Clinical insights and policy adaptations of COVID-19: lessons learned for future health crises from the *Hong Kong Medical Journal* and beyond

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Introduction

COVID-19 epidemic resulted in many remarkable changes to healthcare systems worldwide. It challenged clinical practices and public policy planning at the time with new and distinctive issues. In this editorial, five dimensions of the pandemic are discussed: clinical management, variant-driven shifts, protecting vulnerable populations, public awareness and behavioural changes, and healthcare innovation. These elements are essential to future public health responses because they can better prepare global healthcare systems to face other similar emergencies. This editorial provides a reflective overview of key COVID-19 insights published in the *Hong Kong Medical Journal* between 2020 and 2023, along with related literature, to highlight clinical, public health, and technological lessons learned during the pandemic.

COVID-19 has substantially reshaped medical care, population health initiatives, and social norms. In early 2020, Hong Kong experienced a 28-day mortality rate of 12.0% among patients with severe or critical illness.[1] Key risk factors for mortality included advanced age, a history of stroke, use of renal replacement therapy, and shorter durations of lopinavir–ritonavir treatment.[1] Given the lack of effective treatments and vaccines at the time, social distancing and self-isolation became essential containment strategies.[2,3] However, these measures also led to long-term physical and psychological consequences, particularly among children.[2] Cancer care was also affected: patients expressed concerns about delays in treatment development and a lack of information regarding COVID-19's impact on their care.[4] Many reported declines in physical, mental, and dietary health due to prolonged isolation.[4] Similarly, patients with knee osteoarthritis experienced more severe symptoms and functional decline due to reduced access to care and prolonged inactivity during lockdowns.[5]

As the virus evolved, so did understanding of its clinical manifestations, public health implications, and the role of technology. The pandemic accelerated the development of artificial intelligence,[6] whereas researchers investigated COVID-19's diverse effects—from cutaneous symptoms and autoimmune responses,[7] to the safety of healthcare workers.[8] This article explores five interconnected dimensions of the pandemic: clinical management, variant-driven shifts, protection of vulnerable populations, public awareness and behavioural changes, and healthcare innovation.

Clinical management

The COVID-19 challenged conventional clinical management, particularly in severe and atypical cases. For instance, a patient with COVID-19 presented with severe abdominal and back pain and was diagnosed with a rare mycotic aortoiliac aneurysm caused by *Salmonella typhimurium*.[9] Despite controversy surrounding endovascular stenting in septic conditions, it proved effective for this critically ill patient.[10] In another example, an immunocompromised patient experiencing septic shock received high-dose intravenous N-acetylcysteine to manage an influenza-induced cytokine storm, highlighting the need for flexible treatment approaches, especially for those who were unvaccinated or immunocompromised.[11] Unusual manifestations further complicated diagnosis and

care. A 72-year-old woman developed adult-onset Still's disease after receiving an mRNA vaccination, which resulted in myocarditis and cardiogenic shock.[12] Another patient developed autoimmune myopathy post-infection, with persistent anti–Mi-2 antibodies.[13] Additionally, there was an increase in cases of acute acquired esotropia—a rare form of strabismus—linked to excessive screen time during lockdowns.[14] These cases underscore the importance of adaptability in clinical care and the need to recognise atypical presentations.

The Omicron variant: changing the pandemic landscape

As the virus evolved, its impact on different populations also changed, prompting a shift in the focus of public health. After the Omicron variant emerged, clinical and public health responses shifted, marking a critical point in the pandemic. The new variant was associated with more serious paediatric cases of croup and a broader range of co-morbidities. As a result, caregiver stress increased and healthcare supplies were strained.[15] To meet the challenges posed by the new variant, hospitals had to refine their facilities, such as nebulisation units. Public health initiatives adapted to the evolving circumstances. During Hong Kong's fifth wave of COVID-19, mortality rates were high among peritoneal dialysis patients, a situation attributed to low vaccination coverage and poor adherence to safety measures, including handwashing, mask-wearing, and social distancing.[16] These high mortality rates emphasised the importance of basic hygiene practices, as well as the necessity of targeted vaccination campaigns. Shenzhen's municipal government implemented targeted interventions by closing schools and encouraging remote work to prevent transmission.[17] These measures, in combination with nucleic acid testing and optimised screening schemes, played a key role in the early identification and containment of cases. Understanding the transmission dynamics of Omicron is important for public health policies, which would enable timely protection of vulnerable populations and the development of tailored strategies to promote vaccinations.

