

The importance of multi-level resilience in healthcare systems in small countries like Singapore

Benjamin Kian Chung Ong^{1,2} FRCP

The COVID-19 pandemic highlighted the critical importance of developing resilient health systems that can adapt to crises while maintaining essential healthcare functions. The World Health Organization (WHO) defines resilience as the ability to prepare for, absorb, adapt to and recover from shocks while maintaining core operations.¹ To this, one must add the ability to learn continuously, apply lessons in real time and adjust strategies as a crisis unfolds. In Singapore, effective coordination among government agencies, healthcare organisations, professionals and the community was essential in addressing both the immediate crisis and the underlying challenges of an ageing population and rising chronic disease burden. Thus, resilience should be viewed as a multi-dimensional construct that extends beyond the healthcare system itself.

Singapore's compact geography and integrated governance structure enabled rapid coordination, setting it apart from larger and more fragmented systems. Although it lacked the spare capacity available to bigger nations, this limitation was offset by tightly synchronised decision-making across government ministries and agencies, allowing for swift reallocation of manpower and logistics. During COVID-19, ministries such as manpower, defence and digital development played pivotal roles: the Ministry of Manpower oversaw containment and care within migrant worker dormitories; the Singapore Armed Forces provided essential logistical and engineering support; and the Ministry of Digital Development and Information, renamed from the Ministry of Communications and Information on 8 July 2024, facilitated national communications and digital initiatives. At the national level, governance and financing form the bedrock of health system resilience. The WHO's Health Systems Resilience Toolkit emphasises the integration of preparedness within universal health coverage.¹ Resilience should therefore be understood as a continuous process—of preparing, absorbing, recovering and adapting. Singapore's pandemic response exemplified these principles. Chua et al. identified

6 pillars underpinning the national response: strong leadership and governance, transparent communication, early detection, maintenance of essential healthcare services, crisis financing and a robust legal framework to enable policy implementation.²

Singapore's geographic realities play a pivotal role in shaping its approach to resilience. As a global port and aviation hub with one of the world's highest population densities, Singapore is inherently vulnerable to infectious disease importation, zoonotic spillover and disruptions in global supply chains. These risks are further intensified by climate change, which brings additional threats such as heat stress, dengue proliferation and flooding. Moreover, Singapore's economic vitality is deeply tied to its openness and connectivity. Consequently, national resilience planning must extend beyond healthcare to incorporate robust border health measures, climate adaptation strategies and sustainable urban development. Hospitals and Singapore's healthcare clusters, organised into 3 geographic regions, serve as the operational engines of resilience. They translate national policy into practice through surge capacity management, service continuity and the protection of staff welfare.³ Maintaining public trust requires that both the healthcare system and its professionals act with transparency and competence.⁴ During the pandemic, Singapore's hospitals implemented triage innovations, expanded telemedicine platforms and established step-down facilities, while strengthening partnerships with primary and community care providers.

Digital infrastructure further reinforced these efforts. The widespread adoption of Electronic Health Records (EHRs) and the National Electronic Health Record, coupled with HealthHub (Singapore's integrated digital health platform that enables users to access health records, appointments and transactions with public healthcare institutions) enhanced the capacity to harness data-driven systems.⁵ EHRs and personal digital health records have created interlinked datasets that will underpin the next phase of resilience building. Public hospitals and healthcare clusters were

The Annals is an open access journal, allowing non-commercial use under CC BY-NC-SA 4.0.

¹ Division of Neurology, Department of Medicine, National University Hospital, Singapore

² Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Singapore

Correspondence: Prof Benjamin Kian Chung Ong, Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore, Level 10, NUHS Tower Block, 1E Kent Ridge Road, Singapore 119228. Email: mdcongkc@nus.edu.sg

Accepted: 4 November 2025

Published Online First: 13 November 2025

also deployed to support migrant worker dormitories, setting up on-site medical posts to manage testing, isolation and treatment in collaboration with the Ministry of Health (MOH) and non-governmental partners.^{6,7} In parallel, transitional care facilities were rapidly established in venues such as Changi Expo to accommodate medically stable patients discharged from acute hospitals, alleviating bed pressures and sustaining continuity of care. These facility and service innovations—borne of necessity—preserved critical hospital capacity during the crisis.

Overall, the pandemic catalysed the rapid adoption of telehealth, digital triage and remote monitoring, demonstrating how technology can enhance system resilience when integrated effectively into clinical workflows. Singapore's TraceTogether and SafeEntry systems, developed collaboratively by the Government Technology Agency (GovTech) and the MOH, illustrated the nation's ability to deploy large-scale digital solutions rapidly within an integrated Smart Nation framework.⁸ These tools were rolled out nationwide within weeks, supported by close coordination across GovTech, MOH and private-sector partners. Hansen and Dahiya characterised TraceTogether as emblematic of Singapore's governance model—balancing innovation, coordination and citizen engagement within a coherent resilience framework. However, as Tan et al. observed, digital contact tracing also raised questions regarding trust, transparency and the boundaries of surveillance, underscoring that technological success depends not only on functionality but also on sustained public legitimacy.⁹ Low et al. highlighted longstanding concerns about infrastructure strain arising from Singapore's ageing population, a challenge expected to intensify in the coming years.¹⁰ Building future resilience must therefore extend beyond crisis preparedness towards proactive adaptation to demographic and epidemiological transitions. The growing burden of ageing, multimorbidity and chronic disease demands deeper integration across health and social care sectors. Strengthening primary care, embedding preventive services and developing home- and community-based care models are key strategies being advanced under Healthier SG—the national initiative by Singapore's MOH to shift from reactive to preventive healthcare that was launched in July 2023.¹¹

