Medical Staffing Plan for Flu Season

Mary Kane / Interim Report / 3.1.2025

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INTERIM REPORT

PROJECT OVERVIEW

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

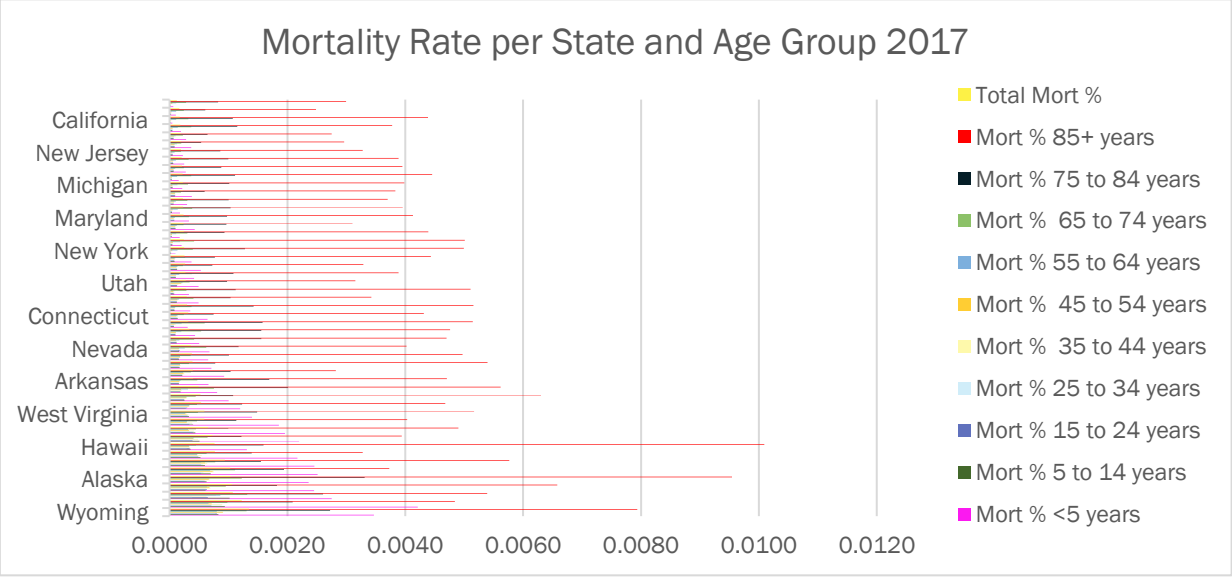
● **Objective**: Determine when to send staff, and how many, to each state.

● **Scope**: The agency covers all hospitals in each of the 50 states of the United States, and the project will plan for the upcoming influenza season.

RESEARCH HYPOTHESIS

If 85+ years old people get the influenza virus, then they will have a higher risk of death than people 84 years of age and younger with influenza.

DATA OVERVIEW



The Influenza deaths by geography data is based on death certificates for U.S. residents and includes 10-year age groups. The cause of Death database contains mortality, and population counts for all U.S. counties from 2009 to 2017.

The Population Data by Geography (US Census) contains the total number of people living in each State and town from 2009 to 2017, including population demographics such as age and gender.

DATA LIMITATIONS

THE INFLUENZA DEATHS BY GEOGRAPHY

- A significant number of death counts have been suppressed to protect the people's identity.
- The death certificates only list one cause of death, which can bring discrepancies within populations with previous health conditions, increasing their vulnerability.

THE POPULATION DATA BY GEOGRAPHY

- Timeliness: Given that the goal is to plan for the upcoming influenza season, having access to the most recent information is essential. We have data from 2009 to 2017.
- Inaccuracies due to manual data collection increase the margin of error.

STAFFING NEEDS FOR THE OLDERLY

The U.S. is projected to experience a shortage of Registered Nurses (RNs), which is expected to intensify as Baby Boomers age and the need for health care grows. Compounding the problem is the fact that nursing schools across the country are struggling to expand their capacity to meet the rising demand for care. The American Association of Colleges of Nursing (AACN) works with schools, policy makers, nursing organizations, and the media to bring attention to this healthcare concern. AACN is leveraging its resources to shape legislation, identify strategies, and form collaborations to address the shortage.

“Changing demographics signal a need for more nurses to care for our aging population.”

