Unveiling The Dynamics of Covid-19-Examination of Testing, Vaccination and Travel Patterns

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Executive Summary

Our project's main goal is to obtain a thorough knowledge of the pandemic's effects in the counties of Los Angeles and San Francisco by using COVID-19 data visualization. Through an examination of annual case reports, hospital admissions, and date-specific occurrences of new cases, fatalities, and tests we aim to provide inclusive insights into the local severity and spread of the virus.

Furthermore, we examine passenger flow at Los Angeles International Airport (LAX) and San Francisco International Airport (SFO) during three key periods: prior to, during, and following the COVID-19 pandemic. We aim to understand how travel patterns have changed throughout the pandemic and correlate these changes with the virus's spread by visualizing the influence of COVID-19 on monthly passenger traffic at SFO.

Our study intends to provide useful insights into the complex effects of COVID-19 by fusing data visualization tools with thorough analysis. This will allow stakeholders to decide on the best course of action for managing the pandemic and promoting recovery in both counties.

Introduction

The COVID-19 pandemic has sparked a global crisis, impacting communities, healthcare systems, and economies worldwide. In the face of this unprecedented challenge, it has become imperative to understand the dynamics of the virus's spread, the efficacy of mitigation measures, and the factors influencing decision-making at various levels of society. In response to this need, our project, titled "Unveiling the Dynamics of COVID-19: Examination of Testing, Vaccination, and Travel Patterns," seeks to comprehensively analyze archived data from two major urban centers, Los Angeles, and San Francisco.

Despite increased testing and vaccination in LA County from 2020 to 2022, COVID-19 cases persist, prompting a review of vaccine impact and other contributing factors.

The consistent positive cases of COVID-19 in LA County over three years, despite vaccination efforts, highlight the need to evaluate ongoing pandemic response strategies. The effect of the pandemic towards the different age grouped people in Florida is compared with other health conditions like pneumonia and Influenza is compared with the covid cause deaths.

An analysis of COVID-19 cases by state and the identification of any seasonal variations are aided by the US States dataset. Additionally, by anticipating an increase in cases, it helps with proper action.

Moreover, our initiative aims to assess the significant influence of the pandemic on healthcare systems, infrastructure, and society behavior, going beyond just identifying patterns. We hope to offer important insights into the complex dynamics of the COVID-19 pandemic by evaluating the burden on healthcare resources, the effectiveness of testing and immunization programs, and the impact of numerous decision-making factors on travel patterns, public health regulations, and individual behaviors.

Ultimately, our research endeavors to contribute to the collective understanding of COVID-19 dynamics, aiding policymakers, healthcare professionals, and the public in making informed decisions and formulating effective strategies to combat the pandemic. Through rigorous analysis and interpretation of data, we aspire to pave the way for a more resilient and prepared response to future public health challenges.

Data Sets

This study's core components are based on 4 different datasets.

The Florida State Dataset consists of 3079 Data entries of Age groups with the Deaths due to Covid and other Health illness cased deaths i.e., Pneumonia and Influenza as a comparison from 2020 to 2023.

There are about 34690 records for the LA County Covid Cases, including covid testing and pandemic recovery data from 2020 to 2023.

There are about 7936 records in the San Francisco dataset and 2210 records in the Los Angeles dataset about their Passenger counts after taking the required data by data cleaning from 2018 to 2023.

The US States Dataset by The New York Times contains nearly 60,000 entries of the COVID cases recorded in every state in the US for each date from 2019 to 2021.

Data Description

Florida State Dataset:

This dataset comprises 3,079 entries detailing various age groups and corresponding deaths attributed to COVID-19, pneumonia, and influenza from 2020 to 2023. It serves as a comparative analysis to understand the impact of COVID-19 on different age demographics in Florida.

LA County Covid Cases Dataset:

The dataset encompasses COVID-19 cases, testing data, and pandemic recovery information specific to Los Angeles County. Spanning from 2020 to 2023, it provides insights into the trends and dynamics of the pandemic within the region.

San Francisco Passenger Counts Dataset:

This dataset focuses on passenger counts at San Francisco International Airport. Additionally, there are 2,210 records for passenger counts at Los Angeles International Airport. These datasets, spanning from 2018 to 2023, offer valuable insights into air travel patterns and the impact of the pandemic on airport activity.

