

# Temporary Staffing During Influenza Seasons: Interim Report

*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.

*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.

## Hypothesis

If an individual is younger than 5 years or older than 65 years, then those individuals will have a higher risk of death by influenza.

## Data Overview & Limitations

### Influenza Deaths by Geography, Time, Age, and Gender

*Source:* Centers for Disease Control (CDC)

#### Summary:

The National Center for Health Statistics (NCHS) collects death certificate information from each state's statistics office. Influenza deaths are identified using diagnostic death codes which are used to record cause of death. Counts of influenza deaths for each state are from 2009 to 2017. Records with less than ten reported deaths are listed as "suppressed".

#### Limitations:

The privacy policy for this data requires results to be suppressed if there are less than ten deaths reported for a group. This is to be taken into consideration when drawing insights as this may produce some inaccuracies.

Other underlying health issues could also contribute to the cause of death but were not recorded as the cause.

Individual death location may also create inaccuracies because it is possible that some individuals did not die in a healthcare setting where health status is likely to be recorded more frequently and accurately.

Different healthcare institutions might collect and record patient information differently than others. Patient information may have been recorded manually which can produce errors.

## United States Census Population Data by Geography

*Source:* U.S. Census Bureau

### Summary:

Population counts for each state and county from 2009 to 2017. Total population, male/female total populations, and populations by five-year age group are recorded.

### Limitations:

There is a time delay for the availability of this data. The U.S. Census Bureau releases the national and state total population estimates in December of each year. Population estimates for the nation, states, and counties by demographic characteristics are released the following summer.

## Counts of Influenza Visits by State

*Source:* Fluview owned by the World Health Organization (WHO) Collaborating Laboratories System, CDC's National Respiratory and Enteric Virus Surveillance System (NREVSS), and the U.S. Outpatient Influenza-like Illness Surveillance Network (ILINet)

### Summary:

Influenza-like illnesses (ILI), number of providers, and total patients are recorded weekly for each state, including District of Columbia, from 2010 to 2019. An unweighted percentage for influenza-like illnesses is recorded for each state and year.

### Limitations:

100 public health and over 300 clinical laboratories participate in the surveys, but this may not cover all clinics that test for influenza.

Influenza testing practices differ between different laboratories. Clinical testing provides diagnoses, timing and intensity of the flu. Public testing uses previously confirmed positive samples and are interested in virus types, subtypes, lineages, and ages of people infected.

ILI visits only capture respiratory-related visits with symptoms of fever plus cough or sore throat. This may over represent the number of influenza visits.

There is no data present for the state of Florida in this data set.

## Descriptive Analysis

	Average	Standard Deviation
Influenza Deaths	277 deaths	404 deaths
Population	268996 people	358380 people
Influenza-like Illnesses	271 patients	555 patients

The amount of influenza patients had a strong correlation (0.5) with state population size, meaning that states with larger populations tend to have more influenza patients.

The number of influenza deaths had a moderate correlation (0.38) with age groups 65 and older. Age groups 65 years or older tend to experience more influenza deaths.

## Results & Insights

**Null:** There is no significant difference between age groups and number of influenza deaths.

**Alternative:** Age groups 65 and older experience significantly more influenza deaths than younger age groups.

At an alpha of 0.05, or confidence level of 95 percent, there's a significant difference in the age of the population and the number of influenza deaths reported. As age changes, the number of deaths due to influenza also changes significantly.

**Null:** There is no significant difference in the number of influenza patients and number of providers.

**Hypothesis:** The number of influenza patients decrease as the number of providers increase.

At an alpha of 0.05, or confidence level of 95 percent, there's a significant difference in the number of providers available and the number of influenza patients.

## Remaining Analysis & Next Steps

These statistically significant results will need to be explored further prior to making final conclusions. The next steps will be:

- Create visualizations illustrating the following relationships:
  - As age changes, the number of influenza deaths change.
  - As the number of providers change, the number of patients with influenza-like symptoms change.
- Repeating analysis to explore correlation between number of providers and state population to determine if some states have access to more providers than others.
  - If a correlation is found, create a visualization illustrating relationship.
- Determine vulnerable populations based on age groups, areas with historically low number of healthcare providers and proportionally high number of influenza patients.
  - This information will be presented to stakeholders to make decisions regarding temporary medical staffing placement across the United States during future influenza seasons.

# Appendix

## Hypothesis Development

*What populations are considered the most vulnerable?*

Pregnant women, children under 59 months, the elderly, individuals with chronic medical conditions, individuals with immunosuppressive conditions, and health care workers.

*What is considered a “serious complication” and how is that documented and recorded?*

Severe coughs caused by lower respiratory tract infections can cause serious illness or death. Individuals who are suspected to be infected with influenza are clinically tested using samples from the nose or throat. Hospital staff monitor and record patient symptoms and can link these records to patients confirmed to be infected with influenza.

Source: [Influenza \(Seasonal\)](#)

*What characteristics makes these populations the most vulnerable?*

These populations are most susceptible to disease due to lower socioeconomic status, poor health status, lack of transportation, inability to communicate independently (non-English speakers, disabilities, etc.), limited access to medical care, health beliefs, population location (rural vs. metropolitan), or require a caregiver.

Source: [Protecting Vulnerable Populations From Pandemic Influenza in the United States: A Strategic Imperative](#)

*Do all high-risk populations experience high cases of influenza each year?*

High-risk populations experience cases of influenza each year due to changes in immunity with increasing age, and the presence of underlying medical conditions, including pregnancy.

Source: [People at Higher Risk of Flu Complications](#)

*Does the geographic location of vulnerable populations affect the number of influenza cases?*

Each year each state reports different levels of reported influenza cases. Some states may have larger populations that are considered high-risk. Varying influenza rates may also be due to differences in population density, access to healthcare resources such as health clinics and vaccinations, and economic conditions of the residing population.

Source: [National, Regional, and State Level Outpatient Illness and Viral Surveillance](#)

## Data Overview

Influenza deaths by geography, time, age, and gender

Variables	Description
State	Location of reported influenza death
Year	Year of reported influenza death
Month	Month of reported influenza death
Ten-Year Age Groups	Age group of deceased
Deaths	Count of reported deaths in each state by month and year

	Year	Deaths
minimum	2009	0
maximum	2017	512
mean	2013	6

Population data by geography

Variables	Description
County	County of residence
Year	Census year
Total population	Total county population
Male Total population	Total county male population
Female Total population	Total county female population
Age Groups	Age group of individuals in each county in 5-year increments

	Year	Total Population	65 to 69 years	70 to 74 years	75 to 79 years	80 to 84 years	85 years and over
minimum	2009	41	0	0	0	0	0
maximum	2017	10105722	415243	295420	215181	161647	177493
mean	2013	107854	4592	3427	2625	2000	1950

### Counts of influenza visits by state

Variables	Description
Region	State name
Year	Year of reported ILI
Week	Week number of reported ILI
% Unweighted ILI	Ratio of ILI patients to total patients
ILI total	Total reports of ILI
Number of Providers	Reported number of healthcare providers
Total Patients	Total patient visits

	Year	Week	Unweighted ILI	ILI Total	Number of Providers	Total Patients
minimum	2010	1	0%	0	0	0
maximum	2019	53	19%	11452	214	121837
mean	2015	26	2%	298	33	14483