

Fighting COVID-19 in the Cities of Guangzhou, Hong Kong SAR, Macao SAR, and Zhuhai, a Case for Cross Cities Complementary and Supplementary Supports

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Abstract

This paper is basically a regional study on health emergency responses of city governments in the Guangdong Greater Bay Area of China, under the unforeseen impact of the COVID-19 Pandemic from 2020 to 2022. Employing the Interpretive Policies Analysis Approach, four cities of Guangzhou, Zhuhai, Hong Kong SAR and Macao SAR were sampled purposively for case studies as they represent adjacent, different and yet devotailing healthcare systems. The Oxford Government Response Indicators were used to form the comparison framework for cities health emergency policies. Results showed that the four cities have adopted basically similar stringency and containment measures in line with. However, the cities varied significantly in terms of health outcomes. Out of a population of 7.5 million, more than 10,000 died due to COVID-19 in Hong Kong SAR. Macao SAR's record was second worse, recording 38 deaths with only 0.67 million of residents. The case studies revealed that among the four cities during this battle, there were complimentary and supplementary measures to safeguard and improve overall health outcomes in the Greater Bay Area. Further synergies and symbiosis in healthcare are expected in post Pandemic Era.

Keywords

COVID-19 Pandemic, Vaccination and NPI, Regional Developments, EDRM, Guangdong GBA

1. The COVID-19 Challenge to Regional Public Health

This paper aims to study the emergency responses of the city governments in the

Guangdong-Hong Kong SAR-Macao SAR Greater Bay Area (GD-GBA), their strengths and inadequacies, under the public health crisis of the COVID-19 from 2020-2022. In December 2019, cases of novel coronavirus (nCoV) were first detected in China and spread rapidly across the world. All governments were driven to take immediate measures to protect lives. China, with a huge population, could not afford to lose control over this communicable disease.

The country adopts an Emergency Management Scheme of One Plan Three Systems (Wang, Chan, Liu, & Yeung, 2016). It refers to one disaster plan, from national, provincial to city levels of plans, and three systems namely, Legal, Organizational and Operational Systems. Guangdong has been one of the most open provinces in China. It was and still is the pioneer region for foreign trade and international travelers. It is also densely populated. As COVID-19 knows no city boundaries, the GD-GBA is one of the most vulnerable regions in China.

In the early stage of the COVID-19 attack, the Health Commission of Guangdong Provincial advocated for the construction of a linkage mechanism for prevention and control of the viral disaster (People's Paper, 2020-05-01; Takungpao, 2020-05-26). According to the Agreement on Consensus of Guangdong-Hong Kong SAR-Macao SAR Greater Bay Area Health Cooperation Macao (China Daily, 2019-02-25), the Government of the HKSAR and the Government of Macao SAR in the GD-GBA should maintain close cooperation with the Guangdong Provincial Government for public health emergencies, and liaison mechanism for disasters, health emergencies and medical rescue. Furthermore, the Outline Development Plan for the Guangdong-Hong Kong SAR-Macao SAR Greater Bay Area (State Council of the People's Republic of China, 2019-02-25), stated that one of the development goals is to shape a Healthy Bay Area, including the establishment of close medical and health cooperation among the cities, and to improve the linkage mechanism for medical emergency rescue. The question is how can these policy objectives be operationized and effectively achieved when challenge comes.

2. Management of Public Health Emergency Response

2.1. Preparation for Public Health Emergencies

The John Hopkins University in collaboration with the Economist and the Nuclear Threat Initiative, developed in 2019 the Global Health Security Index (GHSI) to measure preparedness of countries in facing a public health crisis (Cameron & Bell, 2019). However, those countries ranked top in the Index, like the United States ranking number one and seconded by the United Kingdom ranking number two, all fared poorly in the COVI-19 Pandemic. Research suggested that GHSI does not have the power to predict (Abbey et al., 2020). Counter arguments were also presented in a more recent research as the GHSI published its 2021 Issue (Ledesma, Isaac, & Dowell et al., 2023). These findings suggest that effective responses are also crucial to save lives in front of a lethal crisis.

2.2. Government Response Actions Recommended by WHO

WHO declared a Public Health Emergency of International Concern (PHEIC) on

30 January 2020 and announced it as a pandemic on 11 March 2020. The WHO, in a Strategy Update published on April 14, 2020, Dr Tedros Adhanom Ghebreyesus the WHO Director-General, stated:

One of the main things we've learned is that the faster all cases are found, tested and isolated, the harder we make it for this virus to spread. This principle will save lives and mitigate the economic impact of the pandemic (WHO, 2020-04-14, p. 1).

On May 30, 2020, at the Seventy-third World Health Assembly, WHO made the calls for COVID-19 Response to all member states. A comprehensive policy guideline for governments to combat the Pandemic was then presented to the world that required whole government and whole community approaches.

2.3. China's National Strategy for NPI

In the absence of vaccines, governments have to rely on non-pharmaceutical interventions (NPI) to minimize the spread of the Coronavirus. The State Council Information Office of the People's Republic of China released the policy paper *Fighting COVID-19: China in Action* on June 7, 2020. It stressed a well-coordinated prevention, control, and treatment strategy with the five characteristics below:

1. Centralized and Efficient Command;
2. Tight Prevention and Control System involving All Sectors of Society;
3. All-Out Effort to Treat Patients and Save Lives;
4. Releasing Information in an Open and Transparent Manner as required by Law; and
5. Underpinning China's Efforts by Science and Technology (State Council of People's Republic of China, 2020-06-07).

All city governments in the GD-GBA must follow the same Pandemic Control Policy of the China Central Government and specific guidelines of the China Center of Disease Control.

2.4. The Test for Regional Health Collaboration in Crisis

Measures of cross cities cooperation in public health crisis could be classified as complimentary actions and supplementary actions. Khamseh & Jolly (2014) applied these concepts to examine knowledge transfer and business alliances in the field of regional economic management. Complimentary public health support can be viewed as those necessary resources or manpower provided by one city to another without which collapse of the healthcare system or significant live loss will occur to the latter city. Supplementary actions refer to those resources or manpower provided by one city to another which will mitigate the crisis and enhance the health performance of the latter.

The study on the GD-GBA's Cross Cities Complimentary and Supplementary Support is highly valued because no government or country can face natural and human disasters single-handedly in this stage of globalized economies. The findings will contribute to regional and global collaborations in emergency

management.

To summarize this study focused on the performances of health emergency response of the cities in the GD-GBA and examine whether mutual supports are evident during the processes of combating the COVID-19 Pandemic.

