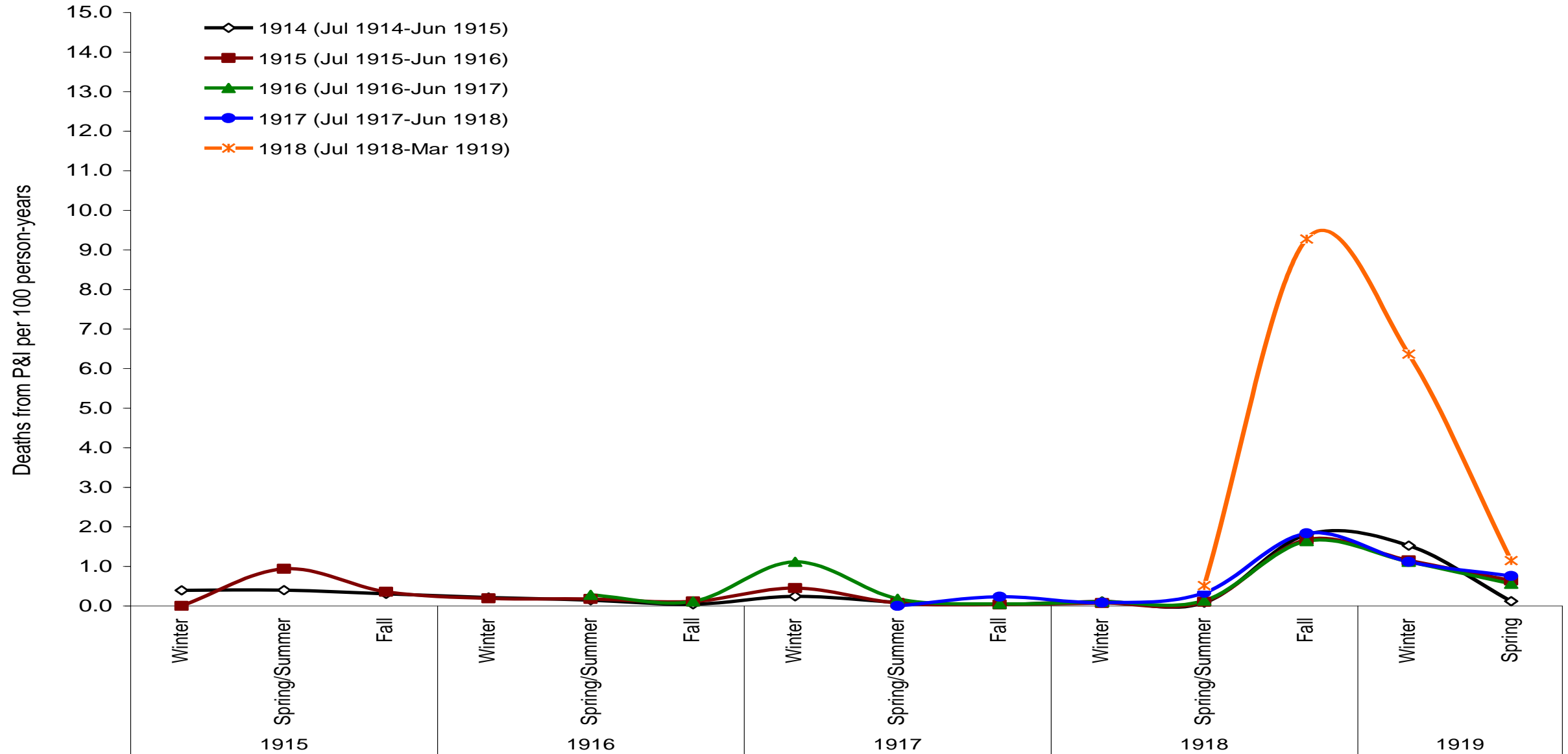
