Flu Jersey: Risk Analysis of Influenza Virus in New Jersey

Background
Influenza is a group of viruses that infect the respiratory systems of both humans and non-human animals. Some strains of influenza are known to be zoonotic. The two main types of influenza virus that often infect humans are influenza A and influenza B. Common symptoms of influenza include fever, muscle pains, chills, sweats, headache, cough, fatigue, and sore throat (CDC 2017). Three major influenza epidemics occurred in the twentieth century, the Spanish Flu of 1918, Asian Flu of 1957 and the Hong Kong Flu of 1968. Historically, influenza epidemics are caused by the influenza subtypes H1, H2 and H3 (Cox & Bender 1995). The early twenty-first century brought about the Swine (H1N1) flu pandemic.

In the northern hemisphere, influenza outbreaks tend to arise between November and March. When these outbreaks occur, school-aged children are attacked more frequently than older individuals (Cox & Subbarao 2000). This spread through school children will then expose family members to the virus. Households with lower income are often limited in their access to proper health care (Shoen et al 2000). Socioeconomic factors as well as proximity factors were examined. A risk analysis was performed to assess the likelihood of an outbreak of influenza in New Jersey.

Methods
Risk Factors: Six factors were examined to establish risk of contracting and spreading an influenza virus.
Risk Analysis: Census tract data was scored and a union of all factors was performed.

Conclusion
The average risk score for the state was 15.58. The county with the highest average risk is Hudson county with an average risk score of 19. This is followed by Passaic and Essex counties with risk scores of 18. New Jersey’s overall risk is increased due to it’s proximity to both New York City and Philadelphia. When considering individuals commuting to these cities and New Jersey’s abundant public transportation system, the risk of spread is exponentially increased. Future assessment will consider these major factors in analyzing these risk factors.

Drive time from hospitals:
An individual’s proximity to health care may influence the likelihood that they seek medical attention when needed. Without proper treatment, infected individuals risk spreading the infection to others. Time required to drive to a hospital was analyzed using Network Analyst. Time required to drive to the nearest hospital was used and scored into five rankings to assess risk of individuals failing to seek medical care.

Population per Square Mile:
Population size is correlated with the rate of spread of an infectious agent. A larger population density increases an individual’s chances of becoming infected and spreading infections to others. Census tract data was used to establish the population densities throughout the state. These values were scored into five rankings to assess risk of infection.

Percentage of Individuals Over 65 years old:
Age is often correlated with an individual’s immune strength. Elderly individuals are at a higher risk of infection as their immune system responses tend to slow. This slow response may impair the effectiveness of vaccines. Census tract data was used to establish the percentage of individuals under five years of age. These percentages were scored into five rankings to assess risk of infection.

Percentage of Individuals Under 5 years old:
Age is often correlated with an individual’s immune strength. Children are often shown to have weaker immune systems than that of healthy adults as their bodies are growing and developing. Census tract data was used to establish the percentage of individuals under five years of age. These percentages were scored into five rankings to assess risk of infection.

Percentage of Individuals Without health insurance:
An individual’s health insurance status will impact their ability to acquire proper treatment and preventative methods for infectious agents. Individuals without health insurance are less likely to get any necessary vaccinations or seek treatment if they become infected. This increases the chance of spreading an infectious agent. Census tract data was used to get percent age of uninsured individuals throughout the state. These percentages were scored into five rankings to assess risk of failing to obtain necessary treatment or prevention options.

Influenza Vaccination Rates:
Proportion of vaccinated individuals is correlated with risk of spreading infectious agents. Areas with higher vaccination rates tend to have lower incidence of spreading infectious agents. Influenza vaccination rates were scored in five rankings to assess susceptibility to infection spreading.

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Data Sources: US Census Bureau, ESRI, CDC