3. Methodology

3.1. Selection of sample Cities

The Guangdong-Hong Kong SAR-Macao SAR Greater Bay Area composes of 11 cities, namely Guangzhou, Dongguan, Shenzhen, Hong Kong SAR, Macao SAR, Zhuhai, Zhongshan, Fushan, Zhaoqing, Huizhou, and Jiangmen. The former eight cities can be referred as the Pearl River Delta Cities while the later three are added to create a larger economic entity.

This study aims to study city government responses to COVID-19 in the GBA however it is not advisable to include all the above 11 cities since they are not comparable in many aspects. Notably the former Pearl River Delta cities have stronger economic performances than the latter three. Population structures of the 11 cities also vary in population size and composition. Cities with higher level of industrialization like Guangzhou, Dongguan, Shenzhen, Zhongshan and Fushan have attracted more migrant workers from peripheral cities of Guangdong and other inland provinces.

Since Hong Kong SAR and Macao SAR enjoyed the status of Special Administrative Regions, implying that they may adopt different responses to COVID-19, these two cities will be included in this study. Another two cities were selected for comparison.

Among the GBA cities, Guangzhou, Shenzhen and Hong Kong SAR are first-class cities having comparable socioeconomic development and city scale, with Dongguan next to the list. However, in terms of medical facilities and expertise, Guangzhou being the provincial capital is much stronger than Shenzhen. When Hong Kong SAR faced the attack of the 5th wave in early 2022, Guangzhou also played a leading role in providing medical assistance to Hong Kong SAR. Guangzhou instead of Shenzhen was selected as one of the sample cities also because it is exemplary for all cities in the Guangdong province or even for all China. Zhuhai, on the other hand, is adjacent to Macao SAR with continuous geographical environments and similar cultural heritages. From 2020 Government of Zhuhai and Government of the Macao SAR, have been very active in taking corresponding epidemic prevention and control measures to combat COVID-19.

As a result, Guangzhou, Hong Kong SAR, Macao SAR and Zhuhai were selected as the sample cities. The Inter-connections of these four cities are very high therefore their measures in cross-borders COVID-19 control deserve grave attentions.

3.2. Measurements and Comparisons of City Responses

This study was based on secondary data for analysis of government responses in the four cities. Only official government reports released from 2020 to the end of

2022 were included in the response actions review. The comparisons were qualitative and exploratory.

The Oxford University developed a Government Responses Tracker since the outbreak of COVID-19. Before the availability of approved vaccines, the Tracker provided three sets of Indicators. They were the Containment Index, the Stringency Index, and the Financial Assistance Index. Financial assistance to the needy is considered important in many countries if work places were closed. After 2021, the Tracker added to the list of three, the Vaccination Index.

The Stringency Index was developed from the recommendations of the World Health Organization and included eleven indicators, as listed below:

1. Establish a unified and efficient command system: establish a unified command, unified coordination, and unified dispatch, and a command unit responsible for coordination and execution.
2. Construction of a tight prevention and control system with universal participation: social mobilization, mobilization of universal participation.
3. Fully treating patients and saving lives: implementing categorized treatment and graded management, mobilizing the best doctors, the most advanced equipment and the most urgent resources, and treating at all costs.
4. Releasing epidemic information in a timely, open and transparent manner in accordance with the law: releasing continuous, authoritative and clear information on the epidemic in the first instance, and responding effectively to public inquiries.
5. Full use of scientific support: scientific research, rapid and sensitive detection systems, use of big data and artificial intelligence to support prevention and control, such as health codes, epidemic maps, analysis of risk areas, etc.
6. School closures: there are closures of non-higher education schools and higher education schools during the epidemic phase.
7. Workplace closures: there are closures of workplaces during the epidemic phase.
8. Public events cancellation: public events are canceled during the epidemic prevention and control period.
9. Public transport closures: there are closures of public transport in response to the epidemic.
10. Public information campaigns: public messages generated in response to the epidemic.
11. Intra-cities mobility restrictions: restrictions on the movement of citizens within the city in response to an epidemic.
12. International travel control: control of international travel in response to the epidemic.
13. Fiscal measures: economic stimulus policies in response to the epidemic.
14. Monetary measures: adjustment of monetary strategies in response to the epidemic.
15. Medical emergency delivery: short-term medical support in response, such as additional hospitals, manpower, medical supplies such as masks and gloves.

16. Vaccine delivery: publicly stated investment of resources in vaccine development in response to the epidemic (Oxford University, 2024-10-23).

3.3. Measurements of Complimentary and Supplementary Support

The Agreement of Guangdong-Hong Kong SAR-Macao SAR Greater Bay Area Health Cooperation (China Daily, 2019-2-25), did call for close mechanisms in coordination, liaison and rescue, in case of a public health crisis. These mechanisms during COVID-19 should be operationalized in measurable terms. Lacking of clear logistic requirements in these mechanisms left the agreement in empty terms.

To realize the cooperation mechanisms, it is suggested to divide Cross Cities Cooperation into the following categories:

1. Information sharing and standardization;
2. Vaccination sharing and standardization;
3. Sharing and standardization of Containment facilities, like cabin hospitals and isolation shelters;
4. Medical equipment and assistance sharing and standardization;
5. Sharing and mutual support of medical human resources, including physicians, nurses, and para-medicals;
6. Sharing and standardization of medical facilities including hospitals, clinics and mobile medical centers;
7. Financial risks sharing through joint insurances and complimentary financial assistance of medical expenses (State Council of the People's Republic of China, 2019-02-25).

Therefor the four cities were compared according to the 16 possible government response measures mentioned above derived from the Stringency and Containment indices developed by the Oxford University. Second, the cooperation mechanisms in two paired cities namely between Guangzhou and Hong Kong SAR, and between Macao SAR and Zhuhai, will be analyzed according to the 7 Cross Cities Cooperation Indicators listed above.

4. Case Studies of Government Responses in the Four Cities

4.1. Medical, Legal and Administrative Capacities of the Four Cities

To what extent different cities were capable of carrying out the national and regional strategic goals is crucial. For example, the scientific support each city enjoys is different.

Guangzhou is the medical hub of the province. The city is privileged to have seven Medical Schools offered by the Sun Yat Sen University, the Guangzhou Medical University, the Guangdong Medical University, the South China Polytechnic University, the Jinan University, the Guangdong Provincial Chinese Medical University, and the Guangdong Pharmaceutical University. Their Medical Hospitals frequently serve patients coming from other cities in Guangdong and even from other provinces.

Hong Kong SAR, on the other hand, is benefited from having two Western Medical Schools of the Hong Kong University, and the Chinese University of Hong Kong (CUHK), plus the Chinese Medicine Medical School of the Hong Kong Baptist University. Its public health sectors have the experiences of fighting the SARS in 2003, which is considered to be an asset.

