

Understanding Vaccine Uptake: Insights from the H1N1 and Seasonal Flu Dataset



**ANALYZING KEY DRIVERS, BARRIERS, AND
PREDICTIVE FACTORS TO IMPROVE PUBLIC
HEALTH STRATEGIES**



Business Problem



- How can public health organizations effectively increase the uptake of H1N1 and Seasonal flu vaccines by identifying key influencing factors and targeting the right populations with tailored interventions?
- Vaccination uptake is critical for preventing the spread of H1N1 and Seasonal flu, but not all individuals choose to get vaccinated. Public health organizations need to understand the drivers and barriers to vaccine adoption to design effective strategies. Insights into demographic, behavioral, and opinion-related factors can guide targeted outreach and resource allocation, ultimately improving public health outcomes.

Objectives



Business Understanding

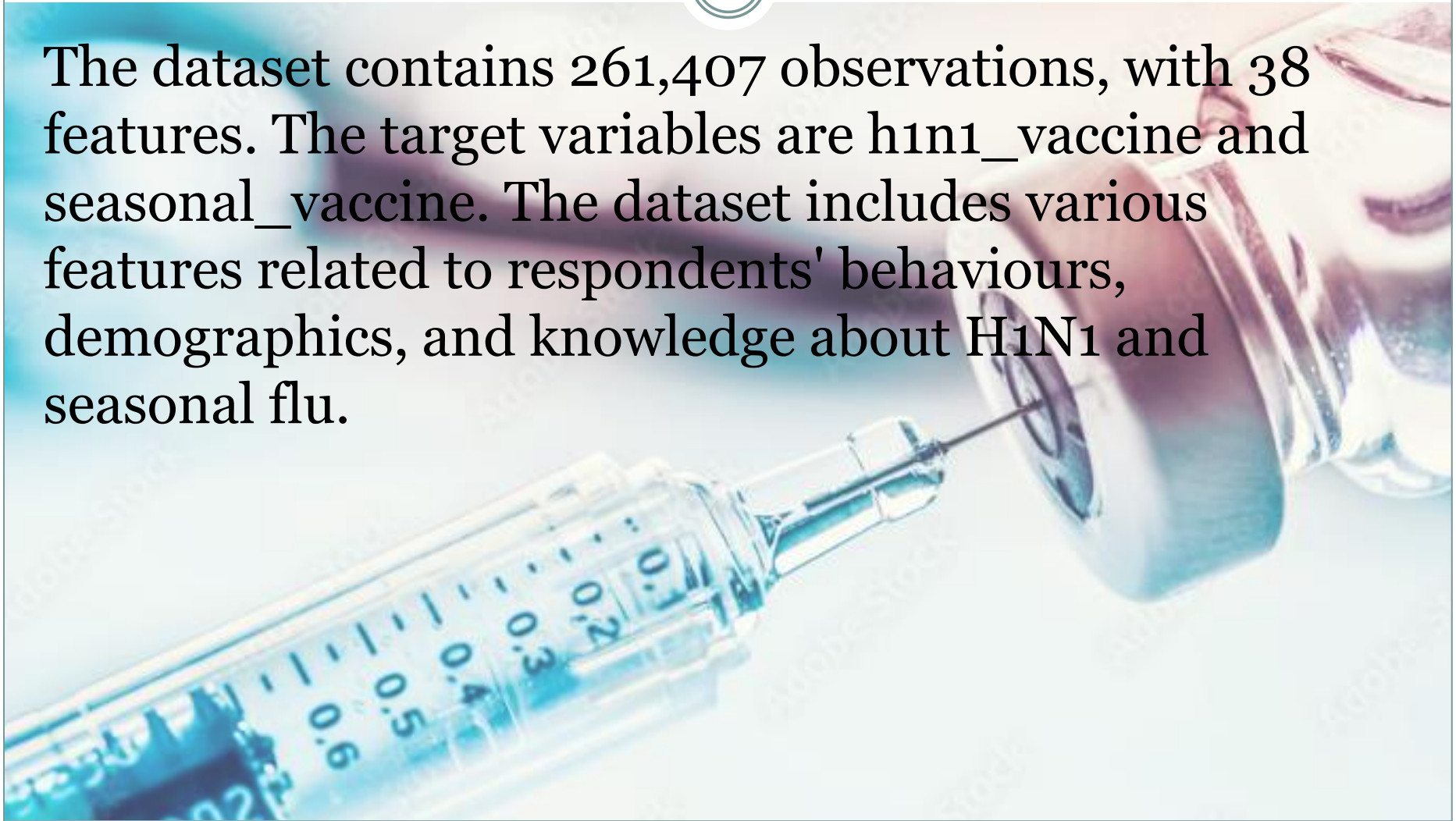
From the H1N1 and Seasonal flu vaccine dataset, the following business questions and insights can be addressed:

1. What are the key factors influencing vaccination uptake for H1N1 and Seasonal flu?
2. What is the distribution of vaccine uptake in the population?
3. How do behaviours and opinions influence vaccine adoption?
4. Can we predict the likelihood of individuals receiving the H1N1 and Seasonal flu vaccine? If so, what are the most important factors?

Data Understanding



The dataset contains 261,407 observations, with 38 features. The target variables are `h1n1_vaccine` and `seasonal_vaccine`. The dataset includes various features related to respondents' behaviours, demographics, and knowledge about H1N1 and seasonal flu.

