Received: 14 December 2021 | Accepted: 23 February 2022

DOI: 10.1002/jmv.27678

RESEARCH ARTICLE

JOURNAL OF MEDICAL VIROLOGY WILEY

Analysis of influenza trend and impact of COVID-19 in Kezhou, Xinjiang for 8 consecutive years

Lin Zeng[1] | Feng Zang[2] | Ninghong Song[3,4] | Zhanjie Li[2]

[1]Department of Public Health and Hospital infection, The Affiliated Kizilsu Kirghiz Autonomous Prefecture People's Hospital of Nanjing Medical University, Artux, Xinjiang, China

[2]Department of Infection Control, The First Affiliated Hospital of Nanjing Medical University, Nanjing, Jiangsu, China

[3]Department of Urology, The First Affiliated Hospital of Nanjing Medical University, Nanjing, Jiangsu, China

[4]Office of the Dean, The Affiliated Kizilsu Kirghiz Autonomous Prefecture People's Hospital of Nanjing Medical University, Artux, Xinjiang, China

Correspondence

Ninghong Song, Department of Urology, The First Affiliated Hospital of Nanjing Medical University, No. 300 Guangzhou Rd, Nanjing, 210029 Jiangsu, China. Office of the Dean, The Affiliated Kizilsu Kirghiz Autonomous Prefecture People's Hospital of Nanjing Medical University, Hospital 5, Pamir Rd West, Artux, 845350 Xinjiang, China.
Email: songninghong_urol@163.com

Zhanjie Li, Department of Infection Control, The First Affiliated Hospital of Nanjing Medical University, No. 300 Guangzhou Rd, Nanjing, 210029 Jiangsu, China.
Email: LZJ070591@163.com

Funding information

Social Science Foundation Project of Jiangsu Province, Grant/Award Number: 20SHB002; National Science and Technology Research Fund, Grant/Award Number: 2020YFC0848100; Research Fund for Infection Prevention and Control of Chinese Geriatric Society, Grant/Award Number: GRYJ-LRK2018016

Abstract

To study the trend of influenza and the impact of coronavirus disease 2019 (COVID-19) in Kezhou, Xinjiang from 2013 to 2020. The data of influenza in Kezhou, Xinjiang from January 1, 2013, to December 31, 2020, were collected by the China Influenza Surveillance Information System to study the trend of ILI proportion, the distribution of influenza-like cases in different age groups, the positive cases and positive rate of influenza, and the trend of different influenza subtypes, and to analyze the impact of COVID-19 epidemic on influenza. The proportion of ILI in the Xinjiang Kezhou area was mainly children under 15 years old, and children under 5 years old accounted for the largest proportion. The proportion of ILI, the number of influenza-positive cases, and the influenza-positive proportion were mainly in winter and spring, especially in December and January each year. At the same time, this study found that the overall trend of H3N2 influenza in this region was on the rise, and the outbreaks in 2018 and 2019 were dominated by novel H1N1 and H3N2, respectively. The trend of influenza in Kezhou, Xinjiang is on the rise, and the prevention and control measures of COVID-19 have significantly reduced the data of influenza. It is necessary to strengthen the vaccination work and maintain the basic prevention and control measures of respiratory infectious diseases to prevent and control influenza more effectively.

KEYWORDS

change trend, COVID-19, influenza, Xinjiang Kezhou

Lin Zeng and Feng Zang are co-first authors.