Zhuhai, though much smaller in size, was prided with the Zun Yi Medical School and the Zhong Shan University 5th Hospital which is operated by the Sun Yat Sen University Medical School. Macao SAR, the smallest city among the four, is weakest in terms of medical experts and facilities.

Hong Kong SAR and Macao SAR being Special Administrative Region possess a significant degree of legal and administrative autonomy. Shenzhen and Zhuhai, granted with the legislative rights of Special Economic Zones, enjoyed a certain level of administrative freedom but during public health crisis will follow provincial management closely. Guangzhou, being the provincial capital where the Guangdong Health Commission stations, is the arms of the brains figurative speaking. Responses of these cities may vary, not in principles but in specific practices based on their health capacities, community cultures, administrative efficiencies, and governance.

4.2. The Clues to Success, or Failures

The above government responses options are all public information well documented and promoted by the World Health Organizations. As the Pandemic lasted for a long period of three years there are no excuse even for the slowest learners not knowing what should be done. Social Distancing is one of the orthodox approaches in public health. Unexpectedly Hong Kong SAR suffered from an outbreak not in the year 2020, but in 2022 with a long lapse of 24 months. In addition, Hong Kong SAR has the bitter experience during the outbreak of SARS in 2003. Its people and Government should have learned from the lessons of SARS.

As mentioned earlier that in this study, the COVID-19 Response Actions of the Four City Governments of Guangzhou, Macao SAR, Zhuhai and Hong Kong SAR, under the structure of One Country Two Systems, were scrutinized with a case study approach, in the hope of finding some clues to their successes and failures.

4.3. Macao SAR

The Macao SAR government adheres to the epidemic prevention and control policy of “strict prevention and control at all costs” and the epidemic prevention strategy of “early detection, early reporting, early isolation, and early treatment”. A series of epidemic prevention and control measures were launched after the outbreak of the epidemic. Under the guidance of the Central Chinese Government, the Macao SAR and its neighboring regions in the Mainland have started cross-regional cooperation in epidemic prevention and control, aiming to achieve zero fatalities, zero community infections, low rates of serious illness and high rates of cure.

On January 21, 2020, the Chief Executive of Macao SAR, Ho Iat Seng, announced the establishment of the Novel Coronavirus Response and Coordination Centre, in accordance with the Law on the Prevention and Control of Infectious Diseases ([Official Bulletin of Macao SAR, 2020](#); [Xinhua Net, 2020](#)). The Coordination Center is responsible for the overall planning, guidance and coordination of the work of the various public and private entities regarding the prevention, control and treatment of novel Coronavirus infections. Its objectives are listed below:

1. To develop appropriate anti-epidemic prevention and control policies and guidelines at all stages, depending on the severity of the infection with the Coronavirus pneumonia;
2. to coordinate and direct the efforts of various public and private entities regarding the prevention, control and treatment of Coronavirus pneumonia; and
3. To coordinate the anti-epidemic measures taken by the Coordination Center (see [Figure 1](#)).

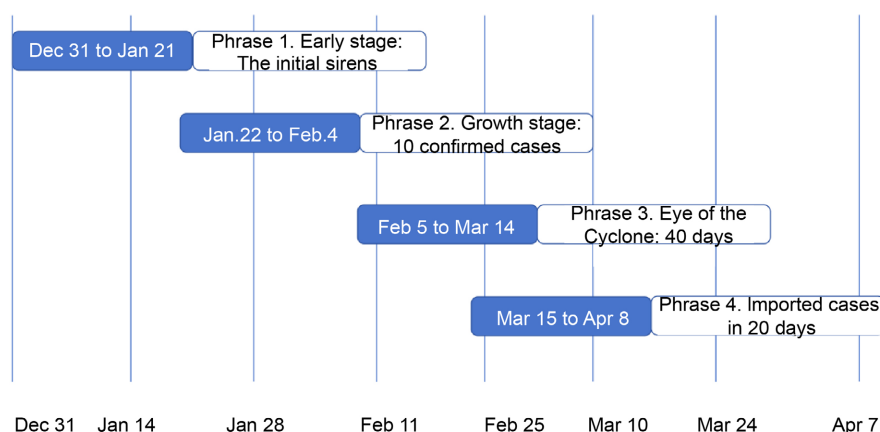


Figure 1. Fours stages of Conronavirus control in Macao SAR in 2020; Source: [Bian, Yao, & Bian \(2020\)](#).

The Macao SAR Coordination Center further announced a series of prevention strategies, governing entry quarantine measures (15 items), medical observations (4 items), medical institutions and healthcare workers (7 items), personal precautionary measures (4 items), environmental hygiene measures (3 items), tourism, gaming, entertainment and hotel establishments (8 items), industries and establishments (16 items), government departments and public facilities (4 items), the general public (14 items), and non-pharmacological measures for the prevention and control of the epidemic such as the supply of masks ([Macao SAR Government Tourism Office, 2020-01-22](#)).

Facing the prolonged epidemic, the Macao SAR government formulated an epidemic prevention strategy of “external prevention of importation and internal prevention of rebound” in 2021. Electronic technologies were employed to implement and monitor prevention and control work. At the same time, Macao SAR

improved its capacity in prevention, treatment, detection and coordination by ensuring adequate quarantine facilities, drugs and logistic materials, and cabin hospitals.

In October 2020, the Macao Health Bureau stated that it always had a plan for cabin hospital with the capacity of 500 beds could be set up in away from residential areas. The number of negative pressure beds in this cabin was increased to 266, believed to be sufficient to meet the emergency demands of the epidemic prevention measures at that time.

By March 2021, in order to follow the central government's prevention and control strategy of "external prevention of importation and internal prevention of rebound", Macao SAR introduced differentiated control measures according to the risk classifications of the epidemic in community. The Novel Coronavirus Infection Response Coordination Center then designed a Zoning and Grading Precision Prevention and Control Plan. The purpose is to implement zoning (areas) and grading (risk levels) containment management to exercise containment in a confined area while allowing the larger community to resume normal city activities.

On August 3, 2021, there were four new confirmed cases in Macao SAR, including one imported case and three related local infections. The Macao SAR Government activated the "zoning and grading" measures immediately, and traced the source of infection of the confirmed cases. In addition, to allow for universal nucleic acid test, the Government of the Macao SAR set up 41 sampling points from August 4 to August 7, 2021. A large community vaccination station at the Mong-Há Sports Center was used as a nucleic acid test site on August 5. In order to provide universal nucleic acid testing to mobility-impaired persons in residential institutions and communities, the Social Welfare Bureau coordinating with the Department of Health, organized an outreach nucleic acid testing service on August 6.