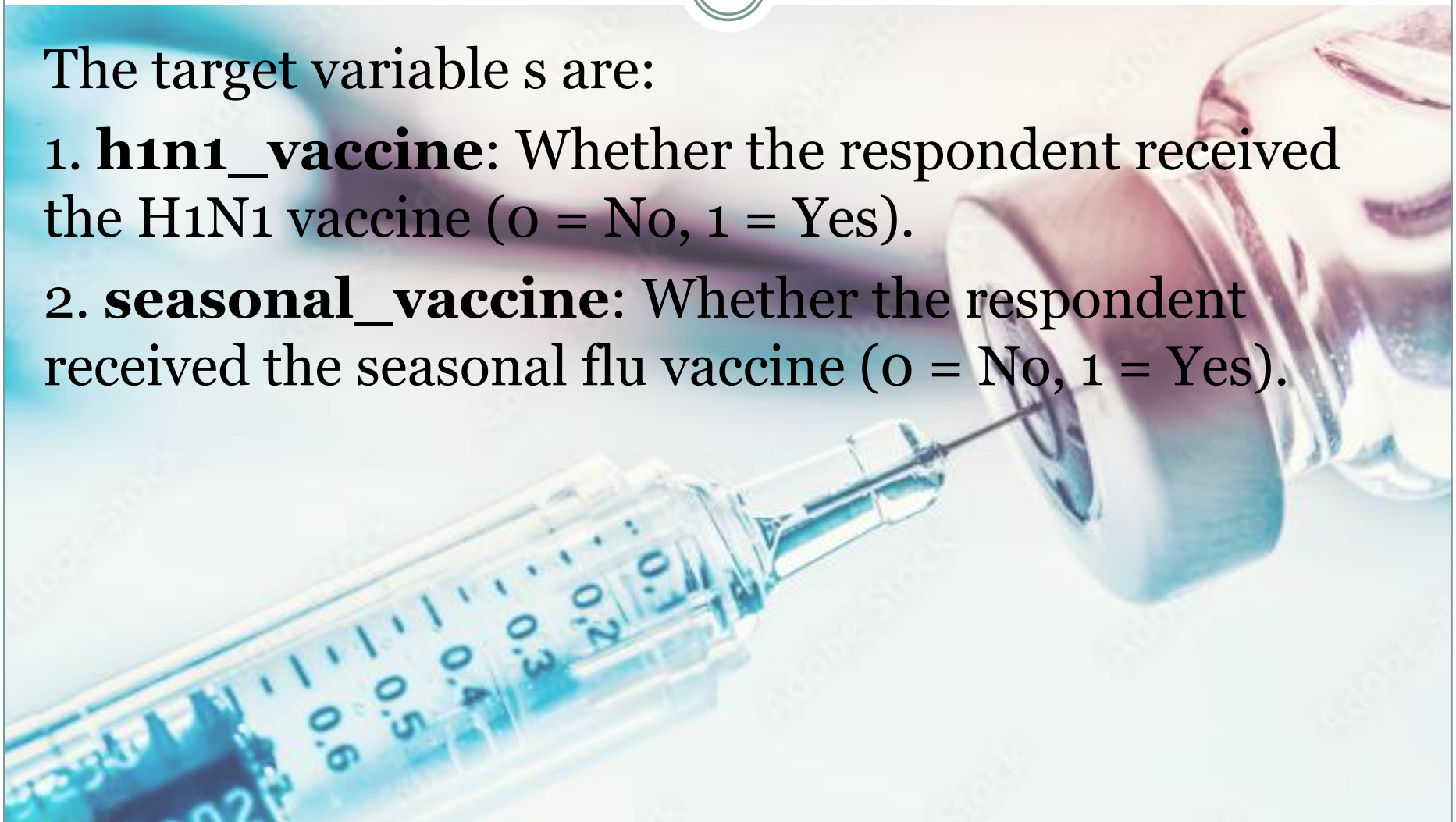


Target Variables



The target variable s are:

1. **h1n1_vaccine**: Whether the respondent received the H1N1 vaccine (0 = No, 1 = Yes).
2. **seasonal_vaccine**: Whether the respondent received the seasonal flu vaccine (0 = No, 1 = Yes).



Summary of missing values



Significant missing data is found in

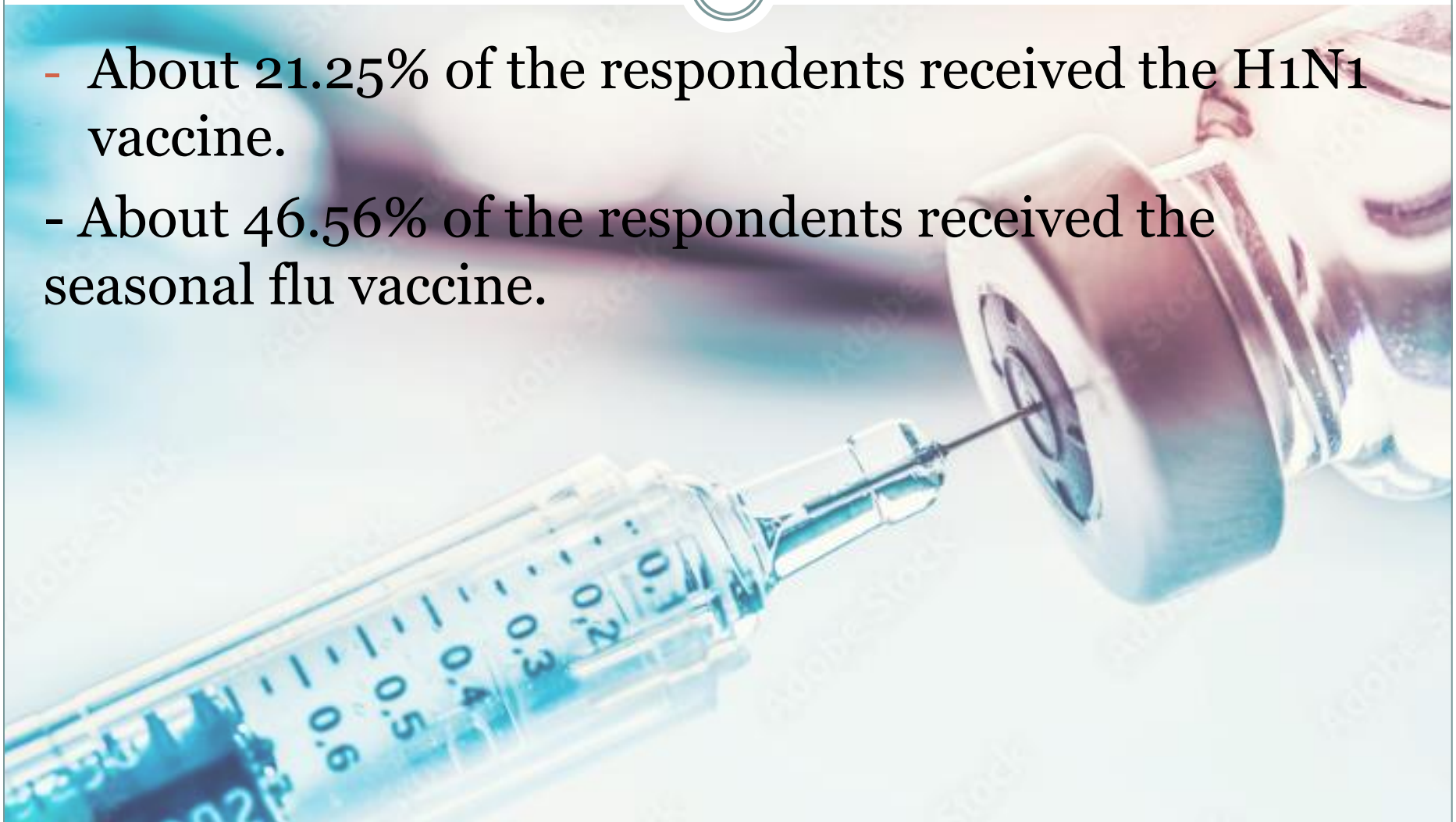
1. **employment_occupation**: 50.4% missing data
2. **employment_industry**: 49.9% missing data
3. **health_insurance**: 46.0% missing data
4. **income_poverty**: 16.6% missing data

