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## **The Different Factors Contributing to Flu Vaccine Results**

### **Abstract**

Influenza otherwise known as the flu, is a highly contagious sickness and an important health concern. The flu vaccine is an essential public health need that helps prevent the spread of the flu within communities. However, vaccination rates can vary across the different populated areas we looked at, potentially because of demographic factors. This project will examine flu vaccination trends by ethnicity, age group, and borough, using data representations, such as pie charts, bar graphs, line plot, e.t.c. The results indicate clear differences in the amount of vaccinations among ethnic groups, higher vaccination rates among younger children, and differences among the boroughs from 2022-2024. Understanding these patterns and trends can help identify certain populations that have less vaccinations, and make it known which areas need improved public health strategies.

### **Introduction**

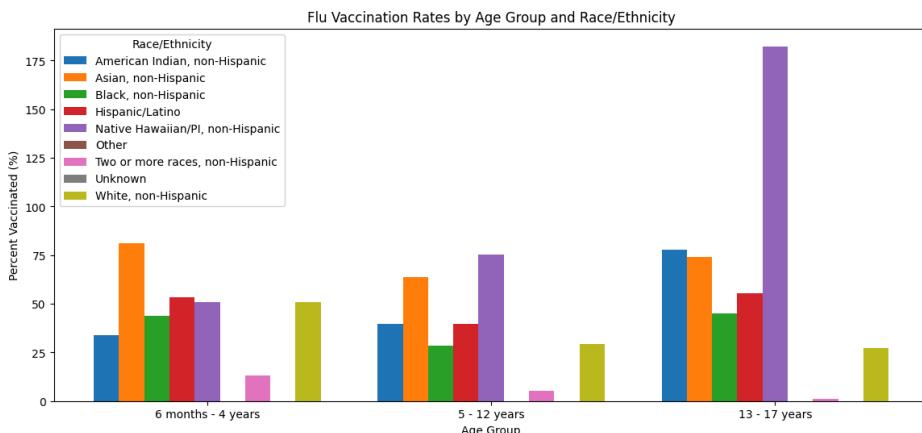
As we know, the flu remains a significant health issue, and a vaccination is one of the most effective methods to prevent the spread of the virus and protect yourself and others. Despite the availability of the vaccines. The rates of them aren't evenly distributed among all the areas and populations. Shown throughout the figures, there will be differences among age, ethnicity, and location. Studying these variations is important because it will identify discrepancies that can possibly increase the risk of illness in certain populations. By examining these patterns and data, our analysis aims to identify potential gaps in the distribution of the flu vaccine and emphasize areas that need their health efforts to be strengthened.

### **Methods**

Population data for the study were obtained from publicly available datasets and analyzed using Google Colab with Python. The libraries used were pandas for data manipulation and matplotlib for data visualization. The dataset included information on age groups, ethnicities, and borough population statistics. Data visualization techniques were used to summarize and compare demographic patterns. The data was cleaned and preprocessing involved selecting columns, handling missing values and calculating percentage, if necessary.

A pie chart was used to demonstrate comparisons between populations across different demographics. Percent values were calculated from the total population count and each category's contribution to the whole chart was illustrated to highlight the relative proportions. We used matplotlib.pyplot to develop the pie chart. A bar chart was also used to compare population counts within different age groups and ethnicities. Using pandas, relevant variables were grouped and the population total was calculated for each category. The group values were then visualized to emphasize differences between demographic groups.

A line plot was generated to examine trends in population data across different categories or time-related variables. The data was sorted for plotting, allowing changes and patterns to be seen across different groups or years. All visualizations were generated using matplotlib, with labeled axes and titles to improve clarity and interpretation. Legends were also added if necessary. NumPy was used to support numerical operations and array-based calculations required for data analysis and visualization.



