Preparing for Influenza Season in the U.S.

Project Description

Every year, the U.S. experience a season when more people than usual get the flu, especially among the vulnerable population. This causes a surge in patients at hospitals and clinics across the 50 states.

I worked with a medical staffing agency, that provides temporary healthcare professionals to the hospitals and clinics, to examine influenza trends and maximize their staffing plan.

The flu season staffing project was critical to ensuring that hospitals and clinics were able to provide timely and effective care (nurses, physician assistants, and doctors) to patients during a time of increased demand.

Lexicon

Influenza a contagious viral infection, often causing fever and aches.

Vulnerable populations patients likely to develop flu complications requiring additional care, as identified by the Centers for Disease Control and Prevention (CDC). These include adults over 65 years, children under 5 years, and pregnant women, as well as individuals with HIV/AIDs, cancer, heart disease, stroke, diabetes, asthma, and children with neurological disorders.

Data sets

Population data by geography

The data contains the total US population count divided by county, year of collection, gender (M/F) and age (divided in 5 year age groups).
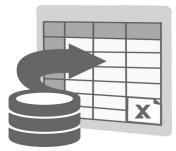
The census information is relevant to my project to determine which states have a predominantly vulnerable population.

Influenza Deaths

The data contains monthly death counts for influenza-related deaths in the United States from 2009 to 2017. Counts are broken into two categories: state and age.

The historical influenza data can be used to predict future influenza seasons for planning purposes.
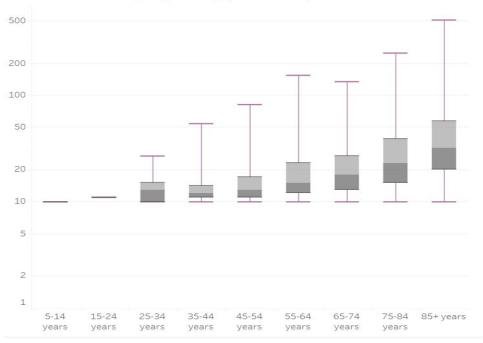
Used Analytical Methods

1. Exploratory Data Analysis to analyze historical data and understand trends in flu season staffing needs and population volumes.
2. Statistical Analysis to quantify relationships between the variables, such as the correlation between flu deaths in different regions and age group.
3. Spatial Analysis to identify geographical hot spots of high flu activity. This information can be used to target staffing resources more effectively to areas with the greatest need.
4. Time Series Charts to visualize trends in flu-related deaths and population volumes over time.
5. Dashboards on Tableau to create interactive dashboards to present key data insights and staffing recommendations to stakeholders.

EDA

On a first look at our data on a chart, we can see that flu-related deaths increase as age increases.

The age groups over 65 years comprise 91% of total deaths on average across the years!
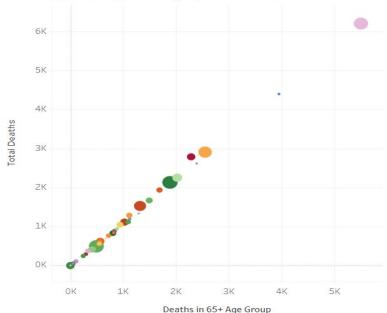
Influenza Deaths by Age Group (2009-2017)

Statistical Analysis

Identifying variables for a correlation

Correlation between Total Flu Deaths and Flu Deaths in 65+ Age Group by US State in 2017

I calculated a correlation of 1 between the '***Total Flu Deaths***' and '***Deaths among 65+ Age Group***' variables, indicating a **strong positive relationship** between the two variables.

The historical data showed that the highest flu-related deaths were among the senior population.

Hypothesis testing

I then conducted a hypothesis testing and statistically proven that **flu deaths among 65+ age group is indeed higher than in other age groups**, as we rejected the hypothesis that stated the opposite (Deaths in 65+ Age Groups are less than Deaths in 0-64 Age groups).

