Rapid epidemic expansion of the SARS-CoV-2 Omicron BA.2 subvariant during China's largest outbreaks

Yeyu Dai (freddie999999@hotmail.com)
China Wireless-Valley (HK) Ltd.

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Rapid epidemic expansion of the SARS-CoV-2 Omicron BA.2 subvariant during China's largest outbreaks

----A statistical panorama shows a 20-fold large difference in morbidity rates in different cities, and 0.10% of confirmed cases are severe

Yeyu Dai

Abstract

A complete and accurate statistical panorama and analysis of cases contracted with the SARS-CoV-2 Omicron BA.2 subvariant are given under the conditions of strict mandatory quarantine and isolation and of a high rate of full vaccination. Sars-Cov-2 is still new, and little is known about either its direction of variation or its propagation laws. No country other than China has been able to disclose every infected case and to have the data of heavily intervening large outbreaks. Here, my study reveals that the BA.2 subvariant can still spread very fast and wide in areas with strict "dynamic zero-COVID strategy"[i] in China, that there exist in different cities as many as twenty-time large differences in morbidity rate unrelated to any of the influence factors known and that the Omicron BA.2 subvariant is unpredictable of its virulence, although its severe rate of confirmed cases is low. This analysis provides first-hand solitary and valuable information for further research on similar epidemics in the future. It may bring new thoughts for correction of present epidemiological theory and mathematical models. It may also give other countries time to be better prepared for the coming 6th wave driven by Omicron BA.2.

Main

China has been struggling with its largest COVID-19 outbreaks driven by the SARS-CoV-2 Omicron BA.2 subvariant reported by the Chinese Center for Disease Control and Prevention and its Provincial Centers on the press conferences since March, with over 100,000 people infected in mainland China within 31 days (hereafter also called the March outbreaks). Although there were more than a hundred dissemination and several moderate outbreaks before March, China had been stuck to its "dynamic zero-COVID strategy" by zero clearing each active chain of transmission, and it seemed to work well even during the period of the 5th wave driven by Omicron in the world[ii] from November 2021 to February 2022. These outbreaks driven by the Omicron BA.2 subvariant started in Shenzhen and Dongguan, two of the most industrialized cities in southern China adjacent to Hong Kong, on March 01. Hong Kong had just recorded the most critical attack in February, with (Lewis, 2022) close to 900 cases of COVID-19 per 100,000 residents in Hong Kong, the highest level recorded anywhere in the world during the pandemic. The virus swept rapidly across 100 cities of all 31 provinces of the country, causing a total of 105,546 people to be infected in a month. Among those, there are ten cities with over 800 people infected, and three of them are the most critical.

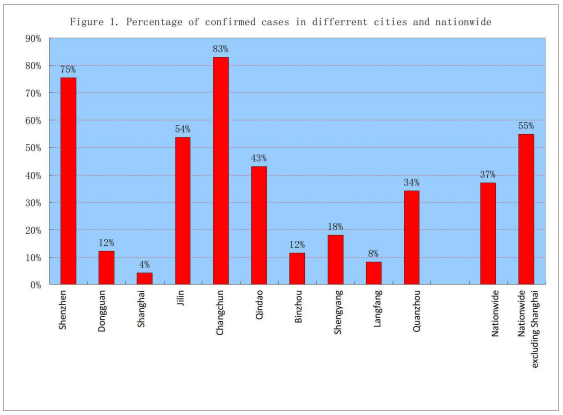
China's "dynamic zero-COVID strategy" has been evolving for a year. Mandatory quarantine and