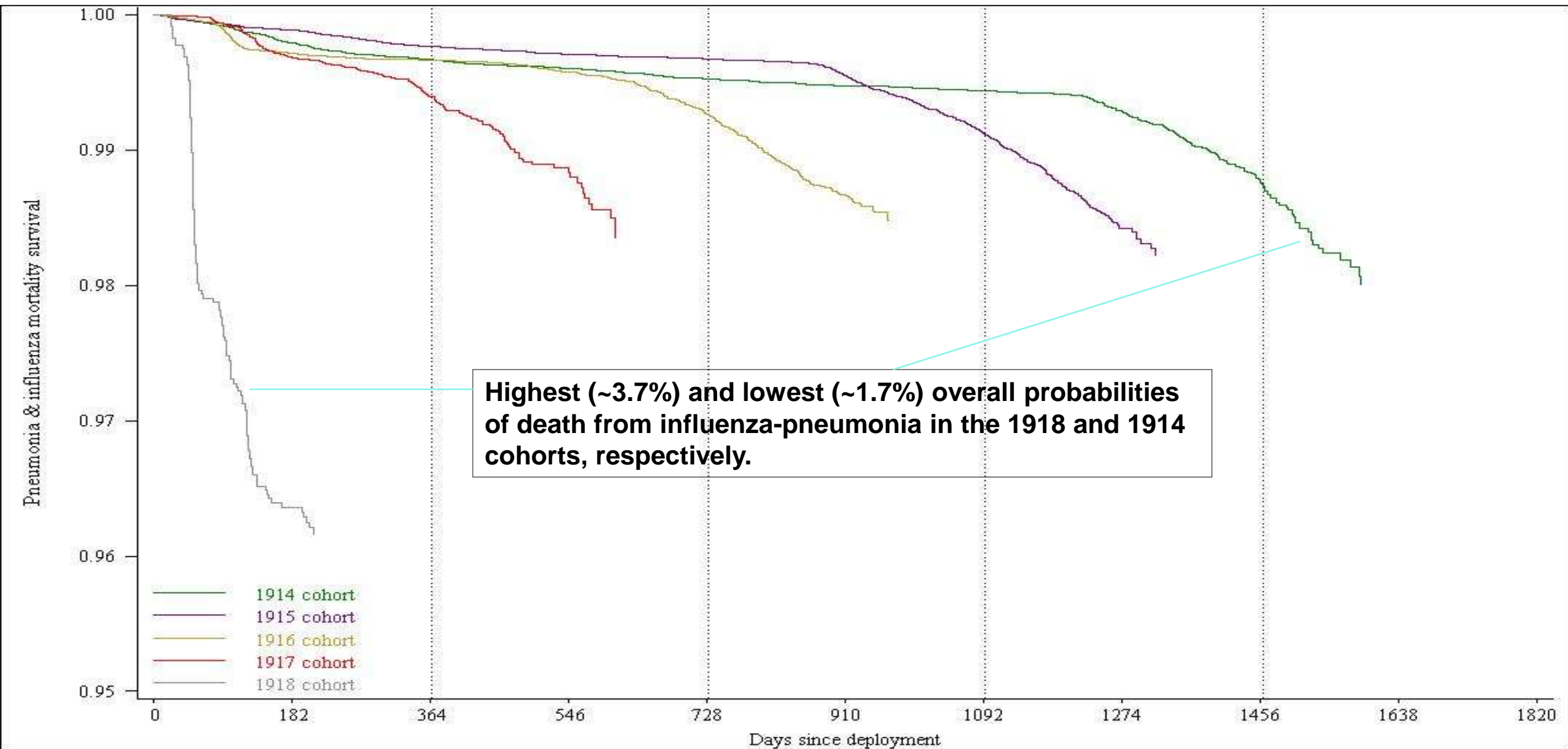


