

Mortality burden of the 1918–1920 influenza pandemic in Hong Kong

Pak-Leung Ho, Kin-Hung Chow

Department of Microbiology and Carol Yu Centre for infection, The University of Hong Kong, Hong Kong, China

Correspondence: Pak-Leung Ho, Division of Infectious Diseases, Department of Microbiology and Centre of Infection, The University of Hong Kong, Queen Mary hospital, Pokfulam Road, Pokfulam, Hong Kong, China. E-mail: plho@hkucc.hku.hk

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To the editor:

The 1918 Spanish flu pandemic is estimated to have infected one-third of the world's population and caused mortality ranging from 20 millions to 100 millions.¹ The geographical origin of the 1918 influenza remains debatable. During an approximately 12-month period in 1918–1919, the pandemic spread more or less simultaneously in Asia, Europe, and North America in three waves.^{1–3} In the United Kingdom, the first pandemic influenza wave appeared in June 1918 (Spring), followed in rapid succession by two more severe waves in the fall (October to December) and winter (February to April) of 1918–1919.² Although the mortality burden of this pandemic across the world is well documented, little has been described for China. Here, we describe the impact of the 1918 pandemic in Hong Kong; a metropolitan city geographically situated in the epicenter of the influenza basin in southern China.⁴

To estimate the excess all-cause and pneumonia and influenza (P&I) mortality rates for the 1918–1920 pandemic, we calculated the average mortality rate in 1915–1917 and 1921–1923, and subtracted this from the mortality in 1918–1920 as previously described.¹ The vital registration data was taken from the historical Hong Kong government annual report database.⁵ These records were compiled and maintained by the government as official records. Hard copies of all the reports and the vital registration data could be accessed at the Hong Kong Central Library and the Public Records Office of Hong Kong.⁵ All the annual reports were complete copies and no pages were missing. As age-specific information is not available, the annual data for all ages were used. Monthly mortality data for influenza was only available from January 1918 to December 1928 because a pandemic was known to be starting in 1918 and the detail breakdown was provided in two special reports.^{6,7} The annual and monthly mortality rates for this period were calculated as per 100 000 population. The following census populations were used for all calcula-

tions: 509 160 in 1915, 529 010 in 1916, 535 100 in 1917, 548 000 in 1918, 596 100 in 1919, 648 150 in 1920, 686 680 in 1921, 662 200 in 1922, 681 800 in 1923, 799 550 in 1924, 874 420 in 1925, 874 420 in 1926, 977 900 in 1927, and 1 075 690 in 1928.

Hong Kong experienced four major waves of excess pandemic mortality during 1918–1920, peaking in June 1918, November 1918, June 1919, and February 1920 (Figure 1A). Smaller waves continued to occur during 1921–1922, after which it fell to a low level. During 1915–1917, there were only two registered deaths under influenza. The influenza-related deaths toll rose sharply from one case in May 1918 to 108 cases in June 1918. The annual influenza mortality rates per 100 000 populations showed that they were higher from 1918 to 1922, than 1915–1917 and 1923–1928 (Figure 1B). Influenza-related admission and death figures could be obtained for the two major hospitals, the Civil and Tung Wa hospitals at that time.⁵ Both hospitals provide general care to outpatients and inpatients. The Civil hospital built in 1848 was operated by the government. It was the main accident and emergency hospital in the Hong Kong Island. At that time, it treated around 300 inpatients and 14 000 outpatients with Western Medicine annually, including most government employees, Europeans and Indians. In 1937, it was replaced by the Queen Mary Hospital.⁸ In contrast, the Tung Wa hospital (built in 1872) was run by a charity organization and provide both Western and Chinese medicine service to the poor and the underprivileged groups.⁹ During 1918–1920, it treated approximately 7000 inpatients and 140 000 outpatients annually. The findings were notable for substantial differences in the case–fatality ratios among persons admitted to the two hospitals during 1918–1920; being 2.2% [95% confidence interval, CI 1.5%–3.2%] (25/1157) for the Civil hospital as compared with 19.2% [95% CI, 17.6%–21.1%] (369/1917) for the Tung Wa hospital. As a whole, the excess all-cause and P&I deaths in

