



INTERIM REPORT: PREPARING FOR FLU SEASON

1.10 Consolidating Analytical Insights

James Talbot

Report on US populations and influenza
deaths from 2009 to 2017.

Project Overview

Motivation

The United States has an influenza season where more people than usual suffer from the flu. Some people, particularly those in vulnerable populations, develop serious complications and end up in the hospital. Hospitals and clinics need additional staff to adequately treat these extra patients. The medical staffing agency provides this temporary staff.

Objective

Determine when to send staff, and how many, to each state.

Hypotheses

- If age increases (after the age of 5 years old), then mortality rates increase.
- If the population density of a state is higher, then mortality rates increase.
- If a patient has a lower income, then the risk of mortality increases.

Data Overview

US Census Population Data

- This data shows the population of each county in each state from 2009 to 2017
- It divides the populations into demographics
 - Male/Female
 - Under 5 years old
 - Then 10 year age-bands

CDC Influenza Deaths Data

- This data shows the number of deaths attributed to influenza (-like symptoms) in each state from 2009 to 2017
- Measures deaths by month
- Divides the population into age demographics
 - Under 1 year old
 - 1 to 5 years old
 - Then 10 year age bands

Data Limitations

- CDC Influenza Death Data
 - Gives data only by state, so no more guidance can be given for staffing other than by state.
 - No further data is provided other deaths associated with flu like symptoms, so unable to determine whether deaths may be significantly associated with other causes.
 - Trustworthy data, but with the possibility of lower reliability, given most data will be manually entered at source (prone to human error)
 - Unable to compare affluence to death rates, as the data does not exist

Descriptive Analysis

Impact of Age on Mortality

- Age-Bands divided into Vulnerable (under 5 and over 64 years old) and Non-Vulnerable populations
- Vulnerable population
 - *Mean deaths per state per year - 829*
 - *Standard deviation - 1012*
- Non-Vulnerable population

Impact of Population Density on Mortality

- *The correlation between population density and average mortality of each state is 0.25*
- This shows weak, positive correlation
- There is a weak relationship to suggest a higher population density may lead to higher mortality rates

- Mean deaths per state per year - 79
- Standard deviation - 151

Hypothesis Testing, Results & Insights

Impact of Age on Mortality

- **Hypothesis - the vulnerable population has a higher mean mortality than the non-vulnerable population**
 - t-Tests show that this is statistically significant
- Hypothesis - the greater the age, the greater the mortality rate
 - There was strong positive correlation between age-band midpoints and mortality rates
 - Graphical analysis indicated this has a non-linear relationship and so ANOVA testing was not used, however graphical analysis shows a clear and strong positive relationship
- **Conclusion - the greater the age (over 5 years old), the greater the mortality rate**

Impact of Population Density on Mortality

- **Hypothesis - the greater the population density, the greater the mortality rate**
 - ANOVA testing on mean mortality against age-band midpoints show that this is not statistically significant
- **Conclusion - population density does not affect mortality rates by state**
- *This could be further tested if mortality rates by county could be provided*

Remaining Analysis & Next Steps

- Produce visualisations for the key variables to demonstrate significance.
- Produce a full report and present full findings to stakeholders.
- Determine states with higher proportions of vulnerable groups.
- Assign agency staff proportionally to states by vulnerable populations.

Appendix

- [Full Project Brief](#)
- [Data Overview and Profiles](#)
- [Hypotheses & Statistical Analysis](#)