1 | INTRODUCTION

The outbreak of coronavirus disease 2019 (COVID-19) has rapidly developed into a worldwide pandemic.[1] The virus is highly transmitted among people and spreads rapidly,[2] resulting in huge health threats and socioeconomic losses. The prevention and control of respiratory infectious diseases have received increasing recognition.[3,4] Influenza (or Flu), a kind of acute respiratory infectious disease caused by the influenza virus, is characterized by a short incubation period, strong infection, and rapid spread, which seriously endangering people's health. At present, people have been mainly infected with H1N1 and H3N2 subtypes of influenza A virus and Victoria and Yamagata strains of influenza B virus.[5] Globally, seasonal influenza is associated with high morbidity and mortality each year.[6] It is estimated that influenza causes about 290 000 to 650 000 respiratory-related deaths every year, which is an increase from the previous estimate of about 250 000–500 000 respiratory and circulatory-related deaths every year.[7] Consequently, influenza has become a prominent public health issue of global concern, and also the first infectious disease that needs global surveillance. China has established a national influenza surveillance network since 2000. Currently, there is only one national influenza-like illness (ILI) surveillance sentinel hospital (Xinjiang Kezhou People's Hospital) in Kezhou, Xinjiang. In 2010, the surveillance network began to be used for influenza surveillance in Kezhou, Xinjiang. This study analyzed the distribution and change trend of influenza by collecting influenza data in Kezhou, Xinjiang from 2013 to 2020, hoping to confer reference for future influenza prevention and control.

2 | MATERIALS AND METHODS

2.1 | Data source

The cases came from the China Influenza Surveillance Information System. The supervised cases were diagnosed as ILI in the outpatient and emergency department (including the fever clinic) of Xinjiang Kezhou People's Hospital, a national sentinel hospital, from January 1, 2013, to December 31, 2020.

2.2 | Research methods

According to the national influenza surveillance protocol, the treatment situation and etiological test data of influenza-like cases in Xinjiang Kezhou People's Hospital from 2013 to 2020 were analyzed by collecting the data in the China Influenza Surveillance Information System, including the changing trend of ILI proportion, distribution of influenza-like cases in various age groups, change trend of influenza-positive cases and positive rate, and changing trend of different influenza subtypes from 2013 to 2020, to analyze the impact of COVID-19 on influenza.

2.2.1 | Surveillance data source

The data in the China Influenza Surveillance Information System came from the daily surveillance report of the influenza-like case surveillance sentinel hospital. According to the definition of ILI, the medical staff in the surveillance clinic of the sentinel hospital registered the patients who meet the definition every day. The relevant responsible department input the number of influenza-like cases and the total number of outpatient and emergency cases registered by the surveillance clinic into the China Influenza Surveillance Information System at the specified time.

2.2.2 | Surveillance object

The definition of ILI referred to the National Influenza Surveillance Protocol (2017 Edition) issued by the National Health and Family Planning Commission in 2017,[8] that is, one with fever (body temperature ≥ 38°C), accompanied by cough or sore throat. ILI proportion (ILI %) = number of influenza-like cases/total number of outpatient and emergency cases × 100%. Positive rate of influenza detection = number of positive samples/total number of samples × 100%.

2.3 | Sample collection

According to the national influenza detection protocol, throat swabs of patients within 3 days of onset were collected. The collection time was from April to September of each year, with an average of 20 influenza-like case samples collected every month, and from October to March of the next year, with an average of 20 influenza-like case samples collected every week. The collected samples were transported to the corresponding influenza surveillance network laboratory within 2 working days and stored at 4°C. If the samples failed to be sent to the laboratory within 48 h, they were stored at −70°C or below, and then sent to the corresponding network laboratory within 1 week.

2.4 | Sample detection

In line with the Laboratory Technical Operation Specification for Influenza Surveillance, a real-time polymerase chain reaction was performed to detect the influenza virus nucleic acid of the submitted samples. The positive samples were subjected to the isolation and identification of the influenza virus. The isolated virus strains are sent to the Center for Disease Control and Prevention of Xinjiang Uygur Autonomous Region for review and reported to the system.

2.5 | Statistical analysis

WPS 2019 software was used to summarize and sort out the data, and Graphpad 8.0 software was used for graphing.