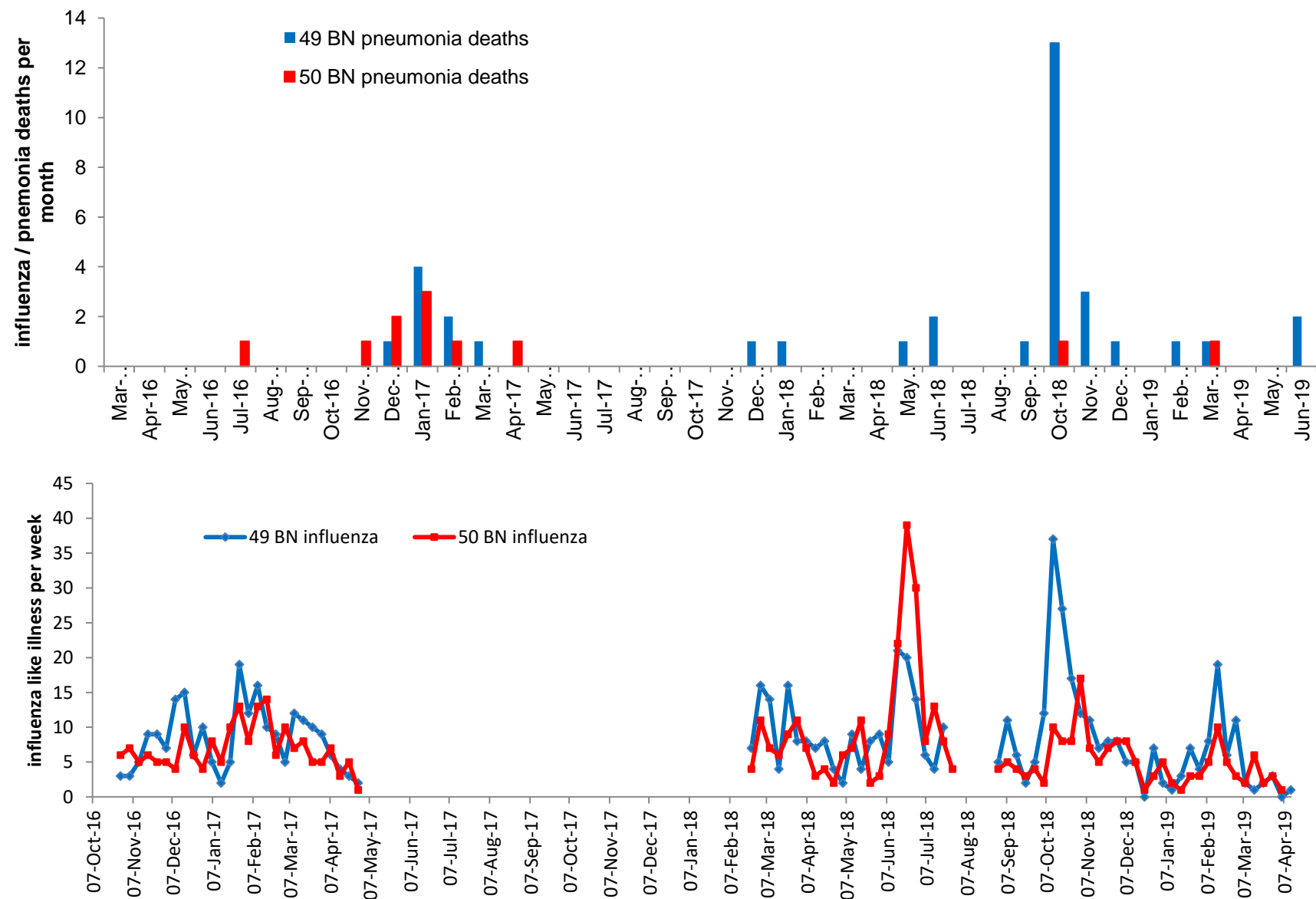
# Mortality Inverse of Length of Army Service



