



The Incidence of COVID-19 Among Primary Middle School Students and Co-residents in Nan'an District, Chongqing, China: A Cross-Sectional Study

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To cite this article:

Hui Xiang, Yan Wang, Linlin Yang, Wenwen Deng, Jing Qin, LuYu, Li Qi, Xiaoqing Tang. The Incidence of COVID-19 Among Primary Middle School Students and Co-residents in Nan'an District, Chongqing, China: A Cross-Sectional Study. *International Journal of Infectious Diseases and Therapy*. Vol. 8, No. 1, 2023, pp. 46-49. doi: 10.11648/j.ijidt.20230801.17

Received: March 1, 2023; Accepted: March 21, 2023; Published: March 24, 2023

Abstract: *Objective:* To understand the infection situation of COVID-19 among primary and middle school students and co-residents in Nan'an District of Chongqing during the new stage of "a Class B infectious disease under Category B management", and to provide scientific basis for the subsequent timely analysis of the epidemic situation and prediction of the demand for medical treatment resources. *Methods:* From December 20 to 21, 2022, 19225 students from 86 primary and secondary schools in Nan'an District were selected by stratified random cluster sampling method to conduct an electronic questionnaire survey. *Results:* A total of 17744 valid questionnaires were received, the response rate was 92.30%, the average age was 11 years old. The infection rate of novel coronavirus was 64.09%, among which the infection rate of middle school study group was higher than that of primary school study group, accounting for 65.39%. The infection rate of male students was slightly higher than that of female students (63.02%) The infection rate of Nanping residential area was higher than that of other residential areas, accounting for 66.25%. The symptoms, infection, medical treatment and hospitalization of co-residents were statistically significant. *Conclusion:* The infection rate of COVID-19 among primary and secondary schools and co-residents in Nan'an District is higher than that of Chongqing in the same period, but the subjects have high health awareness and take the initiative to seek medical treatment or be hospitalized. In the future, it is necessary to focus on people in junior high schools, male, old urban areas, etc. Publicity and education on family COVID-19 prevention measures shall be well conducted to ensure medical treatment resources in the region and provide timely and satisfactory medical and health services for residents.

Keywords: Infection by COVID-19, Primary and Middle School Students, Co-residents

1. Introduction

Omicron strain had become a global epidemic dominant strain. Its general direction becomes lower pathogenicity, tends to the upper respiratory tract infection, and appears a shorter incubation period. The pathogenicity was significantly reduced compared with the early stage, and the disease gradually evolved into a common respiratory

infectious disease [1-4]. Thus, the epidemic control and prevention of novel coronavirus infection in China are facing a new situation and different tasks. The work on control and prevention has entered a new stage. Since January 8, 2023, COVID-19 disease has adjusted from Category B, Management A to Category B, Management B. The China Center for Disease Control and Prevention pointed out that the focus of the work on novel coronavirus infection in China will shift to the monitoring and reporting of hospitalized

patients and severe cases [5, 6]. To grasp those new cases infected in the district more comprehensively and accurately, analyze the development trend of the epidemic situation in time, and predict the demand for medical treatment resources. This study investigated the infection situation among primary and middle school students and co-residents in Nan'an District, Chongqing.

2. Materials and Methods

2.1. Study Design and Participant

Primary and secondary school students and their co-residents who have lived in Nan'an District of Chongqing for six months or more. Data sources and sampling methods: the questionnaire designed by the expert team and the stratified cluster sampling, all 86 primary and middle schools under the jurisdiction were divided into primary schools, middle schools and high schools, according to grade level for stratified sampling from December 20 to 21, 2022. Schools with less than 10 grade classes were randomly selected to have 1 class in each grade, and schools with 10 or more classes were randomly selected to have 2 classes. The link of the electronic questionnaire was sent to the school doctor of the corresponding school, who uniformly transferred it to the selected class. All students and co-residents were included in this study. Inclusion criterias: (1) Residence in the jurisdiction for six months or more; (2) Students or co-residents who are willing and able to complete the form independently; (3) At least seven years old; Exclusion criterias: (1) Residence in the jurisdiction for less than six months; (2) Non-primary and secondary school students and co-residents; (3) Students or co-residents are not allowed to use smart phones. Quality control: To formulate a unified quality control plan, each district designates a special person to take charge of quality control. Before the investigation, the school doctors in the area were trained uniformly. After the investigation, 5% of the questionnaires were selected for review.