The U.S. Census Bureau reported that the number of Americans aged 65 and older is projected to increase from 58 million in 2022 to 82 million by 2050 (23% of the population). With a larger number of older adults, there will be an increased need for geriatric care, including care for individuals with chronic diseases and comorbidities.

DESCRIPTIVE ANALYSIS

Data Spread			
Variable	Flu Deaths 85+	Population 85+	Total Population
Dataset name	Integrated Data set	Integrated Data set	Integrated Data Set
Sample or population	Sample	Sample	Population
Normal distribution	Right-Skew	Right-Skew	Right-Skew
Variance	293,326	14,972,925,984	46,231,613,588,616
Standard Deviation	542	122,364	6,799,383
MEAN	477	107,962	5,973,991
Outlier lower bound	-607	-136,766	-7,624,776
Outlier upper bound	1,560	352,690	19,572,757
Outlier count	18	27	22
Outlier percentage	4%	6%	5%

Correlation		
Variables	Population 85+ and Flu Deaths 85+	Total Population and Total deaths
Proposed relationship	To test the relationship between the population 85+ years and the total deaths on 85+ years.	To test the relationship between the total population and the total deaths due to influenza.
Correlation Coefficient	0.9407	0.9545
Strength of correlation	Strong Positive Correlation	Strong Positive Correlation
Usefulness/ Interpretation	As the population of 85+ years increases, the deaths due to influenza for 85+ years people increase.	As the total population increases, the number of deaths increases, meaning that other age groups are also at risk.

The total flu mortality had a strong positive correlation with the total population, at 0.95. This tells us that although 85+ year olds are at higher risk of mortality, they are not the only vulnerable age group.

RESULTS AND INSIGHTS

Hypothesis:

If people 85+ years old get the influenza virus, they will have a higher risk of death than people 84 years old and younger with the flu.

Null Hypothesis:

Ho: The Flu Death Rate for people 85+ years is less than or equal to the flu death rate for people 84 years and younger.

Alternative Hypothesis:

Hα: The Flu Death Rate for people 85+ years is greater than the flu death rate for people 84 years and younger.

The null hypothesis can be rejected since the inferential analyses present a P-value (2.2158E-229) significantly less than 0.05 (significance level). The alternative hypothesis, "Ha: The Flu Death Rate for people 85+ years is greater than the Flu Death Rate for people 84 years and younger," has been approved. With a 95% confidence, the test supports the initial hypothesis: "If people 85+ years old get the influenza virus, then they will have a higher risk of death than people 84 years old and younger with Flu."

t-Test: Two-Sample Assuming Unequal Variances		
	Mort % <84 years	Mort % 85+ years
Mean	0.000329175	0.004850556
Variance	8.17546E-08	2.47761E-06
Observations	459	459
Hypothesized Mean Difference	0	
df	488	
t Stat	-60.54962962	
P(T<=t) one-tail	2.2158E-229	
t Critical one-tail	1.647982077	
P(T<=t) two-tail	4.4316E-229	
t Critical two-tail	1.96483707	

Summary: The difference in influenza death rates between the 85+ age group and those 84 years and younger is statistically significant, confirming that older individuals are at higher risk of death due to the influenza virus than the rest of the population. That difference suggests a critical need for support for those states with a higher population of 85+ year olds.

After identifying the 5-year-olds and younger group as the group with high vulnerability, a second test was performed between the 85+ years group and the 5-year-olds and younger group, and it was confirmed that the older individuals are at higher risk of death. With a P-value significantly lower than 0.05 (significance level), we can say, "If people 85+ years old get the influenza virus, then they will have a higher risk of death than people 5 years old. And younger with the Flu"

REMAINING ANALYSIS AND NEXT STEPS

- Categorize the vulnerable population by size and age.
- Categorize each state based on its vulnerable population count.
- Perform statistical tests to detect potential gender-specific biases or trends within different age groups.
- Develop visualizations to identify peaks and illustrate influenza spread across different regions over time.
- Identify vaccination policies and care capacity per region.
- Create and deliver a focused presentation to communicate the results effectively and actionable insights to the stakeholders.

APPENDIX

..\..\..\..\OneDrive\2.8 Conducting Statistical Analyses.xlsx
..\..\..\..\OneDrive\2.9. Statistical Hypothesis Test.xlsx

https://www.aacnnursing.org/news-data/fact-sheets/nursing-shortage

https://www.cdc.gov/fluvaxview/coverage-by-season/health-care-personnel-2022-2023.html