

Pandemic lessons from Hong Kong

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Abstract

COVID-19 offers many valuable lessons, many of which could be found in unique societies like Hong Kong. The metropolis is special for its drastically varying—good and bad—COVID-19 performances. Hong Kong was widely considered a pandemic control and containment success for maintaining a remarkably low number of COVID-19 infections and deaths, until it was not. In March 2022, for instance, Hong Kong had the world's highest COVID-19 infection rates. As Hong Kong shares many similarities with other metropolises around the world, it is important to learn the hard-earned lessons from its failure to control infections. Drawing insights from the literature and our own research, this analysis aims to identify key lessons societies could gain from Hong Kong's COVID-19 responses to ensure better preparation for future pandemics.

Keywords Zero-COVID policy · Public health · Health policy · Disaster preparedness

Abbreviations

COVID-19	Coronavirus disease 2019
GDP	Gross domestic product
SARS	Severe acute respiratory syndrome
US	United States

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1 Introduction

Hong Kong is special. It is a city of great prosperity—as one of the most affluent societies worldwide per gross domestic product (GDP) per capita [1], a largely frictionless port for global trade and a well-acclaimed international financial hub [2, 3]. It is also a city of great controversy when it comes to its response to the coronavirus virus 2019 (COVID-19) pandemic—Hong Kong has been the subject of heated debates for adopting, succeeding at, and subsequently failing to adhere to the zero-COVID policy rigorously [4–7]. The zero-COVID policy is a pandemic prevention strategy that is known for its ability to curb virus spread, save lives and livelihoods, as well as its high demand on public health officials’ ability to maintain people’s mental health and economic prospects against strict community-wide or whole-of-society prevention measures [13, 14]. The zero-COVID policy is one of the signature disease elimination strategies adopted amid the pandemic. Similar to other elimination strategies, and in line with tried-and-true infectious disease prevention practices [8], the zero-COVID policy employs robust measures to curb local flare-ups to prevent them from deteriorating into worse outbreaks [9–11].

Like many societies across the globe, such as Australia, New Zealand, mainland China, Macau, Singapore, and Taiwan, Hong Kong adopted the zero-COVID policy from the early days of the pandemic, a decision which helped the city maintain remarkably low COVID-19 infection and death rates in early waves of the pandemic [12]. However, what makes Hong Kong stand out centres on how, once a success, the city failed to capitalize on its hard-earned early advantages of the zero-COVID policy to control and contain the Omicron surges [13]. Even though scientists in South Africa and other nations continuously underscored the dangers of the Omicron variant—highly transmissible with the potential to circumvent vaccine-induced defence [14–16]— Hong Kong was still ill-prepared for it. In March 2022, the case-fatality rate for the general population in Hong Kong had already risen to 2% (12% for people aged over 80), roughly ten times higher than those of Australia, New Zealand, or Singapore [17]. Subsequent estimates showed that, in merely 2 months since the Omicron wave started, more than 8000 Hong Kongers died of COVID-19 [17], making the city one of the worst places to live in early 2022.

Hong Kong is also typical (please see Table 1). For starters, Hong Kong is often mentioned vis-à-vis Singapore across issues and disciplines, largely due to their shared similarities in terms of significance in international trade, gross domestic product makeup, location and size, and population density, despite notable differences (e.g., Singapore is more racially diversity) [18]. Tokyo—the capital of Japan—and Shanghai, the financial centre of mainland China, are also key metropolises that share marked similarities to Hong Kong, from their population age structure, racial makeup (all of which are largely monoethnic), to population density—factors that have a meaningful impact on pandemic control and prevention [19–22]. In other words, a key reason that insights into Hong Kong’s COVID-19 control success and failures are important is that the city shares many traits with other pivotal metropolises across the globe. Furthermore, Hong Kong also has a population makeup that many societies worldwide may soon transform into. As, Hong Kong is a society that adopted and failed a once well-managed zero-COVID policy [23–27], it holds precious insights that could be valuable for better pandemic control and management across societies.

