Impact of the 1918–1919 influenza pandemic on the New Zealand military and persisting lessons for pandemic control


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We aimed to briefly review literature on the impact of the 1918–1919 influenza pandemic on New Zealand’s military forces in the First World War. Collectively, this work identified established risk factors, for example, relating to age, pre-existing chronic conditions, a relatively short time from enlistment to foreign service, and crowded conditions (e.g. in military camps and on a troop ship). But novel risk factors were also identified, e.g. larger chest size and relatively early year of military deployment. The historical experience also has some potential lessons for future pandemic control including: the need to minimise crowding in institutions and other settings; being prepared for future pandemic waves; and planning for ‘protective sequestration’ in some settings.

The New Zealand military forces did not escape the global spread of the 1918–1919 influenza pandemic, which also had a severe impact on the whole of New Zealand society1. We have estimated a total of 930 pandemic-attributable deaths among personnel who were in the New Zealand Expeditionary Force (NZEF)2. This number represented 5.1% of all NZEF deaths from the First World War (WW1), making pandemic influenza the main specific cause of disease deaths (ahead of such causes as malaria and dysentery3, 4). The epidemic curve for pandemic deaths was more drawn out in the Northern Hemisphere compared with the Southern Hemisphere, where it was concentrated in the month of November 1918. Mortality rates also varied greatly by setting and were particularly high amongst troops in military camps2, 5. Significantly higher mortality rates were found amongst NZEF personnel who were: aged 30–34 years, of Māori ethnicity (indigenous New Zealanders), from a rural background, and who left New Zealand for Europe in 1918.

More specifically, the mortality rate for Māori military personnel was 2.3 times higher (95% CI: 1.6–3.1) than for those of European ethnicity (rates of 2.5 vs 1.1 per 100 personnel6). This unequal burden for Māori was also present for civilians in two subsequent pandemics, including the 2009 one. New Zealand military personnel of Pacific peoples ethnicity (e.g. Niue and the Cook Islands), also had a raised mortality rate in 1918, but the absolute number of deaths was small and the difference was not statistically significant.

To help understand the risk factors for death from pandemic influenza in the NZEF we conducted a case-control study using individuals situated in the Northern Hemisphere during the

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pandemic period \((n = 218\) cases, \(n = 221\) controls)\(^7\). In the fully adjusted multivariable model, the following were found to be significantly associated with increased risk of death from pandemic influenza: ‘age (25–29 years), pre-pandemic hospitalisations for a chronic condition (e.g. tuberculosis), relatively early year of military deployment, a relatively short time from enlistment to foreign service and having a larger chest size (e.g. adjusted odds ratio for 90–99 cm vs ≤90 cm was 2.45; 95% CI = 1.47–4.10)’ (p. 329)\(^7\). Some of the findings in this study were consistent with previous research on risk factors (such as chronic conditions and age groups); however, others appear novel (e.g. larger chest size). In contrast, this study found no significant associations with military rank, occupational class at enlistment and rurality at enlistment.

One of the worst discrete outbreaks from the pandemic, in terms of high mortality rates for the NZEF personnel, occurred on a troop ship (Tahiti, July 1918). In this outbreak the mortality risk was increased amongst those aged 25–34 years\(^8\). Being accommodated in cabins rather than sleeping in hammocks in other areas was also associated with increased mortality risk (rate ratio 4.28, 95% CI: 3.04–6.81). Similarly, being in a particular military unit, the ‘field artillery’ (who were probably housed in cabins), was also associated with increased risk (adjusted odds ratio in logistic regression 3.04, 95% CI: 1.59–5.82). The poor ventilation of the cabins along with crowding may therefore have played roles in the mortality risk in this outbreak.

Relevance for today?

The 1918–1919 influenza pandemic is still probably the greatest natural disaster in recorded history in terms of loss of human life. It is therefore important to understand the risk factors, some of which may be modifiable, that determined vulnerability during this event. The detailed military records for the First World War period at an individual and group level, allow for the exploration of such risk factors (as with the various studies detailed above). But there is still much to learn and in particular, the strange age-distribution of mortality risk still needs to be better explained (although it may relate to exposure to a previous pandemic)\(^9\).