-> Columns with excessive missing values are dropped to reduce the risk of interfering with the models results.

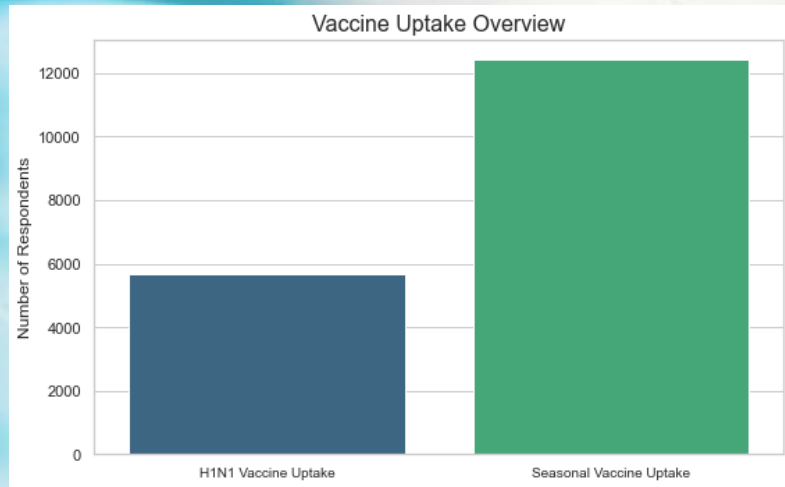
Distribution of vaccine uptake



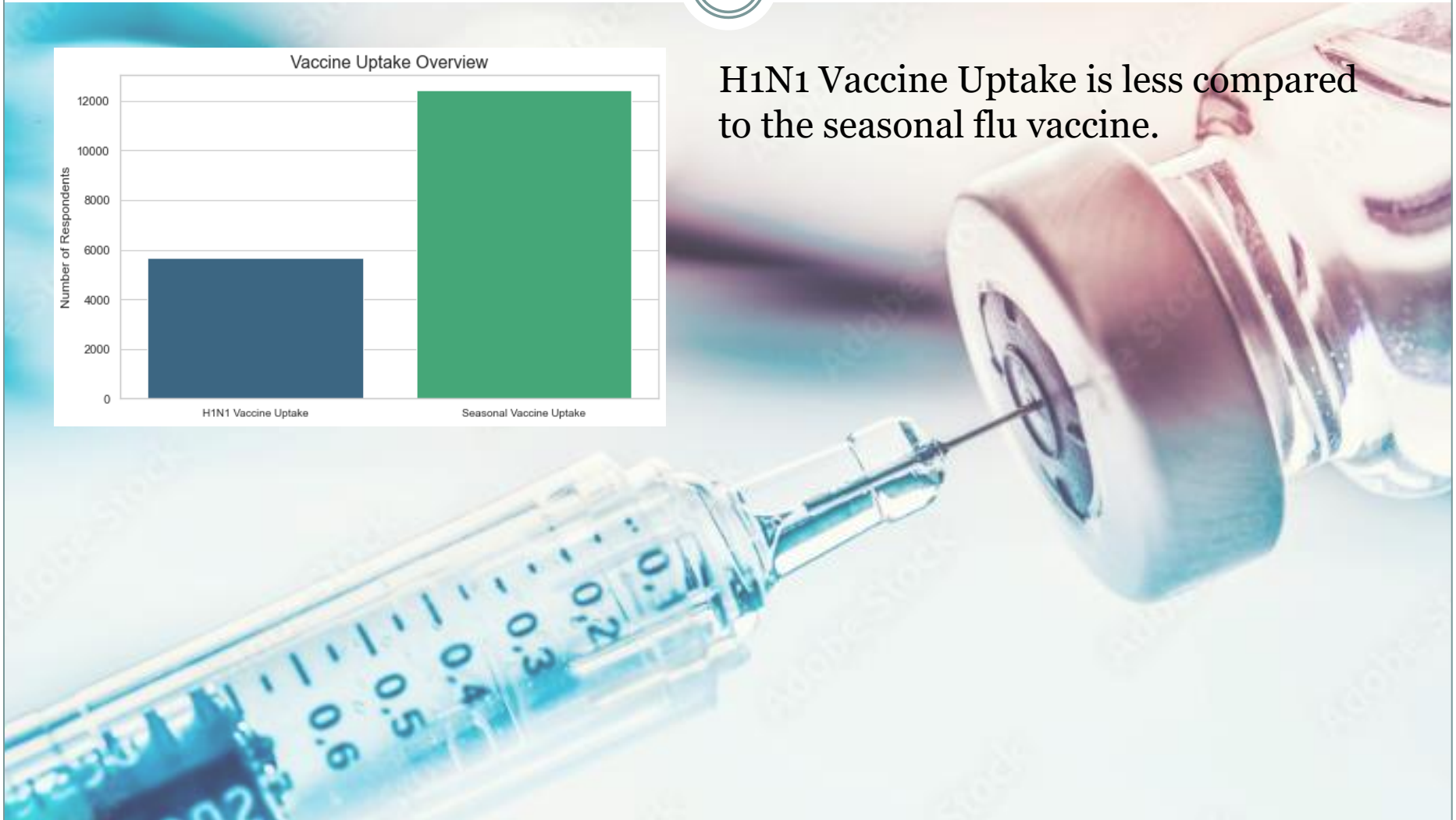
- About 21.25% of the respondents received the H1N1 vaccine.
- About 46.56% of the respondents received the seasonal flu vaccine.