COVID-19 is a critical inflection point that offers valuable lessons for public health crisis management [28–34]. As the pandemic continues to evolve, paired with the inevitability of infectious disease outbreaks in general [35–38], it is

Table 1 Example societies’ shared similarities to Hong Kong

Criterion	Target city	More similar to	More different from
Population density	Hong Kong	Macau Singapore	Shanghai Taipei Tokyo
Ethnicity/Homogeneity	Hong Kong	Macau Shanghai Taipei Tokyo	Singapore
Friction of international travelling (amid COVID-19)	Hong Kong	Macau Singapore	Shanghai Taipei Tokyo
Attraction to global trade/finance-related travelling	Hong Kong	Shanghai Singapore Tokyo	Macau Taipei

important to learn from the precious and hard-earned lessons from Hong Kong so that our society can become more prepared for future global public health emergencies³⁹. To this end, this study aims to investigate the factors that shaped Hong Kong's troubled response to the Omicron wave, and identify key lessons society could gain from Hong Kong's COVID-19 experiences in the insight of policy review, so that more informed public health decision-making can be made in the current and future pandemics.

2 Pandemic management lessons from Hong Kong

2.1 Methods

This study adopted a dual-track iterative approach based on two components: existing literature and our ongoing research. For the first part, the literature review also leveraged the advantages of a dual track system, which contains two parts: the first part was conducted at the inception of the study—the pre-review stage, and the second one at the post-review stage (please see Fig. 1). Both parts of the literature analyses were focused on peer-reviewed journal articles published in English. Key concepts—COVID-19, Hong Kong, and pandemic policy—were searched in three databases:

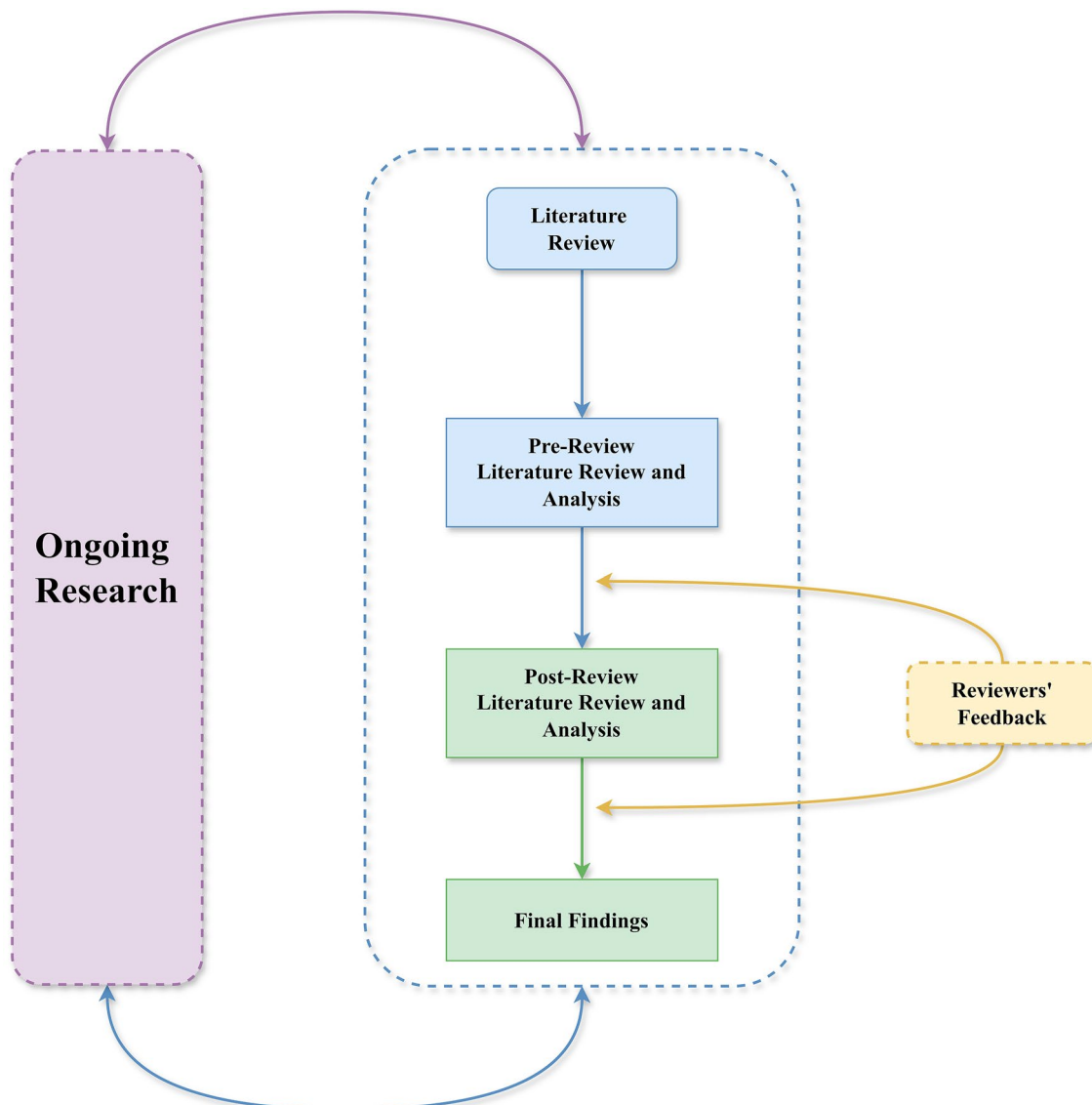


Fig. 1 The dual-track approach methods adopted in the study

PubMed, Web of Science, and EBSCO. The selection criteria of the databases were predominantly based on two considerations: database accessibility and scope. For the second part, our ongoing research is an integrated project that aims to investigate the short-term and long-term impacts of COVID-19 policies, especially on vulnerable populations like older people, domestic violence survivors, and people living with mental disorders; it strives to identify useful and transferable lessons that could help society at large better brace for future global public health crises. Our research is mixed-methods in nature, which includes qualitative research (e.g., in-depth interviews, focus groups, Delphi interviews, etc.) and quantitative endeavours (e.g., online surveys, sentiment analyses, systematic reviews, etc.), some of which have already been published (e.g., [7, 28, 40, 41]).

In the following sections, we will detail the key pandemic control and prevention lessons identified from Hong Kong. While the lessons are not exhaustive, they nonetheless could provide a roadmap for recognizing the promises and pitfalls public health decision-making could generate, especially in the face of fast-moving outbreaks and lacklustre pandemic governance. The concentration will be primarily focused on the following aspects: (1) Development and Implementation of the Overarching Pandemic Policy, (2) Quality Pandemic Control and Prevention Policies, (3) Vaccine Hesitancy and Government-Led Interventions, (4) Unique socio-ecological characteristics and challenges, and (5) Long-Term Disease Prevention Mindset.

2.2 Development and implementation of the overarching pandemic policy

While the zero-COVID policy is largely in line with best real-world pandemic practices, the poor implementation of the policy by the local government undermined its potential to curb virus spread. Rather than implementing the zero-COVID policy in its entirety, government and health officials cherry-picked some strategies of the policy while ignoring others, such as failing to initiate lockdowns to curb virus spread or commit to vaccination campaigns to make its residents more resilient to COVID-19 [42], even though all of these strategies are indispensable for the policy to fully function [8]. It is important to note that, most pandemic control strategies, be they elimination-centred or mitigation-focused, utilize the same group of tried-and-true anti-infection control and prevention measures, be they pharmaceutical measures (e.g., vaccination, treatments, and therapeutics) or non-pharmaceutical strategies (e.g., masking, physical distancing, and lockdowns [43]). What differentiates the zero-COVID policy from other pandemic strategies such as the mitigation policy centres on the extent to which the above-mentioned anti-infection measures are robustly integrated and rigorously implemented [8].

In other words, what makes the zero-COVID policy unique, essentially, centres on its respect for both the knowns and the unknowns of the pandemic [11, 44, 45], and subsequently, its requirement for rigorous administration of anti-infection measures, be it masking, vaccination, physical distancing, or lockdowns [8]. What was known about the pandemic, essentially, was that COVID-19 was both contagious and deadly—single COVID-19 cases rapidly escalated into deadly local outbreaks if uncontrolled [46–49]. What was initially unknown about the pandemic, on the other hand, centered on the lack of understanding of the underlying mechanisms of the virus, ranging from the forces that prompted the virus to emerge, spread, or mutate, to factors that enabled some people to stay resistant to COVID-19 infections compared to the general public [50–55]. The fact that society had been playing catch up as the virus evolved may have further compounded the situation [56].

