

The epidemic comparison of influenza and COVID-19 among the elderly population in China

Kaiqi Zhang

University of California, San Diego. 9450 Gilman Drive 10337

kaz008@ucsd.edu

Abstract. Influenza and COVID-19 are both epidemic respiratory viruses, manifesting with similar symptoms such as an abrupt fever, a dry cough, headaches, muscle, and joint discomfort, pronounced fatigue, a sore throat, and nasal congestion. Both of them pose significant threats to the health of the elderly population worldwide, having the risk of developing severe symptoms and potentially leading to death. With their vulnerable immune systems and increased susceptibility to severe complications, older adults must navigate the elevated risk of contracting the virus during its peak activity of influenza. Although COVID-19 has no obvious seasonality, it's have more danger for elder population due to its less predictable patterns and triggering outbreaks at any time. Some common measures are undertaken to protective elderly population for both the flu and COVID-19 because of the similar epidemic characterizations, which induce higher incidence and mortality in elder people. These measures include vaccination, treatment of chronic diseases in time, mask-wearing, social distancing, regular handwashing, and avoiding crowded settings. This essay aims to analyze the prevalence of these two viruses among the elderly population in China, compare the epidemiological characteristics to understand deeply the risks and disease transmission dynamics within the elderly demographic can be acquired, and provide some effective prevention and control strategies.

Keywords: Influenza, COVID-19, Epidemiology, Elderly Population.

1. Introduction

Influenza, as defined by the World Health Organization (WHO), represents an abrupt respiratory ailment brought about by various strains of influenza viruses including A, B, C, and D, which are prevalent worldwide. This infection typically manifests with symptoms such as an abrupt fever, a dry cough, headaches, muscle, and joint discomfort, pronounced fatigue, a sore throat, and nasal congestion. Coronavirus disease of 2019, commonly known as COVID-19, is also an respiratory infectious disease caused by the virus of SARS-CoV-2, leading to symptoms including fever, chills, sore throat, and tiredness. Influenza and COVID-19 are both respiratory viruses that pose significant threats to the health of the elderly population worldwide, which both have the capability of developing severe symptoms and potentially leading to death. Such trend could be identified in Mainland China with the highest population in the world [1]. This essay aims to analyse the prevalence of these two viruses among the elderly population in China, with a particular focus on their and epidemiological characteristics. By doing so, a deeper understanding of the risks and disease transmission dynamics within the elderly

demographic can be acquired. Such analysis could be pivotal in formulating effective prevention and control strategies.

2. Influenza virus prevalence among elderly population in China

Influenza is known for its seasonality, with outbreaks typically occurring during the winter and early spring months, most commonly from December to April. What makes this seasonality noteworthy is that it aligns with the peak flu activity across all age groups. However, for older adults, this synchronization of peaks carries distinctive implications.

China's geography plays a vital role in shaping the influenza season's characteristics (figure 1). Provinces located at high latitudes experience. The epidemic features are intense and short intense annual winter, beginning in November, and semi-annual or once every year at high latitudes from March to August, and mid- or low-latitude, separately. For example, the epidemics spread to southern provinces, resulting in the majority of the country experiencing flu activity during January. Subsequently, the epidemic trend starts decline since March, such as Jilin and Shanxi. Then, the epidemics are persist mainly in south China from May to August, including Guangdong, Fujian, and Guangxi, where experience another infected peak [2].

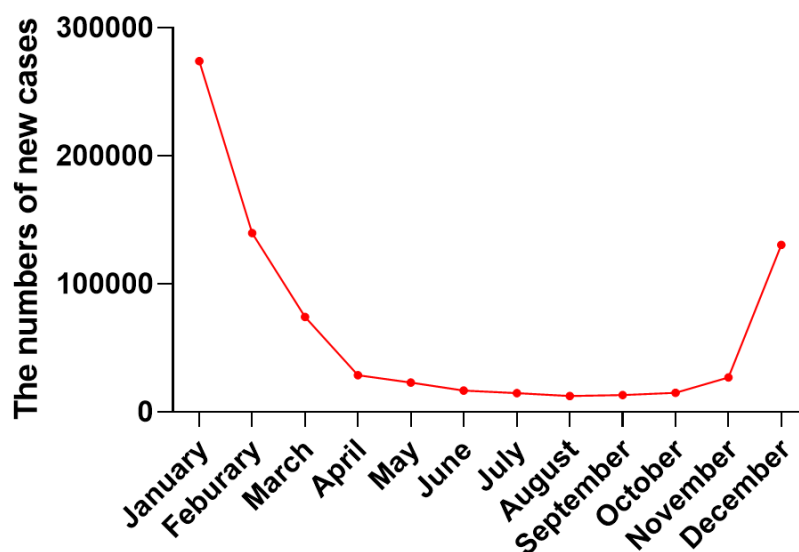


Figure 1. The prevalence of influenza by in China (2018).