US States Dataset by The New York Times:

This extensive dataset contains nearly 60,000 entries documenting COVID-19 cases recorded in every state across the United States. Covering data from 2019 to 2021, it provides a comprehensive overview of the pandemic's spread and impact on a national scale, facilitating comparative analyses and trend identification.

Data Cleaning

To improve the quality of the dataset for insightful analysis, data cleaning is an essential step in the US Adult COVID-19 Impact Survey research. Python and MS Excel are the data cleansing tools we will be using for visualization as they have widely used open-source data manipulation and analysis libraries that provide powerful tools for cleaning, transforming, and analyzing tabular data. We will use Python for calculations and creation of custom data frames because it allows us to export Excel files for use in tableau visualization. Excel can be used to make sure the dataset is accurate and ready for visualization by identifying and eliminating duplicate entries, fixing formatting errors, and filling in missing values.

Insights and Findings

Forming and analyzing several hypotheses is the central focus of this endeavor. These theories cover a wide range of subjects, such as the investigation of gender-specific COVID-19 symptoms, inclinations over working or studying remotely, and how age affects attendance preferences. Data visualizations produced using Tableau and Microsoft Excel are integrated into the presentation of findings to strengthen it. The detailed insights acquired from the data are greatly enhanced using these visual aids, which take the form of charts and graphs.

Hypothesis 1

Throughout the pandemic in Florida, Individuals aged 75 to 84 and older are more vulnerable to fatalities from COVID and related infections, a trend that can be linked to the decline in immune function and other health complications commonly associated with advanced age.

From the findings we observe that the people aged from age groups 75 and above are affected more due to covid and other immune functions regardless of the other age groups. The age groups below 18 and others are affected the least when compared to the other age groups.
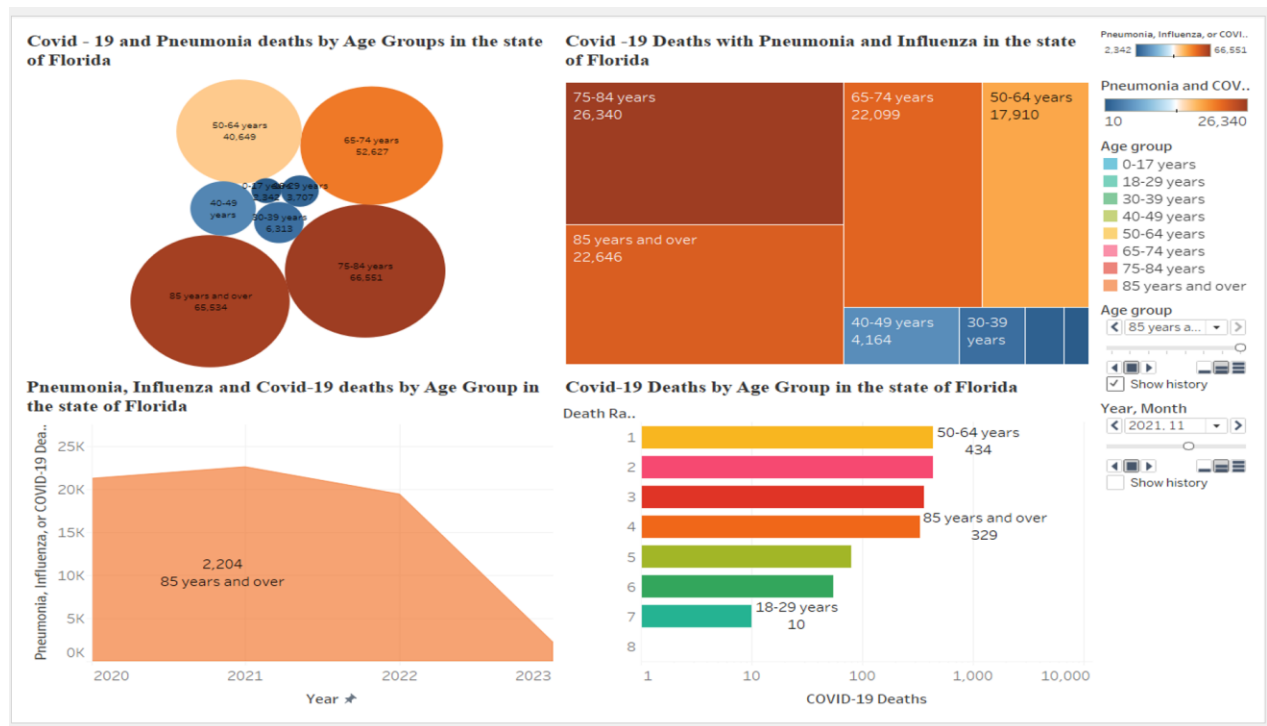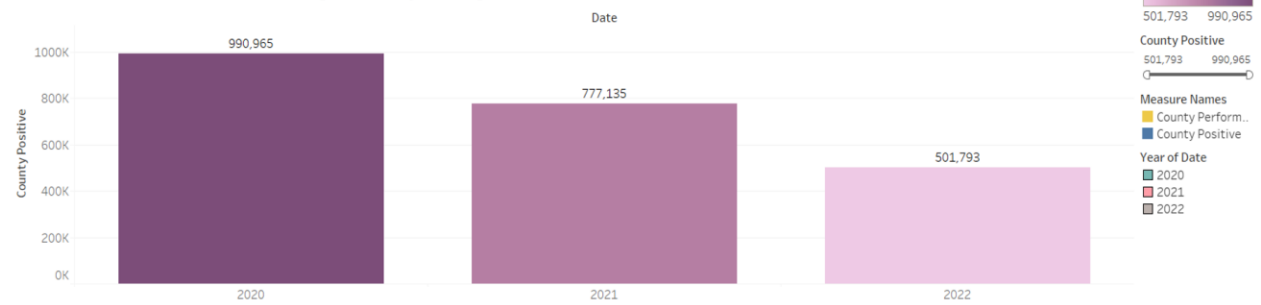

