

# **Machine Learning for H1N1 Vaccine Hesitancy Prediction**

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# GOAL

- **BUILD AN ACCURATE H1N1 VACCINATION PREDICTION MODEL**

# OUTLINE


- Overview
- Business and Data understanding
- Modelling
- Evaluation
- Findings
- Conclusions
- Recommendations
- Next steps

# Overview

**Predicting H1N1 Vaccine Hesitancy by:**

- - Use of 2009 National Flu Survey data to predict who got the H1N1 vaccine.
- Key factors: Doctor recommendations, H1N1 Perception, and opinion on vaccine effectiveness.
- Helps improve us to Improve future vaccination campaigns and public health strategies.

# Business and Data Understanding

- **Challenge: Understanding Vaccine Hesitancy**  
Vaccine hesitancy remains a major public health concern, increasing the risk of disease outbreaks.
- **End Users: Public Health Officials**  
Insights help officials design better vaccination campaigns.
-  **Data Source: National Flu Survey (NHFS, 2009)**
  - 26,000 respondents
  - 79% did not get the H1N1 vaccine
  - Collected behavior, beliefs, and healthcare access data

# Business and Data Understanding

## Dataset

- 2009 National Flu Survey (NHFS)
- Contains health, demographic, and behavioral data

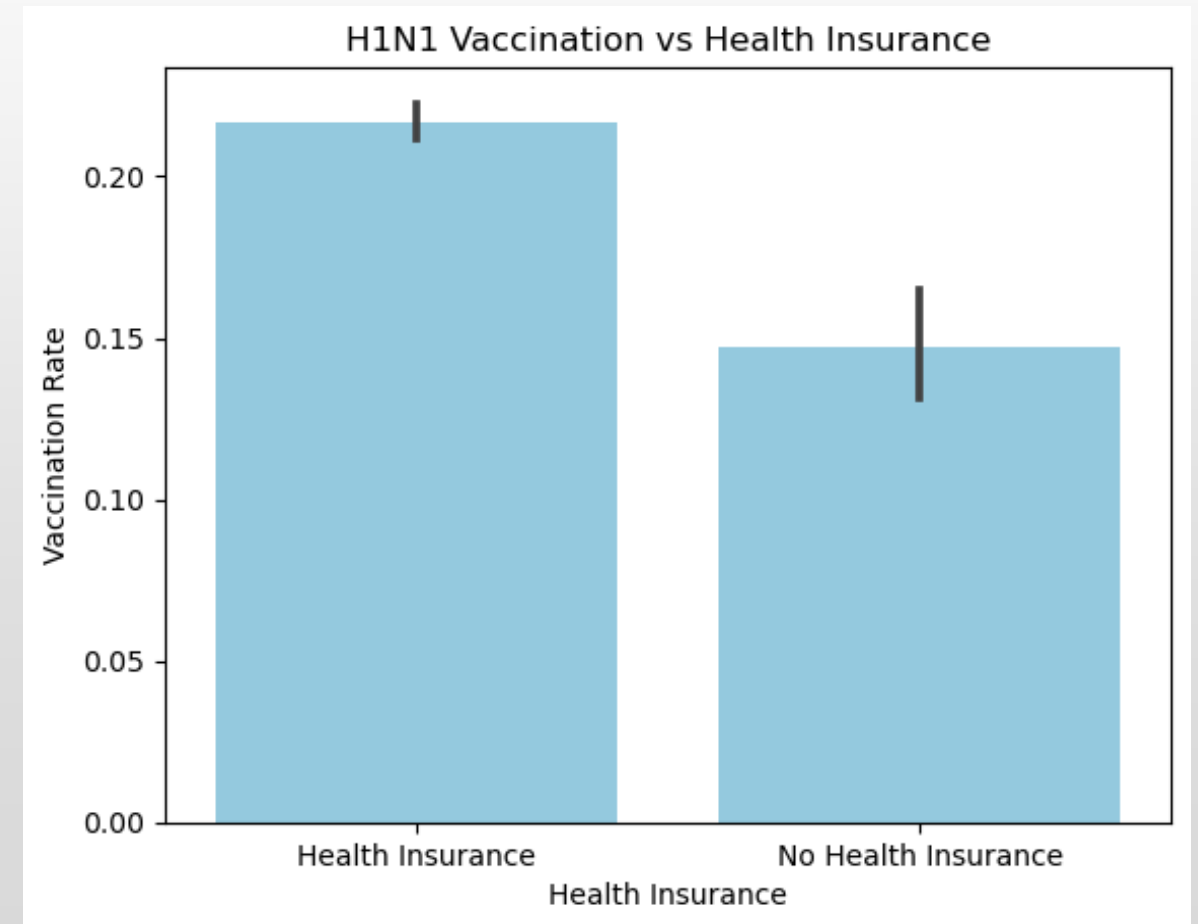
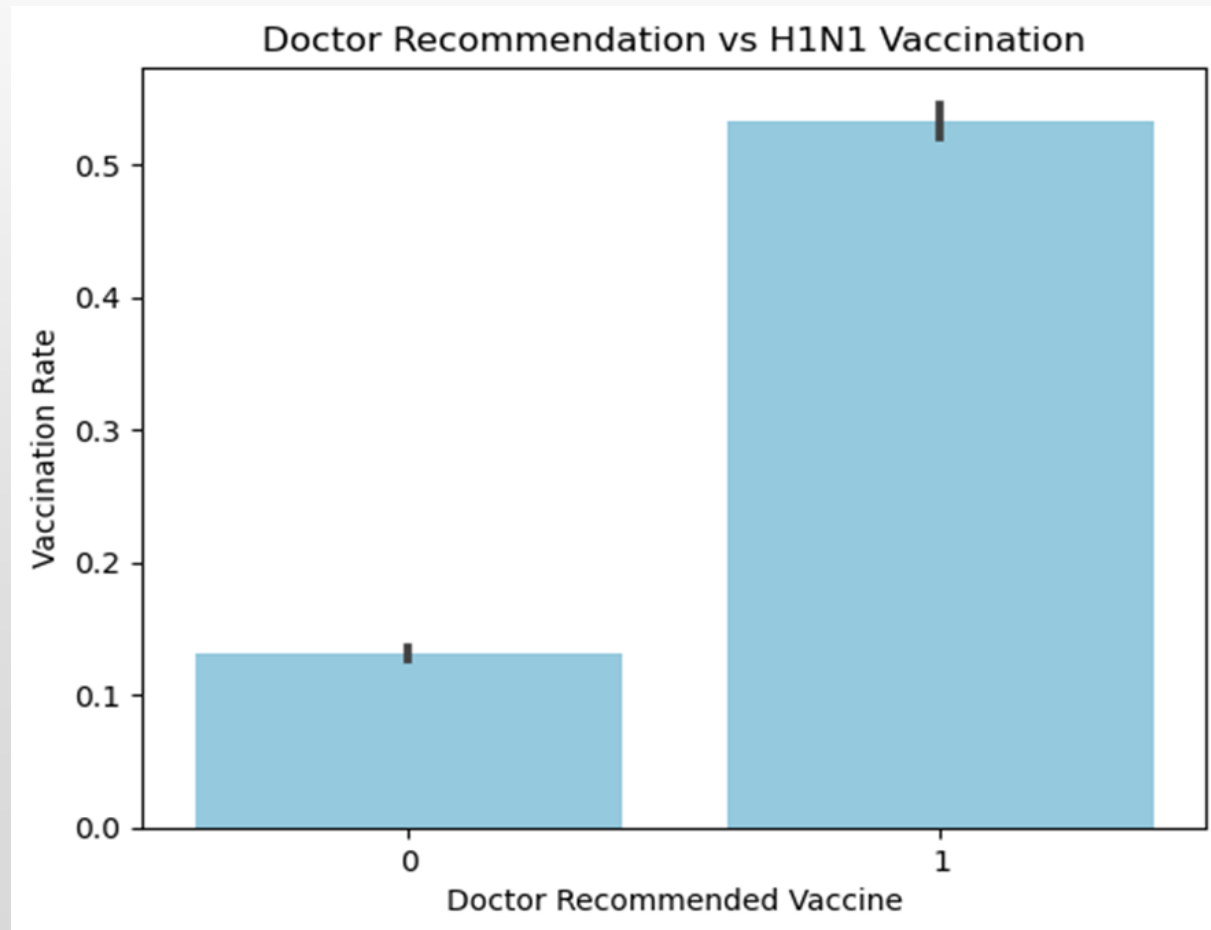
## Target Variable