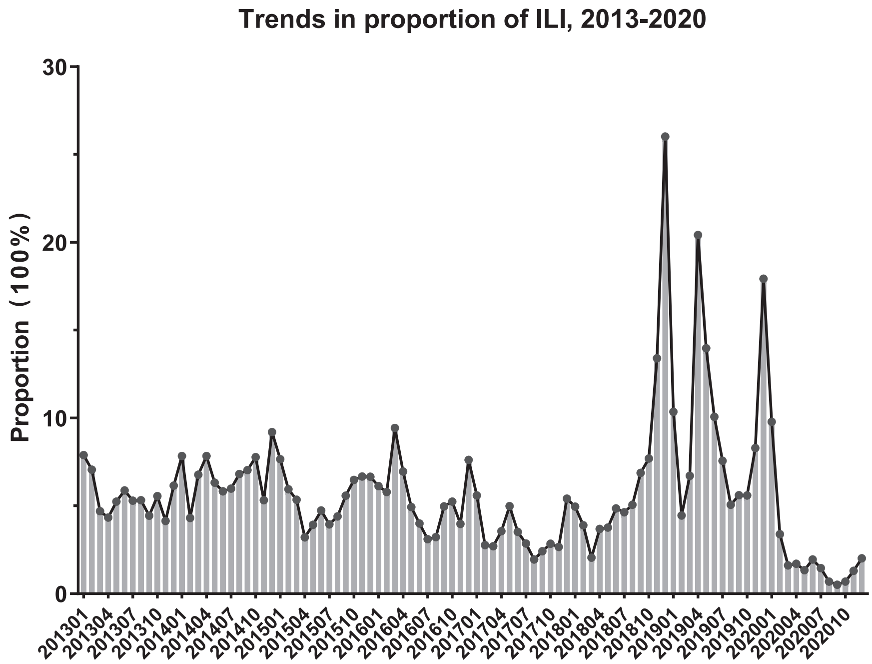

FIGURE 1 Proportion trend of influenza-like illness from 2013 to 2020

3 | RESULTS

3.1 | Proportion trend of ILI from 2013 to 2020

The peak of ILI% from 2013 to 2020 was in winter, and the annual influenza peak was basically the same, generally from December to January of the next year. The peak of ILI% in 2016 was from March to April, and the second peak appeared in April 2019. The proportion of ILI visits was the highest in 2019 (10.26%), followed by 2018 (8.14%), and the lowest in 2020 (2.18%) (Figure 1).

3.2 | Trend of influenza-positive cases from 2013 to 2020

The peak of influenza-positive cases in 2013–2020 was from December to January of the next year, and January and December 2018 were the months with the most positive cases. The peak of positive cases in 2016 was in March, and the second peak was in March 2015 and 2019. No positive cases were detected after January 2020 (Figure 2).

3.3 | Trend of influenza-positive rate from 2013 to 2020

influenza-positive cases were detected from 2013 to 2020, with the highest influenza-positive rate in 2018 (27.31%), followed by 2019 (14.39%) and 2014 (13.93%). The influenza-positive rate was the lowest in 2013 (2.17%) and 2020 (2.74%). influenza-positive cases began to appear in October every year and lasted until April of the next year, with the influenza-positive rate being the highest from December to January of the next year (Figure 3).

3.4 | Distribution of influenza-like cases in all age groups

Influenza-like cases were mainly children under the age of 15, accounting for 85.35%, including 61.39% in the 0–4-year-old group and 23.96% in the 5–14-year-old group. The age group with the highest number of influenza-like cases in 2013–2020 was the 0–4-year-old group; the 25–59-year-old group ranked second in 2015–2016, and the 5–14-year-old group ranked second in other years (Figure 4).

3.5 | Trend of different influenza subtypes from 2013 to 2020

From 2013 to 2020, all other influenza subtypes were prevalent except for H1N1 influenza, dominated by H3N2 and novel H1N1 on the whole. The epidemic strains of different types had different advantages in different years, showing an alternating epidemic trend. Yamagata was the dominant epidemic strain in 2013; H3N2 and novel H1N1 were the dominant epidemic strains in 2014; H3N2 was the dominant epidemic strain in 2015–2016 and 2019–2020; H3N2 and type B influenza were coepidemic in 2017, with Yamagata as the dominant epidemic strain, and novel H1N1 was the dominant epidemic strain in 2018 (Figure 5).

