Short communication

The 4Rs approach to COVID-19 emergency management during the post-pandemic period: What lessons can be learned from Shenzhen, China?

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ABSTRACT

The Omicron variant of SARS-CoV-2 (or Omicron) is extremely contagious and has swept the world in a short period. Shenzhen—a new international city in China with a permanent population of 17.56 million and covering nearly 2000 square kilometers—was attacked by Omicron in 2022. However, the pandemic was controlled in a very short time as a result of prompt government reaction that prevented the variant’s further spread. The total number of cases in this wave of the pandemic was more than 2600. Shenzhen’s successful experience in tackling the Omicron wave deserves in-depth discussion. Proposed by American scholar Robert Heath, the 4Rs model aims to reduce the harm from a crisis through the measures of reduction, readiness, response, and recovery. This article presents the successful experience of Shenzhen’s local government and the Third People’s Hospital of Shenzhen, the only hospital in Shenzhen designated to use the 4Rs emergency management model for the treatment of COVID-19 during the 2022 Omicron wave of the pandemic.

1. Introduction

The rapid mutation of the SARS-CoV-2 virus and the emergence of the Omicron variant have increased the difficulty for countries around the world to fight against COVID-19. Shenzhen completed 2 rounds of national screening within 4 days [1] and checked for potential hidden dangers at the fastest speed. At the same time, the government increased the city’s immunization rate to 72.0% using various incentive measures [2]. The city prevented the broad spread of the virus with a relatively prompt government response. This article aims to analyze Shenzhen’s successful experience using Robert Heath’s 4Rs model to defend against the COVID-19 wave caused by the Omicron mutation. Heath’s 4Rs model is used as a key analysis framework to examine the entire cycle—reduction, readiness, response, and recovery—of Shenzhen’s control of the Omicron pandemic. This article aims to present the scientific experience of relevant departments as they prepared to handle emergencies at different stages.

2. China’s implementation of key policies during the COVID-19 epidemic

The Omicron variant is highly infectious, making the fight against the COVID-19 outbreak increasingly challenging for countries worldwide. China began fighting the Omicron-based epidemic when the first Omicron case was detected in Hong Kong on November 27, 2021. The date of the first occurrence of related cases in Shenzhen was March 15, 2022. As of 24:00 on September 30, 2022, a total of 1812 cases had been confirmed: 1007 local cases and 705 imported cases. No deaths were reported. In addition, 2257 asymptomatic cases—723 local and 1534 imported from abroad—were confirmed [3, 4]. On December 9, mainland China witnessed the first case of the Omicron variant. The BA.5.1.3 variant strain was first detected in Sanya on August 1, 2022 [5]. China’s policies were continuously adjusted, and a dynamic policy reset was consistently improved during the country’s battle against the Omicron wave.

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In the process of fighting against COVID-19, China’s key policies were:

1. Strong legal support: In some cases, sentences were imposed on individuals for causing a serious risk of transmission. The most common crime was obstructing the prevention and treatment of infectious diseases [6].
2. Stringent travel restrictions: With the emergence of COVID-19, China gradually established strict travel restrictions. People from overseas and high-risk areas must follow mandatory quarantine measures. On June 28, the isolation and control time for close contacts and inbound personnel was adjusted from "14 + 7" to "7 + 3" [7]. During the implementation of these measures, health and travel codes were stringently enforced [8]. Rapid quarantine at airports and ports was gradually introduced to reduce the speed of disease spread [9].
3. Rapid and unified resource scheduling: The Chinese government provided comprehensive support to Hong Kong during the Omicron wave. In addition to material and technical support, 5 groups of experts and medical workers were dispatched to assist Hong Kong [10].
4. Comprehensive medical insurance programs: China implemented full medical insurance coverage for patients with COVID-19. As a result, patients with COVID-19 were protected against poverty due to illness [11].
5. Continuous improvement of scientific and technological methods: The government used a variety of technological means including big data mining, AI, and information technology to reduce possible loopholes and errors in prevention and control activities [12,13].

3. The 4Rs approach to COVID-19 emergency management in Shenzhen

As the first among many cities in China that experienced the Omicron epidemic in 2022, Shenzhen provides a valuable reference for other cities given its efficient government response, its control of disease spread, and the resulting rapid urban recovery. Shenzhen’s experience can be summarized and promoted through the 4Rs model, as described below.

3.1. Reduction

3.1.1. Reduce the impact of Omicron on health, the economy, and society by implementing lockdown measures

During the wave of Omicron pandemic, the prevention and control was the Shenzhen government’s urban management priority. Shenzhen implemented a city lockdown measure from March 14 to March 20, 2022 [14] to reduce the chain of virus transmission. As a result of this measure, Shenzhen completed screening within 4 days and returned promptly to normality.

3.1.2. Reduce the risk of disease transmission through three-zone risk assessment and control measures

Residential complexes were considered a basic unit and were divided into 3 risk areas according to the epidemic status. Varying risk control measures were then taken according to the risk area. The specific division conditions and control measures are shown in Figure 1 [15].

