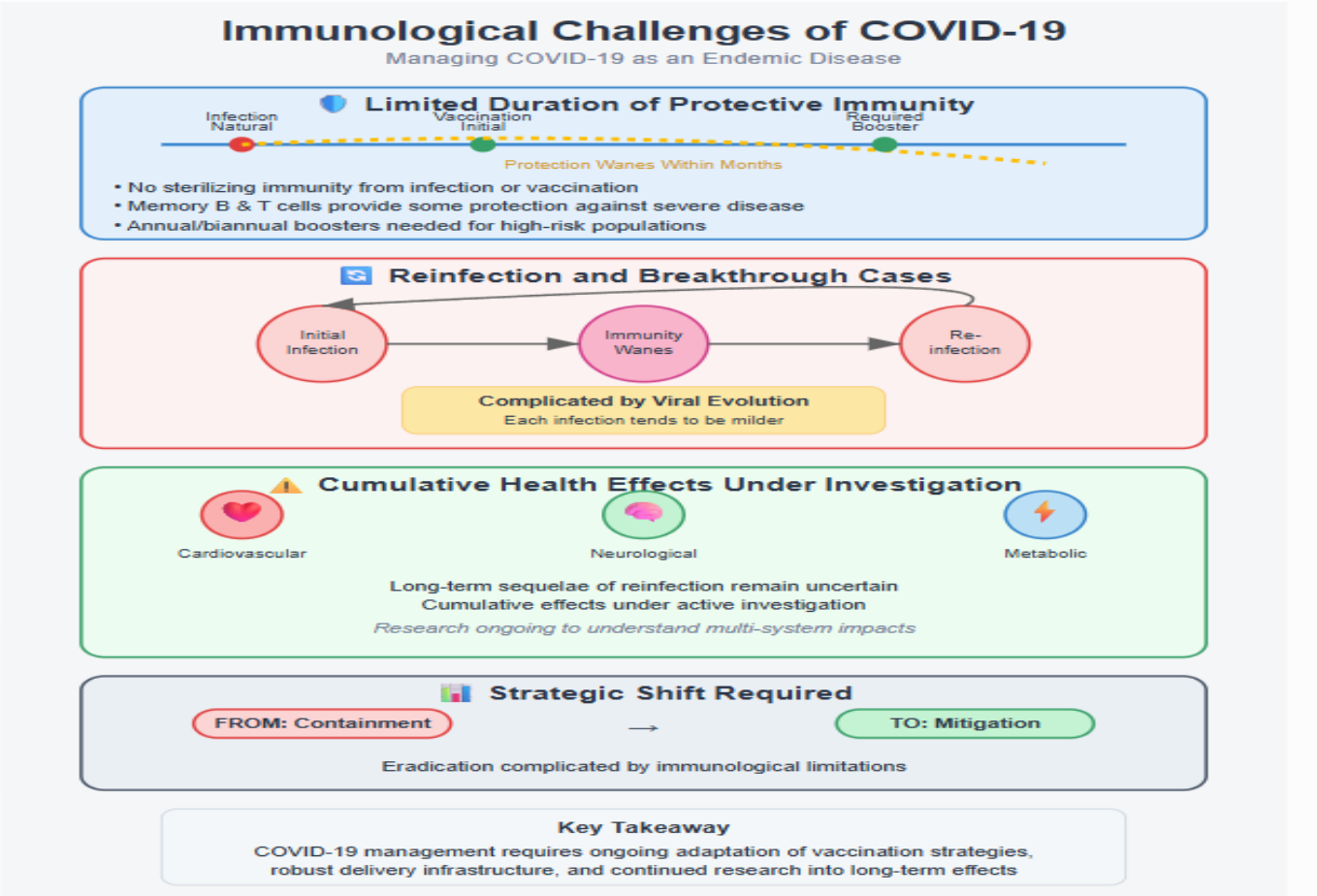

Figure 1. Immunological Challenges of COVID-19

COVID-19 as a Seasonal Respiratory Virus

SARS-CoV-2 is increasingly behaving like other endemic respiratory viruses, including influenza and respiratory syncytial virus (RSV) (7). Similar to these pathogens, it demonstrates seasonal transmission patterns—particularly in temperate climates—and co-circulates with other respiratory viruses. This overlap has contributed to the emergence of so-called "twindemic" or "tripledemic" scenarios during peak respiratory seasons (7).

This evolving epidemiological pattern necessitates a coordinated public health approach in which COVID-19 is no longer managed in isolation but considered part of the broader respiratory disease burden. Accordingly, diagnostic strategies, hospital preparedness, vaccination campaigns, and public health messaging should be aligned and integrated across respiratory viral illnesses (7). A transition toward unified surveillance, diagnostic, and mitigation frameworks for seasonal respiratory viruses is therefore warranted.

Public Health Implications and Strategies

Surveillance and Genomic Monitoring

Robust genomic surveillance is essential to track emerging variants and guide timely interventions. We need to integrate genomic sequencing to track emerging variants and adjust treatment protocols. Initiatives like GISAID have been pivotal in monitoring global viral evolution (8). Continued investment in sequencing capacity and transparent data sharing remains crucial.