Hypothesis 2

In December 2020, LA counties conducted 11,094,477 daily tests, identifying 990,965 positive cases. In December 2021, 21,085,395 daily tests were conducted with 777,135 positive cases, despite ongoing vaccination. Similarly, in December 2022 daily test counting was 8,140,589 with a decline of 501,793 positive cases. This prompts the exploration of vaccine efficacy and potential factors contributing to sustained positivity rates.

Despite increased testing and vaccination in LA County from 2020 to 2022, COVID-19 cases persist, prompting a review of vaccine impact and other contributing factors."

"The consistent positive cases of COVID-19 in LA County over three years, despite vaccination efforts, highlight the need to evaluate ongoing pandemic response strategies.
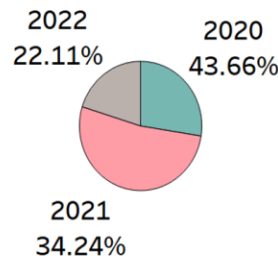
Positive COVID Cases in LA County with respect to years.

Year wise records of Positive Cases from 2020-2022
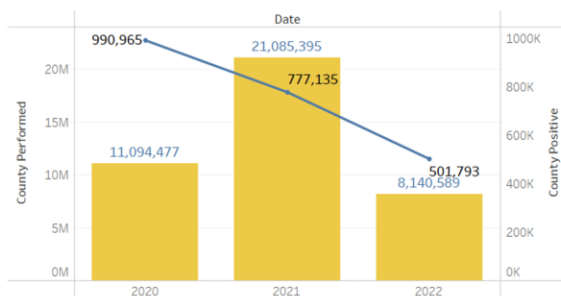
Positive Cases % rate with respect to Years

Hypothesis 3

Throughout the pandemic in the United States, higher mortality rates were recorded, suggesting a seasonal pattern in COVID-19 deaths, with higher rates observed in colder months (November-March) relative to warmer months (April - October).

Seasonal Variation: The data shows a distinct seasonal trend in the number of deaths, with a peak in the winter and a decrease in the summer. Both the bar graph and the line graph, which display greater death rates in the winter and lower rates in the spring and summer, clearly illustrate this trend.