The synchronization of influenza peaks across all age groups during the typical flu season presents a formidable challenge for elderly individuals. With their often-compromised immune systems and increased susceptibility to severe complications, older adults must navigate the elevated risk of contracting the virus during its peak activity. Influenza presents a heightened risk to older individuals, with higher ratio of infection and serious complications. Studies conducted over multiple influenza seasons have consistently shown that the elderly are particularly vulnerable to the flu [3]. In China, individuals aged 65 and above experience an annual influenza-associated mortality rate of 122.79 per 100,000 people [3]. The ratio of influenza-associated all-cause and cause-specific deaths in aged 65 and above populations increased significantly in comparison with those for individuals under the age of 65 [4]. This age-related discrepancy in mortality rates underscores the pressing need to address the unique challenges posed by influenza in older adults.

Despite influenza virus related risks, the elderly people vaccinated suboptimal, due to their fear of the negative impact of the influenza vaccines and the absence of governmental programs that cover the cost of the vaccine [5,6]. Meanwhile, the vaccination rate for the flu virus in China is very low, lower than 10% [5], which undermines the prevention of influenza and the establishment of herd immunity

against influenza. The overall vaccination rate remains insufficient although it has been taken government-sponsored vaccination programs. For instance, in Beijing, the introduction of vaccination subsidies between 2011 and 2015 led to a nearly 50% increase in influenza vaccination rates among older adults [6]. However, nationally, the data on vaccination rates among the elderly is far from ideal. This discrepancy highlights the importance of ongoing initiatives to enhance vaccine uptake among older individuals, especially given their heightened vulnerability to influenza.

Beyond age and lower vaccination, the presence of specific underlying health conditions significantly increases the risk of severe illness or death. In China, the prevalence of these underlying conditions including cardiovascular disease, diabetes, cancer, and kidney disease, is notably high among the elderly population, with rates of 46% in urban areas and 36% in rural areas [7]. When these chronic health conditions combine with the advancing age of individuals, the consequences of influenza infections become even more severe. Compared to healthy individuals, those with cardiovascular diseases face a 16.45 times higher risk of influenza-related hospitalization and a 1.97 times higher risk of death [7,8]. Similarly, individuals with diabetes have a 9.91 times higher risk of influenza-related hospitalization, while those with malignant tumors face a staggering 19.35 times higher risk [8]. Additionally, influenza outbreaks tend to occur more frequently in communal living facilities for older adults, such as elder care center, further emphasizing the need for targeted interventions to protect this vulnerable population [9].

3. SARS-CoV2 virus prevalence among elderly population in China

Similar to influenza, COVID-19 has disproportionately affected the elderly due to age-related declines in their immune system function and the presence of underlying chronic illnesses. People aged from 50-59, 60-69, and 70-79 have relatively high morbidity and mortality rate compared to other age groups according to an investigation made by the Chinese Center of Disease Control (CN CDC) in February 2020, involving 44672 confirmed COVID-19 cases, over 30% and 10% of the patients are aged over 60 and 80, separately [10], demonstrated the trend of causing high deaths among people aged 60 and above.

Among the deaths related to COVID-19, many of them are coexist with hypertension (4.1%) and cardiovascular disease (2.2%). These pre-existing chronic conditions are worsened by COVID-19 while making the symptoms of COVID-19 more severe, leading to excessive health burdens among people with pre-existing conditions. One of the studies done involving 7283 patients with COVID-19 indicated that among the study population, the median age was 64 years, with 7.4% of the patients reporting having or having had at least one chronic disease [11,12]. The respective hazard ratios, expressed as 0.6 for the younger cohort and 5.1 for the older cohort, underscored substantial variations in the likelihood of mortality [13]. These data suggesting that an escalating trend in the susceptibility to symptomatic infection as age advanced.

The most effective measure in combating COVID-19 is vaccination. China has made substantial progress in vaccinating individuals, with a coverage rate of 93% of the first dose and 90.6% of full doses based on data from CN CDC at April of 2023. However, the vaccinating ratio in the elderly population presents uncertainties and challenges. As of the summer of 2022, a comprehensive analysis involving 12,900 participants revealed that the unweighted non-vaccination rate among older adults (aged 60+) was 6.1% and 17.9% in aged 80 and over [14], revealing an inverse relationship between age and vaccination uptake, indicating the need for targeted interventions among the elderly.