4 | DISCUSSION

Influenza virus is the major cause of human acute respiratory diseases and has led to several serious global pandemics due to its transmission dynamics and antigenic variability.[9] In September 2020, the comprehensive group dealing with novel coronavirus

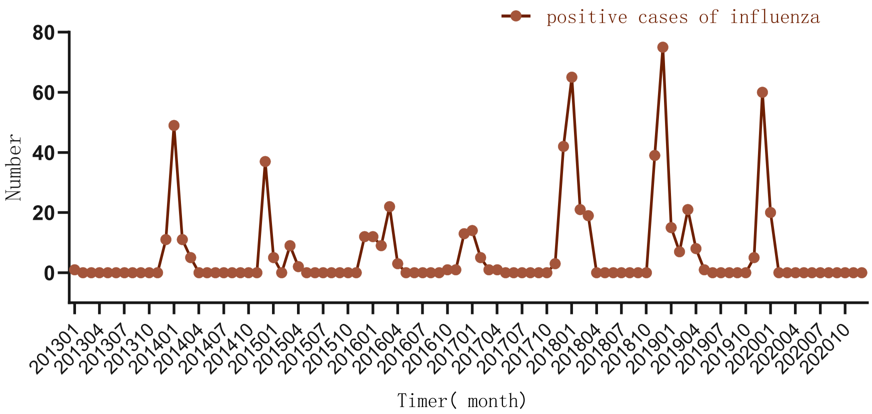

FIGURE 2 Distribution of influenza-positive cases from 2013 to 2020

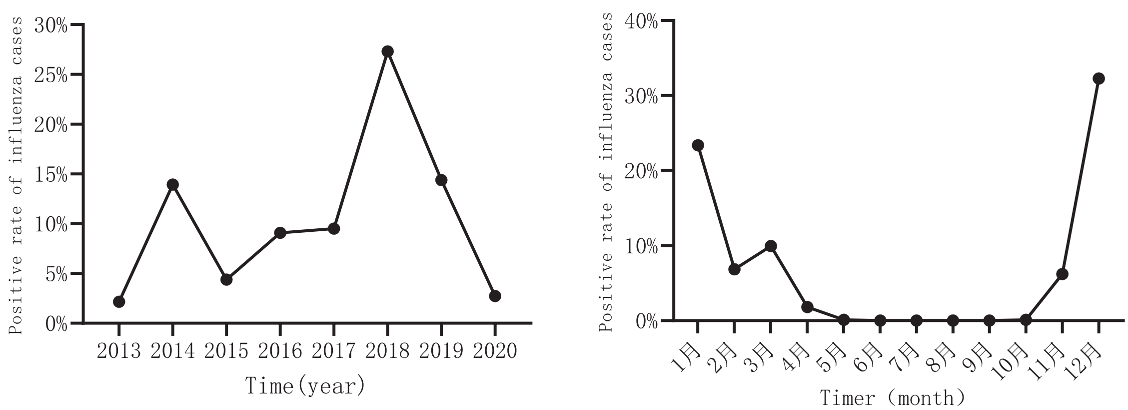

FIGURE 3 Trend of influenza-positive rate from 2013 to 2020

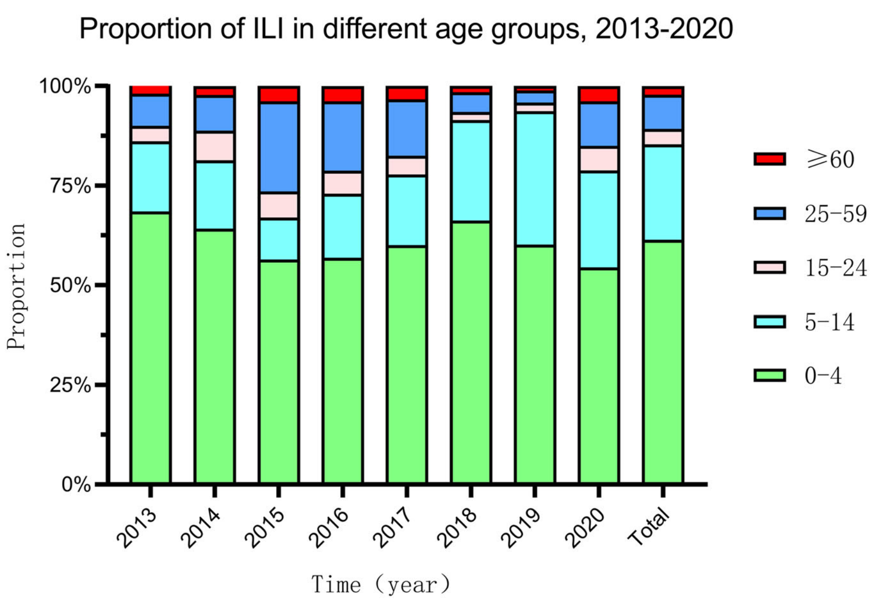

FIGURE 4 Distribution of influenza-like cases by age group

pneumonia prevention and control of the State Council formulated and released the National Influenza Prevention and Control Programme (2020 Edition)[10] that requires consolidated monitoring and early warning and strengthen analysis and judgment, thereby preventing and controlling influenza under the background of novel coronavirus pneumonia normalization. Influenza prevention and control, especially under the background of epidemic normalization, is particularly important.

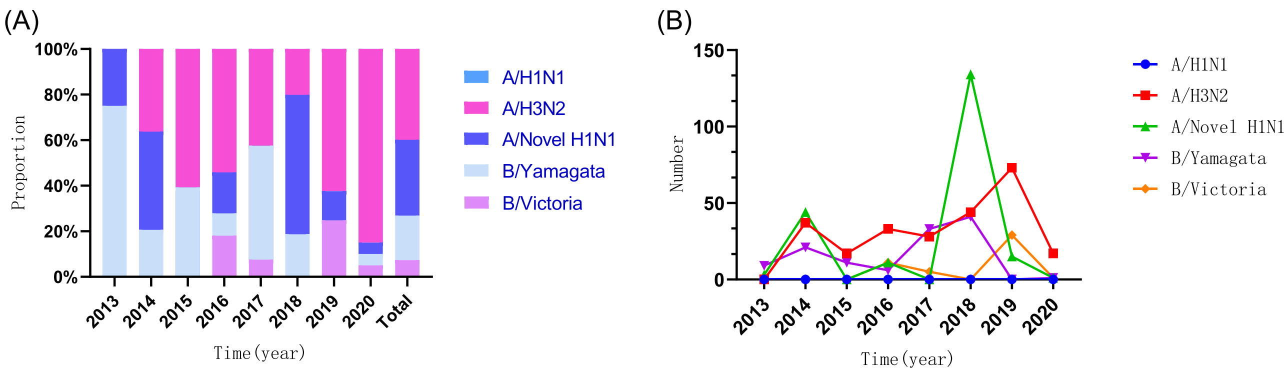

FIGURE 5 Composition ratio and variation trend of different influenza subtypes during 2013–2020

This study demonstrated that most influenza-like cases in Kezhou, Xinjiang were children under the age of 15, of which children under the age of 5 accounted for the largest proportion, which is consistent with the results of domestic research works.[11,12] The major reason is that children have relatively weak immunity and hence become the main infected object of influenza.[13] The proportion of ILI, the number of positive cases, and the proportion of positive cases in this region were mainly in winter and spring, especially from December to January every year. Relevant studies at home and abroad have provided evidence of the correlation between low temperature in winter and influenza.[14] However, such seasonal distribution is different from the influenza trend presenting a stable single peak in winter in Shandong, Gansu, and other northern provinces north of Qinling Mountain-Huaihe River,[11,12] but it is basically consistent with the trend in other regions of Xinjiang provinces proposed in relevant studies.