These insights combined indicate that in the face of the knowns and unknowns about the pandemic and the Omicron variant, when positive cases are emerging in almost all sectors of society fast, the city should immediately administer a robust lockdown and rigorously promote vaccination in the population, especially the elderly, to prevent future spread of the disease, for the reason that single cases often either represent or expand into large outbreaks [57, 58]. The need for rigorous lockdowns is also supported by hindsight gained both from Hong Kong and Shanghai [59–61], where “targeted” approaches have proven to be not only ineffective, but could worsen society’s overall pandemic control timeline and synergy. Take Hong Kong for instance. Citing concerns for the economy and lack of resources, refusing to embrace the zero-COVID policy fully, Hong Kong adopted a “dynamic zero-infection strategy” to cope with its outbreaks first, which does not constitute citywide lockdown, universal screening, or large-scale quarantine—measures which are evidence-based best practices in controlling virus spread [62–64].

This decision is detrimental for a number of reasons. The first one focuses on the scientific support for lockdowns as effective anti-pandemic measures. Throughout history, lockdowns—rigorous management of the mobility of people who could become infected with the virus—remain one of the most effective countermeasures against pandemics [65–68]. In other words, the effectiveness of lockdowns in curbing and controlling infectious disease spread is an age-old tried-and-true strategy in epidemiology. In a study of 149 countries amid the COVID-19 pandemic, for instance, researchers

found that, on average, any physical distancing measures or mandates were associated with a 13% reduction in COVID-19 incidence [66]. The same goes for mass testing as well.

In an observational study of 3,148 confirmed cases in Hong Kong, for instance, researchers found that, as positive cases grow from 1 to 50 per day, the city's delay in virus testing could lead to avoidable surges of undetected positive from approximately 60% to 85% [58]. When factoring in Hong Kong's population and population density [69, 70], the city's disregard for mass testing could effectively lead to the dire possibility that, even when the virus has spread far and fast across society, neither government and health officials nor the general public would have known due to a lack of timely disease surveillance intelligence. Unfortunately, despite the accumulated scientific evidence and the fact that the city has been able to fend off previous outbreaks many thanks to the zero-COVID policy, local government and health officials have repeatedly dismissed the notion of adopting rigorous zero-COVID procedures to tame the outbreaks [42]. These insights indicate that, by refusing to utilize lockdowns to contain the pandemic, the Hong Kong government was essentially refusing to adopt one of the most effective anti-pandemic measures available to avoid the loss of lives.

Second, refusing to embrace the zero-COVID policy fully could tarnish the government's reputation [24]. While the government has allegedly observed the zero-COVID policy, it failed to follow two of its most essential requirements—rigorous containment of positive cases (e.g., lockdowns) and high mass vaccination rates. This discrepancy could compromise the government's image [6], and in turn, its ability to roll out future anti-pandemic measures successfully. In other words, when the government is not even enthusiastic about implementing the very rules it advertises, it could be even more difficult for the general public to believe in what the government aims to preach and adopt critical anti-infection measures to protect personal health, let alone public health. Different from nations that endorse a laissez-faire mitigation principle like the United States (U.S.), as a society that adopted the zero-COVID policy—a signature elimination strategy that prides itself in its robust principles and rigorous measures [11, 44, 45]—as its guiding pandemic control principle, government officials and health experts in Hong Kong should believe in what they preach for the sake of not eroding the general public's trust and confidence, key factors that could shape how the public would follow public health directives [71–73], such as COVID-19 vaccination.

2.3 Quality pandemic control and prevention policies

One of the recurring themes across the pandemic is the comparison of COVID-19 policies between Hong Kong and Singapore [18, 74–76]. Comparisons and competition between Hong Kong and Singapore have been long-standing [77, 78]. A key reason why it is perilous to compare Hong Kong's pandemic measures to those adopted by Singapore recently, particularly in light of the challenges Singapore faces after the city switched from the zero-COVID policy to the mitigation strategy [79–81], centres on the differences between these two cities' key pandemic prevention efforts, such as vaccination rates in the population, especially among vulnerable communities like older people, a factor that could have long-lasting impacts on pandemic control and prevention decision-making [82–84].

It is estimated that approximately 90% of people who died in the recent fifth COVID-19 wave in Hong Kong were not fully vaccinated [26]. Different from many societies, Hong Kong has been able to access both the Pfizer-BioNTech vaccines and the Sinovac ones from the early days of the pandemic, both of which hold great promises in fending off infections, hospitalizations, and deaths [85]. However, the availability of vaccines failed to translate into the adoption of vaccines in Hong Kong [86, 87]. It is estimated that when the Omicron wave started, approximately 65% of Hong Kongers 80 years and older were not vaccinated [88]. For those who live in nursing homes, the numbers are even more sobering—roughly 80% of these older people were not vaccinated [89]. This lack of mass vaccination, particularly among older people, is one of the key reasons why in March 2022, Hong Kong had the highest COVID-19 death rates across the globe [17].