4. Comparing COVID-19 to influenza among the elderly population in China

The susceptibility of elderly individuals to both the flu and COVID-19 is a shared characteristic. The aging process can lead to immune system weakening, rendering older adults more susceptible to infections caused by these viruses (figure 2A). Research studies underscore the challenges posed by immune changes associated with aging, making vaccination a critical concern (figure 2B) [13]. Also, elderly individuals contracting either the flu or COVID-19 face a higher risk of experiencing severe symptoms or even death. Mortality rates are notably elevated among this demographic, particularly

those with pre-existing chronic health conditions. Some chronic diseases including cardiovascular diseases, diabetes, and malignant tumors further compound the risks (figure 2C) [4,9,15].

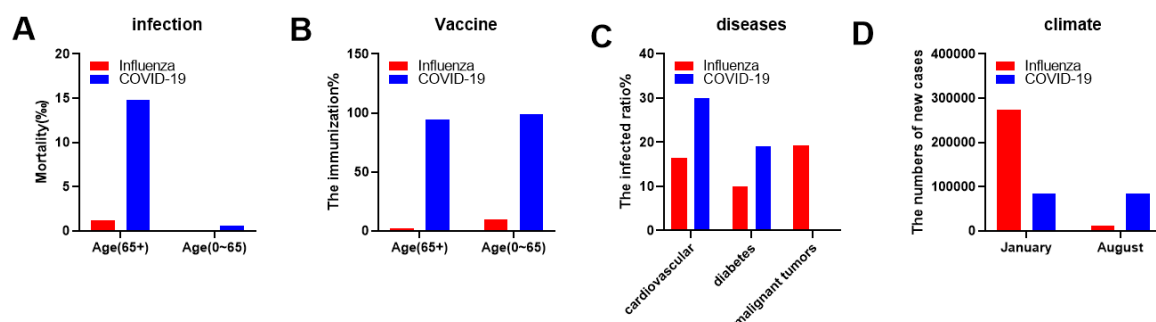


Figure 2. Comparison of influenza and COVID-19 among the elderly population in China.

In the context of prevention, older adults can undertake similar protective measures for both the flu and COVID-19. These measures include vaccination, treatment of chronic diseases in time, mask-wearing, social distancing, regular handwashing, and avoiding crowded settings.

The elderly population in China faces a disproportionate burden of influenza due to higher incidence and mortality rates, lower vaccination rates, and the added risk of underlying health conditions. To mitigate these challenges effectively, it is important to address necessary vaccination, not only among older adults but also within the broader population. Comprehensive vaccination strategies that encompass all age groups, coupled with efforts to prevent and manage chronic diseases, are essential for improving the health and well-being of older individuals and the community at large. Recognizing these challenges is essential for designing and implementing effective strategies to mitigate the impact of influenza on older adults, ultimately improving their health and well-being. Similar to COVID-19 vaccination, it's also necessary for the government to commit to influenza vaccination as a comprehensive strategy to protect the elderly population.

Beside vaccination, it is crucial to acknowledge the pivotal role of common chronic diseases, akin to the impact of influenza, in exacerbating COVID-19 outcomes among older adults. Therefore, simultaneous efforts should focus on the timely prevention and management of these conditions alongside vaccination programs.

One notable distinction lies in the epidemiological profiles of the flu and COVID-19. Influenza typically exhibits a seasonal pattern, with distinct regions of China experiencing epidemics at various times throughout the year (figure 2D). In contrast to influenza, COVID-19 has demonstrated less predictable patterns and can trigger outbreaks at any time. As data gathered by the WHO demonstrated, after the major outbreak of COVID-19 in January and February in China, the monthly confirmed cases do not show a significant increase as seasons alternate. On May 9th, 2020, the total number of confirmed cases in China was 84416. That number changed to 84659 on June 12th, 2020, which is typically considered as the end of summer in most parts of China [15].

5. Conclusion

Future research endeavors should seek to delve deeper into the specific effects of both influenza and COVID-19 on the elderly population. Understanding the unique pathophysiological processes in older individuals when confronted with influenza and COVID-19 is of paramount importance for the formulation of targeted and effective preventive measures. For instance, it is crucial to investigate why elderly individuals tend to experience more severe forms of these infections, potentially involving age-related immune system changes, comorbidities, or other underlying factors. Another avenue of research should focus on the seasonal dynamics of influenza in the elderly population. By scrutinizing the timing and patterns of outbreaks, we can gain valuable insights into the epidemiological behavior of these

viruses in older adults, helping public health authorities anticipate and respond to outbreaks more effectively, and ensuring that the elderly receive timely protection during periods of heightened risk. A third avenue of research should be dedicated to advancing vaccination coverage among older adults. We must not only aim to increase the overall vaccination rate but also rigorously assess the effectiveness of different vaccines in safeguarding older individuals against both influenza and COVID-19. Vaccination is a cornerstone of preventive healthcare, especially for the elderly. Research should focus on developing and promoting vaccines that provide robust protection to this vulnerable demographic. This includes evaluating the efficacy of existing vaccines and exploring the potential for novel formulations tailored to the specific needs of older individuals. Moreover, we should aim to overcome any barriers that hinder access to vaccinations for older adults and enhance public awareness of their importance.