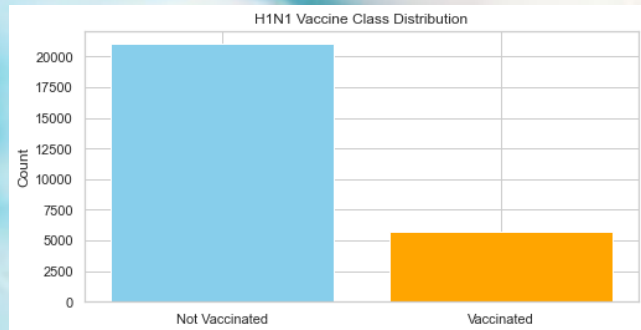
Vaccine Uptake Overview



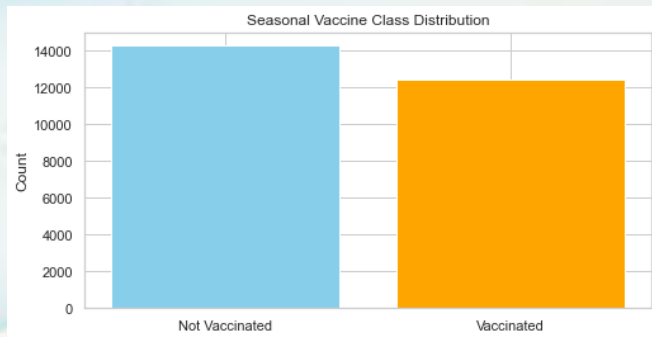
H1N1 Vaccine Uptake is less compared to the seasonal flu vaccine.



Vaccine Class Distribution



- 78.8% of respondents did not receive the H1N1 vaccine.
- 21.2% of respondents received the H1N1 vaccine.
- The distribution of H1N1 vaccine uptake is disproportionate.

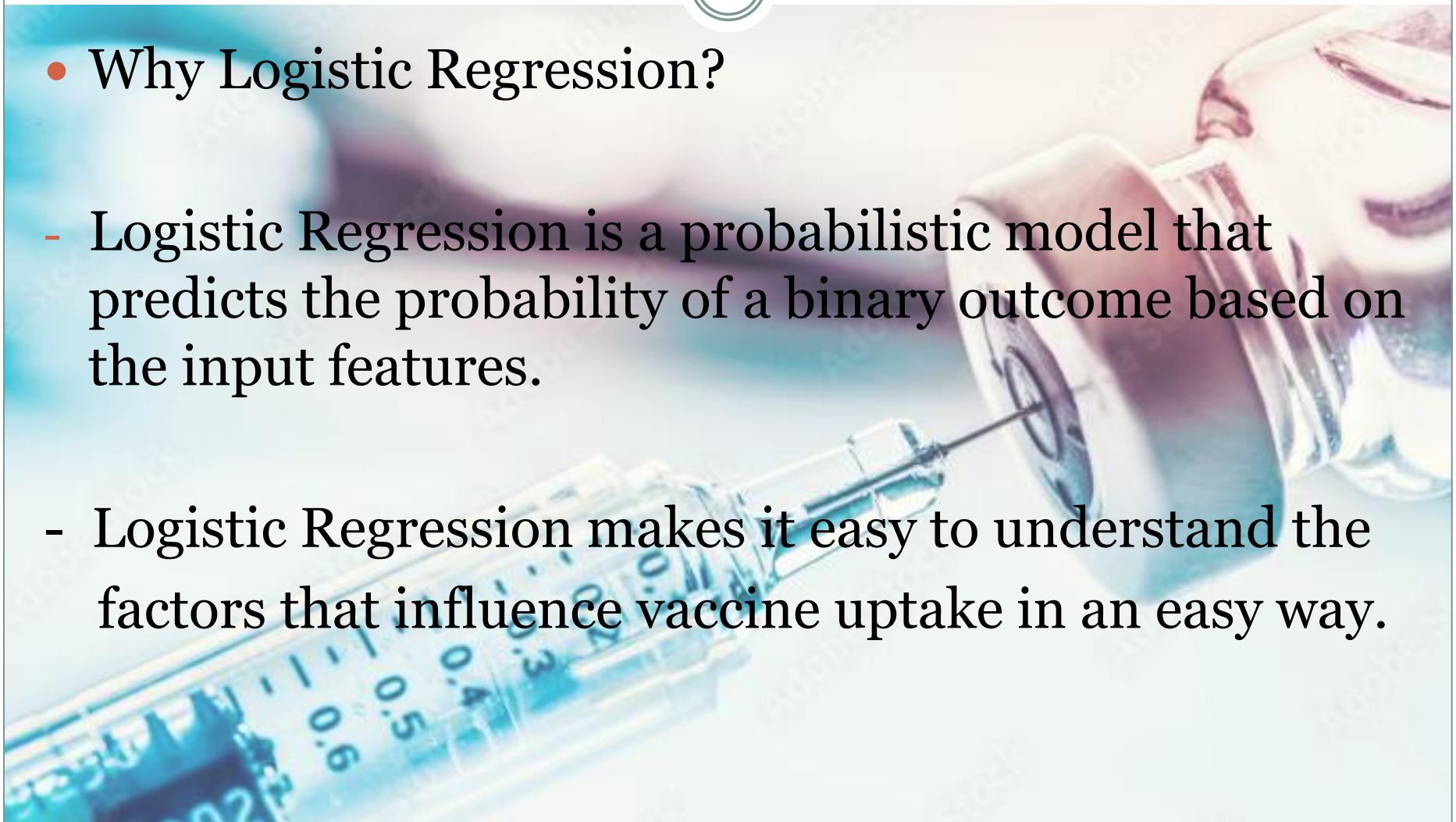


- 53.4% of respondents did not receive the seasonal flu vaccine.
- 46.6% of respondents received the seasonal flu vaccine.
- The distribution of seasonal flu vaccine uptake is proportionate.

Modelling



- Why Logistic Regression?
- Logistic Regression is a probabilistic model that predicts the probability of a binary outcome based on the input features.
- Logistic Regression makes it easy to understand the factors that influence vaccine uptake in an easy way.



Modelling



- Why Random Forest?
 - Random Forest makes very accurate predictions and helps the analyst understand which factors are most important in determining vaccine uptake.
 - It's very good at handling complex data, especially when many factors are interacting. For example, it can recognize patterns like "People who are older, have a doctor's recommendation, and think the vaccine is safe are more likely to get vaccinated."