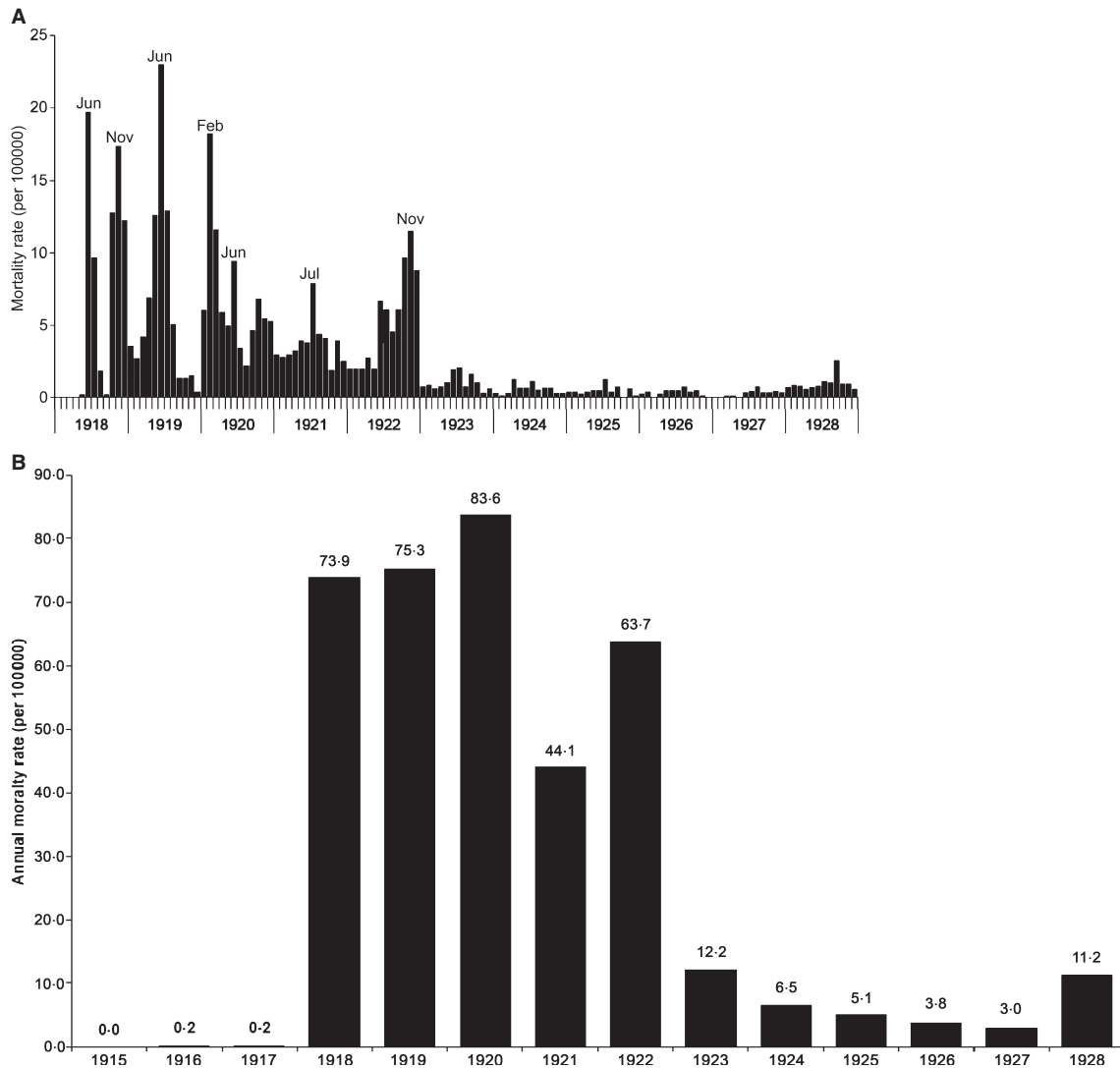


Figure 1. Influenza mortality rates in Hong Kong according to death registration data, 1915–1928. (A) Monthly influenza mortality rates. No monthly data was available for 1915–1917. The months during which the successive pandemic waves peaked were showed above the bars. By comparisons, the usual seasonal influenza periods since the 1990s were from February to March (winter peak) and June to July (summer peak). (B) Annual influenza mortality rates. All rates were calculated using the number of deaths registered under influenza and the census population data in the government annual reports.^{5–7}

Hong Kong were estimated to be 0.52% (95% CI, 0.50–0.53%) and 0.29% (95% CI, 0.26–0.31%), respectively, during the 1918–1920 pandemic period.