References

- [1] Bai Y and Tao X 2021 Comparison of COVID-19 and influenza characteristics. *J. Zhejiang. Univ. Sci. B.* 22(2):87-98.
- [2] Diamond C, Gong H, Sun FY, Liu Y, Quilty BJ, Jit M, Yang J, Yu H, Edmunds WJ and Baguelin M 2022 Regional-based within-year seasonal variations in influenza-related health outcomes across mainland China: a systematic review and spatio-temporal analysis. *BMC. Med.* 20(1):58.
- [3] Mertz D, Kim TH, Johnstone J, Lam PP, Science M, Kuster SP, Fadel SA, Tran D, Fernandez E, Bhatnagar N and Loeb M 2013 Populations at risk for severe or complicated influenza illness: systematic review and meta-analysis. *BMJ.* 347:f5061.
- [4] Li J, Chen Y, Wang X and Yu H 2021 Influenza-associated disease burden in mainland China: a systematic review and meta-analysis. *Sci. Rep.* 11(1):2886.
- [5] Yang XK, Wang L, Zhao HT, LI ZL, Fan SM, Sun JL, Zheng YM, Ren X, Yu JX, Peng ZB, Cui Y, Qin Y, Zheng JD, LI ZJ, and Feng ZJ 2021 Public cognition of influenza vaccine, current status of vaccination and its influencing factors, *Prac. Prev. Med.*, (6):653-657.
- [6] Zhao ShY, Dong SH, Li XC, Zhu QL, Fu FT, and Jin H 2021 Current situation and influencing factors of vaccine hesitancy among the priority groups recommended for influenza vaccine vaccination in China. *Chin. J. Prev. Med.* 22(10):798-803.
- [7] Mertz D, Kim TH, Johnstone J, Lam PP, Science M, Kuster SP, Fadel SA, Tran D, Fernandez E, Bhatnagar N and Loeb M 2013 Populations at risk for severe or complicated influenza illness: systematic review and meta-analysis. *BMJ.* 347:f5061.
- [8] Yang J, Atkins KE, Feng L, Baguelin M, Wu P, Yan H, Lau EHY, Wu JT, Liu Y, Cowling BJ, Jit M and Yu H 2020 Cost-effectiveness of introducing national seasonal influenza vaccination for adults aged 60 years and above in mainland China: a modelling analysis. *BMC. Med.* 18(1):90.
- [9] Influenza Prevention and Control Working Committee of the Chinese Society of Preventive Medicine. 2021 Expert consensus on promoting seasonal influenza vaccination for the elderly. *Chin. Med. J.* 101(8) : 530-538.
- [10] The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. 2020 The Epidemiological Characteristics of an Outbreak of 2019 Novel Coronavirus Diseases (COVID-19) — China, 2020. *China CDC Weekly* 2(8): 113-122.
- [11] Wang F, Cao J, Yu Y, Ding J, Eshak ES, Liu K, Mubarik S, Shi F, Wen H, Zeng Z, Bai J and Yu C 2021 Epidemiological characteristics of patients with severe COVID-19 infection in Wuhan, China: evidence from a retrospective observational study. *Int. J. Epidemiol.* 49(6):1940-1950.
- [12] Wu JT, Leung K, Bushman M, Kishore N, Niehus R, de Salazar PM, Cowling BJ, Lipsitch M, and Leung GM 2020 Estimating clinical severity of COVID-19 from the transmission dynamics in Wuhan, China. *Nat. Med.* 26(4):506-510.
- [13] Liang CK, Lee WJ, Peng LN, Meng LC, Hsiao FY and Chen LK 2022 COVID-19 Vaccines in Older Adults: Challenges in Vaccine Development and Policy Making. *Clin. Geriatr. Med.* 38(3):605-620.

- [14] Wang G, Yao Y, Wang Y, Gong J, Meng Q, Wang H, Wang W, Chen X and Zhao Y 2022 COVID-19 non-vaccination among older adults in China: a nationwide survey based on the China Health and Retirement Longitudinal Study (CHARLS). Res. Sq. [Preprint]. 3.rs-2380496.
- [15] Cao G, Guo Z, Liu J and Liu M 2023 Change from low to out-of-season epidemics of influenza in China during the COVID-19 pandemic: A time series study. J. Med. Virol. 95(6):e28888.