• Winter Peaks: The graphic representations draw attention to the notable rise in fatalities that occurs in the winter, especially in November and December. There is a clear seasonal influence on mortality, as seen by the larger and darker blocks in both the bar graph and the treemap, which correspond to greater death rates during these colder months.

• Seasonal Contrast: Using larger, darker blocks for cold months like February and December and smaller, lighter blocks for warmer months like June and April, the treemap effectively contrasts the mortality rates by season. This demonstrates the striking disparity in mortality rates between the winter and the summer.
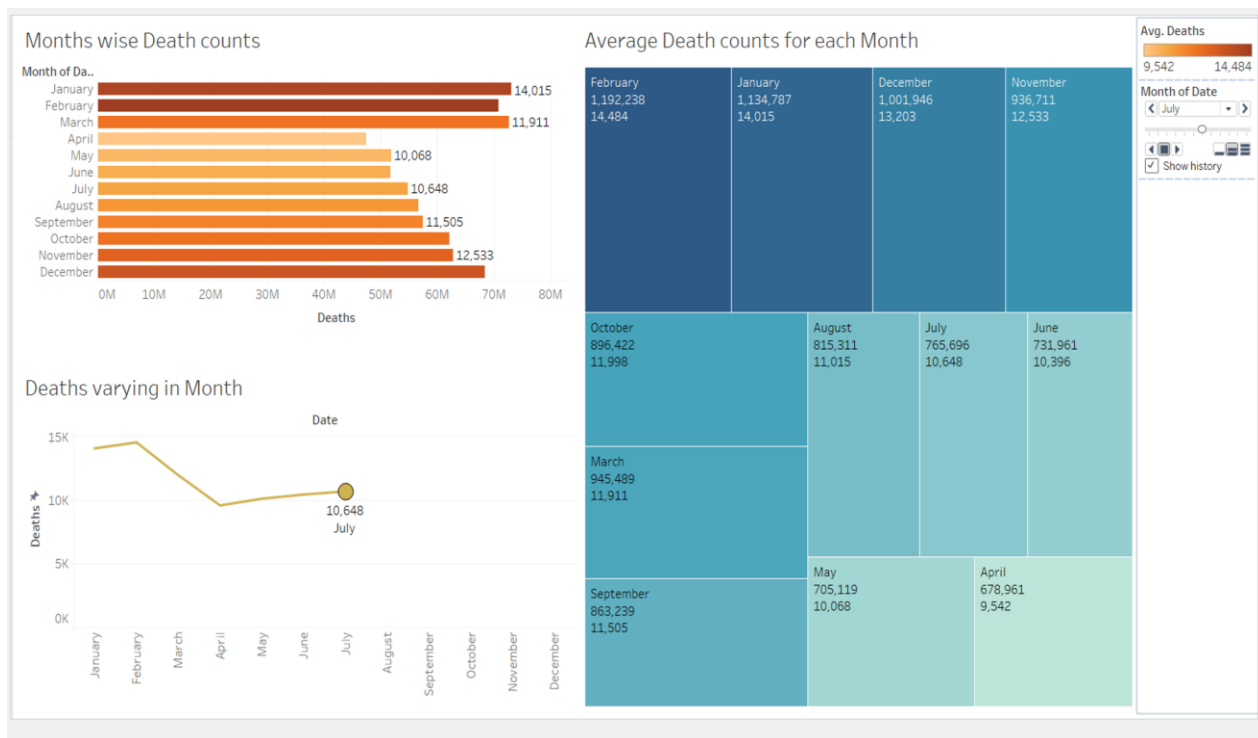
Hypothesis 4

Similar passenger traffic patterns are expected between San Francisco International Airport (SFO) and Los Angeles International Airport (LAX). The anticipation is for LAX to consistently show higher overall passenger counts, with domestic flights outweighing international flights across pre-COVID (Jan 2018-Dec 2019), pandemic (Jan 2020-Dec 2021), and post-pandemic (Jan 2022-Dec 2022) periods. Findings from these are:

* Sharp decline in passenger counts at San Francisco Airport in 2020 during the COVID-19 pandemic.

  * Gradual recovery observed post-2021, indicating a rebound in passenger numbers.