[15,16] In addition to winter, there is also an influenza peak in spring, which may be related to the fact that Xinjiang is more vulnerable to the invasion of the influenza virus due to changeable weather and heavy sandstorm in spring. From 2013 to 2017, the overall trend of influenza in Kezhou, Xinjiang was relatively stable, but the proportion of ILI and influenza-positive cases were increased explosively in 2018 and 2019, mainly from December to March, which lasted until January 2020. After the outbreak of COVID-19 (January 23, 2021), the proportion of ILI, the number of influenza-positive cases, and the proportion of influenza-positive cases in this region were decreased significantly to the lowest level for eight consecutive years from 2013 to 2020 (the proportion of ILI was decreased to the lowest, and the number of positive cases and positive rate were only slightly higher than those in 2013). The above three data were decreased from 8.14% and 10.26%, 219 and 117, and 27.31% and 14.39% in 2018 and 2019 to 2.18%, 20, and 2.74% in 2020, respectively, which is consistent with the research of Liu et al.[17] and Feng L et al.[18] on the national influenza trend. Since January 23, 2020, all provinces in China have launched the highest level of public health emergency response to novel coronavirus pneumonia. Subsequently, the influenza-positive rate was decreased from 33.8% in the 10th week in southern China (Wuhan blockade) and 26.5% in the 8th week in northern China (Wuhan blockade) to 0.6% in the 13th–19th week in southern China and 3.2% in the 11th–17th week in northern China. The principal consideration was that since January 23, China has carried out public health intervention measures, health warning lines, and travel control, which limited the spread of influenza among regions. Moreover, the Chinese people took self-protection measures such as wearing masks, washing hands frequently, and staying at home. These preventive measures also significantly reduced the spread of influenza, which made the influenza season reach a low level earlier than usual and continue.[19–21] Briefly, we found that the influenza season in this region ended much earlier than in previous years in 2020, suggesting that intervention measures and behavioral changes to alleviate COVID-19 might affect the transmission dynamics of influenza and other respiratory diseases.