# Pneumonia Survival Depended on Time in Military

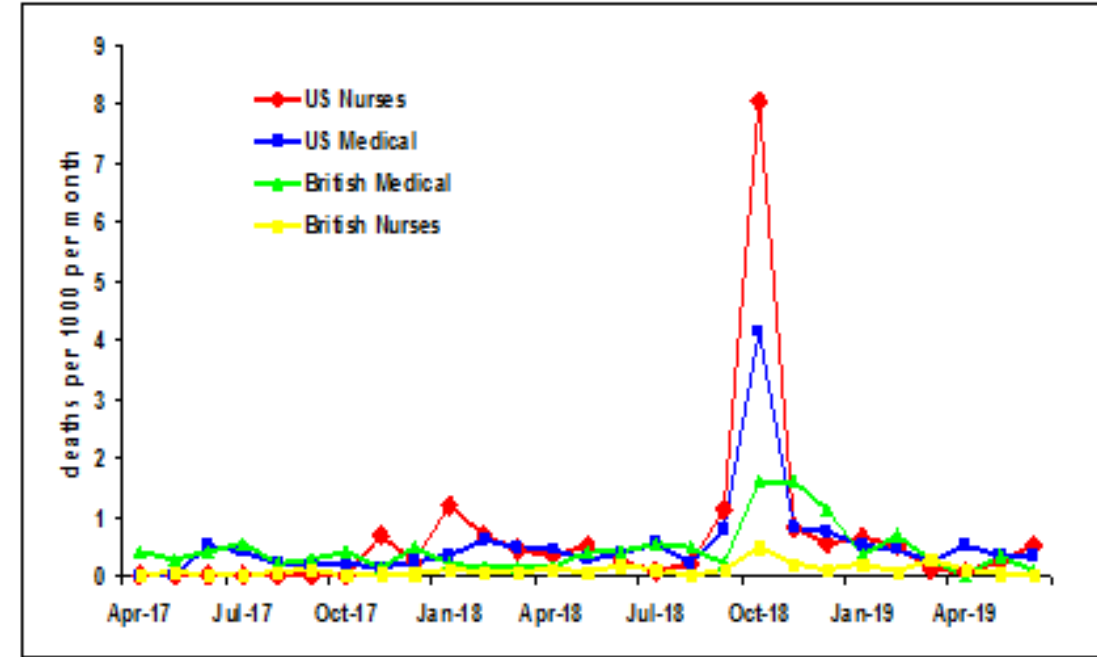


# Different Influenza Mortality in Co-located Units



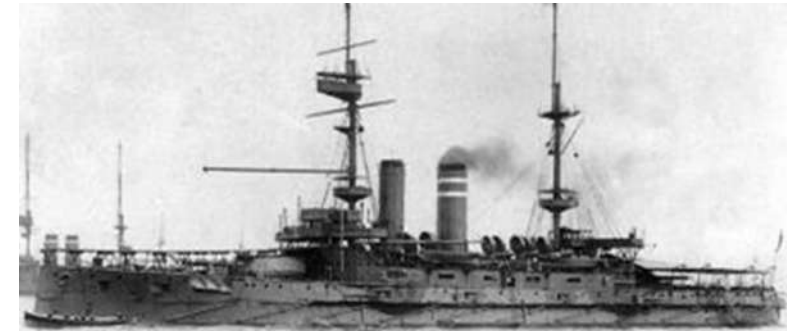
# Low Mortality in Medical and Nursing Personnel

- Large numbers of military doctors and nurses became ill but very few died during pandemic
- Exception was newly recruited USA nurses or doctors who died at high rates
- Immunity may have been more directed against secondary bacterial infections than any influenza virus



# Naval Mortality Depended on Hemisphere

- **Most capital ships in USA and UK navies had 0-1 deaths from hundreds of crew members**
- **Troopships from Australia / New Zealand either had no or disastrous influenza experience**
- **Cruisers on isolated patrol in Southern Hemisphere had much greater mortality (6-14%)**
- **Likely difference was whether crew had been exposed to first wave in early 1918 or not**

