Recent work on the NZ epidemiology of the 1918 pandemic & relevance to pandemic planning

Prof Nick Wilson, Uni. of Otago Wellington (UOW)
Dr Jennifer Summers, Kings College, London
Prof Michael Baker, UOW
(Thanks to co-authors over the years: especially Geoff Rice & Dennis Shanks)
Outline

• Key pandemic parameters
• Risk factors for death
• Control measures used
• How pandemic was remembered in NZ
• Implications for further research?
• Implications for pandemic planning?
Key parameters: timing

## Key parameters: Reproduction Number

<table>
<thead>
<tr>
<th>Location</th>
<th>Reproduction number (95%CI)</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Island</td>
<td>1.60 (1.47 to 1.78)</td>
<td>Nishiura &amp; Wilson 2009, <em>NZMJ</em></td>
</tr>
<tr>
<td>South Island</td>
<td>1.47 (1.33 to 1.68)</td>
<td></td>
</tr>
<tr>
<td>Auckland</td>
<td>1.44 (1.33 to 1.61)</td>
<td></td>
</tr>
<tr>
<td>Wellington</td>
<td>1.55 (1.42 to 1.76)</td>
<td></td>
</tr>
<tr>
<td>Christchurch</td>
<td>1.33 (1.22 to 1.50)</td>
<td></td>
</tr>
</tbody>
</table>
Risk factors for death

• Age (late 20s)
• Sex (male)
• Ethnicity (Māori)
• Urban living (rurality protective)
• Crowding
• Various others from case-control study: chronic disease (eg, TB)
Age of peak death rate: 28y (birth cohort at time of previous pandemic in 1889-92) [Wilson et al 2014, JID]
Mortality rates by military settings
[Summers et al 2013, NZMJ]

Cumulative deaths per 1,000 (pandemic influenza)

- All Northern Hemisphere: 6.4
- Second Wave, Northern Hemisphere: 4.4
- Third Wave, Northern Hemisphere: 1.8
- France/Belgium: 3.6
- Egypt: 4.5
- United Kingdom: 8.1
- All Southern Hemisphere/Transit: 10.0
- New Zealand Discharged/Transit: 7.3
- New Zealand Military Camps: 17.2
- Narrow Neck Camp, Auckland: 3.9
- Featherston Camp, Wairarapa: 20.4
- Awapuni Camp, Palmerston North: 22.1
- Trentham Camp, Upper Hutt: 23.5
- Troopship HMNZT Tahiti: 68.9

Key:
- □ Specific Outbreaks
- □ Overall Estimates
NZ Troopship Outbreak in 1918 (HMNZT Tahiti)
[Summers et al 2010 & Summers 2012, Emerg Infect Dis]
NZ Troopship Outbreak – Risk factors for death

- Accommodations in cabins vs hammocks in other areas, RR 4.3, 95%CI: 2.7–6.8
- Assignment to a specific unit (probably housed in cabins), aOR = 3.0, 95%CI: 1.6–5.8.
Rurality – protective (mortality rates per 1000 popn. over 3 months) [McSweeny et al 2007, NZMJ]
Risk factors for death: case-control study of NZ military personnel
[Summers et al 2014, Influenza Other Respir Viruses]

• Age-group: 25-29y
• Pre-pandemic hospitalisations for a chronic condition (eg, tuberculosis)
• Early year of military deployment
• Short time from enlistment to foreign service
• Larger chest size (eg, aOR for 90-99 cm vs <90 cm = 2.45; 95%CI=1.47-4.10).
• Nil associations: military rank, occupational class at enlistment, and rurality at enlistment
Long term sequelae of infection?: Probably no


Mean lifespan (years)

<table>
<thead>
<tr>
<th>Troopship with outbreak (Tahiti) (n=1107)</th>
<th>Contemporaneous troop ships (n=1108)</th>
</tr>
</thead>
<tbody>
<tr>
<td>71.5</td>
<td>71.0</td>
</tr>
</tbody>
</table>
Control measures used

• Quarantine in the Pacific [McLeod et al 2008, EID]

• Travel restrictions: Comparison of NZ vs Iceland: Iceland's use of travel restrictions and ship quarantining, appeared to protect 36% of the population [Summers, Wilson, Baker, Gottfredsson 2013, NZMJ].

• Local quarantine: Incoming travellers to Coromandel – associated with lower death rate in this County [Wilson et al 2005, NZMJ]
Protective effect of maritime quarantine on South Pacific Islands in 1918-19 [McLeod et al 2008, EID]
How the pandemic was (not) remembered in NZ

- Only 7 public memorials identified & no national memorial [Wilson et al 2017, NZMJ]
- 11 memorials in private settings (9 for Māori)
- Very rare compared to war memorials
- Erebus disaster has more memorials
- Of the 7 public memorials:
  - Nil have signage leading to them
  - Nil have links to online educational resources
Memorials (m) per 1000 deaths (d)

South African War (1899-1902), m=49, d=230

Both World Wars, m=941, d=29,986

NZ Wars (1845 to 1872), m=68, d=3000

1918 influenza pandemic, m=7, d=9000
Statue of Dr Margaret Cruickshank (Waimate) – died caring for her patients during the pandemic
Memorial to 1128 Aucklanders who died (and acknowledging the health workers) at Waikumete Cemetery, Glen Eden, Auckland.
Implications for further research?

- Why ethnic inequalities but no apparent socio-economic gradient in contrast with some international studies?
  - Better understand impact of social class on health at this time [work in press]
  - Further use of the occupational class system developed by Olssen et al for this period?
  - Consider modern statistical analysis of Auckland suburb mortality data (eg, in Linda Bryder’s 1980 thesis)
Average annual assessed income in NZ (in £) by population quintile for tax returns for the 1922-1923 period (calculated from Yearbook data, Wilson et al, in press ANZJPH)
Small but statistically significant differences in mean lifespans of 2046 non-combat male NZ military personnel by occupational class in 1918, Wilson et al, in press ANZJPH)
Implications for further research?

• What were the overall demographic impacts (eg, the 9% drop in birth rates in 1918 & 17% in 1919, vs 1917)?

• Were there long-term impacts from fetal exposure to the pandemic virus in 1918 (as suggested in some international literature)?
Implications for pandemic preparations & planning?

• Enhanced strategies to reduce future impact & ethnic health inequalities
  • Reduce chronic disease burdens (eg, Smokefree NZ 2025, prevent diabetes)
  • Address crowding (housing interventions)
• Reduce deprivation
Implications Continued

- Border control / internal travel restrictions may have potential in island nations → investigate further
  - Eichner et al 2009, *BMC Infect Dis* (modelling border control & islands)
Implications Continued

• Use memorials for public education on pandemic threats?

• Enhance social capital – linked to other civil defence preparations (should there be a national disaster preparation day?, should everyone have a smartphone & internet access?)
Implications Continued

Given the speed of pandemic spread:

- Enhance public health capacity in the NZ health sector now – particularly MoH
- Enhance pandemic planning & use of simulation exercises
Conclusions

• The 1918 influenza pandemic in NZ – relatively well described
• But still much potential for further research (SES issues, natality etc)
• Some implications for pandemic preparations & planning (eg, addressing ethnic inequalities in health)
Questions?