Factors on Receiving the Flu Vaccine

Abstract

This paper analyzes some of the factors behind why people choose, or not, to receive the seasonal influenza vaccine. While the analysis, using ANOVA, Chi-Squared, and regression, ended up revealing that all the studied variables were statistically significant (all having p-values significantly less than .000), age and sex had the biggest impacts on vaccination rates.

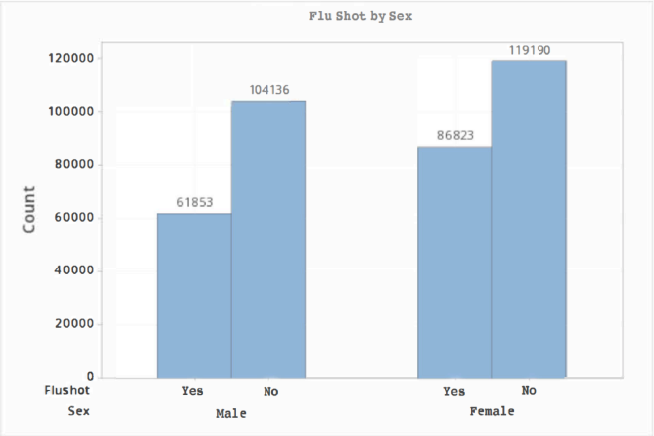
Background and Significance

What causes people to receive, or not receive, the yearly influenza vaccine? While the flu is generally seen as a relatively harmless illness, it sickens millions and leads to tens of thousands of deaths a year. (CDC) However, only approximately 43 percent of American adults receive a flu vaccine every year. The COVID-19 pandemic elevates the importance of answering this question. If a vaccine against the virus is found, who likely wouldn't get it, and, should the pandemic continue into the fall when the flu season starts again, which groups will be at a high risk of contracting both?

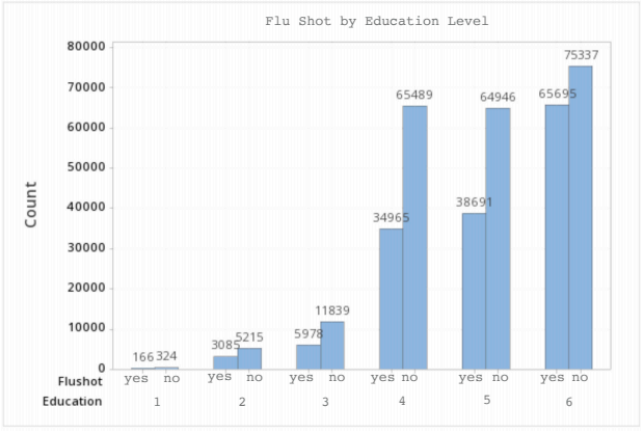
To analyze this, I pulled data from Centers for Disease Control and Prevention (CDC) 2018 *Behavioral Risk Factor Surveillance System Survey* (BRFSS) data set. I chose variables based on factors that affect access to medical care – income and urban/rural location, for example – along with other factors such as gender. The response variable was of course whether people had received a flu shot.

Methods

The BRFSS data set is a yearly survey conducted by CDC that studies people of all ages in all 50 US states, Puerto Rico, and Guam. This survey included approximately 400,000 responses, with 275 variables. For the purposes of the analysis, however, I ignored many of the variables, choosing to focus on the explanatory variables of the respondent's sex, their education level, income, whether they live in an urban or rural county, what their race/ethnicity is, their age, and whether or not they drive with a seatbelt. The response variable was whether the respondent had received any form of a flu vaccine in the last 12 months. I also removed any respondents who did not fully complete the survey. To do this, I used Chi-Squared tests on all the variables except for Age, on which I used ANOVA testing.