And if comparisons were made between Hong Kong and Singapore, it is clear that Singapore has substantially better vaccination rates than Hong Kong. When the Omicron waves first started in January 2022, compared to Singapore's 87% vaccination rates, Hong Kong had only 65% of its residents vaccinated [86]. Even amid the height of the fifth wave, in April 3, 2022, Hong Kong's vaccination rates—78%, were still lower than those of Singapore—91% [86]. Not to mention that, in the same month, only 58.5% of those aged 80 and older had been vaccinated against COVID-19 [90]. In other words, while Hong Kong and Singapore both have a large older people population [70], because older people living in Hong Kong are less likely to be vaccinated against COVID-19 compared to their Singapore counterparts, they are more likely to fall victim to the pandemic as well. In 2022, when Singapore's deaths per million were around 235, a considerably high number compared to those of China's 3.21, Hong Kong's estimated numbers were as high as 1093 [17]. These data suggest that, when it comes to mass vaccination rates alone, which is a key prerequisite for even entertaining

the idea of exposing the population to the risks of the pandemic from incoming tourists, especially those travelling from places with high COVID-19 infection rates.

2.4 Vaccine hesitancy and government-led interventions

To make the situation even more complicated, even in light of the immense death and suffering, many older people remained reluctant to uptake the COVID-19 vaccines [90, 91]. The local government, along with media professionals, may have to shoulder the blame. For much of the pandemic, though the zero-COVID policy gave the city ample time to prepare for future variants, if not future pandemics, the city has done noticeably little in curbing vaccine infodemics [92, 93]. It is important to note that poor vaccination promotion is not rare amid the pandemic, especially in the early days. As a matter of fact, a lack of zeal in promoting mass vaccination in the population can also be seen in some African countries, where there are plenty of COVID-19 vaccines but not enough vaccination [12]. However, Hong Kong's unique status—lack of COVID-19 immunity both from infection and inoculation, densely populated, and a large ageing population—makes the government's lacklustre promotion of COVID-19 vaccination a fatal policy failure.

It is important to note that the lack of scientific insights is not a reason why the local government failed to acknowledge and then address the city's prevalent vaccine hesitancy. In a study on 1,200 Hong Kongers published in 2020—the early days of the pandemic, researchers had already reported that there was only a 37.2% vaccine acceptance among the participants [72]. Interestingly, in the same study, the authors also found that government recommendation is the strongest predictor of the residents' vaccine acceptance [72]. Needless to say, this is only one of the pools of studies on Hong Kongers' vaccine intention and hesitancy amid the COVID-19 pandemic [94–99], especially among older people and people with underlying diseases. In addition to governmental policies, reasons for vaccine hesitancy also include a number of socioeconomic factors, such as reduced confidence in vaccines, lack of continuity in the health care system, difficulty for older adults in obtaining adequate and clear advice from health care providers, and people's lack of ability in identifying and utilising suitable health information to make informed medical decisions [56, 100]. While vaccine hesitancy among the elderly has been a key hindrance to inoculating this particular volunteer population, it is important to note that, as seen across the globe, vaccine hesitancy is not an insurmountable issue.

One study shows that, around June 2022, Shanghai's COVID-19 vaccine coverage rate was around 78% for those aged 60 years and over [101]. This means that Shanghai's comprehensive, albeit strict, outbreak prevention and control strategy may have bought much-needed time for better society-wide vaccination coverage. Overall, the importance of vaccination is well-recorded in the literature. In a 2015–2019 survey, for instance, researchers found that only 9% of Japanese deemed vaccines as safe to adopt, while an equally worrisome proportion of the population (15%) believed vaccines are effective. However, amid the COVID-19 pandemic, thanks to the Japanese government's active promotion, as of April 4, 2022, over 80% of the eligible population in Japan has been vaccinated against the virus [86]. Considering that Japan had the world's highest share of older people (approximately 29.1% [102]), this finding shows how government interventions can effectively dissipate vaccine hesitancy and promote rigorous vaccination at a population level.