Meanwhile, this study demonstrated that H3N2 influenza in this region showed an upward trend as a whole. The influenza outbreaks in 2018 and 2019 were mainly novel H1N1and H3N2 respectively, which is similar to results in previous studies on pandemic influenza[22,23]: pandemic influenza is usually caused by influenza A virus because of its rapid antigen variation, strong replication ability, and transmission ability related to gene recombination. Although the influenza B virus does not occupy the main position, it has shown a rising trend in recent years. The frequently overlooked influenza B virus has been prevalent. In some seasons, it is more prevalent than the influenza A virus, especially in children,[24] suggesting that the influenza A virus in this region should be taken as the key prevention and control object, and the influenza B virus should not be ignored.

5 | CONCLUSION

To sum up, the influenza trend in Kezhou, Xinjiang is on the rise, and the prevention and control measures of COVID-19 have significantly reduced various data of influenza. It is necessary to strengthen vaccination and continue to maintain the basic measures for the prevention and control of respiratory infectious diseases, thereby more effectively preventing and controlling influenza and ensuring people's health and safety.

ACKNOWLEDGMENTS

We would like to acknowledge the reviewers for their helpful comments on this article. Project supported by the National Science and Technology Research Fund (2020YFC0848100); Project supported by the Research Fund for Infection Prevention and Control of Chinese Geriatric Society (GRYJ-LRK2018016); Social Science Foundation Project of Jiangsu province (20SHB002).

CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

ETHICS STATEMENT

An ethics statement was not required for this study type, no human or animal subjects were used.

AUTHOR CONTRIBUTIONS

Ninghong Song and Zhanjie Li finished study design. Lin Zeng and Feng Zang finished experimental studies. Zhanjie Li finished data analysis. Zhanjie Li and Feng Zang finished manuscript editing. All authors read and approved the final manuscript.

DATA AVAILABILITY STATEMENT

Not applicable.

ORCID

Lin Zeng http://orcid.org/0000-0003-2776-6084
Feng Zang http://orcid.org/0000-0003-4257-4638
Ninghong Song http://orcid.org/0000-0001-8600-1060
Zhanjie Li http://orcid.org/0000-0002-0703-3230