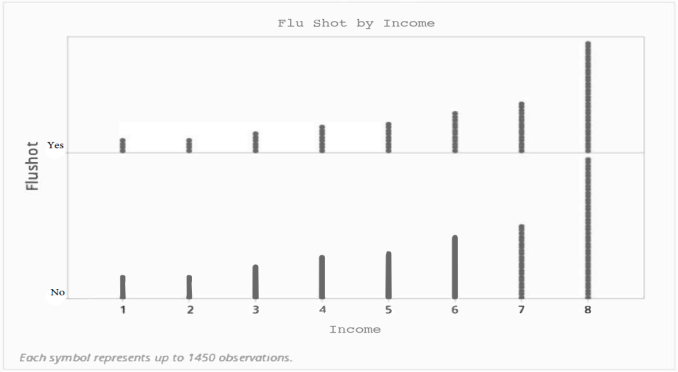


I first tested if sex had any bearing on people getting flu shots. There were two choices: 1 is male and 2 is female. I used the Chi Squared test on the variables Sex and Flu Shot.

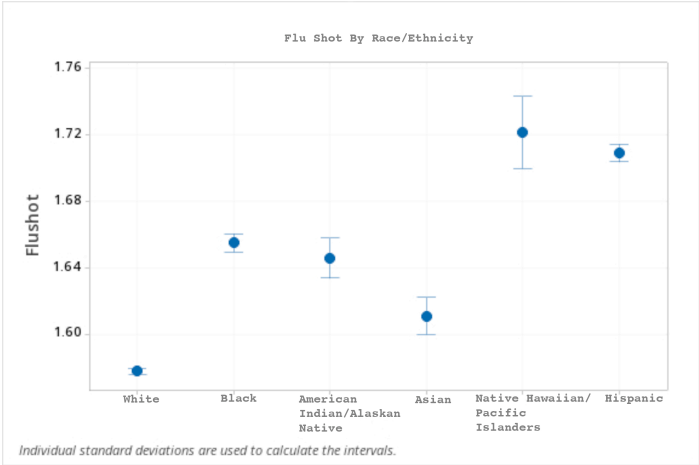


From there, I looked at education. There were six choices: 1, Never attended school; 2, Elementary; 3, Some high school; 4, High school graduate; 5, Some college; 6, College graduate. I used a Chi Squared test on the variables Education Level and Flu Shot.

Following that, I wondered if income had any effect. Income was reported on a scale of 1-8, with 1 earning less than $10,000 and 8 earning more than $75,000. I again used the Chi-Square test on Income and Flu Shot.

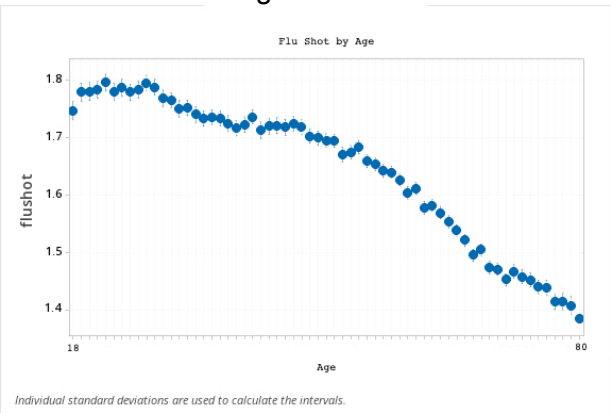


I was also interested in whether or not location affected a person's likelihood of getting a flu shot. I looked at the variable Urban/Rural. There were two choices: 1 is urban county and 2 is rural county. I used the chi-squared test on Urban/Rural and Flu Shot.



Next, I looked at respondents' race or ethnicity. There were nine choices: 1, White; 2, Black; 3, American Indian or Alaskan Native; 4, Asian; 5, Native Hawaiian or Pacific Islander; 6, Other; 7, Multiracial; 8, Hispanic; 9, Don't know/refused to answer. However, I ignored respondent categories 6, 7, and 9, as they were non-specific. I used the Chi-Square analysis on Flu Shot and Race/Ethnicity.

After this, I looked at age, which was input directly as age in years. I did an ANOVA test with Flu Shot and Age.



The final variable I examined was whether respondents' propensity for risk taking had any effects on whether they got vaccinated. I decided that seatbelt use was a good stand-in for this. It was reported on a scale of 1-5, with 1 being “always wears a seatbelt” and 5 “never wearing one.” For this analysis, I used a Chi Squared test on the variables Flu Shot and Seatbelt.