Healthcare professionals form the human backbone of system resilience. The WHO recognises that workforce adaptability and well-being are fundamental to the sustainability of health systems.¹² The Organisation for Economic Cooperation and Development has similarly identified workforce shortages and burnout as major vulnerabilities.² During the pandemic, Singapore's healthcare professionals demonstrated

exceptional flexibility—adapting rapidly to new care models and maintaining service delivery under intense pressure. Nevertheless, it remains essential to address these stressors in tangible and sustained ways.¹³ Building workforce resilience for the future requires structural redesign and process optimisation. Automation can alleviate repetitive administrative tasks, allowing clinicians to devote more time to complex and high-value care. Greater integration of allied health professionals and nurse practitioners can distribute workloads more equitably, while continuous professional education should emphasise digital literacy, systems thinking and crisis management skills. Embedding these reforms into organisational culture will help ensure that resilience is institutionalised and sustained beyond the most recent crisis.¹⁴

Singapore's compactness and operational efficiency will remain core strengths; however, future resilience will hinge on addressing cross-cutting challenges such as population ageing, workforce sustainability and climate adaptation through anticipatory governance. A data-driven, digitally connected ecosystem, guided by transparent leadership and supported by a strong community collaboration, will be essential to the next generation of healthcare resilience. The goal is not merely to withstand future shocks but to evolve and emerge stronger from them.¹⁵

The community remains an indispensable partner in building and sustaining resilience. The WHO emphasises that engaged and well-informed communities enhance system resilience by fostering compliance, participation and trust.¹⁶ In Singapore, high levels of public cooperation during the COVID-19 pandemic were grounded in transparent communication and a strong foundation of societal trust. However, the disproportionate burden experienced by migrant workers highlighted that inclusivity is integral to resilience and requires continued strengthening. Gilson has noted that trust functions as a social institution, shaping how populations perceive and respond to public health measures.¹⁷

Resilience operates across multiple, interconnected levels. Blanchet et al.¹⁴ proposed that governance capacity is distributed across system, organisational, professional and community tiers rather than being concentrated within ministries. Singapore's experience exemplifies this layered resilience: national leadership coordinated resources; hospital clusters operationalised policies; healthcare professionals adapted care delivery; and communities provided the social legitimacy that sustained public health efforts. As a small, manpower- and resource-constrained nation, Singapore must continually reinforce, practise and refine this coordinated approach. With the possibility of future pandemics or major health crisis, learning,

adapting and strengthening our collective capacity for resilient response remain imperative.

Ethics statement

Not applicable as no patient data was used.

Declaration

The author has no affiliations or financial involvement with any commercial organisation with a direct financial interest in the subject or materials discussed in the manuscript.

Keywords: COVID-19 pandemic, crisis preparedness, health system resilience

REFERENCES

1. World Health Organization. Health systems resilience toolkit. Geneva: WHO; 2022.
2. Chua AQ, Tan MMJ, Verma M, et al. Health system resilience in managing the COVID-19 pandemic: lessons from Singapore. *BMJ Global Health* 2020;5:e003317.
3. World Health Organization. Comprehensive Safe Hospital Framework. Geneva: WHO; 2015.
4. Organisation for Economic Co-operation and Development. Does Healthcare Deliver? Building Trustworthy 21st Century Healthcare Systems. Paris: OECD; 2023.
5. Ministry of Health, Singapore. HealthHub Singapore—Your Health at Your Fingertips. <https://www.healthhub.sg>. Accessed 5 November 2025.
6. Mok YJ, Tan YX, Chia T, et al. Operational requirements of medical posts in migrant dormitories during the COVID-19 pandemic. *Ann Acad Med Singap* 2021;50:678-87.
7. Ministry of Health, Singapore. Measures to Contain the COVID-19 Outbreak in Migrant Worker Dormitories. Press release, 14 December 2020. <https://www.moh.gov.sg/newsroom/measures-to-contain-the-covid-19-outbreak-in-migrant-worker-dormitories/>. Accessed 5 November 2025.
8. Hansen MM, Dahiya B. TraceTogether contact tracing: a Smart Nation innovation. *Front. Sustain. Cities* 2025;7:1552449.
9. Tan GKS, Lim SS. Communicative strategies for building public confidence in data governance: Analyzing Singapore's COVID-19 contact-tracing initiatives. *Big Data & Society* 2022;9:205395172211040.
10. Low SP, Liu JY, Wu P, et al. Resilience of hospital facilities in Singapore's healthcare industry: a pilot study. *Int J Disaster Resil Built Environ* 2017;8:256-70.
11. Ministry of Health, Singapore. Healthier SG—Our Future of Health. <https://www.healthiersg.gov.sg>. Accessed 5 November 2025.
12. World Health Organization. Building a resilient health workforce: supporting health workers and keeping health systems resilient. Geneva: WHO; 2021.
13. Shanafelt T, Ripp J, Trockel M. Understanding and addressing sources of anxiety among health care professionals during the COVID-19 pandemic. *JAMA* 2020;323:2133-4.
14. Blanchet K, Nam SL, Ramalingam B, et al. Governance and capacity to manage resilience of health systems: towards a new conceptual framework. *Int J Health Policy Manag* 2017;6:431-5.
15. Thomas S, Sagan A, Larkin J, et al. Strengthening health systems resilience: key concepts and strategies. Copenhagen: European Observatory on Health Systems and Policies; 2020.
16. World Health Organization. Community engagement for quality, integrated, people-centred and resilient health services. Geneva: WHO; 2020.
17. Gilson L. Trust and the development of health care as a social institution. *Soc Sci Med* 2003;56:1453-68.