This study revealed several unique aspects of the influenza-related deaths which occurred during 1918 pandemic in Hong Kong. First, the initial wave was as deadly as the second and third wave. This may partly be explained by its occurrence during the summer influenza season. Second, the impact of the pandemic was much more prolonged with excessive deaths continuing after the third wave hit in the summer of 1919. Third, a marked difference in the case–fatality ratios among patients hospitalized in different hospitals in the same city was observed. As the Civil

hospital served different occupational subgroups than those by the Tung Wa hospital, the observation could reflect difference in socioeconomic status, prior health status, crowdedness and hospital hygiene. The interplay of these factors could mean that those who were treated in the latter hospital were at higher risk of secondary bacterial infection; a major confounder of influenza mortality.¹⁰ Because most of the territory's poor population was treated at the Tung Wa hospital, the massive mortality could merely reflect the higher occurrence of coexistent diseases such as malnutrition, typhoid fever, cholera, malaria and tuberculosis. Hence, caution is required in interpreting the case–fatality ratios.

According to Murray *et al.*, excess all-cause mortality from the 1918–1920 pandemic exhibit wide variations by geographic areas, ranging from 0.2% in Denmark to 4.4% in India.¹ The 0.52% excess deaths for Hong Kong were slightly higher than those reported for the United States (0.39%) and England (0.34%) but were lower than those for several Asian areas; namely Taiwan (0.92%), Japan (0.94%), and Philippines (2.84%). Similar rates were reported in Argentina (0.54%) and Chile (0.52%).¹

In conclusion, this study highlights several unique features of the 1918 pandemic in a city with subtropical climate and two influenza seasons per annum. The finding indicates that the ongoing 2009 H1N1 pandemic has the potential to cause more prolonged outbreak and excessive mortality may occur during both summer and winter in areas with subtropical climate.

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Potential conflict in interest

None to declare.

References

- 1 Murray CJ, Lopez AD, Chin B, Feehan D, Hill KH. Estimation of potential global pandemic influenza mortality on the basis of vital registry data from the 1918–20 pandemic: a quantitative analysis. *Lancet* 2006; 368:2211–2218.
- 2 Taubenberger JK, Morens DM. 1918 Influenza: the mother of all pandemics. *Emerg Infect Dis* 2006; 12:15–22.
- 3 Ansart S, Pelat C, Boelle PY, Carrat F, Flahault A, Valleron AJ. Mortality burden of the 1918–1919 influenza pandemic in Europe. *Influenza Other Respi Viruses* 2009; 3:99–106.
- 4 Yap FH, Ho PL, Lam KF, Chan PK, Cheng YH, Peiris JS. Excess hospital admissions for pneumonia, chronic obstructive pulmonary disease, and heart failure during influenza seasons in Hong Kong. *J Med Virol* 2004; 73:617–623.
- 5 Hong Kong Government. Medical and sanitary reports, 1910 to 1928.
- 6 Hong Kong Government. Report on Sanitary Department Hong Kong: report of the medical officer of health on influenza, 1927: M50 p.
- 7 Hong Kong Government. Deaths from special diseases and locally important causes. Report of Medical Department Hong Kong, 1928: M149 p.
- 8 Hospital Authority. Historical timeline of Queen Mary Hospital. Available at: <http://www3.ha.org.hk/qmh/index.htm>. (Accessed July 22, 2009).
- 9 Tung Wah Group of Hospitals. History of Tung Wah Group of Hospitals. Available at: <http://www.tungwah.org.hk/?content=317>. (Accessed on 22 July 2008).
- 10 Morens DM, Taubenberger JK, Fauci AS. Predominant role of bacterial pneumonia as a cause of death in pandemic influenza: implications for pandemic influenza preparedness. *J Infect Dis* 2008; 198:962–970.