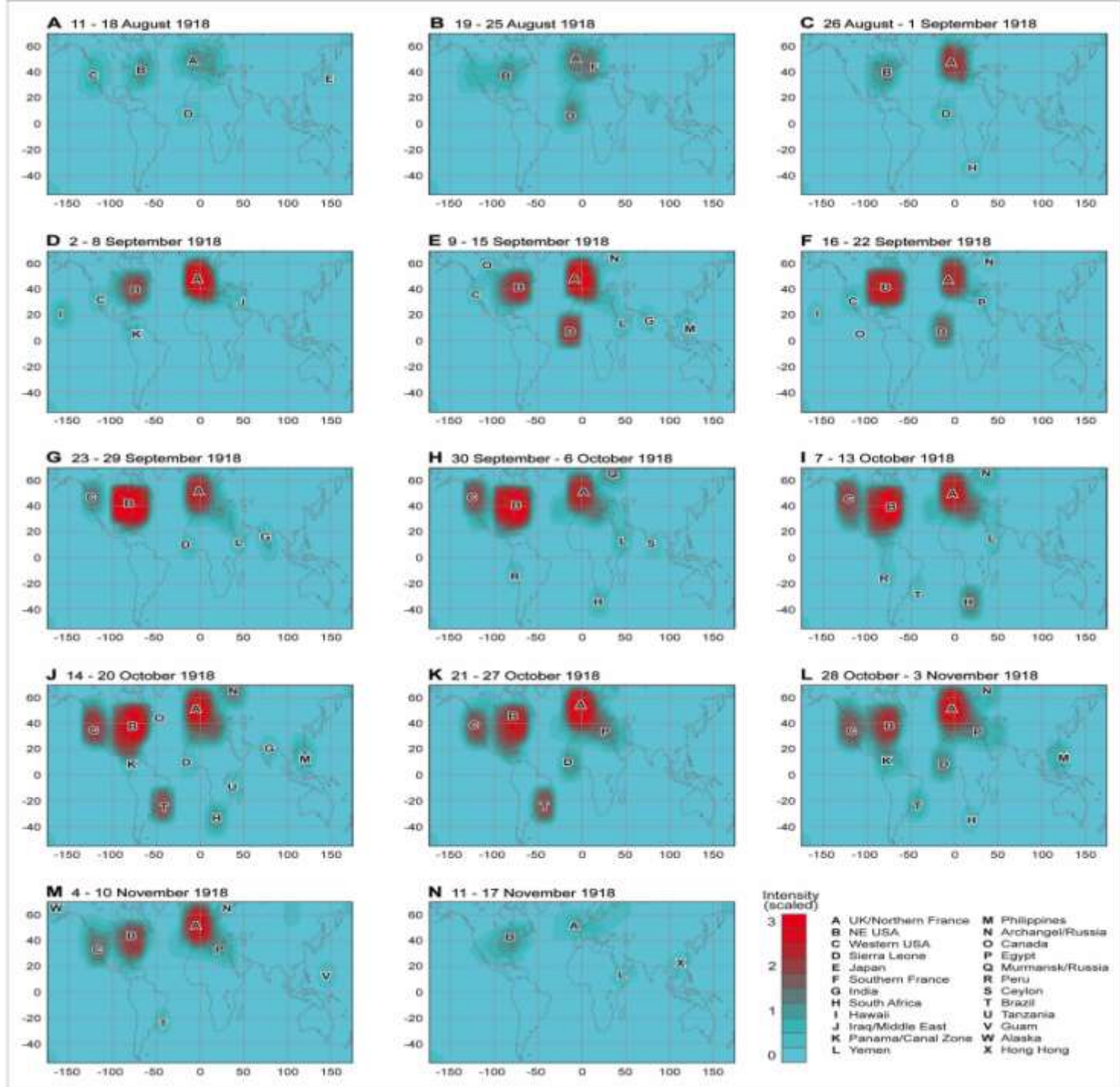




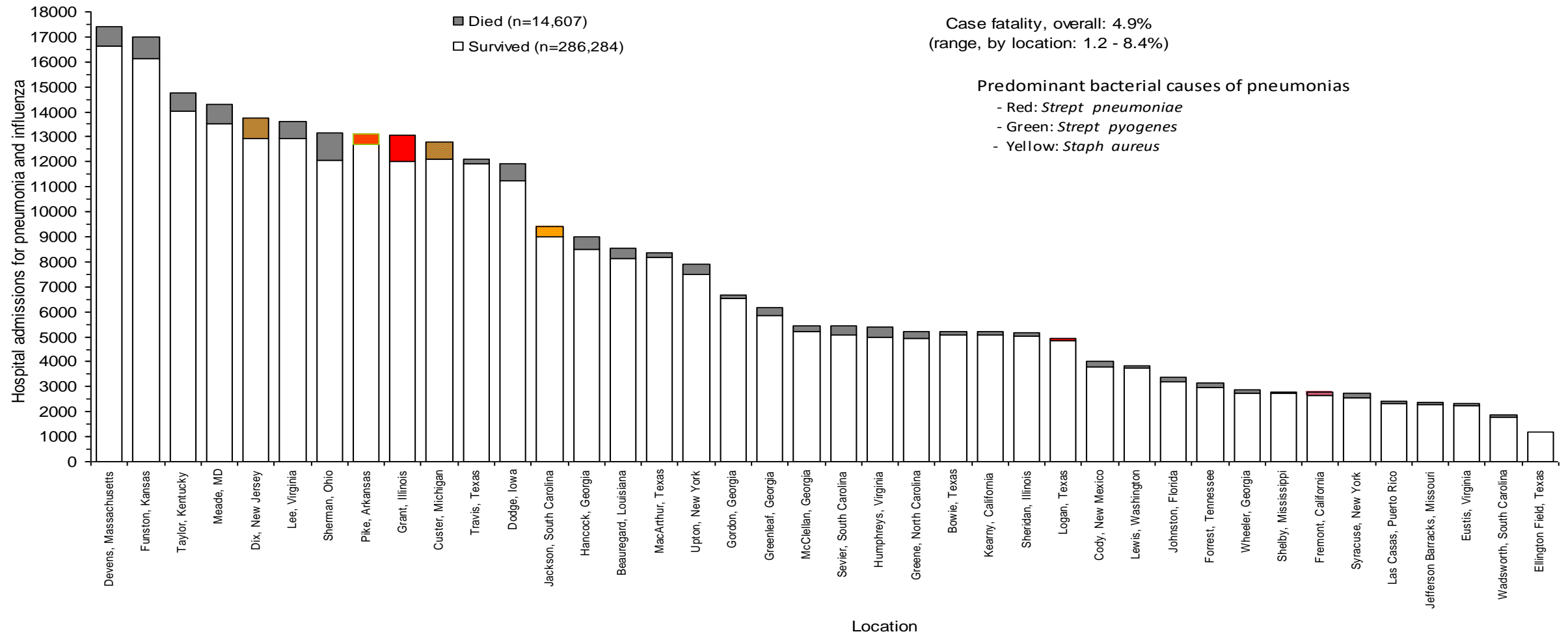
# Disease Mortality in UK, USA, French Navies Aug-Nov 1918