Model Evaluation



- What is an AUC Score?

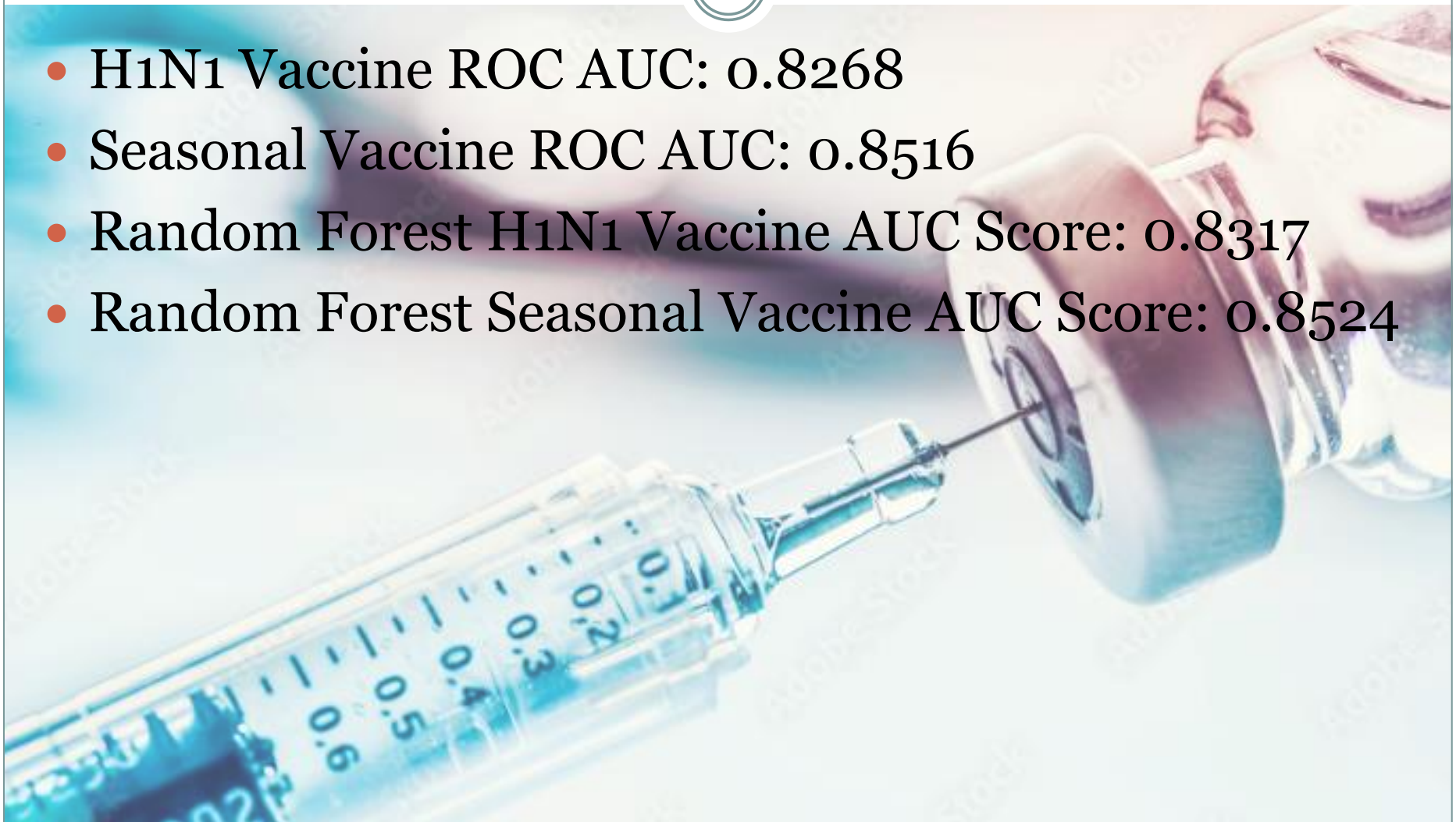
-> The AUC Score measures how well our model can tell apart two groups i.e those who are likely to be vaccinated and those who are not.

- In simple terms, the AUC score tells us how good our model is at making accurate predictions. For example, our logistic model for predicting H1N1 vaccination has an AUC of 0.83, meaning it is 83% effective at distinguishing between vaccinated and unvaccinated individuals. This high score reassures us that the model is reliable and can guide us in targeting the right groups. If the AUC were much lower, say 0.60, it would indicate the model is only slightly better than random guessing, and we'd need to improve it before using it to make decisions.

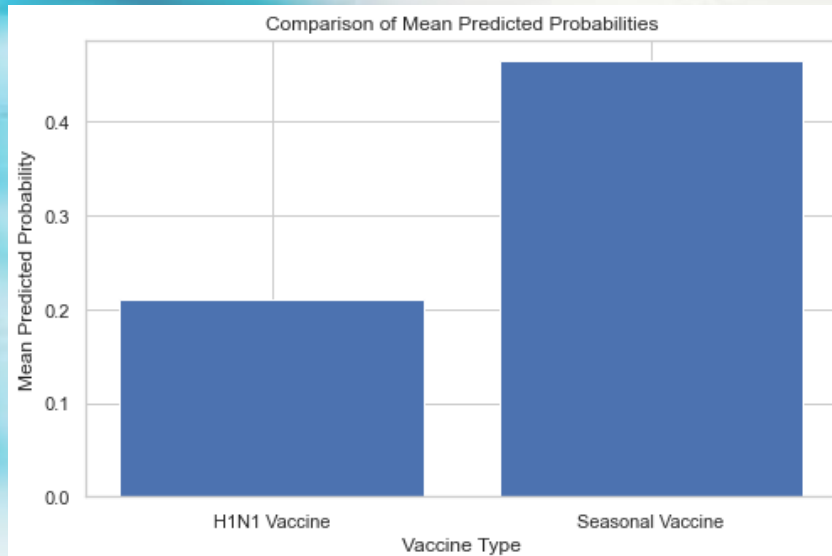
AUC Scores



- H1N1 Vaccine ROC AUC: 0.8268
- Seasonal Vaccine ROC AUC: 0.8516
- Random Forest H1N1 Vaccine AUC Score: 0.8317
- Random Forest Seasonal Vaccine AUC Score: 0.8524