These insights combined, overall, further underscore the role of pandemic management in shaping the trajectory of COVID-19 in society. It is important to underscore that, if left unaddressed, vaccine hesitancy caused by false beliefs about the vaccination could lead to far-reaching consequences above and beyond the Omicron surges. For starters, there is a likelihood that Omicron or the BA.2 subvariant might not be the last COVID-19 variant [103]. In light of the possibility that more virulent variants might be on the horizon, it is then of utmost importance to prevent future waves of avoidable infections and deaths in Hong Kong and beyond. Second, while COVID-19 has been on the centre stage of public health, it is neither the only nor will be the last infectious disease in the world [35–38]. This means that whether and to what degree people's vaccine hesitancy can be addressed in a timely fashion not only influence the trajectory of the current pandemic, but also other infectious diseases as well.

2.5 Unique socio-ecological characteristics and challenges

Another lesson Hong Kong offers centres on the importance of factoring in the society's unique characteristics, circumstances, and challenges in public health decision-making, especially in times when both government, health officials, and the public might be plagued by fatigue and complacency [104, 105]. In the context of this study, we will be mainly focused on the dire and dense living spaces in Hong Kong as an example. While dense population is a common feature among East Asian first-tier cities, Hong Kong's housing crisis stands out as being uniquely severe, with an outstanding higher proportion of the population living in extremely cramped and substandard conditions compared to its regional

peers [69]. What is unique about Hong Kong's situation is that the city's living space per capita could be appropriately described as inhumane [106]. In 2024, the population density in Hong Kong is 7110.39 people per km²,² and for mainland China in general is 151.81 [107]. While these numbers are already alarming, due to varying zoning laws, situations are considerably worse in Hong Kong when it comes to accessible residential space [108, 109].

In 2021, for instance, the per capita residential space in Hong Kong was 16 m², which is significantly lower than other densely populated cities in East Asia (per capita residential spaces in Shanghai and Beijing in 2020 were 32 m² and 35 m², respectively) [110, 111]. For eleven consecutive years, Hong Kong has been ranked as the least affordable housing market across the globe [69]. Similar rankings could also be seen in other reports. According to the Global Living Report 2020, Hong Kong ranked as the world's most expensive place to purchase a property, with an average property price being \$1,254,442 [112]. These factors, collectively, shaped the dire housing situations in Hong Kong [113], where many people live in harrowingly tiny units that are often referred to as "coffin cubicles", with the average space being 4.6 square meters or m² (50 square feet or ft²), approximately the size of a parking lot and smaller than most prison cells [114]. In a government report published in 2016, it is estimated that over 65% of families in Hong Kong live in housing units between the size of 7 to 13 m² (75 and 140 ft²) [115].

These insights combined suggest that COVID-19 outbreaks in Hong Kong may spread considerably faster compared to societies with better population density and living standards, including other East Asian first-tier cities. The unique and severe housing dilemma Hong Kong faces is also a key reason why the city should be extremely cautious about easing its infection control policy. Even if the local government could manage to significantly improve its vaccination rates at a population level, including but not limited to its older population, its other more deep-rooted issues such as housing shortages can hardly be addressed overnight. This means that, in light of the fact that vaccination could seldom prevent COVID-19 infection, and more vaccine-resistant COVID-19 variants might be on the horizon [30, 31, 116, 117], the government should factor in scientific insights and its unique circumstances in deciding whether, when, and to what extent the city should change course with its overarching pandemic prevention strategy, as opposed to following the footsteps of others nations that might have considerable better vaccination rates, housing situation, and income equity.

Amid the COVID-19 pandemic, concurrently with the persistence of social movement, people's trust and satisfaction in the government's response to the outbreak sharply declined [13, 20]. A survey indicated that over 70 percent of the public expressed dissatisfaction with the government's performance in responding to the COVID-19 pandemic. Prior to the fifth wave, the government inherited public mistrust, which further fragmented the broader emotional bonds between government officials and the public, diverted attention from the epidemic, and hindered the effectiveness of the community's response to the public health crisis [118].