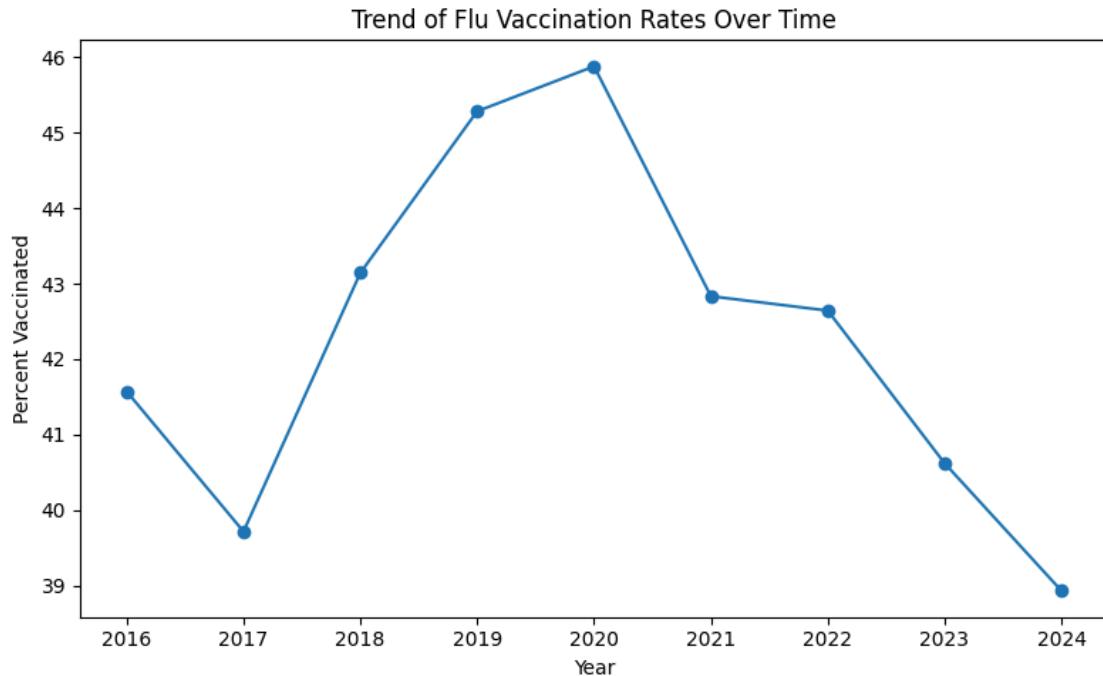
## **Results:**

*Figure 1. Flu vaccination rates across different age groups categorized by race and ethnicity. The bar chart compares vaccination coverage between many ethnic/racial populations with each age group.*

The bar chart shows flu vaccination rates across three age groups broken down by race and ethnicity. Vaccine rates vary among ages and race/ethnicity. Among the youngest age group (6 months - 4 years), Asians, non-Hispanics have the highest vaccine rate, while on the other hand, children with unknown and others have the lowest vaccine rate. In the 5 - 12 years old age group, Native Hawaiian/PI and Asian, non-Hispanic populations had the highest vaccine rate coverage among the rest of the groups.

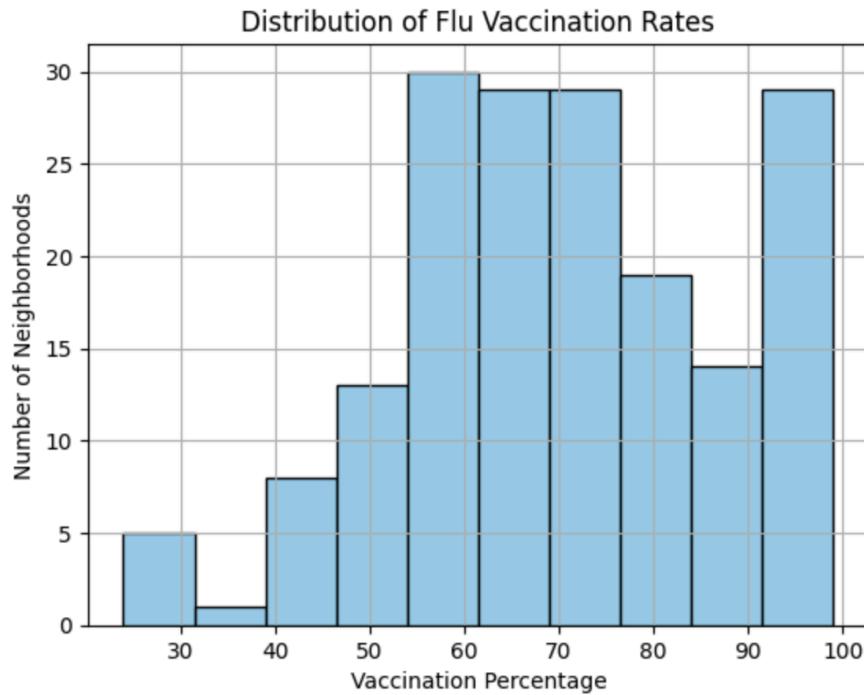
In the adolescents (13-17 years) group , Native Hawaiian/PI, non hispanics had the highest vaccination rates by a large amount. On the other hand, two or more non-Hispanics and unknown had the lowest rates. Overall, the chart highlights the differences in flu vaccination

coverage across age and race/ethnicity. This indicates disparities in immunization patterns among different demographic groups.