4.4. Zhuhai

In response to the Wuhan outbreak, the Zhuhai Municipal Government established the Zhuhai Municipal Government Novel Coronavirus Pneumonia Epidemic Prevention and Control Command Group (hereinafter referred to as Zhuhai Epidemic Command), led by the municipal government office, with the Mayor of Zhuhai as the Commander, the Executive Vice Mayor and the Vice Mayor in charge as Deputy Commanders, and the main leaders of relevant functional departments as Members.

The Group composition and leadership was structured to ensure organizational leadership, financial security, material security, personnel security, and technical security. These "five in place" structure made it possible to implement a Four All approach, as in the following:

1. All residents who visited Wuhan and returning to Zhuhai should take their body temperature in mornings and evenings and avoid crowded places;
2. All people who planned to visit Zhuhai from Wuhan were discouraged;
3. All festive events were suspended; and

4. All people were required to wear masks in public places.

Thus, Zhuhai took the lead in restricting the flow and the gathering of people, implementing the mask policy, and encouraging people to seek early medical attention if they had suspected symptoms.

On January 24, in response to the epidemic prevention needs of the Macao SAR Government, passengers entering Macao SAR from Zhuhai were required to fill out health declarations at all ports of entry, and are encouraged to use electronic forms to fill out the declarations and present or submit them when entering Macao SAR. From January 25, 2020 onwards, Zhuhai observed the requirements of the China General Administration of Customs, and implemented health declarations system at all points of entry.

According to the instructions of the Zhuhai Epidemic Prevention and Control Command Announcement (No. 1), all business units and public place operators in Zhuhai were required to install body temperature testing equipment, to take temperature and impose masks wearing practices to all visitors patronized these places.

All estate managers must set up quarantine stations in their districts for multi-party monitoring. In January 2020, even falling into the Chinese New Year season, Zhuhai canceled all kinds of large-scale activities, closing all tourist attractions, suspending operations of 61 bus routes, and putting all schools to home and online learning.

To all visitors from other cities, quarantine measures of 14 days were compulsorily implemented until July 15, 2020. Travelers from Macao SAR has to apply for the Guangdong Health Code online, 24 hours before entry. The Health Code was tied to a health declaration and agreement to allow tracing of movements in the past 14 days by the authority.

Zhang Yisheng, Deputy Secretary of the Zhuhai Municipal Party Committee, Mayor and Executive Deputy Director of the city's Epidemic Prevention and Control Command Group, stressed the need to maintain prevention and control of the epidemic as a long term measure (*Zhuhai Daily*, 2020-01-22).

Zhang Yisheng was concerned about the reopening of the Macao SAR-Zhuhai City Border Ports. Increased publicity and public education on the Guidelines for cross borders handling procedures in relation to prevention and control of the epidemic, was considered important to reduce congestion while protecting port clearance safety. He also called for close collaboration between governments of the two cities Zhuhai and Macao SAR.

In the implementation of vaccination, Zhuhai planned to fully cover the city's population between 18 and 59 years of age by the end of June, 2021. The Zhuhai Municipal Government Executive Meeting held on March 18, 2021 adopted the Zhuhai's Coronavirus Vaccination Implementation Plan. On top of the existing 20 vaccination sites, 2 large temporary Vaccination Base (Zhuhai Sports Center and Doumen Gymnasium) were established. On April 20, 2021, Zhuhai had provided a cumulative total of 1,417,000 vaccinations against the Coronavirus, and became the first prefecture-level city in China to have a vaccination coverage rate

of more than 80% within the target population aged 18 - 59.

In August 2021, new cases emerged in the Gongbei Area of the Xiangzhou District, and Zhuhai immediately adopted a Zone Closure Strategy in order to effectively cut off the transmission route. Full nucleic acid testing in the sealed zone of Xiangzhou District was enforced in the Sealed Zone of Gongbei. A total of 25 nucleic acid sampling points in 8 sites within the sealed control area began operation until the test results are all negative to allow unsealing.

Zhuhai attributed its vaccination success to its ability in mobilizing all of the city's medical and nursing staff to carry out vaccinations as quickly as possible, in rapidly deploying large vaccination sites, and in implementing a pay-as-you-go strategy by using mobile vehicles for vaccination, to make it possible in administering 12,000 doses per day.

4.5. Guangzhou

In Guangzhou, since the outbreak in Wuhan in December 2019, the Municipal Government has taken active measures to respond to the outbreak, starting with an emergency notification issued by the Guangzhou Health Commission on December 31, 2019, requesting medical and health institutions at all levels in the city to strengthen case investigation.

The Guangzhou Municipal Party Committee and the Guangzhou Municipal Government established the Guangzhou Coronavirus Infection Prevention and Control Command and Expert Group to organize and lead the battle against the epidemic. The Guangzhou Center for Disease Control and Prevention also played an important role in constantly updating the epidemic data and providing health promotion, such as guidelines and scientific knowledge on the prevention and control practices.

In March 2020, Circular No. 4 of the Guangzhou Coronavirus Pneumonia Epidemic Prevention and Control Command on Further Strengthening the Prevention and Control of the Epidemic, clearly stated that the prevention and control measures should be led by communist party cadres at all levels. All members of society should take active and advanced preventive and control measures such as reducing going out, maintaining personal hygiene, washing hands regularly and ensuring air circulation, seriously.

If positive cases were found in railway stations, airports, passenger terminals and hospitals, they will be immediately isolated, diagnosed and treated. The next step is requiring people returning to Guangzhou to take home-isolation, centralized-isolation or health observation for 14 days, depending on the levels of epidemic in places they have visited. For management of city spaces, including urban and rural communities, work and production units, commercial service and entertainment areas, parks and open spaces, educational and medical institutions, detail guidelines of prevention and control were issued.

Another areas of COVID-19 control is the protection of vulnerable target groups. For example, catering staff, courier workers, cleaning staff and other general

workers who were frequently exposed to public contacts, were required for regular acid tests. With the help of Digital Guangzhou Health Code, the public health department was capable of better tracking and containing practices. It can also be used to monitor and avoid over crowding in certain public places.

In May 2020, the epidemic in Guangzhou was basically stabilized and entered into the phase of normalization, returning to normal city life as far as possible while maintain high alert on rebound of the communicable disease. The strategy of preventing internal rebound and stopping external import of the disease is a national policy within all China (Government of Guangzhou, 2020). However, it was particularly difficult for cities like Guangzhou, Hong Kong SAR, Shanghai and Beijing where international and national travelers are in huge numbers.