The response variable, Received a Flu Shot within the previous year presented two choices: 1, had the shot; 2, did not have shot.

Results

Test	Result
Sex and Flu Shot	Women were most likely to get a flu shot. The result had a χ^2 of 902.803 with 1 degree of freedom, and a p-value less than 0.000.
Education Level and Flu Shot	College graduates were significantly more likely to get a flu shot than any other education level. The result had a χ^2 of 3867.803 with 5 degrees of freedom and a p-value less than 0.000.
Income and Flu Shot	People with higher incomes were more likely to get a flu shot. The result had a χ^2 of 1287.732, with 7 degrees of freedom, and a p-value less than 0.000.
Urban/Rural County and Flu Shot	People who live in urban counties were more likely to get a flu shot that those in rural ones. The result had a χ^2 of 35.419, with 1 degree of freedom, and a p-value less than 0.000.
Race/Ethnicity and Flu Shot	People who identify as white were likelier to get a shot than

	other races or ethnicities. The result had a χ^2 of 2553.258, with 5 degrees of freedom, and a p-value less than 0.000.
Age and Flu Shot	Older people were more likely to get a flu shot than younger people. The ANOVA test yielded an F-value of 445.10, with 62 degrees of freedom, and a p-value of less than 0.000.
Wears Seatbelt and Flu Shot	Generally, people more likely to wear a seatbelt were more likely to get a flu shot. The result had a χ^2 of 2044.060, with 4 degrees of freedom, and a p-value less than 0.000.

Discussion

I found that several factors are associated with people getting the seasonal flu shot. Age appears to be the most important factor. Through a regression analysis, age is seen to have an r-squared value of 6.36 percent, which is much higher than any of the other factors. Sex, too, seems to have a large effect: women are more likely to get the vaccine than men. A potential explanation is that receiving a flu shot increased with age because people generally go the doctor more frequently as they get older and insurance companies encourage the vaccines by providing it for free. They are more likely to be in a situation where the vaccine is easy to receive, such as a doctor's office or pharmacy.

Two of the factors in particular – “Education Level” and “Urban/Rural” – are interesting. I had expected there to be much larger differences between education levels than there are, such as high school graduates being much more likely to get flu shots than non-graduates. But, the likelihood that respondents at any level would get vaccinated is pretty much the same until the college graduate level, where vaccination is much more likely. I had also hypothesized that people from urban counties would be much more likely to get flu shots than those in rural counties. However, while I had expected there to be a dramatic difference between the two, the difference – while found to be statistically relevant, (likely due to the extremely large sample size) – in vaccination rates was very close, only 1.596 to 1.609, urban and rural respectively.

That people who “always wear a seatbelt” were more likely to get a flu shot came as no surprise. However, respondents who “never wear seat-belts” were much more likely to get flu shots than those who “usually drive without them.” That surprised me. Perhaps the never-seatbelt people are acting on some principle, and are otherwise more risk-averse than the sometimes-seatbelt people.

It’s also important to note that this was an observational study, not an experiment. So, although these associations exist, there may be confounding variables, or other factors that were not accounted for. Therefore, it's not possible to draw conclusions about causation. As well, this was a probability weighted survey; however, I did not apply the sampling weights in my analysis. Further analysis might also delve deeper into target groups by examining other variables for a finer grained understanding.

Overall, based on my findings it seems that the most effective and sustainable way to increase the number of people receiving flu vaccines would be to tackle systemic issues: bolster the educational system; help more people graduate college; and increase peoples' incomes, possibly by raising the minimum wage. As well, making the shot accessible would likely raise the vaccination rate. Accessibility – free or reduced cost and geographic availability – and targeted promotion are near-term strategies that would likely have a significant impact on increasing the number of people who get the flu vaccine and decreasing influenza's disastrous effects. These could include offering the vaccine in more places, such as libraries.

These findings are likely applicable to Covid-19 as well as the flu, though it’s likely that there would be higher vaccination rates across the board. As such, many of the same near-term strategies could be applied to any vaccine for the current pandemic.

References

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