*Figure 2-Percentage of populations receiving flu vaccinations from 2016 to 2024. The line plot illustrates an increase in immunization rates in 2020. It is followed by a consistent decrease until 2024.*

In Figure 2, There was a decrease from 2016 to 2017 followed by a sharp increasing trend. The rates increased to their maximum value of 46% in 2020 . After 2020, there was a steep decline in vaccination uptake. In 2021, the rate decreased from 46% to 43% and continued to decrease until it reached the lowest point of 39% in 2024. Overall, the data shows that even though flu vaccine uptake was increasing leading up to 2020, those gains have reversed and have decreased below the vaccine rates in 2016.



*Figure 3. Flu vaccine rates among various neighborhoods. This histogram shows that a large amount of neighborhoods achieve between 55% to 80% vaccination coverage. The second peak of the neighborhood reached 100% coverage.*

The distribution analysis shows variability in vaccination success across different neighborhoods. The majority of the neighborhoods fall within 55% to 80% vaccine range. The highest vaccine percentage is 55 - 62% with approximately 30 neighborhoods. About 28 neighborhoods achieved about 92% to 100% of vaccination rates. On the other hand, the very few neighborhoods reported rates below 40%. The lowest frequency was between 32% to 48% range.

## **Discussion**

The results of research show distinct trends in the uptake of flu shots among various demographic regions of New York City. There is an uneven distribution of vaccination rates among populations, as shown by the pie chart that illustrates the percentages of the flu vaccinations by race and ethnicity. Certain racial and ethnic groups seem to have higher vaccination rates than others, indicating the existence of inequalities that could be impacted by things like socioeconomic level, exposure to public health outreach, access to healthcare, and trust in medical systems. These differences highlight the need for culturally relevant immunization programs that tackle the unique issues and obstacles encountered by under-vaccinated populations.

Younger age groups, especially children, typically have greater vaccination counts than older age groups, according to the bar plot showing the plot received by each age group. Parental

engagement in healthcare visits, pediatric healthcare visits, and school-based immunization requirements could all account for this tendency. On the other hand, lower vaccination rates in older adults or adolescents may be due to vaccine hesitancy, decreased healthcare utilization, or a lower perceived risk of influenza. These results imply that increasing flu vaccination knowledge and accessibility for older age groups may require more focus in public health strategies.

Overall, these results lend support to the hypothesis that a mix of regional and demographic factors, rather than just one, affects the uptake of flu vaccinations. Although this study offers insightful information, it is restricted by the use of gathered data, which leaves out individual-level characteristics like education, insurance status, or personal values. To further understand the underlying reasons of vaccination inequities, future research may benefit from including more variables.

## **Conclusion**

In summary, this study shows that racial and ethnic groups, age groups, and boroughs in New York City have substantially different flu vaccination rates. The findings indicate that vaccination rates are greater in younger people and some geographic locations, but differences still exist between particular boroughs and demographic groups. These trends demonstrate the ongoing need for focused public health initiatives that enhance vaccine access, education, and confidence in populations with low vaccination rates.

This study demonstrates how data analysis can be used to find significant trends can be used to find significant trends in vaccination behavior by utilizing Python tools like Pandas and Matplotlib to examine actual public health information. The results highlight how public health campaigns and government participation influence vaccine uptake. Reducing the health burden associated with influenza outbreaks in New York City and increasing general flu vaccine coverage could be achieved by addressing the inconsistencies found in this research.

## **References**

- <https://github.com/nychealth/covid-vaccine-data/blob/main/people/Readme.md>
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- <https://www.nyc.gov/site/doh/about/press/pr2025/nyc-health-department-launches-childhood-vaccination-data-explorer.page>
- 
- [https://github.com/nychealth/immunization-data/blob/main/demo/Main\\_Routine\\_Vaccine\\_Demo.csv](https://github.com/nychealth/immunization-data/blob/main/demo/Main_Routine_Vaccine_Demo.csv)
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- [https://github.com/nychealth/immunization-data/blob/main/visualizations/4313314\\_geo\\_24\\_35mo\\_2022\\_Q2.csv](https://github.com/nychealth/immunization-data/blob/main/visualizations/4313314_geo_24_35mo_2022_Q2.csv)