Predicted Mean Probabilities



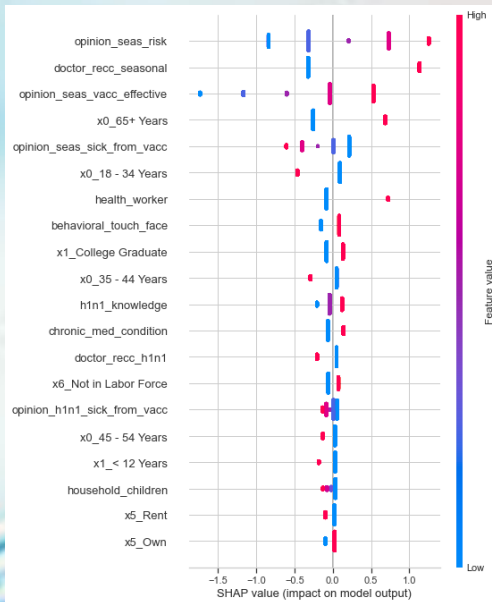
The model predicts a higher probability of individuals receiving the seasonal flu vaccine compared to the H1N1 vaccine.

The prediction is strongly influenced by features like *doctor_rec_h1n1* and *opinion_h1n1_vacc_effective*.

Feature Importance



- Feature importance tells us which factors in the data are most influential in predicting whether someone is likely to get vaccinated. It helps us understand what drives people's decisions and where we should focus our efforts.



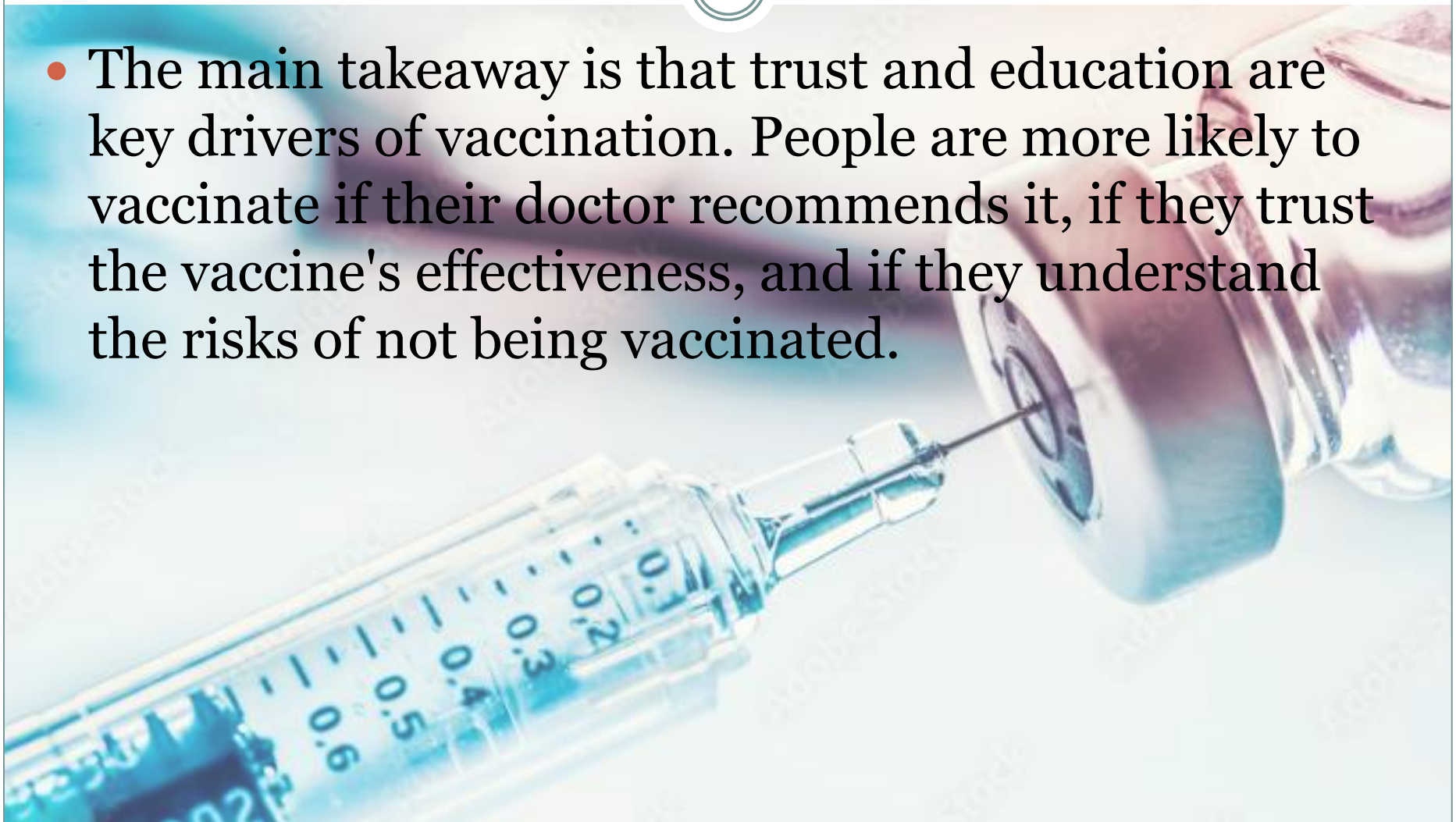
For Example, If we know that 'doctor recommendations' and 'perceived vaccine effectiveness' are the most important factors, we can focus our efforts on educating doctors to promote vaccination and addressing concerns about vaccine effectiveness in public campaigns.

This is true for both the H1N1 and Seasonal Flu vaccine.