When it comes to 2021, the epidemic in Guangzhou entered the second phase of outbreak, in spite of the Guangzhou Government's tremendous efforts to optimize vaccination rate. In March 2021, free vaccination against the Coronavirus was introduced for people aged 18 - 59 years (Government of Guangzhou, 2021a). 15 In April 2021, Vaccination was also opened to the compatriots from Taiwan region (Government of Guangzhou, 2021b). On June 6, 2021, four new cases of domestic infection (three confirmed and one asymptomatic) were unexpectedly detected, through active screening. In addition to isolate the zone residential area, the Guangzhou Coronavirus Pneumonia Prevention and Control Command enforced that entertainment venues (KTV), mini singing booths, internet service establishments, chess and poker rooms, mahjong parlors, and all similar units should all be suspended of business and took hygienic measures (Government of Guangzhou, 2021c).

The "Notice on the Full Vaccination of the Coronavirus for Residents Over 18 Years of Age" was then announced on June 30, 2021. Residents could made appointments to receive the Vaccination through Digital Health Code (People's Government of Guangdong Province, 2021-07-01), while foreigners could use the Guangdong Health Apps for vaccination appointments. As of August 17, 2021, a total of 30.7 million doses of vaccine have been administered in the city, with a cumulative total of 17.25 million people having at least one shot. Among them, 13.71 million people have taken two shots and completed the full course of vaccination, representing a coverage rate of 73.4% (People's Government of Guangzhou, 2021-08-19).

4.6. Hong Kong SAR

In December 2019, the Government of Hong Kong SAR held an expert meeting to discuss the Coronavirus attack, and the authorities promised to strengthen all preventive and control measures, including introduction of health surveillance at entry and exit points. The Government also expressed concerns for Hong Kong SAR people who were in Hubei, hope to assist them in returning to Hong Kong SAR.

On the other hand, Hubei travelers who were in Hong Kong SAR at that time were required for medical assessment and observation, and health advice were provided to them. On January 4, 2020, the HKSAR Government announced the

Preparedness and Response Plan for Emerging Infectious Diseases of Public Health Importance (the HK Response Plan), which set out the Government's actions to deal with the outbreak of this infectious diseases that threatened public health. (Government of Hong Kong SAR, 2020a) A Steering Committee and Command Center to oversee the prevention and control of the epidemic was formed. Four working groups have been established under the Command Center, namely the Working Group on Epidemic Prevention and Control, the Working Group on Contingency Operations, the Working Group on Public Engagement, and the Working Group on Anti-Epidemic Transmission, with the following functions.

1. Epidemic Prevention and Control Working Group: responsible for formulating strategies for handling infected cases and maintaining close contact with the relevant Mainland authorities and the World Health Organization.

2. Contingency Action Working Group: responsible for coordinating the anti-epidemic work of all relevant departments.

3. Public Participation Working Group: responsible for promoting community participation in the fight against the epidemic.

4. Anti-epidemic Communication Working Group: responsible for prompt and effective communication of the latest and accurate information to the public and the community.

Simultaneously, the Hong Kong SAR Food and Health Bureau proposed prompt, rigorous and transparent actions, based on the advice of scientists and experts, and containment measures to achieve early identification, isolation early treatment.

Carrie Lam, the Chief Executive of the Hong Kong SAR, pointed out that:

1. The epidemic prevention mechanism and organizational structure should be upgraded to the highest emergency level;

2. To strengthen control of entry and exit points, indefinite suspensions were introduced for flights and high-speed rails to and from Wuhan, Hubei Province, until the epidemic is clearly under control. Health Declarations are required for all entry and exit ports;

3. Large-scale activities should be canceled to reduce the risk of infection and transmission in the local community;

4. Classes of primary and secondary schools, kindergartens, nursery schools and special schools, were suspended and not to resume until February 17, 2020;

5. For the supply of masks, the government would try to identify suitable sources in the mainland and other regions.

In March 2020, the HKSAR government due to the surge in imported cases put forward a Four-Pronged Approach to strengthen preventive measures, namely:

1. Prevention of imported cases to break the chain of transmission of the virus;
2. Early identification of non-significant entrants;
3. Crackdown on violators of Quarantine Orders; and
4. Further promotion of reducing social contacts and gatherings (Government of Hong Kong SAR, 2020b).

Beginning from September 1, 2020, the HKSAR Government launched the

Universal Community Testing Programme to provide free nucleic acid testing for Hong Kong SAR citizens. A community testing center was set up in November 2020.

In July 2020, Hong Kong SAR recorded six consecutive days of new confirmed cases breaking triple digits, and as a result, the Hong Kong SAR government announced a series of new measures that would take effect on July 29, including:

1. A limit of two people per group gathering, with exemptions for members of the same family.
2. A ban on dine-in food in restaurants and eateries all day, with exemptions for certain public places, such as the cafeterias of public hospitals.
3. Banning of outdoor activities with no exemptions for smoking or exercising. (Government of Hong Kong SAR, 2020c).

Hong Kong SAR had no confirmed local cases for 23 consecutive days after introduction of these measures. Mistaken the trends and underestimating the risk, the HKSAR government subsequently relaxed a number of epidemic prevention measures, including lifting the restriction on the number of customers greeted in-store (dine-in) in restaurants, removing crowd gathering restrictions, and beginning to allow cross-border business travelers, students, etc. to enter and leave Hong Kong SAR without mandatory quarantine. The limit on occupancy rate for seats in bars and cinemas was also raised from 50% to 80%.

Unfortunately, no sooner than June 2020, the number of newly confirmed cases in Hong Kong SAR re-bounced. According to BBC, more than 1000 new cases of COVID-19 or half the total since the first reported case in Jan 2020, were reported in Hong Kong SAR within July (BBC, 2020a). This up-rise was described as the “Third Wave of the Epidemic” by the Hong Kong SAR government (see Figure 2).

The failure of the HKSAR Government to close the epidemic prevention loopholes, commented by BBC (2021), was responsible for the Rebound. One of the loopholes was to allow airline crew members to enter Hong Kong SAR without mandatory quarantine and subject only to medical surveillance. As the epidemic developed, the supply of medical and quarantine facilities in Hong Kong SAR were