  * Domestic passenger counts consistently outweigh international passenger counts at both San Francisco and Los Angeles airports.

  * Identical trend patterns observed between San Francisco and Los Angeles airports, with comparable increases and decreases in passenger counts.

  * Los Angeles International Airport (LAX) registers higher passenger volumes compared to San Francisco International Airport (SFO).
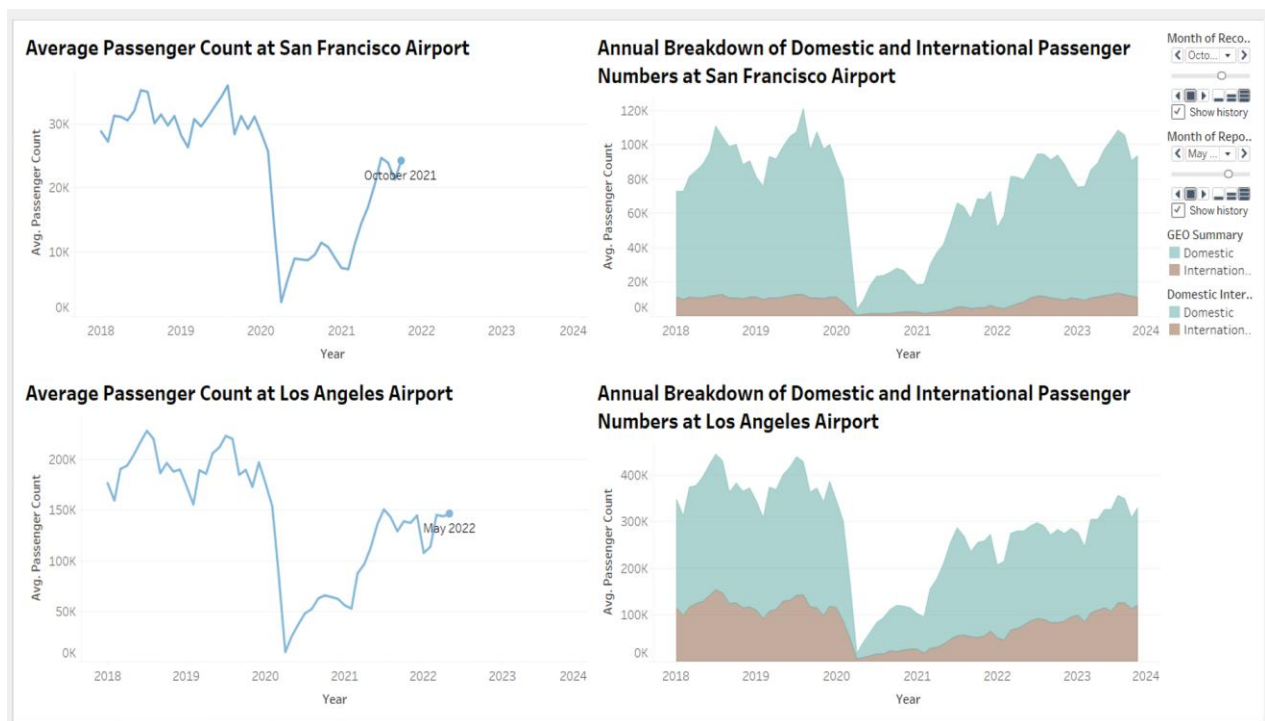
Hypothesis 5:

The monthly passenger flow at San Francisco International Airport was significantly affected by COVID-19, leading to a 50% reduction during the pandemic (January 2020 to December 2021). A subsequent recovery in passenger numbers is anticipated post-pandemic (January 2022 to December 2022), aligning with the levels observed in the pre-COVID period (January 2018 to December 2019).