- H1N1 Vaccine Uptake
  - 1 = Vaccinated, 0 = Not Vaccinated

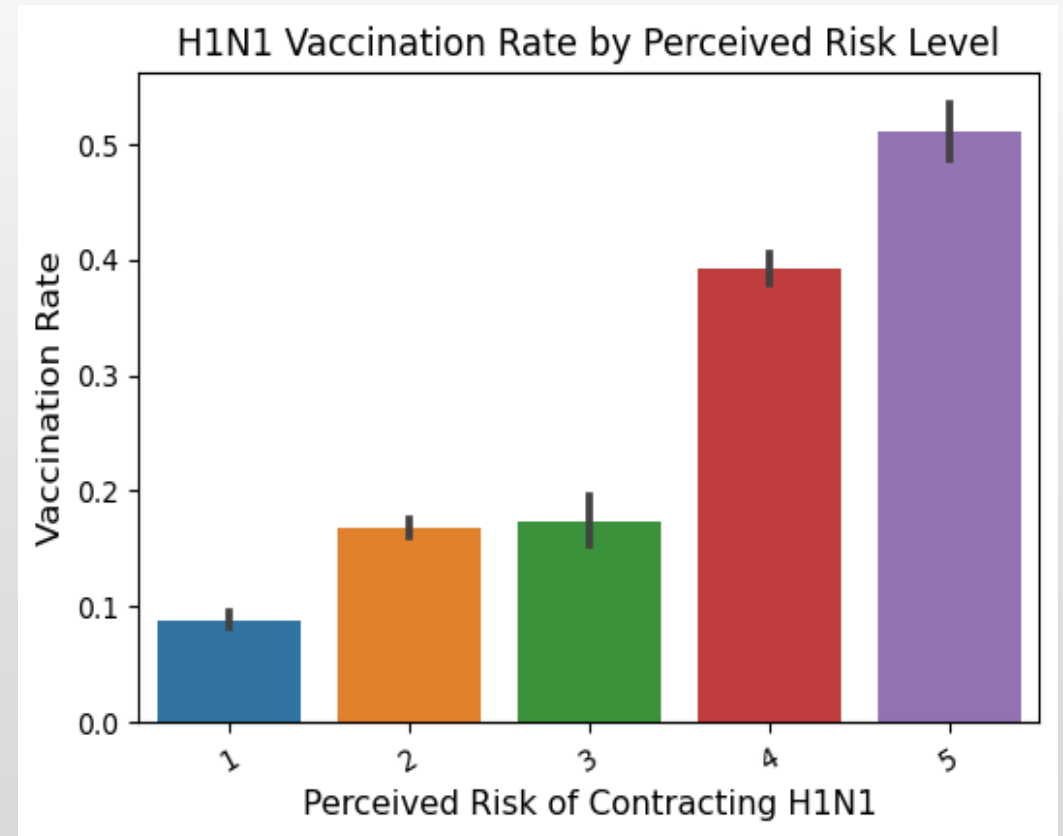
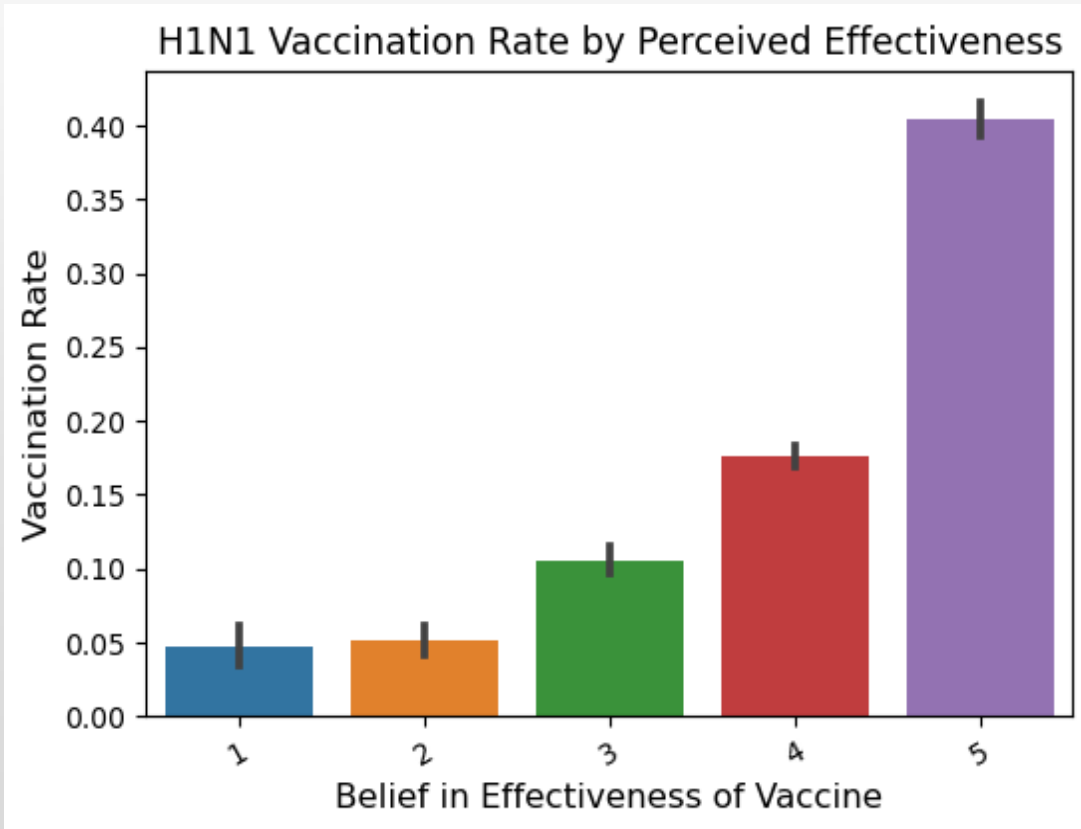
## Key Features