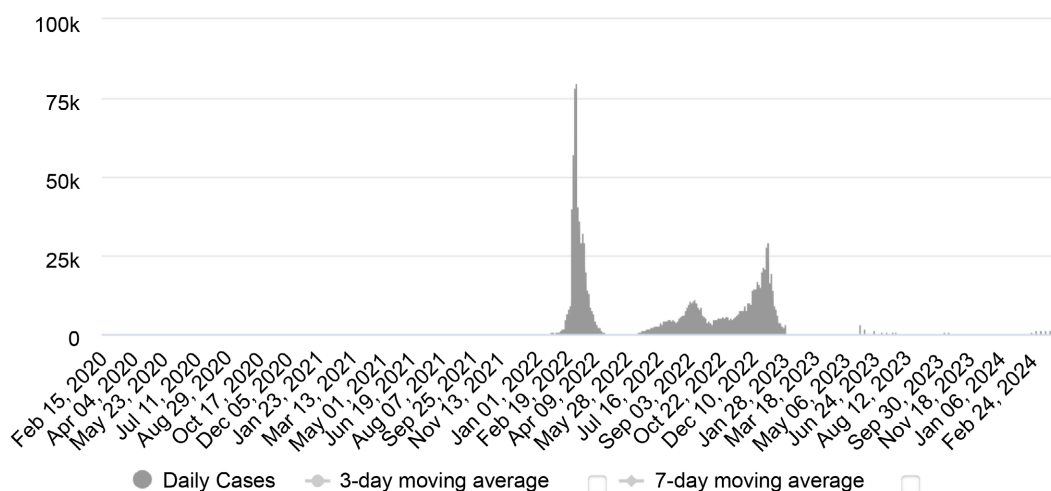


Figure 2. Daily new cases in Hong Kong SAR from Feb 2020 to Aug 2023. Source: [Worldometer, 2023-10-02](#).

strained, and the long-standing problem of inadequate capacity, such as inadequate hospital beds and testing facilities, in the public healthcare system resurfaced (BBC, 2020b).

Because of the Third Wave the HKSAR government has no choice but tightened its policy on limiting social distance and reducing gatherings again. The sudden twists in tight and loose COVID-19 Control Policies made it difficult for HK residents and outside visitors to adapt. The situations improved again after mid 2020 and last through 2021. By the end of 2021, the city of 7.5 million had recorded only 12,650 cases and fewer than 220 deaths. To everyone surprise the Fifth Wave re-bounced again in early 2022 (see **Figure 2**) and brought the Hong Kong SAR Healthcare System about to “implode” (BBC, 2022).

Hong Kong SAR was hit by the Delta variant in 2022. It led to a total death of more than 10000 persons (see **Figure 3**). Hospitals were over crowded and there is no Cabin Hospital beds prepared, patients were forced to take home care. Low vaccination rates particularly among older people, especially those who resided in care homes, lost their life in thousands (Government of Hong Kong SAR, 2020d). By the end of 2022, according to the official statistics provided by the Hong Kong SAR Department of Health and the Hong Kong SAR Hospital Authority, the number of deaths due to COVID-19 has risen to 9289 persons. Comparing the number of deaths in 2021, which was recorded as 220, the deaths in 2022 alone were 9069 persons (HK Department of Health, 2023). Afterall the Government of Hong Kong SAR has not learned from the warnings of 2021 and at the end they have to face the defeat of Waterloo. It proved that there is no room for complacency in public health emergencies. Data of COVID-19 Deaths of other three cities were minimal since there was no death case in Guangzhou and Zhuhai, and 19 deaths in Macao SAR (see **Table 1**).

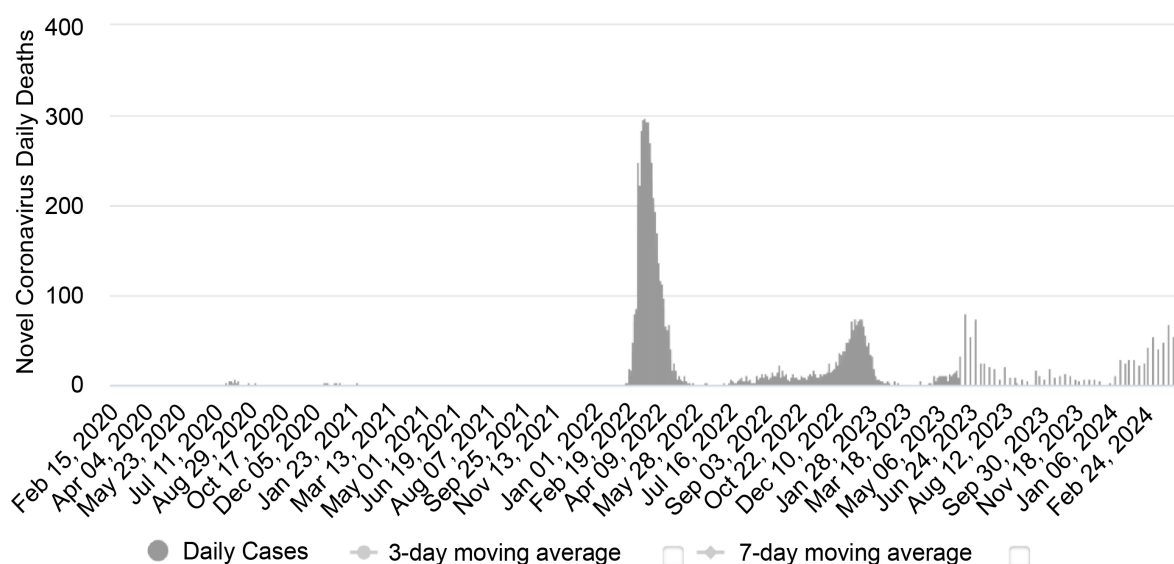


Figure 3. Daily death cases in Hong Kong SAR from Feb. 2020 to Aug. 2023. Source: [Worldometer, 2023-10-02](#).

5. Analysis of City Response Performances

5.1. Government Responses in the Four Cities

Although there are great differences in population structure of Guangzhou, Hong Kong SAR, Zhuhai and Macao SAR, after calculating the infection rate of Coronavirus Pneumonia, it can be found that Hong Kong SAR region has the highest Infection Rate (0.347), Case Fatality Rate (1.77%) and Death Rate, 15.22% (see **Table 1**).

In terms of the scale of urban development, both Guangzhou and Hong Kong SAR are large international cities, but the results in **Table 1** reflect that epidemic prevention and control outcomes in Hong Kong SAR are less satisfactory than those in Guangzhou. Zhuhai and Macao SAR are very close in terms of urban geography and economic level, and Macao SAR's infection rate (1.60) is worse than Zhuhai's (0.02), and the case fatality rate for Macao SAR is as high as 1.5987%.

To effectively compare whether there are differences in policies across the four cities, this paper uses 11 common tracking indicators for outbreak prevention and control as suggested by the Oxford COVID-19 Government Response Tracker.

One set of indicators measure Stringency and composed of 11 indicators, namely: school closures; workplace closures; public event cancellations; public transportation closures; public information campaigns; restrictions on internal mobility; international travel controls; fiscal measures; monetary measures; medical emergency investments; and vaccine investments (**University of Oxford, 2020**). Another 5 indicators refer to basic containment strategy, that include: Command System, Whole community approach, Life Saving, Open Information and the recognition of Science and Technology. Measures taken by the 4 cities in relation to Stringency and Containment are checked below (see **Table 2**).