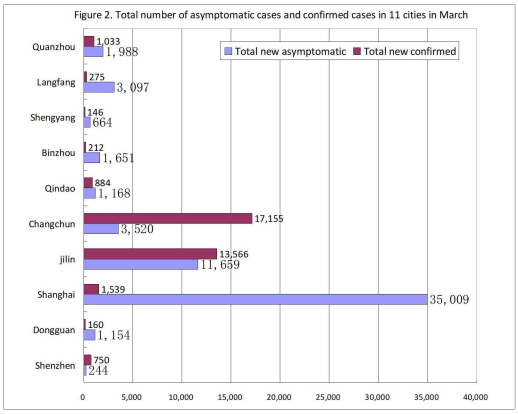
isolation measures were enriched and were said to be precise, being able to track every individual and his or her potentiality of contracting the virus on every chain of transmission to disclose as well as to quarantine, isolate and classify by symptoms every infected person with support of the most updated app and a large quantity of fully trained epidemiological investigators and dedicated doctors. China had already reached its high rate of full vaccination before these large outbreaks. As press conferences of the Department of State reported, over 87% of the population was fully vaccinated by mid-February 2022. The full vaccination rate is 87.45% overall by 05 February and 87.77% by 14 March 2022. This rate of full vaccination is 88.01% in the overall population by 24 March 2022, with 84.36% or 222.72 million of those aged 60 and above. A total of 138.24 million (or 52.36% of) people over 60 years old received boost shots. China's 7th census published its population as 1.412 billion, among them 264 million or 18.70% are aged 60 or above[iii].

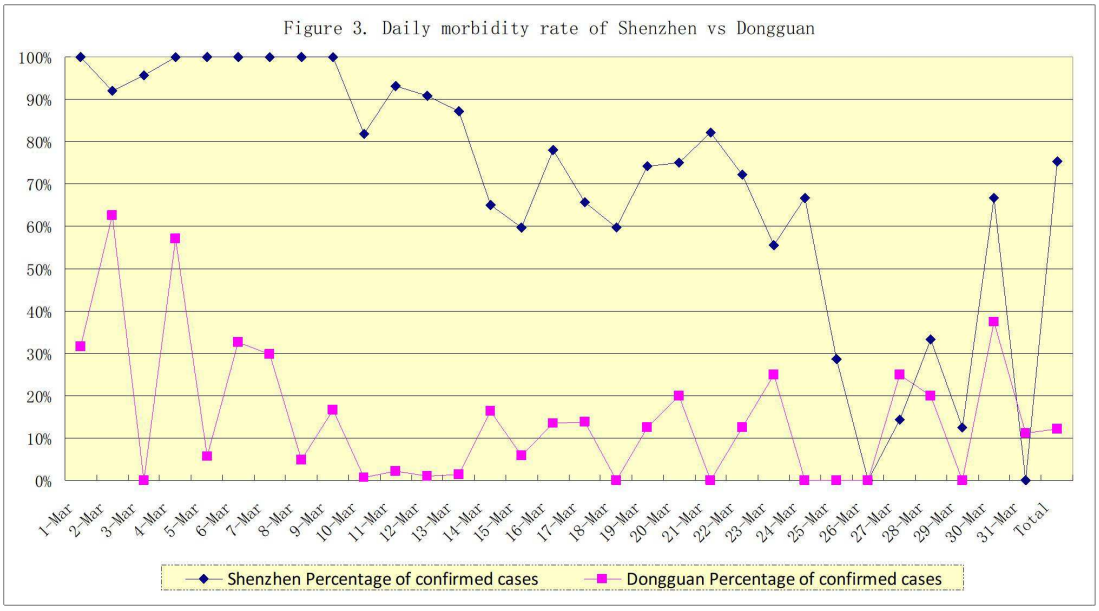
Data cover all daily reported numbers of new PCR-positive cases from March 01 to March 31. All 10 cities with over 800 infected cases were chosen for this statistical analysis. These 10 cities are located from north to south, and some are close to each other, while some are very far away from each other. All cities followed the same mandatory policy and the same test and diagnosis standards published by the nation. All cities except Shenzhen did not implement lockdown for one week. Genome analysis revealed that all outbreaks in March were driven by the Omicron BA.2 subvariant according to the report from press conferences by the Department of State and CDC provincial center. There were enough doctors to diagnose and classify all infected cases daily except one-day delay once in Jilin. Every essential event will be described in the related section to avoid missing possible messages relevant to influencing factors of transmission, infection or morbidity. During the March outbreaks, the appearances are different in many aspects in different cities, and some are contradictory.