Reflecting on the historical experience of how the military authorities responded to this pandemic may also be useful in guiding future pandemic planning and response. We briefly discuss some possibilities below.

The need to minimise crowding in institutions and other settings. The 1918–1919 pandemic involved relatively high death rates in the military training camps in New Zealand\(^2\), and it seems likely that crowding in these camps was a likely contributing factor. The situation in the Featherston military camp (in the lower North Island of the country) was probably made worse by some of the men using tents for accommodation, many of which had been blown down during a severe storm\(^7\). Furthermore, the crowding on the troop ship Tahiti is likely to have contributed to the particularly high mortality rate in this outbreak.

In planning for future pandemics, military authorities could therefore consider plans to rapidly reduce personnel numbers in crowded or high population density settings such as in some military camps and on non-essential military vessels. Such an approach could also apply to boarding schools, university hostels and even low security risk prison inmates. Of course crowding is good to avoid in terms of preventing other infectious diseases in the modern era as well\(^10\).

Being prepared for future pandemic waves. During the First World War, a mixed bacterial vaccine was delivered to some of the New Zealand troops. Somewhat surprisingly, given the state of vaccine technology at the time, it seems to have been effective in reducing mortality rates from the 1918–1919 pandemic according to a modern analysis\(^11\). Unfortunately the use of this vaccine was not continued and so an opportunity to reduce mortality from the subsequent February/March 1919 wave in Europe was not realised. The epidemic curve for this subsequent wave is detailed in figure 2 of Summers et al.\(^2\).

Fortunately in the modern era it may be possible to institute a range of control measures after wave one of an influenza pandemic. These measures include vaccination for the pandemic strain (potentially prioritising vaccination towards high-risk groups identified from surveillance of seasonal influenza and previous pandemics), restocking supplies of antivirals (if appropriate), increasing coverage of pneumococcal vaccination for vulnerable groups and intensifying mass media campaigns that promote hygiene and other measures to reduce transmission. At least for New Zealand, there appears to be substantial scope for improving respiratory\(^12\) and hand hygiene\(^13\).

Planning for ‘protective sequestration’ in some settings. This particular control measure refers to preventing human movement at a border or area boundary so as to limit the spread of infection into such an area (it differs somewhat from quarantine – where the focus is on preventing spread from potential cases who may be incubating disease, and isolation where the focus is on preventing spread from identified cases). Such a control measure failed in 1918 in the case of the troop ship Tahiti as the measures to prevent disease spread from the shore or other ships were inadequate. Promptly closing military camps to try to protect them was not
attempted in New Zealand, even though this approach was successful for schools in New Zealand and for a township. Internationally, some military installations closed themselves off and successfully kept out the pandemic, including a naval base in San Francisco and American Samoa (the site of a US naval base). Iceland also successfully protected one part of the country from the pandemic with travel restrictions.

At a national level, New Zealand also failed to keep the pandemic out of the country – in contrast to Australia (at least in 1918), and some other parts of the Pacific.

In a modern age with high-speed air travel, controlling pandemic spread is likely to be substantially harder (indeed the 2009 pandemic reached New Zealand fairly quickly). Furthermore, available border screening measures do not appear to be particularly effective for detecting influenza in arriving passengers. Nevertheless, there could be further consideration of options for island countries such as New Zealand (and for smaller populated islands in New Zealand’s territorial waters) around highly systematic use of border control measures and protective sequestration. Such planning may inform protection against other pandemics, for example, arising from possible genetically engineered bioweapons.

References


Biographies

Nick Wilson trained as a public health physician and now works as an associate professor in public health at the University of Otago, Wellington, New Zealand. He has worked on a wide range of infectious disease topics, but particularly the epidemiology and control of pandemic influenza and enteric diseases such as campylobacteriosis.

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