Table 1. Impact of COVID-19 in the four cities (Up to the year end of 2022).

City	Population	Confirmed cases	Deaths Cases	Infection Rate	Case Fatality Rate	Death Rate /10000
Guangzhou*	187341000	42067	1	0.02	0.14	0.0000
Hong Kong SAR [#]	7474200	3,093,948	11,373	41.40	1.77	15.2163
Zhuhai**	2477200	571	1	0.02	0.1751	0.0000
Macao SAR ^{##}	672800	2377	38	1.60	1.5987	0.5648

*Guangzhou Hygiene and Health Committee, COVID-19 News, 2022-12-22,

https://wjw.gz.gov.cn/ztl/xxfyyqfk/yqtb/content/post_8725323.html; **Shiye Coronavirus Data—Zhuhai (2023-10-02),

<http://m.sy72.com/covid/list.asp?id=388&s1=0&s2=2023-10-1>; [#]Worldometer 2023-10-02. Coronavirus Data—China Hong Kong,

<https://www.worldometers.info/coronavirus/country/china-hong-kong-sar/>, ^{##}Worldometers 2023-10-02. Coronavirus Data—China

Macao, <https://www.worldometers.info/coronavirus/country/china-macao-sar/>

Table 2. Anti-Coronavirus measures taken by the four cities.

Government Responses adopted: ✓Yes, × No	ZH	MO	GZ	HK
1. Establish a unified and efficient command system	✓	✓	✓	✓
2. Build a strict prevention and control system involving the whole people	✓	✓	✓	×

Continued

3. Make every effort to save patients and lives	✓	✓	✓	✓
4. Timely, open and transparent release of epidemic information according to law	✓	✓	✓	✓
5. Give full play to the supporting role of science and technology	✓	✓	✓	✓
6. School closure	✓	✓	✓	✓
7. Workplace closure	✓	✓	✓	✓
8. Cancellation of public activities	✓	✓	✓	✓
9. Public transport is closed	✓	×	×	×
10. Public information campaign	✓	✓	✓	✓
11. Restrict intra-cities flow	✓	×	✓	✓
12. International travel control	✓	✓	✓	✓
13. Financial measures	✓	✓	✓	✓
14. Monetary measures	×	×	×	✓
15. Emergency medical release	✓	✓	✓	✓
16. Vaccine delivery	✓	✓	✓	✓

A brief review of **Table 2** showed that the Four Cities cannot be differentiated by measures they have taken to combat the COVID-19 battle. Hong Kong SAR was the only city that provided financial assistance. Possibly it showed that community governance in other cities were stronger. Zhuhai on the other hand is the only city that closed down its public transportation facilities. Other cities probably are correct to maintain essential transportation services. Wuhan people suffered a lot when the city was totally locked down and during that time even medical staff found no means to travel from home to hospitals and vice versa. In terms of vaccination, please refer to **Table 3**.

Vaccination rates was very high for Hong Kong SAR, Zhuhai and Guangzhou, by the end of 2022. However, Hong Kong SAR suffered from a slow pick up in vaccination rate in early 2022. Among the 9289 deaths under COVID-19, 69.6% or 6470 have never received any vaccination (HK Department of Health, 2023).

Table 3. Vaccination status in the Four Cities up to Mar 2022.

City	Vaccinated Persons (10000)	Vaccinated for the first dose (10000)	Fully Vaccinated with the second dose (10000)	Vaccinated with the third dose	Full Vaccination Rate (%)
GZ*	2084.1	2084.1	1948.6	1103.9	93.4%
HK SAR [#]	690.1	690.1	677.3	574.5	91.6%
ZH**	288.8	288.8	275.5	195.32	100.00%
MO SAR [#]	65.2	65.2	62.7	35.3	48.5%

Source: *People's Government of Guangdong Province (2022); **Zhuhai Hygiene and Health Bureau (2022); #Shenzhen Hygiene and Health Bureau (2022).

Macao SAR recorded the lowest full vaccination rates of 48.5%. And in case fatality rate, it was 1.59%, just slightly below that of Hong Kong SAR at 1.77%. The two percentages are not comparable because Macao SAR has only 2377 infected patients to look after, while in Hong Kong SAR there were more than 3 million, bearing in mind Omicron, the weaker variant, was not in domination yet. The weaknesses of Macao SAR in medical interventions should be considered.

5.2. The Keys to Success

Findings of Anti-Coronavirus Measures taken by the four Cities did not show major differences as their governments mainly follow the guidelines of the China Central Epidemic Control Guidelines which are also international practices.

The relative “failure” in Hong Kong SAR suggested that it is not a result of what one government has done, and the determining factors were when the measures were taken and how they were performed. Time and technology factors are determinants while responsiveness and resources are pre-determinants.

Time

Time refers to early intervention as well as the need time for effects to be seen. Hong Kong SAR is slow in following the Central Guidelines because of political and organizational reasons. The Government of HKSAR was also opportunistic in non-decisive in its priorities, trying to balance between enforcing social distancing with normalizing economic activities. This is a general problem faced by most developed countries in the last three years of challenge because they considered capitalistic competition as more important than social security.

Technologies

Technology in this COVID-19 refers primarily to healthcare technologies. However, the overall manufacturing capacities are important components. Hong Kong SAR is famed for its high level of medical competencies, but it has lost other industrial capacities.

Responsiveness

The Government of Hong Kong SAR supposedly should be benefited from having the experience of combating SARS. Prior experience usually made the Government and people more capable to respond. Unfortunately, prior experience can also lead to habitual patterns of response and lead to failures in responding to the changing conditions. By the same token, citizens were angry at anyone who wear a mask on street because during the time of SARS only infected patients wore masks. In the case of Hong Kong SAR, the Government was ambivalent in adopting the Zero COVID Policy when China in 2021 considered the fight against the COVID-19 Pandemic would become a prolonged battle. Hong Kong SAR Government did not respond positively because of its opportunistic political narcissism and its intentions to please the public. Obviously inadequate administrative governance was undermining its leadership in policy making capacity. Interestingly, professional leadership from the Expert Advisory Group in the Steering Committee for COVID-19 led by Carrie Lam, did not take any significant effect

in shaping public opinion because there was no unified voice. It suggests that having an emergency response structure is not good enough if people cannot perform their functions in the organizational framework.