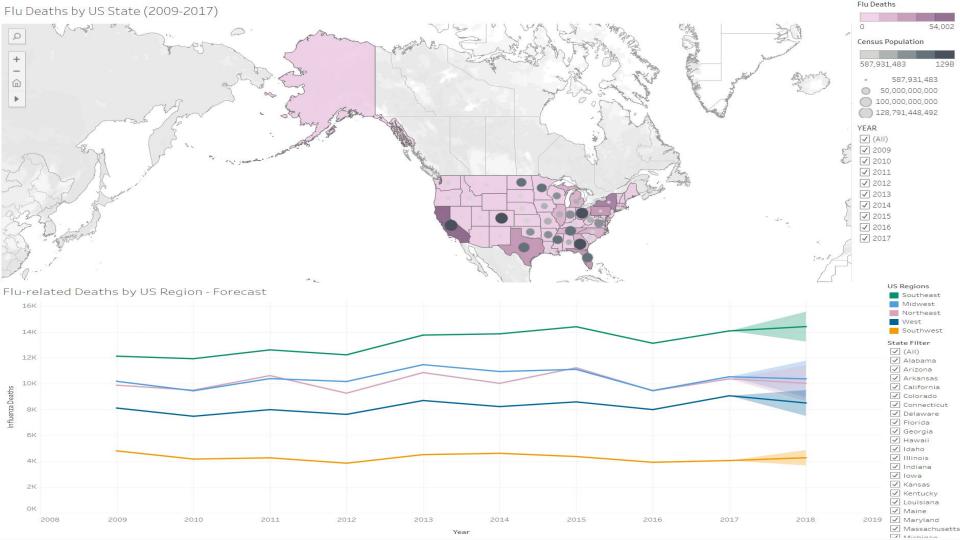|	
Dependent variable	Deaths in 65+ Age Group
Independent variable	Deaths in 0-64 Age Group
Null Hyphotesis	Deaths in 65+ Age Group are < than Deaths in 0-64 Age groups.
Alternative Hyphotesis	Deaths in 65+ Age Group are > than Deaths in 0-64 Age groups.
One- or Two- Tailed Test	One-Tailed Test as I'm only interested in one direction: if the sample mean is lower or higher than population mean
Aplha	standard: 0,05
p value / significance level	4,95504485446727E-45 rounded to 4,96% which is lower that 5% significance level (). Null hypothesis is rejected.

Spatial Analysis

We assessed that if a state has a predominantly older population, then influenza deaths are more frequent during peak season. _So which states have the biggest population over 65?_

The staffing agency has a limited number of medical personnel, therefore it's pivotal to identify the states most in need. I conducted a spatial analysis and visualised the variables on a combination map and on a line chart filtered by U.S. regions (see next slide)

Insights

- California, New York and Florida have been the top states with recorded flu-related deaths between 2009-2017.
- Alaska reported zero deaths in all years.
- On average, the Midwest has low records.

Flu Deaths by US State (2009-2017)

Flu Deaths

0 — 54,002

Census Population

587,931,483 — 129B

587,931,483
50,000,000,000
100,000,000,000
128,791,448,492

YEAR
- ☑ (All)
- ☑ 2009
- ☑ 2010
- ☑ 2011
- ☑ 2012
- ☑ 2013
- ☑ 2014
- ☑ 2015
- ☑ 2016
- ☑ 2017

Flu-related Deaths by US Region - Forecast

US Regions
- Southeast
- Midwest
- Northeast
- West
- Southwest

State Filter
- ☑ (All)
- ☑ Alabama
- ☑ Arizona
- ☑ Arkansas
- ☑ California
- ☑ Colorado
- ☑ Connecticut
- ☑ Delaware
- ☑ Florida
- ☑ Georgia
- ☑ Hawaii
- ☑ Idaho
- ☑ Illinois
- ☑ Indiana
- ☑ Iowa
- ☑ Kansas
- ☑ Kentucky
- ☑ Louisiana
- ☑ Maine
- ☑ Maryland
- ☑ Massachusetts
- ☑ Michigan

Conclusions

➢ Vulnerable populations suffer the most-severe impacts from the flu and are the most likely to die.

➢ Prioritize states with large vulnerable populations. In my final report I identified the top 10 US states that have recorded the highest flu-related deaths among the seniors, however further data is needed to identify a better staff-patient ratio.

➢ Continue tracking staffing data (absenteeism, demand, patients death) that will help us understand if the hospitals and clinics we cater to face over/under staffing issues.

You can watch my full presentation on Youtube.