Protecting the vulnerable through vaccination

Pregnant women, children, older adults, and individuals with chronic conditions were considered vulnerable populations and faced disproportionate risks during the pandemic.[18] However, low vaccination rates were observed among pregnant and postpartum women in early 2022.[19] To address this issue, hospital-based vaccination teams comprising obstetricians and midwives were created to provide personalised support and dispel vaccine-related fears.[19] Frailty is a known risk factor for COVID-19 mortality,[20] particularly among those aged over 80 years.[21] A notable case in Hong Kong involved a centenarian who survived a breakthrough infection after completing the Comirnaty vaccine regimen and receiving a booster shot.[20] This example illustrates the potential benefits of vaccination, even in the oldest age-groups.

Recent studies have indicated that the gut microbiome plays a role in predicting responses to vaccines and adverse events.[22,23] A Hong Kong study demonstrated that the G-NiiB immune formula is safe for children aged 5 to 17 years.[24] It also reduced adverse side-effects from the vaccine in the experimental group compared with unvaccinated controls.[24] These results may help to alleviate vaccination concerns among parents and children. Public health initiatives prioritised at-risk populations, which in turn influenced societal behaviours.

Public awareness and behavioural shifts

Public awareness and perception played a pivotal role in shaping the trajectory of the COVID-19 pandemic. Although prevention is generally more effective than treatment, the relative impact of individual preventative measures was unclear during the early stages.[25] Notably, regions with lower daily case counts usually demonstrated higher levels of public awareness, suggesting that informed communities are better equipped to support disease control efforts.[25] Additionally, notable behavioural shifts were observed. A study by Lin et al[26] showed an increase in unhealthy lifestyles in Hong Kong. This trend included poorer dietary behaviours and reduced physical activity, largely due to the shutdown or restriction of public sports facilities.[26] The shift of education and work to online platforms further amplified these unhealthy habits. Even in rural areas, such as western China, students increasingly experienced eye fatigue and visual impairment due to prolonged screen use.[27] However, there was also a positive change: smoking and alcohol consumption decreased, owing to restrictions on social gatherings and reduced operating hours for bars and clubs.[26] These changes reveal how the pandemic broadly affected society and emphasise the importance of combining health promotion with public policy. Not only did behaviours change, tools and technologies also advanced.

Innovation and the future of healthcare

The COVID-19 pandemic also drove vast innovation in healthcare, particularly in the realm of digital health. Telemedicine was crucial for doctors to

maintain contact with patients during lockdowns. However, older adults with limited technological literacy expressed concerns about difficulties using the new technology.[28] These concerns raised awareness of the need for government-supported initiatives to improve technological literacy.[28] Although telemedicine played an important role in bridging gaps in medical care during the pandemic, it should complement—not replace—conventional in-person consultations, which facilitate comprehensive care.[28] Other technologies accelerated by COVID-19 included novel diagnostic tools. One example is volatile organic compound analysers,[29] which have been studied for rapid COVID-19 testing. RNA-sequencing analysis is another example, employed to identify differentially expressed genes in severe and non-severe cases, revealing the mechanisms underlying lung inflammation and neurological complications.[30] Most recently, artificial intelligence chatbots powered by large language models have emerged as a promising asset in healthcare,[31] with enormous potential for enhancing practice management, facilitating patient-physician interactions, and supporting clinical decision making in pandemic preparedness and epidemic response.

These developments indicate progress towards precision medicine and data-driven healthcare. In the Greater Bay Area, professionals have supported the adoption of an integrated healthcare model. This model aims to harness each region's strengths, combining Hong Kong's spirit of compassionate care with Shenzhen's technological expertise to create a synergy capable of addressing complex medical challenges.[32] Looking ahead, standardised data collection will be crucial to address key questions regarding COVID-19's pathophysiology, risk factors, treatment outcomes, and long-term vaccine safety.[6] Although the pandemic posed many complex challenges to healthcare systems, it also created opportunities for transformation and long-term improvement.

Conclusion

The pandemic offered experiences that enabled Hong Kong to identify and address shortcomings in its healthcare system. As a result, healthcare experts were able to strengthen public health planning. To manage atypical cases, emerging variants, and evolving societal changes, professionals developed creative solutions that incorporated flexibility and innovation. The rapid advancement of technology and its adoption into the healthcare system have undoubtedly contributed to alleviating the COVID-19-related disruptions to the delivery of medical care. The outcomes and lessons learned from the pandemic have better equipped healthcare systems to manage similar public health crises in the future.

Author contributions

All authors contributed to the editorial, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

The authors are members of the *Hong Kong Medical Journal* Editorial Board and internal review of this editorial was independently conducted by a senior editor.

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