2.2. Statistical Analysis

Excel.2010 was used to sort out the questionnaire data and the illogical information. SPSS 23.0 software was used for

statistical analysis. Measurement data obey the normal distribution, mean \pm standard deviation; Median \pm interquartile range was used for non-normal distribution, and t test or rank sum test was used for comparison between groups; The enumeration data was expressed as N (%), and comparison between groups was performed as X² test or Fisher's exact probability method.

3. Results

Basic information: A total of 19225 students aged 6-18 years were surveyed, of which 17744 were valid questionnaires, with a response rate of 92.30%. Among 17444 students, 8916 were male and 8826 were female, with an average age of 11 years. The proportion of primary school students is the highest, 64.86%. In the residential area, the number of people in Nanping area accounts for 45.02%, followed by Chayuan area (29.29%) and Tanzishi area (27.41%). Table 1.

COVID-19 infection of students: 11180 students (64.09%) have been infected with COVID-19 in this survey, of which the infection rate of boys is higher than that of girls, accounting for 63.024%; The average age of infection was 11 years; The infection rate of junior high school/high school is higher than that of primary school, accounting for 65.39%; Among the residential areas, Nanping area has the highest infection rate, accounting for 66.25%, followed by Tanzishi area (61.69%) and Chayuan area (59.25%). Table 1.

Infection status of family members living together: 4 ± 1 people living together; The number of co residents with fever or cough symptoms was 4 ± 1 for those infected with COVID-19, and 2 ± 3 for those uninfected, the difference was statistically significant (<0.001); The number of co residents with positive antigen was 4 ± 2 for those infected with COVID-19, and 1 ± 2 for those uninfected. The difference was statistically significant (<0.001); The number of co residents who have infected COVID-19 is 1 ± 0 ; The number of uninfected persons was 1 ± 0 , the difference was statistically significant (<0.001); The number of co residents of those infected with COVID-19 was 1 ± 0 ; The number of uninfected persons was 1 ± 0 , the difference was statistically significant (<0.001). Table 1.

Table 1. The Infection of primary and secondary students and co-residents in Nan'an District, Chongqing.

Variables	Positive with COVID-19 (N=11180)	Negative with COVID-19 (N=6564)	X ² /Z	P
Gender				
male	5619 (63.02)	3297 (36.98)	0.02	0.968
female	5561 (62.99)	3267 (37.01)		
age	11 \pm 6	11 \pm 5	-5.49	<0.001
Grade				
Elementary school	6976 (61.65)	4339 (38.35)	24.58	<0.001
middle /high school	4204 (65.39)	2225 (34.61)		
Resident area				
Chayuan area	3027 (59.25)	2082 (40.75)	70.07	<0.001
Danzishi area	2950 (61.69)	1832 (38.31)		
Nanping area	5203 (66.25)	2650 (33.75)		
Number of co-residents	4 \pm 2	4 \pm 1	-7.83	<0.001
Number of co-residents with fever, cough and other symptoms	4 \pm 1	2 \pm 3	-70.03	<0.001

Variables	Positive with COVID-19 (N=11180)	Negative with COVID-19 (N=6564)	X ² /Z	P
Number of co-residents with positive antigen or nucleic acid	4±2	1±2	-76.48	<0.001
Number of medical treatment visits by myself and co residents due to COVID-19 infection	1±0	1±0	-16.68	<0.001
Number of hospitalizations for myself and co residents due to COVID-19 infection	1±0	1±0	-4.48	<0.001

4. Discussion

COVID-19 infection is nucleic acid positive or antigen positive in this investigation. This study demonstrate that the infection rate of COVID-19 among primary and secondary school students and common residents in Nan'an District is 64.09%, slightly higher than that of COVID-19 among ordinary residents in Chongqing (50.40%) and Sichuan Province (63.52%) in the same period [7]. Because the respondents were primary and secondary school students, who may prone to family cluster infection, therefore the infection rate was slightly higher than that of COVID-19 in residents in Chongqing and Sichuan Province [8]. This suggests that health education and health promotion on COVID-19 infection among primary and secondary schools and co residents.