H1N1 Feature Importance



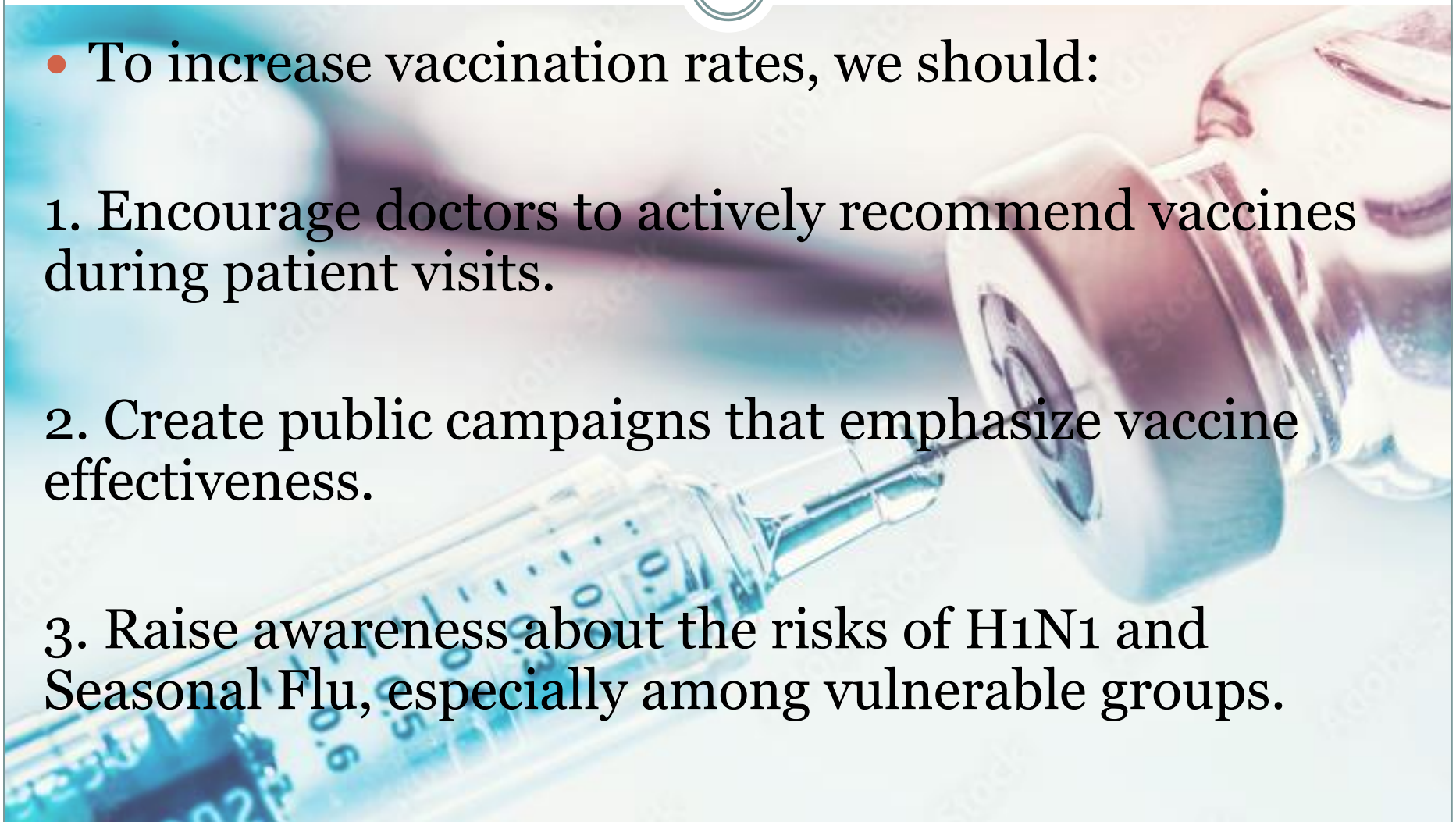
- The main takeaway is that trust and education are key drivers of vaccination. People are more likely to vaccinate if their doctor recommends it, if they trust the vaccine's effectiveness, and if they understand the risks of not being vaccinated.



Recommendations



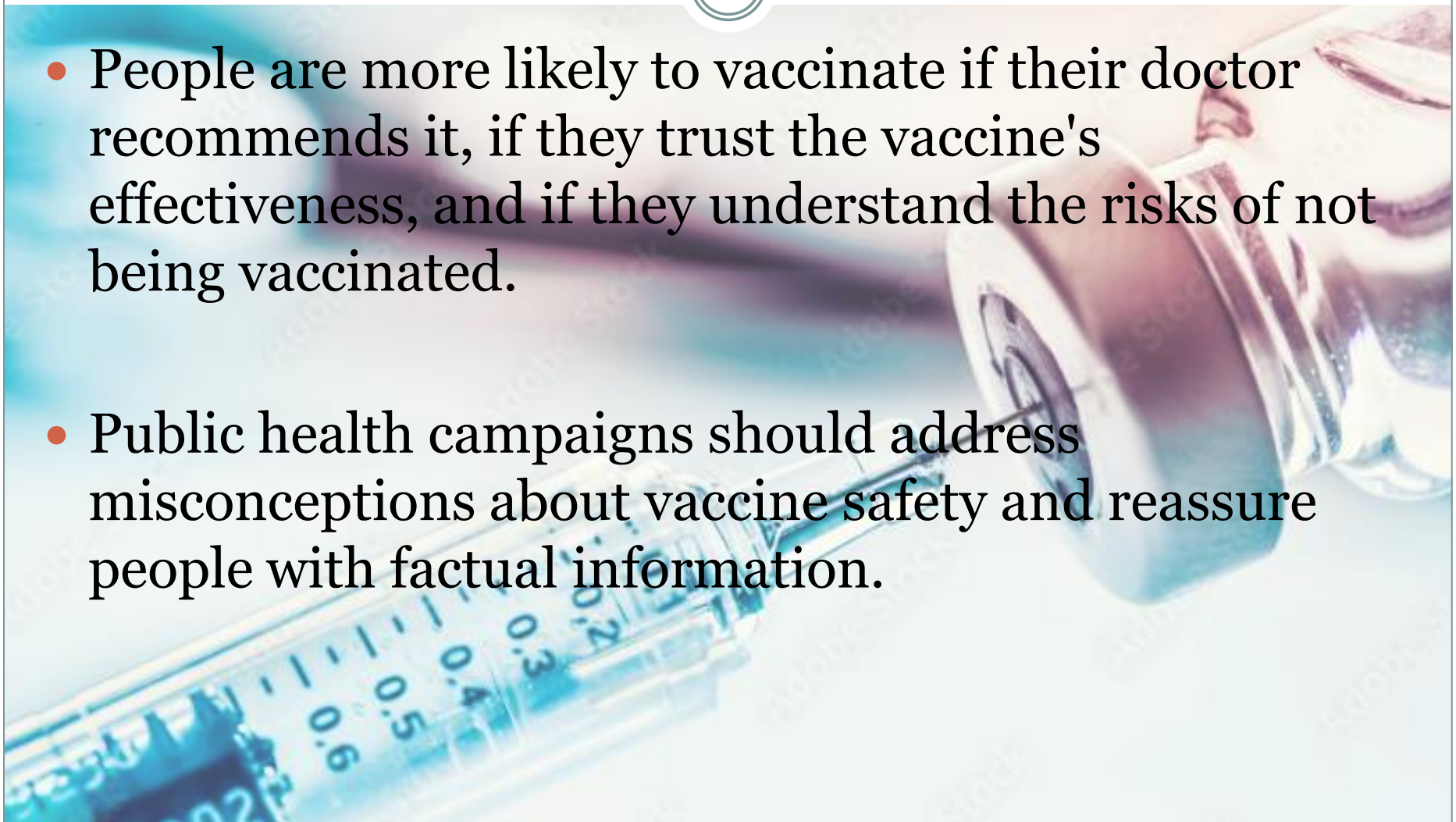
- To increase vaccination rates, we should:
 1. Encourage doctors to actively recommend vaccines during patient visits.
 2. Create public campaigns that emphasize vaccine effectiveness.
 3. Raise awareness about the risks of H1N1 and Seasonal Flu, especially among vulnerable groups.