San Francisco International Airport experienced a sharp decline in monthly passenger flow by 50% during the COVID-19 pandemic from January 2020 to December 2021. However, a recovery in passenger numbers is expected post-pandemic, aligning with pre-COVID levels observed from January 2018 to December 2019. This journey reflects resilience amidst adversity, with SFO poised to welcome travelers back with open arms.
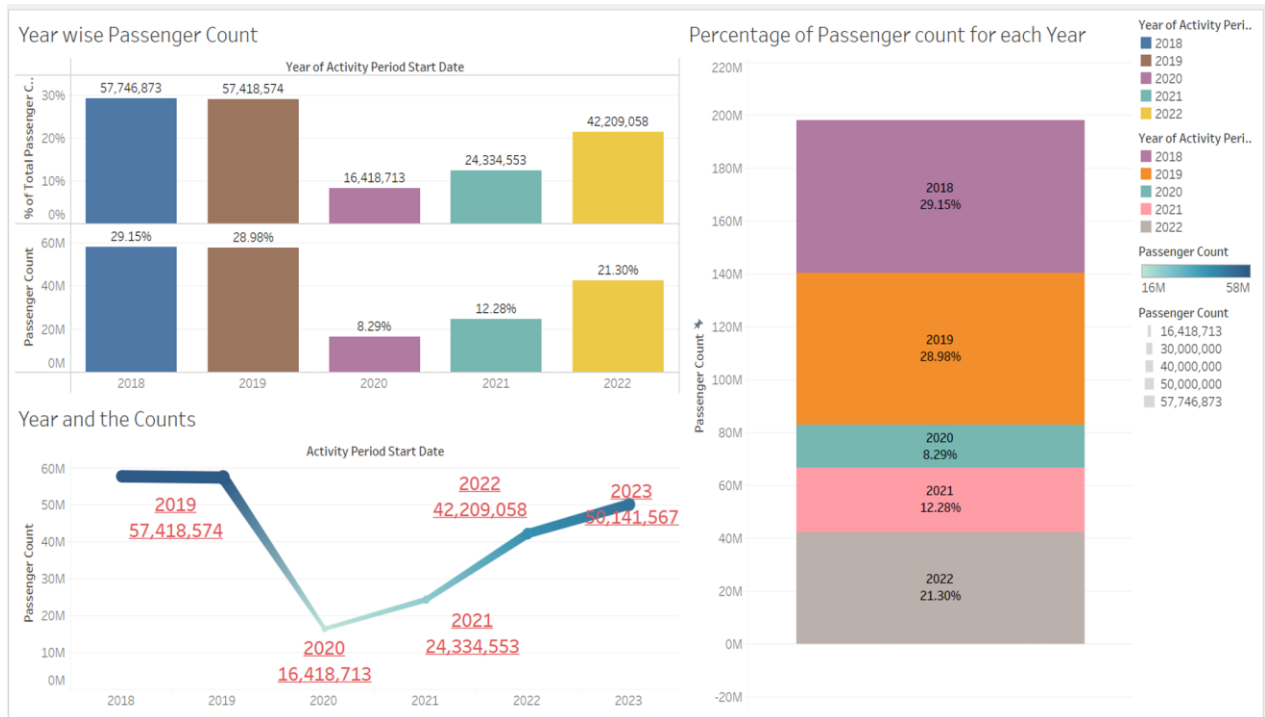
Conclusion

Analyzing the datasets reveals several noteworthy findings regarding the impact of the COVID-19 pandemic on various aspects:

Age and Vulnerability: The data suggests a clear vulnerability among older age groups, particularly those aged 75 and above, to COVID-19 fatalities and related infections. This vulnerability can be attributed to age-related health complications and a decline in immune function.

Testing and Positivity Rates: Despite increased testing efforts and vaccination campaigns, the data indicates sustained positivity rates over time. This prompts further exploration into vaccine efficacy and other factors contributing to the persistence of positive cases.

Seasonal Patterns: A seasonal pattern emerges in COVID-19 mortality rates, with higher rates recorded during colder months compared to warmer months. This highlights the need for targeted interventions during specific times of the year to mitigate the impact of the virus.

Airport Traffic and Recovery: Analysis of passenger traffic at San Francisco International Airport reveals a significant reduction during the pandemic period, followed by an anticipated recovery post-pandemic. Despite this, Los Angeles International Airport consistently shows higher passenger counts, particularly in domestic flights.

These findings underscore the multifaceted nature of the pandemic's impact and emphasize the importance of tailored interventions and ongoing monitoring to effectively manage and mitigate its effects.