- Risk Perception (H1N1 & seasonal flu risk)
- Doctor Recommendations (for vaccine)
- Demographics (age, location, employment)
- Health Behaviors (mask-wearing, social distancing)

# PROVIDER FACTOR FINDINGS

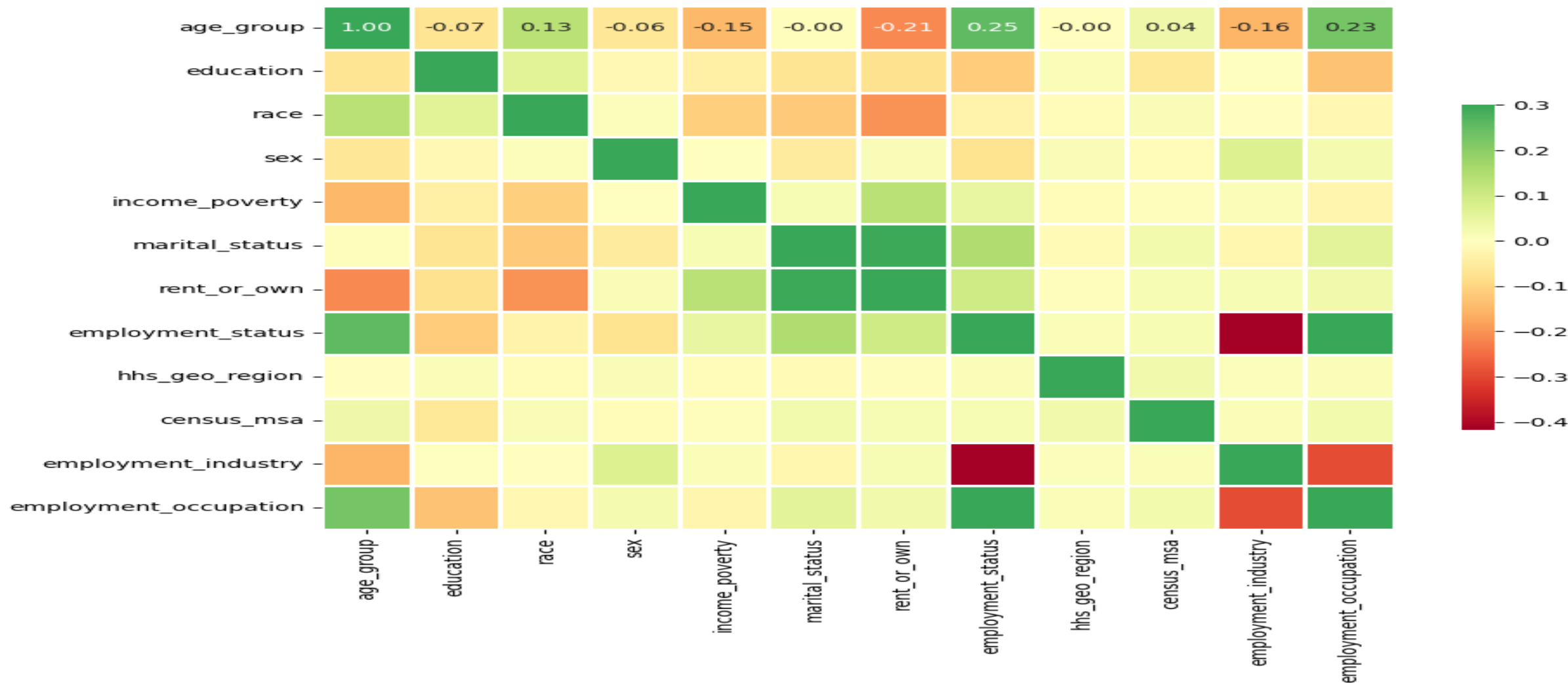


# CLIENT FACTOR FINDINGS





# Business Data understanding: correlational Heatmap



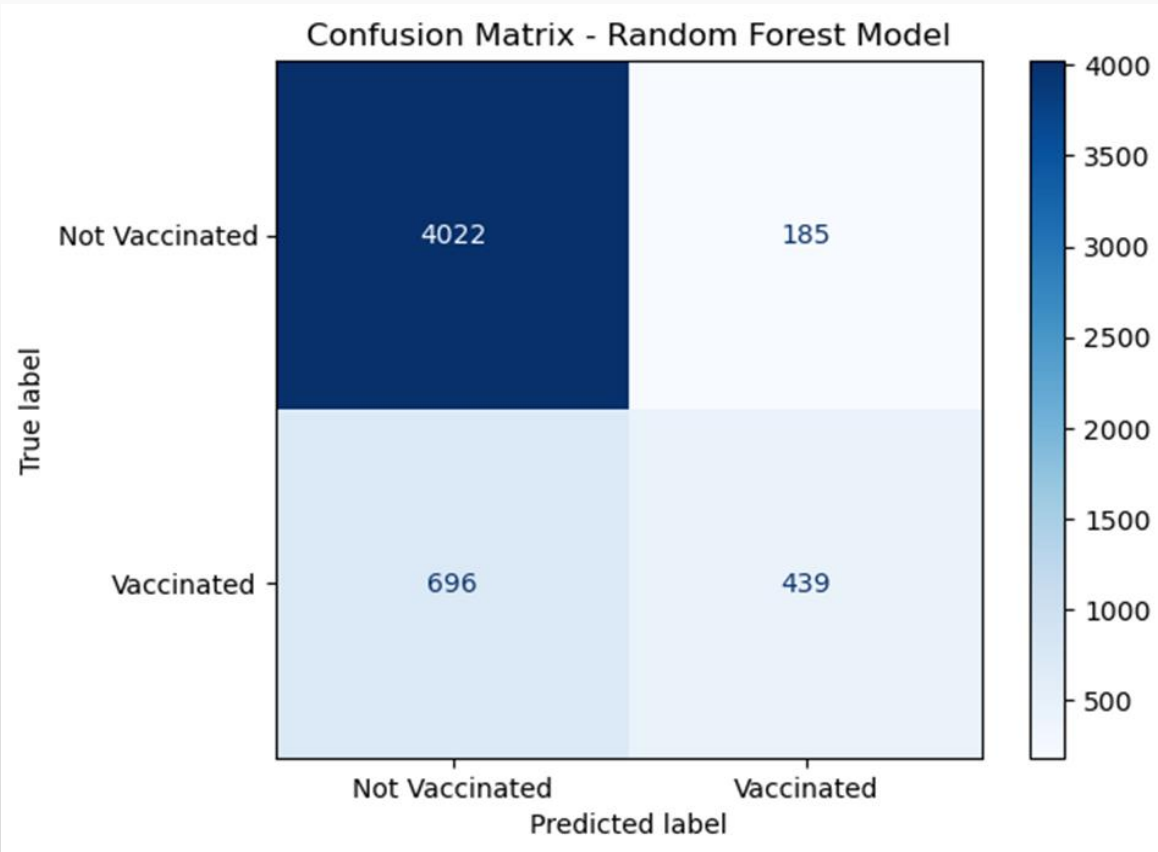
# Modeling

- **Models Used for Prediction**
  - **Decision Tree**
  - **Logistic Regression**
  - **Random Forest**
  - **K-Nearest Neighbors (KNN)**
  - **Naive Bayes**
- **Best Performing Model**
  - **Random Forest** achieved the **highest accuracy**, balancing **precision and recall** for better predictions.
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# Evaluation