Large differences in morbidity rates in the main cities

Mainland China reported 103,979 indigenous COVID-19 cases infected by the Omicron BA.2 subvariant from 01 March 2002 to 31 March 2022. There have been obvious differences in morbidity rates between the 10 cities since the start of the March outbreaks. Their morbidity rates vary from 4% to 83%, and the nationwide average rate is 37%. Since Shanghai has the lowest morbidity rate of 4% and the highest number of total infected cases (36,548), the nationwide average morbidity rate excluding Shanghai rises to 55%. Changchun has the highest, 83%, which is twenty times that of Shanghai (Fig. 1 and Fig. 2)





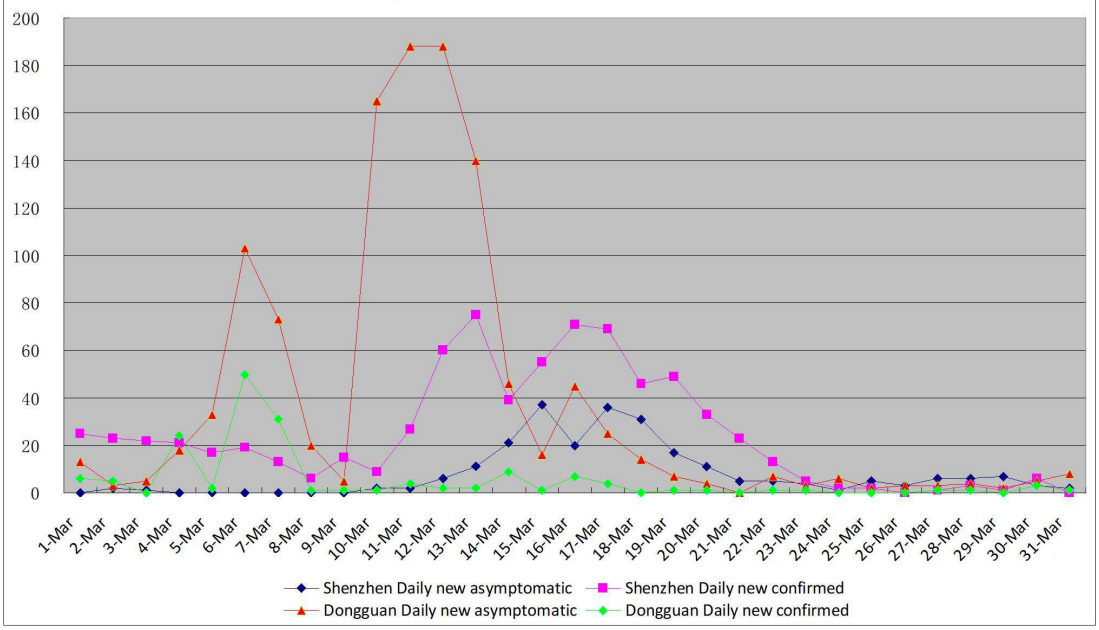


The reason why there are such differences is unknown. They are not related to any of the influence factors known today. There are two pairs of cities that can be compared since two cities of each pair are very close to each other, and both have the same climate, population density and characteristics, diet and living habits, religious background, education background and medical resources. Shenzhen and Dongguan, both adjacent to Hong Kong, are also adjacent. Both are located on the eastern bank of the Zhujiang Delta, which has a very high population density of 17 to 20 million people on approximately 100 square miles of land each. Being immigrant cities, the average ages of their population are relatively young, Shenzhen at 32.5 years and Dongguan at 34 years.

They have also had almost the same scale of circulation of people and cargo as Hong Kong. A large quantity of contaminated cargo and drivers arrived in Shenzhen and Dongguan with an unknown quantity of virus every day during the surge of infected cases of Omicron BA.2 in Hong Kong in the early stage of its COVID-19 outbreak in February 2022. When its medical system was lashed breakdown by the epidemic, Hong Kong was unable to admit all COVID-19 patients who needed hospitalization. People wished to escape from the outbreak. The border between Hong Kong and Shenzhen or Dongguan was strictly controlled to allow a certain limited number of passengers, which was approximately 10% of that in 2019. Illegal entries from Hong Kong to Shenzhen and Dongguan were reported as many dozens and were believed to be fact. Hide and seek follow-up to implement mandatory isolation and PCR tests. Outbreaks started from the end