Seasonal Feature Importance



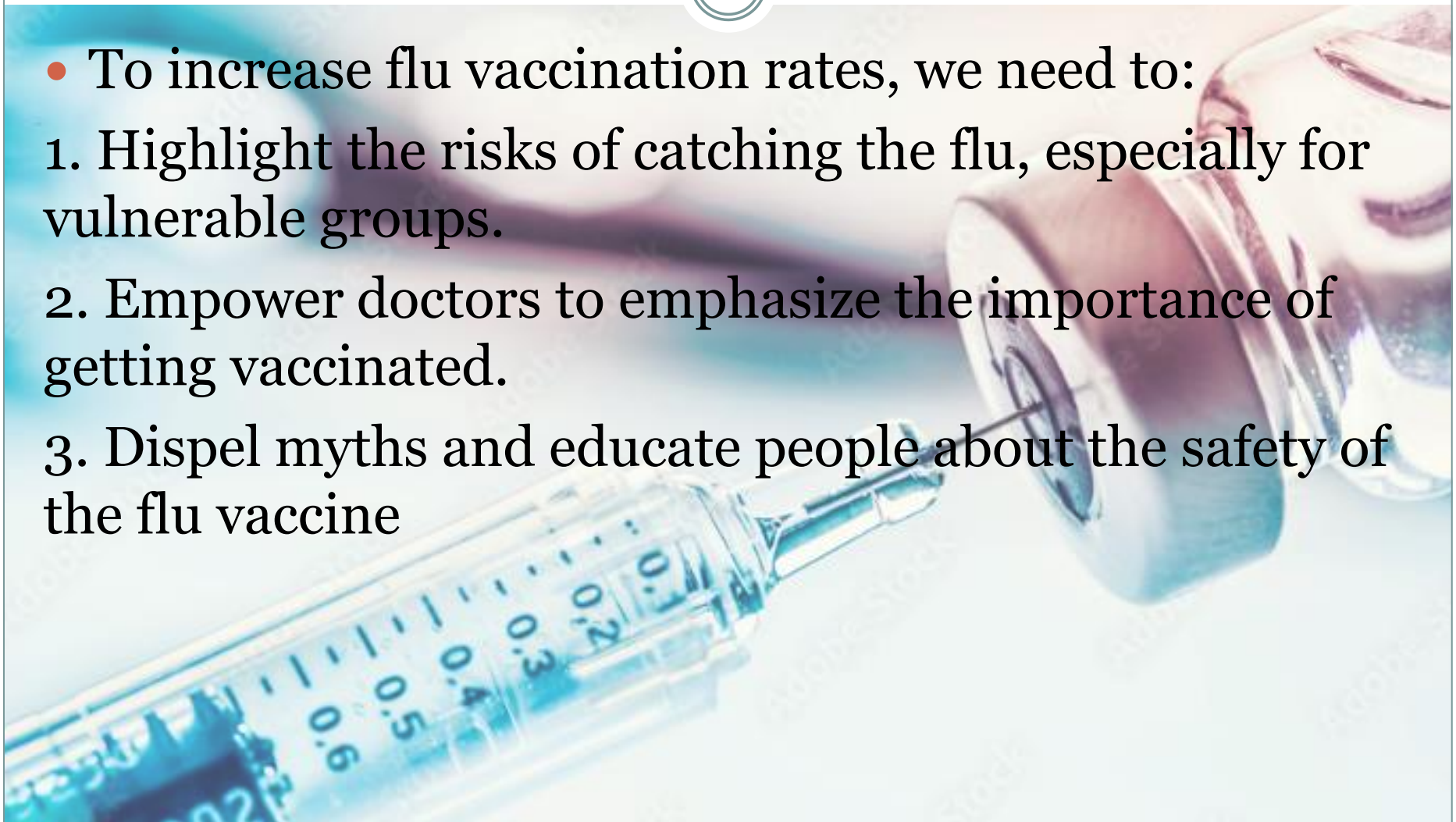
- People are more likely to vaccinate if their doctor recommends it, if they trust the vaccine's effectiveness, and if they understand the risks of not being vaccinated.
- Public health campaigns should address misconceptions about vaccine safety and reassure people with factual information.



Recommendations



- To increase flu vaccination rates, we need to:
 1. Highlight the risks of catching the flu, especially for vulnerable groups.
 2. Empower doctors to emphasize the importance of getting vaccinated.
 3. Dispel myths and educate people about the safety of the flu vaccine



Conclusion from the H1N1 and Seasonal Flu Vaccine Dataset:



- **Key Drivers of Vaccination Uptake:**

1. A doctor's recommendation is the strongest and most consistent factor influencing both H1N1 and Seasonal flu vaccination uptake. Public health organizations should work closely with healthcare providers to encourage vaccine recommendations during patient visits.

2. Perceptions of vaccine effectiveness strongly influence decision-making. People who believe vaccines are effective are more likely to get vaccinated.

3. Risk Perception plays a significant role. Individuals who perceive a high risk of contracting H1N1 or the Seasonal Flu are more inclined to get vaccinated, indicating the need for risk awareness campaigns.