3.1.3. Reduce the threat of infection in high-risk groups by increasing the vaccination rate

The quality and social acceptance of domestic vaccines were improved and the vaccination rate in critical groups such as older adults, children, and individuals with underlying diseases were accelerated. In addition, the development of new vaccine delivery modes including the accelerated investigation of inhaled vaccines was required because Inhalation-stabilized dry powder vaccines are largely safe. The inhalable CanSino vaccine has been approved for clinical trials in China and its effectiveness has been confirmed in phase III clinical studies [16]. A booster vaccination strategy targeting widely conserved T-cell epitopes in COVID-19 can greatly enhance specific T-cell responses in vaccine donors and can protect against all variants [17,18]. Thus, the implementation of mixed heterologous vaccination—the use of injectable and inhaled vaccines to ameliorate the effectiveness of vaccines—has been the direction of vaccine policy development.

3.2. Readiness

This aspect embraced developing a binary-mode operation of civic governance and hospital operations. During the Wuhan epidemic, China created an emergency operation model for Fangcang hospitals. Moreover, metropolises in China continue to improve their civic exigency operational plans and have strengthened the diurnal operations and exigency drills of large sports venues, galleries, and other exigency operation venues to ensure exigency activation and to improve effectiveness. During the wave of the Omicron pandemic, the Third People’s Hospital of Shenzhen provided the city with precious time to respond to unforeseen outbreaks with its “one hospital, two sections” and “the combination of peacetime and wartime” approaches. The hospital was divided into 2 independent operating areas. In the absence of an epidemic or when the epidemic was under control, the hospital operated in a conventional mode. In this mode, the emergency area received specific cases and the headquarters provided comprehensive medical services including general inpatient and outpatient services. When the scale of an epidemic was considerable, the hospital switched to wartime mode: it stopped furnishing other medical services and only accepted verified cases of COVID-19 [19].
3.3. Response

3.3.1. Promote rapid detection and improve detection accuracy to ensure the efficiency of emergency response to the epidemic

This aspect promoted the use of rapid-fire antigen testing point-of-care products [20]. The combination of antigen and nucleic acid approaches was espoused to enhance effectiveness and reduce the false alarm rate. In March 2022, the first COVID-19 point-of-care products were approved for entry into China [21].

3.3.2. Mobilize resources to provide material and human support for emergency response to ensure people’s livelihood

Because residents in unrestricted areas could not venture out, all the necessities of life were provided by social workers. In Shenzhen, the ratio of the unrestricted control labor force to social workers was 1:20. In addition, during the lockdown period in Shenzhen, all productive units were required to continue working to ensure the continued operation of the city [22].

3.3.3. Use routine nucleic acid testing to promptly identify pitfalls and help society resume normal operations as soon as possible

Shenzhen was the first to propose the concept of the “1530 nucleic acid service circle.” Accordingly, every Shenzhen resident had access to a free nucleic acid test circle within a 15-minute walk and could conduct nucleic acid testing within 30 minutes [23]. Such a testing setup increased residents’ enthusiasm for active testing and helped the government conduct community screening. At least 200 positive cases were identified through this program in the wave of the Omicron pandemic.

3.4. Recovery

3.4.1. Dynamically adapt the identification of indigenous threats to help the public return to normal life as soon as possible

By implementing the 3-zone risk assessment and control policy, the threat of complaint transmission was controlled within a range, thereby reducing the potential negative impact of the pandemic wave.

3.4.2. Develop oral medicines to promote the recovery of the infected population as soon as possible

Oral medicines have the advantages of high effectiveness and convenience. The exploration and development of oral medicines improve the efficiency of treatment and complaint resolution. In addition, the early commercialization of oral medicines can help people stay healthy.

4. Conclusion

To control the spillover of the pandemic, Wuhan was closed for 76 days in 2020. The Wuhan government set up Fangcang shelter hospitals to treat mild patients and
built Leishenshan Hospital and Huoshenshan Hospital to focus on the treatment of confirmed patients [24].

In contrast, the Shenzhen government has highlighted the role of speed in epidemic control. Shenzhen promptly established a city lockdown policy during the Omicron outbreak. The city espoused dynamic changes in various regions with its 3-zone risk assessment and control policy. By conducting large-scale testing across the city, Shenzhen prevented implicit risks in the crowd. The city’s most efficient policies in this wave of the pandemic were focusing on screening implicit pitfalls through multiple rounds of civil testing, curtailing transmission in the shortest possible time, and avoiding the large-scale spread of the pandemic wave. In addition, Shenzhen implemented differing control strategies in different areas. Effective pandemic control and the resumption of regular operations relied vitally on control measures during the wave of the Omicron pandemic in Shenzhen.

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Author contributions

Honzhou Lu conceived the Viewpoint; Rongfeng Zhou and Hongzhou Lu participated in content discussions and article revisions. All authors reviewed and agreed on the final version of the viewpoint.

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Declaration of competing interest

The authors declare no competing interests.

Data available statement

These data were derived from the following resources available in the public domain: http://wjw.sz.gov.cn/yqxx/.

Ethics statement

Ethics approval was waived for this study because no patients’ data were reported.

Informed consent

Ethics approval was waived for this study because no patients’ case details or other personal information and any other individuals were reported.

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