2.6 Long-term disease prevention mindset

A key contributor to Hong Kong's suboptimal COVID-19 prevention performance, particularly factoring in the city's past experiences with infectious disease outbreaks, centres on the city's lack of long-term planning. It is important to emphasize that the COVID-19 pandemic is hardly the first pandemic the city faced [119–121]. Take severe acute respiratory syndrome (SARS) for instance. While SARS was considerably less prevalent than COVID-19, Hong Kong experienced a string of SARS outbreaks at the time [122, 123]. However, many factors that contributed to the spread of the SARS pandemic, such as poor housing conditions, remain unsolved and played a significant role in shaping the city's current crisis [124]. Research shows that, for instance, between 2013 and 2015 alone, the living space among subdivided units in Hong Kong has been shrinking, while < 7 m² and 7–13 m² households were on the rise (from 10.8 to 13.4% and 55.4 to 65.5%, respectively), 13–20 m² and > 20 m² ones were declining (from 22% to 16.9% and 11.8% to 4.4%, respectively) [125].

It is important to underscore that, in addition to heightened risks for COVID-19 infections, the grim housing conditions many Hong Kongers have to cope with on a daily basis could also exert a considerable toll on their mental health and well-being [126, 127]. Investigating the impacts of housing affordability among approximately 2,000 Hong Kongers, for instance, researchers found that both housing affordability and economic deprivation adversely compromised people's mental and physical health [127]. Similarly, in a study of 1,978 residents living in Hong Kong, researchers further found that compared to people living in low-density (≥ 13 m²) and medium-density spaces (7–13 m²), those who live in high-density situations (≤ 7 m²) have higher risks of anxiety and stress, with the effects being particularly pronounced in women and young adults [128]. What the above-mentioned evidence illustrates, essentially, are the squandered opportunities that government officials in Hong Kong should have focused on to improve the city's key infrastructure—systems that could help boost the society's resilience to infectious disease outbreaks.

While we only used Hong Kong's housing issue as an example, there are a wide range of systemic shortcomings identified across the pandemic, ranging from the inadequacies in the city's medical system, health professionals' suboptimal health emergency response, to the lack of crisis communication skills seen in government and health officials [129–131], all of which could better insulate the city from avoidable COVID-19 infections and deaths. As COVID-19 enters year five, and possibly wreaking more havoc before it ceases to occupy breaking news and emergency rooms, policymakers in Hong Kong should start to consider the improvements they could and should make to ensure that the city will definitively be more resilient when the next pandemic visits. If history is any guide, the world should appreciate the fundamental understanding that infectious disease outbreaks like pandemics are almost always looming and ready to strike. The question lies in how well society as a whole could protect itself, especially its most vulnerable members, from being devastated by viruses that our ancestors taught us how to curb and control a long time ago [132–134]. The past is but a parologue. Hong Kong and the rest of the world can and should prepare for its next chapter early and sagaciously, based on science and its unique characteristics, so that when it comes to consequential lessons, it has more positive ones to share. To help achieve this objective, based on our analyses, we developed a list of corresponding strategies that can inform future pandemic policy development and implementation (Table 2).

2.7 Limitations

Due to factors such as time and resource restraints, shortages of rigorous evidence, as well as set parameters of the research question, it is likely that insights that can further shed light on pandemic lessons from Hong Kong were not included. Many influences, partly due to their difficult-to-pinpoint and oftentimes overlapping presence, like geopolitical tensions that can curb international collaborations in medical endeavours (e.g., vaccine development and distribution), the presence or absence of regulatory frameworks that can shape people's privacy concerns (e.g., willingness to disclose their diagnoses and assist contact tracing), as well as ingrained and difficult-to-address systemic issues such as the strength and weaknesses of Hong Kong's civil services, etc. are not considered in the paper.

A related limitation is that, due to a lack of strong evidence in the literature, we could not establish how the interplay of the above-mentioned factors, along with others, might influence Hong Kong's COVID-19 response, and in turn, lend critical lessons on pandemic control and management. For instance, there is a dearth of research on whether the pandemic prevention shortcomings rooted in Hong Kong's limited living spaces (e.g., suffocating apartment units) might be compensated by its well-established social service sectors and healthcare systems (e.g., Hong Kong is among the world's top rankings in terms of its people's longevity). To generate research with better replicability, future studies can consider systemic reviews and meta-analyses to delve deeper into niche issues, such as how specific factors might have shaped Hong Kong's pandemic response, and how well these lessons on these factors, especially in retrospect, have been acknowledged in actions forward by regional and international health officials. This paper is also limited due to its cross-sectional nature. One way to address this issue is via conducting longitudinal research that can provide a connected and continuous streams of insights that can help our society at large become better equipped in tackling emergencies large and small.