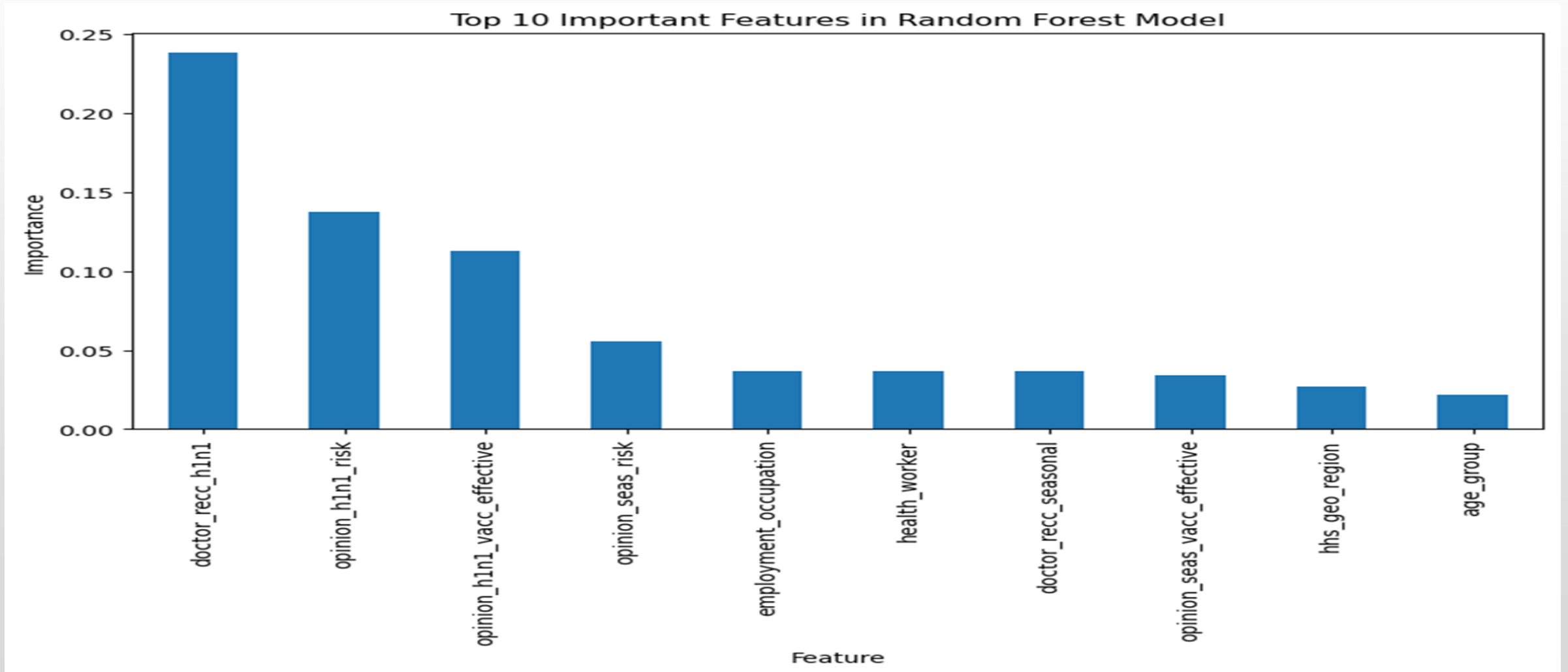
- **Model performance was assessed using key metrics:**
- **Accuracy: Overall correctness.**
- **Precision: How well we identify people likely to vaccinate.**
- **Recall: Capturing hesitant individuals.**
- **F1-score: A balance between precision and recall.**
- **The goal is to reduce incorrect predictions while maximizing useful insights.**

# MODEL FINDINGS



- **Random Forest Model Performance**
- **Key Metrics**
  - **Accuracy: 83.5% – Precision: 70.0%**
  - **Recall: 39.0%**
  - **F1-Score: Balances precision and recall, ensuring fair model evaluation.**

# MODEL FINDINGS: Top 10 Reasons for non Vaccination



# Key Factors Influencing H1N1 Vaccine Uptake

- **Key Predictors**
- **Doctor Recommendations** – Strongest factor influencing vaccination.
- **Perceived Risk & Vaccine Effectiveness** – Higher belief in vaccine effectiveness increases uptake.
- **Demographics & Health Behavior** – Factors like **age, location, and preventive measures** also impact decisions.
- **Public Health Impact**
- These insights can **help officials design better strategies** to increase vaccine uptake.

# KEY INSIGHTS

- **Doctor influence** is crucial in vaccination decisions.
- **Vaccine accessibility** impacts uptake, especially among uninsured individuals.
- **Public awareness** of vaccine safety and effectiveness is essential for reducing hesitancy

# Recommendations

- **Enhance Doctor Recommendations** – Strengthen the role of healthcare providers in encouraging vaccination.
- **Improve Vaccine Accessibility** – Address financial and logistical barriers for those without insurance.
- **Prioritize Public Education** – Promote awareness of vaccine effectiveness and the risks of H1N1



# Next Steps

- **Use findings to develop targeted vaccination campaigns.**
- **Expand the model to track new vaccine trends.**
- **Implement real-time public health monitoring.**

**THANKYOU**