of February in both Shenzhen and Dongguan and resulted in 994 infected cases in Shenzhen and 1,314 infected cases in Dongguan in one month. Contradictory figures of the morbidity rate of the two cities appeared from the very beginning, starting from 100% to 92% in Shenzhen and 68% to 0% in Dongguan (Fig. 3). Each of these two outbreaks develops simultaneously on its own path of morbidity rate, and their rates seemed unlikely to change much until they were close to being controlled by stronger anti-epidemic measures. The difference in their final rates, which was 75% in Shenzhen and 12% in Dongguan, was still enormous. Their final morbidity rates were close to their initial rates, although daily rates may show strong fluctuation due to fewer daily new cases. One essential event was a whole area locking down in Shenzhen, including 11 districts, for one week starting from 14 March 2022, which was announced I the evening of 13 March 2022. On 18 March 2022, the Shenzhen authority canceled the lockdown of 5 districts with "zero active COVID-19 cases". The final termination of the lockdown started at 00:00 on 21 March 2022.

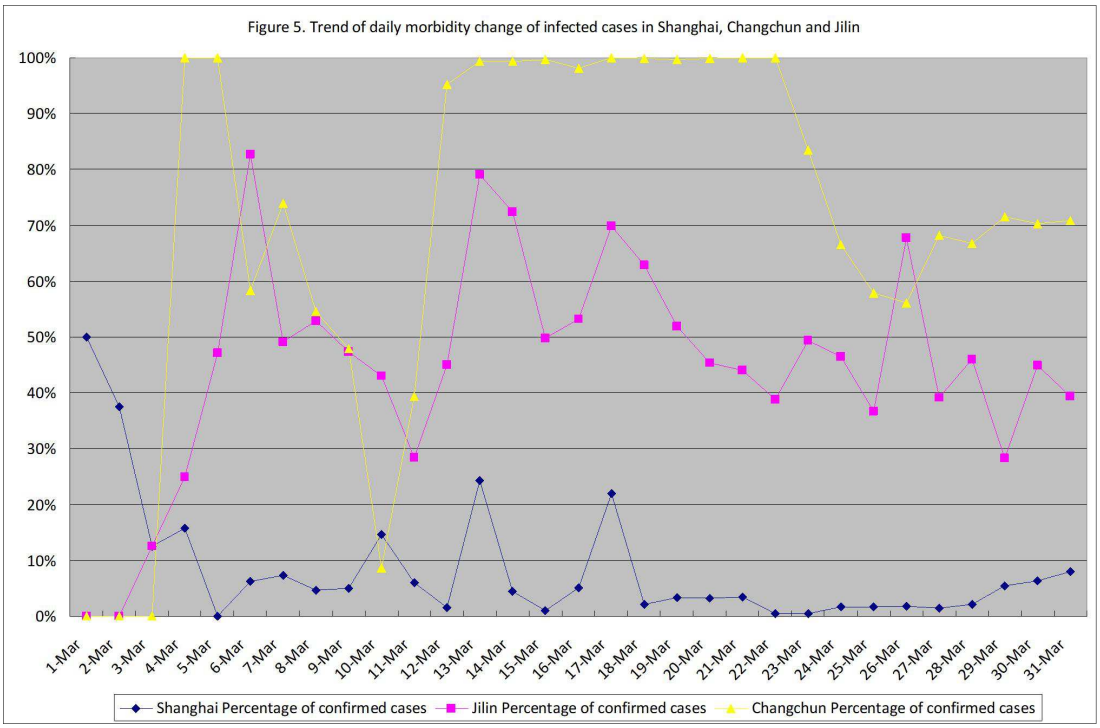
Figure 4. Daily asymptomatic and confirmed new cases in Shenzhen and Dongguan



Dongguan's outbreak did not follow the expansion pattern of its neighbor Shenzhen and had two extraordinary surges of asymptomatic cases (Fig. 4, the red triangle line). The first wave was from 03 March to 06 March, and the second was from 09 March to 12 March. There are belated prevention measures disclosed later on, but this kind of belated measure usually brings to society occulted transmission, likely with an outcome of a higher morbidity rate. However, this did not happen in Dongguan. Its morbidity rate remained steadily low (fig. 3)