Note: near simultaneous  
mortality waves on three  
continents

Influenza cannot move this fast  
today with aircraft instead of  
steam ships

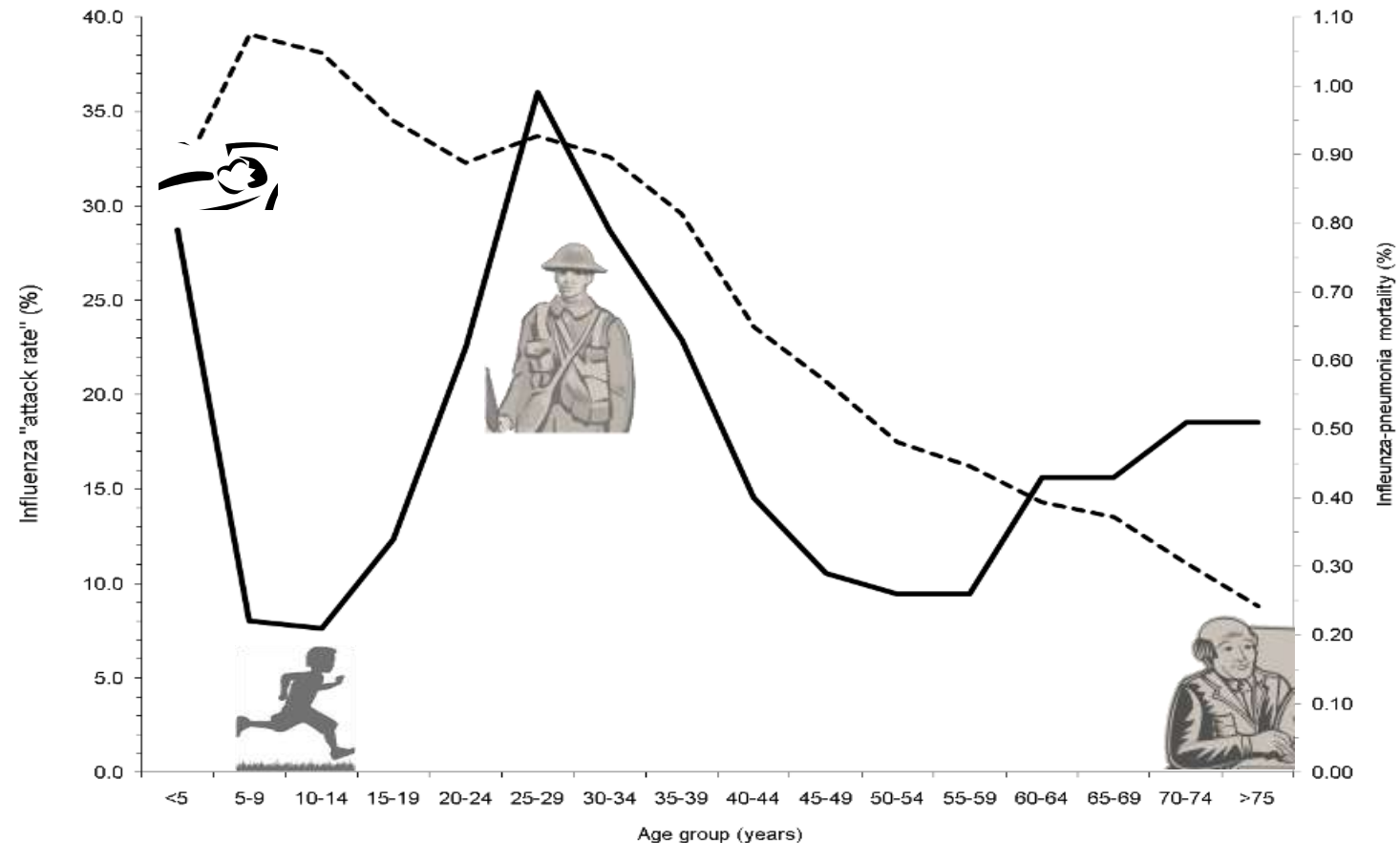


# Morbidity and Mortality US Army Camps 1918



# Unique Age Distribution of Military Mortality

- W curve peaked at age 28 except in military recruit camps were 18-20y predominated
- No general officers died of influenza; old soldiers spared
- Implies that distant influenza infections (1890) created a birth cohort effect 28y later





# Most Deaths Were from Secondary Pneumonia

- **Death due to secondary bacterial pneumonia not primary viral pneumonitis**
- **Most deaths occurred > 7 days after illness began, when lungs' defence against bacteria pathogens was dysfunctional until epithelium restored**
- **Secondary pneumonias due to common respiratory pathogens (*S pneumoniae*, *H influenza*, *Staph aureus*) varied by camp**



FIG. XII. AUTOPSY No. 16. RIGHT LUNG, A WATER COLOR DRAWING OF A GROSS LUNG IN THE ACUTE STAGE. NOTE THE SIZE OF THE LUNG, THE HEMORRHAGES ON THE PLEURAL SURFACE, AND THE BLUE AREAS OF CONSOLIDATION.

# Mortality Risk Factors in 1918

- **Recent infections:** infection early in 1918 protected against death but not infection
- **Distant events:** W mortality curve suggests cohort effect from early life infection during 1890 pandemic to create 28y old peak in 1918
- **Epidemiological Isolation :** Few previous respiratory infections increased risk of mortality in 1918
- **Secondary bacterial infection:** Dysfunctional immunity made person susceptible to bacterial pneumonia

# Influenza Pandemic Study Group



**Universities of Queensland and Otago**

**US Military Academy, West Point NY**

**US Naval Academy, Annapolis, MD**

**Australian Defence Force Academy**

**Walter Reed Army Institute of Research**

**Armed Forces Health Surveillance Center**