Adaptive Vaccination Policies

Vaccination strategies should be aligned with the seasonality and ongoing genetic evolution of SARS-CoV-2. Similar to influenza immunisation programs, annual COVID-19 vaccination—particularly for high-risk populations—should become standard practice (9). Groups at highest risk for severe disease continue to include older adults, individuals with chronic medical conditions, the immunocompromised, and those who remain unvaccinated.

- **CDC-Recommended Vaccination Strategy for Emerging COVID-19 Strains**
- Current CDC guidance for the 2024–2025 season supports an age- and risk-based vaccination approach (9).
- **Age-Based Recommendations**

Ages 6 months–64 years

- One annual dose of the 2024–2025 COVID-19 vaccine (e.g., Moderna's Spikevax) (9)
- Moderately or severely immunocompromised individuals:Two doses annually, with additional doses considered based on clinical judgement (9)
- **Ages ≥65 years**
- Two doses of the 2024–2025 COVID-19 vaccine doses spaced 6 months apart (minimum interval of 2 months) (9)
- **Unvaccinated individuals** receiving the Novavax COVID-19 vaccine require a two-dose primary series (9)

Ventilation and Non-Pharmaceutical Interventions (NPIs)

Improved indoor air ventilation, strategic masking during peak respiratory virus seasons, and sustained hygiene promotion remain critical non-pharmaceutical interventions for reducing transmission of SARS-CoV-2, as well as other respiratory viruses such as influenza and respiratory syncytial virus (RSV) (10). Evidence from global public health guidance, including the World Health Organization, underscores that these measures are particularly effective in high-risk indoor settings such as healthcare facilities, schools, workplaces, and public transport.

As COVID-19 becomes endemic, NPIs should transition from emergency mandates to risk-based, context-specific interventions that can be flexibly deployed during periods of increased transmission. Integrating ventilation standards, respiratory etiquette, and seasonal masking advisories into routine public health practice can reduce healthcare burden while preserving social and economic activity (10).

Healthcare System Preparedness

Hospitals and primary care systems must be adequately equipped to manage seasonal surges of respiratory illnesses, including COVID-19. Key preparedness measures include ensuring sufficient healthcare workforce capacity, availability of personal protective equipment, access to antivirals, and the rapid deployment of diagnostic and triage tools. In line with public health preparedness frameworks, health systems should also strengthen surveillance, surge capacity planning, inter-facility coordination, and continuity of essential services. Integrating these measures into routine preparedness planning can enhance resilience, reduce healthcare strain during peak seasons, and support timely clinical and public health responses to endemic respiratory threats.

Localised Response Models

As immunity levels, vaccination coverage, healthcare capacity, and public compliance vary across regions, national policies should incorporate flexibility to support localised decision-making. Regional health authorities should be empowered to adapt public health interventions based on real-time epidemiological data and contextual risk assessments (11).

Newer Treatment Modalities, Long COVID Surveillance and Management

New antiviral drugs (like Jun13296 and Ensitrelvir)

and broad-spectrum monoclonal antibodies (such as SC27) are expanding the treatment arsenal against COVID-19, including its new and resistant strains (12,13). Continued surveillance and development of new therapies are essential as the virus evolves. Even as acute COVID-19 becomes manageable, the long-term health impacts of post-acute sequelae of SARS-CoV-2 (long COVID) remain a significant concern. Investment in research and clinical infrastructure for the diagnosis and management of long COVID is critical (14).

Public Communication and Risk Literacy

Transparent and timely communication remains essential. Public health authorities must promote risk literacy, explaining the rationale for interventions like boosters, masking, or temporary restrictions during surges. Combatting misinformation remains a cornerstone of effective epidemic response.

India's Specific Vulnerabilities

India's demographic and epidemiological landscape presents unique challenges for managing COVID-19 as an endemic disease. High population density, pronounced urban–rural health disparities, and a highly mobile population amplify transmission risks. Although primary vaccination coverage has been substantial, booster uptake remains uneven, and public risk perception has declined over time (15). Implementation of endemic COVID-19 strategies is further complicated by marked regional heterogeneity across Indian states, including differences in healthcare infrastructure, workforce availability, digital health capacity, and access to essential services. Variations in urbanisation, socioeconomic conditions, and public health governance influence both preparedness and response effectiveness, underscoring the need for state- and district-level adaptation of national policies. Integrating COVID-19 management into existing platforms such as the National Health Mission and the Ayushman Bharat Digital Mission offers an opportunity to deliver scalable and equitable interventions. Leveraging digital health records, telemedicine services, and AI-based forecasting tools can further strengthen surveillance, support early outbreak detection, and enable data-driven decision-making tailored to local contexts.

Conclusion

The post-pandemic world must embrace the reality that COVID-19 is now a part of the larger family of seasonal respiratory viruses. Its endemicity does not imply harmlessness but signals the need for sustained vigilance, targeted public health strategies, and flexible healthcare responses. Policymakers, clinicians, and the public must recalibrate expectations and actions in light of this persistent viral threat. The lessons learned from the pandemic must now be institutionalised into resilient systems that can adapt to future challenges.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to the content, authorship, or publication of this article. No financial or non-financial interests, relationships, or affiliations influenced the preparation or submission of this manuscript.

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