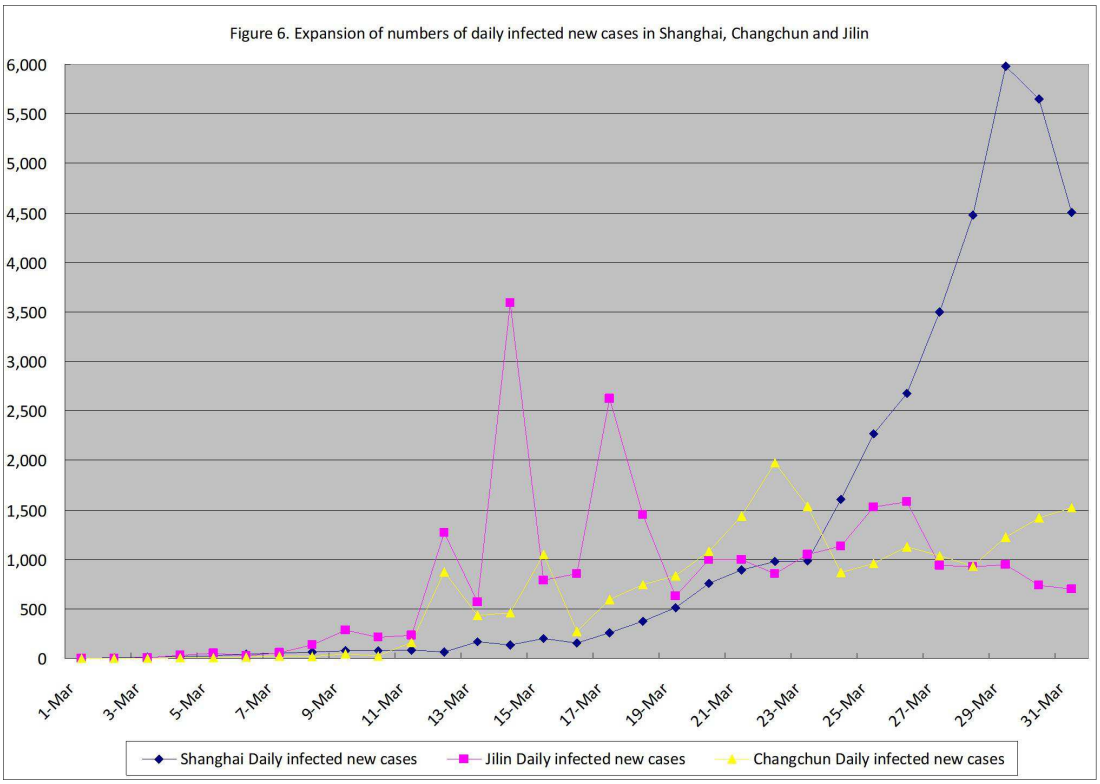
Similar pairs of cities are Changchun and Jilin, which are the first two large cities in Jilin Province in northeastern China and are approximately 111 kilometers apart, with a much larger scale of outbreaks reaching a total number of infected cases of 20,675 in Changchun and 25,227 in Jilin. Their outbreaks started in Jilin on 03 March 2022 and were later reported with a source from South Korea. Before 03 March, infected cases had been cleared to zero in Jilin and Changchun for days. Changchun's outbreaks followed one day after Jilin. Their morbidity rates also differed from the beginning, and their levels seemed steady, with Changchun's approximately 85% and Jilin's approximately 50%. Jilin's number of daily new cases is declining steadily from its peak on 26

March 2022 while Changchun is on its platform. By far, the morbidity rates are 83% in Changchun and 54% in Jilin (Fig. 5).



Morbidity rate did not fluctuate much

Shanghai's outbreak had a very slow start with 2 infected cases on 01 March 2022, reaching over 100 cases on 13 March. Rapid expansion of numbers of daily reported new infected cases appeared, and the number reached nearly 6,000 per day within a period of 17 days (Fig. 6). The total number reached 36,548 on 31 March 2022. The morbidity rates of daily new cases here ranged from 8% to 0% over 24 days of the whole month (31 days) (Fig. 5). The morbidity rate of total infected cases by far was 4% (Fig. 5). As a city with the most critical number of infected cases among the three (the other two are Chungchun and Jilin), Shanghai's morbidity rate is the steadiest among all 10 cities with statistical significance.