Among the subjects who had been infected, the infection rate of primary school students (61.65%) was slightly lower than that of junior and senior high school students (65.39%), which may be due to the higher compliance of younger student with masks [9-10]. Wearing masks is recognized as an important means to block droplet transmission and prevent respiratory infectious diseases such as COVID-19 infection, and has also played an extremely important role in epidemic prevention and control. It is suggested that the Education Commission and relevant departments continue to do a good job in propaganda and education of students wearing masks in crowded places [1, 11-12].

In addition, the study found that the highest infection rate (66.25%) was found among the subjects living in Nanping area. This may be due to the fact that Nanping area, as an old city area of Nanan District, has a large number of schools, education and training institutions, and is densely populated, The infection rate was slightly higher than that of Tanzishi and Chayuan districts [13]. Therefore, in the future, we should focus on the old urban areas, strengthen the health education and propaganda of novel coronavirus in schools, guide the residents in the region to form good personal hygiene habits, and master the preventive measure of family disinfection.

Besides, research shows that there are more study subjects with fever, cough and other upper respiratory symptoms among the cohabitants, which is more likely to cause COVID-19 infection, may be due to COVID-19 itself is transmitted by upper respiratory droplets and daily close contact transmission, so it is more likely to cause the family cluster of COVID-19 infection [6, 8]. Furthermore, If the co-residents of the study were positive for COVID-19 or COVID-19 antigen, the study subjects were more likely to be infected, possibly because the prevalent strains in Chongqing

were BA.1.1 and BA.5.2 of Omicron, which have faster transmission and infection [14-15]. In this regard, we should further promote the vaccination of COVID-19, and protective barriers should be strengthened to mitigate or avoid the impact of the virus [16]. At the same time, health resources and equipment of all medical institutions are fully guaranteed to make health emergency preparations for the prevention and control of the novel coronavirus in the new era and new stage.

This study investigated the infection situation of primary and secondary school students and co-residents in the jurisdiction area from December 20 to 21, which could not dynamically reflect the new crown infection situation and the speed rate of population infection. Researchers are also dynamic studying the infection situation; What's more, this study is innovative to the primary and secondary schools and co-residents as the starting point for the investigation of the population of COVID-19 infection. Although it covers the whole population widely, it lacks the comparison of similar populations. Last but not least, although the school doctor had emphasized to the students and parents that the determination of all infections should be based on the positive results of COVID-19 nucleic acid or antigen before the investigation, it was impossible to verify the situation one by one by reason of the large amount of investigation, and there might be some deviations from the real situation.

5. Conclusion

This study shows the basic situation and population characteristics of COVID-19 infection in primary and secondary schools and their co residents, and provides some background information on how to carry out COVID-19 infection among primary and secondary school students and their co residents in the next step, which provides some theoretical support for scientific and reasonable investigation of COVID-19 infection rate in the future, timely analysis of the epidemic situation, and prediction of medical treatment resource needs.

Author Contributions

X. T., L. Q. and W. D. conceived and designed the study. X. T., H. X., Y. W., performed field investigation and data collection. H. X. and Y. W. conducted data analysis. L. Y. and H. X. drafted the Abstract with input from L. Y. and H. X. reviewed and polished the Abstract. All authors have seen and approved the final version of the Abstract for publication.

Funding Statement

This work was funded by the Municipal Bureau of Science and Technology, Chongqing, China, grant number CSTC2021jscx-gksb-N0005, and the Municipal Health Commission, Chongqing, China, grant number 2023WSJK067.

Conflicts of Interest

The authors declare no conflicts of interest.

Acknowledgements

We would like to thank local education institutions for their kind assistance and co-ordination during the field study.

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