Influenza Season Preparation – Interim Report

PROJECT OVERVIEW

MOTIVATION: During the influenza season in the United States, vulnerable populations are at greater risk of developing serious illness and mortality, often requiring additional medical care. Hospitals and clinics may struggle to provide adequate treatment to these patients without additional qualified personnel.

OBJECTIVE: To determine when and how many temporary staff to send to each state to support medical facilities during the influenza season using data-driven methods. The objective of this project is to develop a data-driven approach for allocating the medical staffing agency resources to support hospitals and clinics during the approaching flu season.

SCOPE: This project will plan for the approaching influenza season and will cover all hospital staffing needs across the 50 states of the United States on a timely basis, using a medical staffing agency to provide temporary personnel.

HYPOTHESIS

IF A STATE HAS A HIGHER PROPORTION OF POPULATION IN THE VULNERABLE GROUP (PEOPLE WITHIN THE AGE GROUP OF 65 AND OLDER), THEN THAT STATE WILL HAVE A HIGHER PROPORTION OF MORTALITY DUE TO INFLUENZA.

DATA OVERVIEW

INFLUENZA RELATED DEATHS

Data Set	Influenza-Related Deaths by geography, time, age and sex in the United States
Source	CDC
Contents	Survey data which shows total influenza-related Deaths by State, Month and Year
Limitations	Suppressed Data: Death counts are marked as suppressed for any count below 10.
	Incomplete Reporting: Not all deaths related to influenza are reported to the CDC.
	Limited Testing: Not all individuals who die from influenza are tested for the virus, which means some deaths related to influenza may not be represented in the data.

POPULATION DATA

Data Set	Population data by geography, age, and sex
Source	US Census Bureau
Contents	Survey data which shows total influenza-related Deaths by State, Month and Year
	Survey data which shows total population of every county and state in the United States categorized by 5-Year age groups and sex

Limitations	Undercounting: The census attempts to count every person, but there are always people who are missed due to people not responding to the census or homeless. People are not included in the official count due to errors or omissions.
	Self-Reporting: The Census Bureau relies on self-reporting demographic information, which can lead to inaccuracies.
	Data Lag: The Census is conducted once every ten years, which means the data could become outdated. This makes it potentially difficult to use for planning and policymaking.

DESCRIPTIVE ANALYSIS

FIGURE 1: DATA SPREAD

Summary Statistics	Deaths Grand Total	Population Grand Total	Deaths > 65 Years	Population > 65 Years
Population or Sample	Sample	Sample	Sample	Sample
Mean	1381.3856	5974027.3946	890.1002	806988.9386
Variance	1189312.4863	46344912927448.3000	952319.6231	786799499984.0970
Standard Deviation	1090.5560	6807709.8152	975.8687	887017.1926

FIGURE 2: OUTLIERS

Outlier Identification	Deaths Grand Total	Population Grand Total	Deaths > 65 Years	Population > 65 Years
2 STDDEVS below Mean (LOWER LIMIT)	-799.7264682	-7641392.236	-1061.637083	-967045.4466
2 STDDEVS above Mean (UPPER LIMIT)	3562.49771	19589447.02	2841.837519	2581023.324
Low Outliers	0	0	0	0
High Outliers	19	22	18	29
Total Records	459	459	459	459
Outlier Percentage	4.14%	4.79%	3.92%	6.32%

FIGURE 3: CORRELATION

Variables	Deaths & Population > 65 Years (Vulnerable)	Deaths & Population 25-34 Years (Not Vulnerable)
Proposed Relationship	High Correlation	Low Correlation
Correlation Coefficient	0.94	0.24
Usefulness/Interpretation	Strong correlation between a given state's population over the age of 65 and the amount of influenza deaths of people over the age of 65. This means the data supports a higher rate of mortality of influenza for this age group	This statistic having a low correlation shows that 25-34 are indeed less vulnerable to mortality from influenza

FIGURE 4

t-Test: Two-Sample Assuming Unequal Variances		
	≥ 65 years	< 65 years
Mean	0.00126755	0.00024299
Variance	2.06044E-07	6.17126E-08
Observations	459	459
Hypothesized Mean Difference	0	
df	710	
t Stat	42.42026178	
P(T<=t) one-tail	3.9055E-197	
t Critical one-tail	1.647002601	
P(T<=t) two-tail	7.811E-197	
t Critical two-tail	1.963310818	