Rapid spread under strict measures

China managed COVID-19 prevention well by adhering to its "dynamic zero-COVID Policy"[iv] until Omicron BA.2 attacked it. The daily infected new cases remained no more than 100 before 01 March. There was no step-back of strict mandatory quarantine and isolation. However, the rapid expansion of daily reported new infection cases revealed that the BA.2 subvariant could still spread very fast and widely in China, with the fastest in Shanghai (Fig. 6). Present strict prevention measures were not able to stop the rapid expansion of Omicron BA.2. China once again had to face the choice of whether to take a higher economic and social cost to control the transmission.

Omicron BA.2 transmission unpredictable

The transmission of Omicron BA.2 is unpredictable, nor is its morbidity rate. Chinese cities are more like isolated islands than those of other countries because of strict prevention measures. This Omicron BA.2 subvariant seems to have developed a different pattern of virulence and transmission in these isolated cities of China. Among the ten cities with outbreaks in March, half had a very low morbidity rate, including Shanghai (4%), Langfang (8%), Binzhou (10%), Dongguan (12%) and Shengyang (18%). On the other hand, these five cities have a very high percentage of asymptomatic cases of infection, including Shanghai (96%), Langfang (92%), Binzhou (90%), Dongguan (88%) and Shengyang (82%). Two cities had high morbidity rates of infected cases: Shenzhen (75%) and Changchun (83%). All data were updated to 31 March 2022.

There are good aspects of the data, as briefed in the following:

Low severity rate and fatality rate

Nationwide data of China in March showed a percentage of 0.10% for the ratio of severe cases to confirmed cases or 0.06% (0.07% in Jilin Province) for the ratio of severe cases to total infected cases since 12 March 2022 (number of accumulated severe cases dropped from 19 on 01 March to 6 on 12 March due to cues of hospitalized COVID-19 patients from February). The fatality rate is less than 1/50,000, as 2 deaths were reported by Jilin on 18 March 2022.

Fewer cases need hospitalization

Only Jilin Province published data on the classification of diagnosed COVID-19 patients daily. Jilin's data showed that 99.30% of the confirmed cases were diagnosed as mild. A total of 0.61% of the confirmed cases were diagnosed as moderate, and 0.07% of those were diagnosed as severe in Jilin Province. Recovered cases returning to positive were not reported but were estimated to be approximately 1%, close to the figure announced by Shenzhen 3rd People's Hospital on a news release in March 2022.

Asymptomatic case conversion

The ratios of asymptomatic cases converting to confirmed cases were 6%, 2.34%, 0.25% and 4.64%, respectively, in Jilin Province, nationwide excluding Shanghai, Shanghai and nationwide including Shanghai.

Conclusion

The SARS-Cov-2 Omicron BA.2 subvariant can transmit rapidly even under the conditions of very strict mandatory measures. Its transmission and morbidity rate in a specific area is unpredictable. Enormous differences in morbidity rates may appear in different areas and may not be related to any of the influencing factors known. Forty-five percent of the infected cases were asymptomatic in China during March 2022. The percentage of mild cases in confirmed cases may be as high as 99.30%, and the percentage of severe cases in confirmed cases may be as low as 0.16% under the circumstances of strict mandatory prevention and of a vaccination rate over 87% to the population. Thus, only 2% of the confirmed cases need to be hospitalized. Deaths may be very rare. Finally, 1% of recovered confirmed cases may return to positive

Methods

I analyzed daily indigenous cases of SARS-CoV-2 in mainland China from 01 March 2022 to 31 March 2022 from publicly released data provided by the National Health Commission of the People's Republic of China. This was accessible through the website of the National Health Commission News Daily Briefing (Http://nhc.gov.cn). The National Health Commission releases daily updates on the number of confirmed new cases and asymptomatic new cases, with a breakdown by province and cities, and severe cases, deaths and recoveries nationwide.

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Supplementary Files

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- Cov22mar31.xls