REFERENCES

1. Guan WJ, Ni ZY, Hu Y, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med*. 2020;382:1708-1720.
2. Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med*. 2020;382:1199-1207.
3. Tan W, Zhao X, Wang W, et al. A novel coronavirus genome identified in a cluster of pneumonia cases—Wuhan, China 2019–2020. *China CDC Wkly 2*. 2020;2(4):61-62.
4. Yang J, Chen X, Deng X, et al. Disease burden and clinical severity of the first pandemic wave of COVID-19 in Wuhan, China. Nat. *Community*. 2020;11:5411.
5. Medical Administration Bureau of National Health Commission. *Influenza Training Manual for Medical Personnel* (Edition)[Z], Beijing. 2019.
6. Qi L, Li Q, Ding XB, et al. Mortality burden from seasonal influenza in Chongqing, China, 2012–2018. *Human Vacc Immunother*. 2020;16(7):1-7.
7. Iuliano AD, Roguski KM, Chang HH, et al. Estimates of global seasonal influenza-associated respiratory mortality: a modeling study. *Lancet*. 2018;391:1285-1300.
8. National Health and Family Planning Commission. *National Influenza Surveillance Protocol* (Edition)[Z], Beijing. 2017.
9. Yan Y, Ou J, Zhao S, et al. Characterization of influenza A and B viruses circulating in Southern China during the 2017-2018 season. *Front Microbiol*. 2020;29(11):1079.
10. *Comprehensive group dealing with novel coronavirus pneumonia prevention and control of the State Council*. National Influenza Prevention and Control Programme (2020 Edition)[Z], Beijing. 2020.
11. Li YH, Li BD, Zhang H, et al. Monitoring on influenza and analysis on epidemic features in Gansu during 2009-2012. Chinese. *J Health Lab Technol*. 2014;024(021):3137-3139.
12. Gao Y, Fang LQ, Zhang Y, et al. Spatiotemporal characteristics of seasonal influenza in mainland China. *Chin J Epidemiol*. 2009;30(11):1097-1101.
13. Sun D, Zhao Y, Bouchard HC, et al. Coronavirus disease 2019 versus influenza A in children: an observational control study in China. *Biomed Environ Sci*. 2020;33(8):617-622.
14. Pan M, Yang HP, Jian J, et al. Association of meteorological factors with seasonal activity of influenza A subtypes and B lineages in subtropical western China. *Epidemiol Infect*. 2019;147:e72.
15. Zhou Q, Shen XX, Du CL, et al. Surveilance of influnza like illness in Akesu prefecture from 2010 to 2018. *Bull Dis Control Prev*. 2019;(3):27-30.
16. Zhang X, Zhao J, Gao ZG, et al. Analysis of influenza surveillance in Xinjiang from 2016 to 2019. *Bull Dis Control Prev*. 2019;034(006):46-49.
17. Liu M, Deng L, Wang D, Jiang T. Influenza activity during the outbreak of coronavirus disease 2019 in Chinese mainland. *Biosaf Health*. 2020;2(4):206-209.
18. Feng L, Zhang T, Wang Q, et al. Impact of COVID-19 outbreaks and interventions on influenza in China and the United States. *Nat Commun*. 2021;12(1):3249.
19. Chen S, Yang J, Yang W, Wang C, Bärnighausen T. COVID-19 control in China during mass population movements at new year. *Lancet*. 2020;395(10226):764-766.
20. Kraemer MUG, Yang CH, Gutierrez B, et al. The effect of human mobility and control measures on the COVID-19 epidemic in China. *Science*. 2020;368:493-497.
21. Leung NHL, Chu DKW, Shiu EYC, et al. Respiratory virus shedding in exhaled breath and efficacy of face masks. *Nat Med*. 2020;26(5):676-680.
22. Chan K-H, Zhang AJ, To KK, et al. Wild type and mutant 2009 pandemic influenza A (H1N1) viruses cause more severe disease and higher mortality in pregnant BALB/c Mice. *PLoS One*. 2010;5:e13757.
23. White MC, Lowen AC. Implications of segment mismatch for influenza A virus evolution. *J Gen Virol*. 2018;99:3-16.
24. Furuse Y, Odagiri T, Tamaki R, et al. Local persistence and global dissemination play a significant role in the circulation of influenza B viruses in Leyte Island, Philippines. *Virology*. 2016;492:21-24.

How to cite this article: Zeng L, Zang F, Song N, Li Z. Analysis of influenza trend and impact of COVID-19 in Kezhou, Xinjiang for 8 consecutive years. *J Med Virol*. 2022;94:3081-3086. doi:10.1002/jmv.27678