Resources

The GHSI debate indicates that resources, healthcare capacities in public health crisis, are not a static concept. It is about the capacities of the country and its government to mobilize and utilize all available or hidden resources to escalate response and services. Hong Kong SAR has the highest number of hospital beds and physicians by population, among the four cities. However, they are inadequate even at normal times. There are spared human resources in the private medical sectors and retired populations. Unfortunately, they are too costly to mobilize unless there is a law to request for their voluntary services under national emergencies. There should be a limit to personal freedom when social responsibility is absolutely required. There are resources in the neighboring cities in the GD-GBA to be mobilized by the Government of Hong Kong SAR if there was a political will (see **Figure 4**). Therefore, the non-actions of the Hong Kong SAR Government, to the definition of Emergency Resources, on top of Medical, Financial, and Legal resources, adds that of Political Will and Leadership.

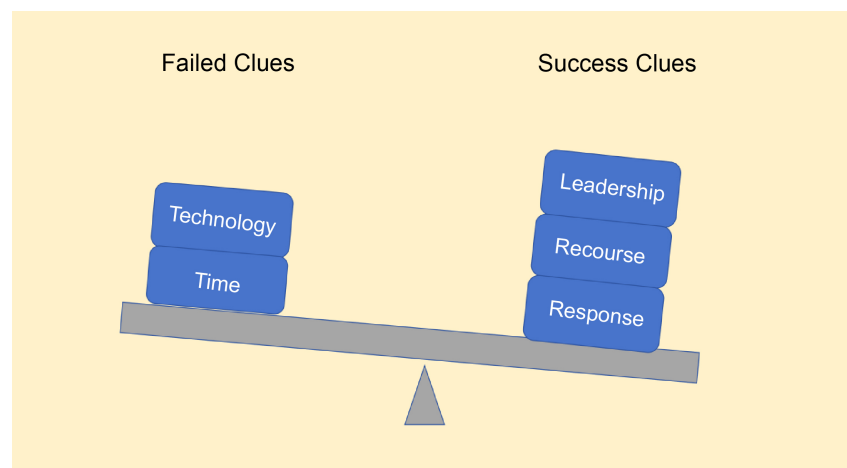


Figure 4. The Success Clues for COVID-19 Emergency Response.

6. Cross Cities Supplementary and Complimentary Supports

6.1. Information Sharing and Standardization

Definitely information sharing and standardization among the four cities were much more frequent during COVID-19 than the times of SARS in 2003. During the previous outbreak of SARS, Hong Kong SAR was not even informed of its onset that began in Guangdong. (Matus et al., 2023) Governments of all four cities recognize the importance of information sharing. For example, under the Steering Committee and Command Center led by the Chief Executive of the HKSAR, one working group on Disease Prevention and Control, was assigned to communicate with China and Guangdong Authorities.

The challenges are whether communications are effective during the public health crisis. For example when Hong Kong SAR needed help from Guangdong during the Fifth Wave, seemingly such actions were not included in any collective response plan. When the medical support team arrived Hong Kong SAR from Guangzhou, the numbers of new cases has already peaked off.

6.2. Vaccination Sharing and Standardization

Seemingly practices in relation to vaccination are not standardized in the four cities. Zhuhai became the forerunner in the race against time. Hong Kong SAR struggled on the selection of different types of vaccines and dared not require older people in care homes to receive vaccination. Responsibilities to protect the safety of fellow residents gave way to the claim for individual freedom. Macao SAR followed the Central vaccination policy however it has left 51.5% of residents unvaccinated. It brings back the message to the Cities Governments that about crisis communication is not about creating a mechanism alone, it is about reaching consensus.

6.3. Manpower and Logistics Sharing and Standardization

Different crisis requires different facilities. For example, it is easier to share cabin hospitals, more difficult to share operation theaters. Medical equipment is easiest among the three categories as China is famed for its manufacturing standards. Respirators, hospital beds, walking support and medical disposables, are good in quality and low in price. When it comes to pharmaceuticals, there is still a mixed feelings caused by the lack of trust and confidence.

Medical Practitioners from Macao SAR and Hong Kong SAR are not ready to work with their counterparts in China Mainland. The latter are more used to practice outside their comfortable city zones as they have a lot of chances to serve after international disasters in all over the world. The COVID-19 outbreak serves as a departing point for Hong Kong SAR and Macao SAR residents to understand and accept the expertise and standards of Mainland Medical professionals. Anyway, it is easier for Hong Kong SAR residents in requesting cross border help from a personal care worker, than a nurse.

6.4. Financial Risks Sharing

Here direct transfer of funds from one city to another is not the concern. The need is to develop long term insurance schemes that are applicable in the GD-GBA without barriers. This is an important financial synergy that affects crisis management as well as long term care for all cities in Guangdong. Obviously, except some underground purchases of private life insurances, large scale insurances system integration has not been started.

To summarize, during the past three years, governments of the four cities were aware of the need to take concerted efforts and the importance maintaining close communications about each stage of events. However, it takes much longer time

to develop common understanding and consensus. Sharing of equipment and facilities are possible with better planning, the barriers lie in the barriers of professional recognition and the lack of joint drilling. While HKU and CUHK can establish medical schools in Shenzhen, the Sun Yat Sen University, the Guangdong Medical University and the Guangdong Provincial Chinese Medicine Hospital should plan to establish medical schools in Hong Kong SAR and Macao SAR. One more structural inadequacy is the absence of Emergency Management Departments in Hong Kong SAR and Macao SAR. If another crisis comes which is outside the realm of health, then Governments of the two SARs may have difficulties in prompt and smooth response actions.

7. Conclusions

All four cities have followed the central government's epidemic prevention and control guidelines after the central government issued the national epidemic prevention and control guidelines, but the length of time and the related support vary from city to city. In terms of the cooperation, Government of Guangzhou could certainly play a supplementary role to Zhuhai government as the former enjoys higher political power and financial resources.

Guangzhou also played a supplementary role for Hong Kong SAR during COVID-19 Pandemic, as Guangzhou is also a medical hub in the Province or even in South China. Theoretically speaking, Hong Kong SAR can complement other cities because of their high standards in training of doctors and nurses. Political Narcissism and Territorial Behaviors, perhaps have limited Hong Kong SAR's professional growth and expansion.

Between another pair cities of Macao SAR and Zhuhai, a complimentary existence is witnessed. Macao SAR has gained international admiration for its performance in fighting COVID-19, as a success care in one of the most densely populated cities. Zhuhai on the other hand is prided in China for its efficiency in carrying out vaccination full dose coverage. It projects a favourable image of the city for its efficiency in administration and cooperativeness in community. As Macao SAR and Zhuhai have different strengths, they can complement each other in the coming economic growth.

However, it is worth noting that the epidemic prevention policies cannot be changing or shifting frequently, especially for cross-border practices. Stability and sustainability are crucial for all regional developments.

Three authors developed the research proposal together and shared writing and editorial work.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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