The 1918 Spanish Influenza pandemic was one of the deadliest global outbreaks of disease since the Black Death. One of the most extraordinary aspects of the Spanish flu pandemic was the unusual age-at-death distribution. Most seasonal outbreaks influenza are primarily fatal to young children and the elderly, generally the segments of the population who are most frail. The 1918 pandemic, however, disproportionately killed young adults between the ages of 20-40 years old, the most resilient segment of a population. Though numerous theories have been advanced to explain this phenomenon, ultimately the reason remains unknown. Were all young adults equally susceptible or were certain individuals more likely to die? Were previously frail individuals more likely to die, or was the flu killing indiscriminately? This project proposes to investigate the role of pre-existing frailty in contributing to increased mortality during the Spanish Influenza Pandemic.

Spanish Influenza Pandemic
The pandemic was one of the deadliest global outbreaks of disease since the Black Death. An estimated 50 million people worldwide died, and while the entire pandemic stretched from about 1918–1920, over two-thirds of these deaths occurred from September December of 1918. The symptoms of the flu ranged from mild respiratory distress, to a deadly pneumonia. Most of the deaths were caused not directly by the influenza virus, but by secondary bacterial pneumonia infection.

Proposed Methods

Anthropologists have relied on the analysis of nonspecific indicators of skeletal stress – skeletal lesions caused by systemic stress – to examine individual- and population-level health. These lesions reflect disruption to biological homeostasis resulting from ecological, environmental or social factors. To measure frailty, I will collect data on 4 nonspecific indicators of skeletal that manifest at various stages in the life cycle from the skeleton and dentition.

State 1 – No lesions

State 2 – Lesions

h2(0), h2(1), h2(2)

State 3 – Dead

h2(0)+h2(1)+h2(2)

The h2 term describes the difference in the risk of death between an individual with a stress lesion and an individual without the lesion. When h2 is greater than one, the rate at which individuals are moving from state 2 to state 3 is greater than moving from state 1 to state 2; when h2 is less than one, the rate is lower.

Expected Results

• If those who were frail were more likely to die during the pandemic I expect h2>1
• Interpretation – If individuals with lesions died at a greater rate than those without, the pandemic did not kill indiscriminately. Individuals with a pre-existing frailty caused by poor nutrition, decreased access to healthcare, genetic susceptibility, etc., were more likely to die.

Significance

This project will:
• Help reveal how and why young adults were disproportionately affected by the 1918 influenza virus.
• Provide insight into the bases of human biological and cultural variation and contribute to our understanding of human origins and human-pathogen coevolution.

• Make more sophisticated methods for analyzing paleopathological data more widely accessible to anthropologists and palaeodemographers.
• Identify risk factors for increased influenza mortality and characterise how the disease may spread differently in various populations.
• Aid with predicting how a future influenza outbreak could spread and develop into another pandemic.

References and Image Credits

• Usher R. M. (2000). A multistate model of morbidity and mortality developed by Usher (2000) will be used to assess whether markers of frailty are associated with increased risk of death during the pandemic.

• In Usher’s model, an individual can exist in one of three non-overlapping states: state 1=no lesions, state 2=lesions, and state 3=death. Using the distribution of ages and lesions within the sample, the model estimates the rate of transition between the states allowing us to predict if an individual with lesions has an increased risk of dying (moving from state 2 to state 3) compared to an individual of the same age without lesions.

• The h2 term describes the difference in the risk of death between an individual with a stress lesion and an individual without the lesion. When h2 is greater than one, the rate at which individuals are moving from state 2 to state 3 is greater than moving from state 1 to state 2; when h2 is less than one, the rate is lower.