3 Conclusion

To survive, or not to survive is hardly a worthwhile question, particularly amidst deadly global health crises. Yet counterintuitively, even though leveraging pandemic control and prevention measures to protect people from the onslaught of the pandemic often directly translates to lives and livelihoods protected and preserved, many societies broke their social contract with the public, as public health officials failed spectacularly at executing "pandemic 101 s" or even public health "common sense" amid COVID-19. Hong Kong is famed both for its zero-COVID success as well as its failures. In this study, we identified the key lessons society could gain from Hong Kong's COVID-19 responses that can be beneficial to government and health officials amid COVID-19 and future pandemics. For Hong Kong, the imperative for action is clear. If Hong Kong aims to reduce morbidity and mortality in future outbreaks, it should consider the lessons and strategies we identified above in the paper. In light of the capricious nature of COVID-19 and the inevitability of infectious disease outbreaks in general, there is a pronounced urgency for society to capitalize on all lessons and resources available, so that, collectively, we become more intelligent and resilient in pandemic control and containment. To live, to live long, and to live prosperously long, are but the most basic human aspirations. Yet to accomplish these goals, we need, first and foremost, to survive the threats from pandemics like COVID-19 and mpox

Table 2 Key pandemic prevention recommendations

Key lesson identified	Key recommendation
Development and implementation of the overarching pandemic policy	<p>Empirical evidence is often the best guide in developing pandemic policies, not least because the most effective and efficient pandemic prevention practices are often repeatedly identified in real-world events and rigorously studied in the literature, ranging from pharmaceutical interventions (e.g., vaccines) to nonpharmaceutical measures (e.g., masking).</p> <p>Having a well-designed pandemic policy yet poorly implemented could also result in disastrous consequences, as Hong Kong's COVID-19 experiences testify. This means that public health officials need to be vigilant in not only the development of the pandemic policy, but also in the implementation of the policy, and if needed, its future iterations as well.</p>
Quality pandemic control and prevention policies	<p>Due to the changing nature of viruses and their mutations, what constitutes as quality pandemic control and prevention policies may differ as the pandemic evolves.</p> <p>This means that, in addition to ensuring the structure of the pandemic policies is based on rigorous empirical evidence and their implementation is orderly and properly carried out, an iterative review-and-improve process should also be developed and leveraged throughout the continuum of the pandemic so that the updated insights and newest technologies can be incorporated into the policies in a timely fashion.</p>
Vaccine hesitancy and government-led interventions	<p>People's vaccine hesitancy could often be used as a barometer of their attitudes toward government-led interventions, if not trust in public services in general. While both short-term and long-term solutions can help people get rid of their ill-founded vaccine hesitancy, long-term solutions and whole-of-society interventions initiated by the government, preferably prior to fast-paced pandemics like COVID-19, may have a better chance at tackling the issue.</p> <p>In addition to boosting vaccine adoption, which often is the most effective way of curbing infectious disease spread, reducing unreasonable vaccine hesitancy via health literacy programs also has the potential to raise people's cognitive and affective capacity and readiness to adopt other government-led interventions.</p>
Unique socio-ecological characteristics and challenges	<p>Pandemic policies that are cognizant and respectful of communities' diverse socio-ecological characteristics and preferences may fare better in terms of establishing public acceptance and compliance of the policies. Acknowledging the unique socio-ecological characteristics and challenges of the people can also give officials and experts an edge in capitalising on existing health infrastructure and social structures that resonate with the on-the-ground reality.</p>
Long-term disease prevention mindset	<p>Fostering a long-term disease prevention mindset can have a positive compounding impact on society's ability to respond to crises big and small successfully.</p> <p>To cultivate a long-term disease prevention mindset, public health officials need to invest more resources during pandemic "peace time" (e.g., limited or subdued disease outbreaks), like whole-of-society interventions on vaccine hesitancy and inter-generational mental health resilience programs, so that, collectively, society can perform better in "war time" when disease spreads are raging far and wide.</p>

outbreaks. Rigorous pandemic preparation should and must be the first line of defence society can count on and rely on, and the COVID-19 lessons and legacies identified in this study have the potential to help the world better survive and thrive in the future against all odds. To live long and prosper, we can, we shall, and we must.

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