RESULTS & INSIGHTS

FIGURE 5

Research Hypothesis:	**If a state has a higher proportion of population in the vulnerable group (people within the age group of 65 and older), then that state will have a higher proportion of mortality due to influenza**
Independent Variable:	Age Group
Dependent Variable:	Influenza Related Deaths
Null Hypothesis:	Influenza Related Deaths in the age group of 65 years and older is ≤ influenza related deaths in the age group of 64 years and younger
Alternative Hypothesis:	Influenza Related Deaths in the age group of 65 years and older is > influenza related deaths in the age group of 64 years and younger
One Tail / Two Tail:	One Tail Test as interest lies only in one direction (if influenza related deaths are higher in the age group of 65 years and older
Alpha:	0.5
P-Value:	3.9055E-197
Significance Level Assessment:	The p-value is less than 0.05. Therefore, rejection of the Null Hypothesis support the Alternative Hypothesis with 95% confidence.

NEXT STEPS

- A comprehensive geographical analysis will be conducted to identify vulnerable populations and high-risk regions for the flu. Additionally, data on vaccine availability by state will be gathered and analyzed to inform recommendations for allocating medical staffing agency resources.
- To communicate progress and decision-making processes, monthly newsletters will be developed featuring visualizations and clear explanations of the methodology used.
- A dynamic report or dashboard using Tableau will also be created to provide stakeholders with real-time updates and insights.
- Findings and recommendations will be presented to stakeholders through a video or verbal presentation, tailored to their specific needs and interests.
- A detailed written report will be produced outlining the methods and analysis for technical experts.

APPENDIX

BUSINESS REQUIREMENTS

- Develop a data-driven logistical plan for deploying medical staffing on a timely basis to areas of need throughout the United States.
- Analyze seasonal flu timelines and variations by state to inform staffing decisions.

- Prioritize and rank states based on vulnerable populations, with a focus on directing medical staffing to areas with the highest need.

GLOSSARY

Influenza, commonly known as the flu, is a contagious respiratory illness caused by influenza viruses that infect the nose, throat, and sometimes the lungs. Influenza viruses are categorized into three types: A, B, and C. Type A viruses are responsible for most seasonal flu epidemics, while type B viruses generally cause less severe illness. Type C viruses cause mild respiratory illness but do not cause epidemics. Influenza is typically characterized by symptoms such as fever, cough, sore throat, body aches, fatigue, and sometimes nausea and vomiting. Influenza can lead to serious complications, particularly in high-risk individuals such as the elderly, young children, pregnant women, and people with underlying health conditions. Vaccination is an effective way to prevent influenza and its complications.

VULNERABLE POPULATIONS

- *Elderly people:* Those aged 65 years and older are at an increased risk of severe illness and death from influenza. This is because their immune system is weaker, and they may have underlying health conditions.
    - *This Project focuses on this specific vulnerable age group as it is the largest vulnerable population and is most at-risk from mortality due to influenza-related illnesses.*
- *Young children:* Children under the age of 5, especially those younger than 2 years old, are also at an increased risk of severe illness from influenza. Their immune systems are still developing, and they may not have had the chance to build up immunity to the virus.
- *Pregnant women:* Pregnant women are more susceptible to influenza and have a higher risk of complications. This is because pregnancy can weaken the immune system and put extra strain on the body.
- *People with chronic health conditions:* People with chronic health conditions such as asthma, diabetes, heart disease, or weakened immune systems are also at an increased risk of severe illness and death from influenza.
- *Indigenous populations:* such as Native Americans and Alaska Natives, are also at an increased risk of severe illness and death from influenza due to higher rates of underlying health conditions and limited access to healthcare.

HYPOTHESIS DEVELOPMENT

FUNNELING QUESTIONS:

- What is the current capacity of healthcare facilities in the target states to handle flu-related illnesses, and how does this compare to previous years?
- What is the current demand for medical staffing agency help in the target states, and how does this vary by region or healthcare setting?
    - Does higher mortality from influenza-related illnesses necessarily mean a state was understaffed in a medical capacity?
- What are the specific skills and expertise needed in the target states to effectively manage the flu season, such as vaccination administration, critical care management, or long-term care support?