Predicting H1N1 Flu Vaccination Status- A Machine Learning Approach

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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

- Understanding vaccination patterns helps address pandemics like COVID-19. This project predicts whether individuals received the H1N1 vaccine using data from the National Flu Survey (NHFS 2009). Key influencing factors include doctor recommendations, health insurance, and risk perception.

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

Key Factors Influencing Vaccine Hesitancy are :

- **Doctor Recommendations**
- **Health Insurance**
- **Perceived Effectiveness**
- **Risk Perception**
- **Why Accuracy Matters?**
  - ✓ Minimize **False Positives** – Avoid misclassifying vaccinated individuals.
  - ✓ Minimize **False Negatives** – Ensure truly hesitant individuals get targeted outreach.

Modeling

The Following Machine learning models were tested to Machine learning helps identify patterns in vaccination behavior:

- - Decision Tree
- - Logistic Regression
- - Random Forest
- - K-Nearest Neighbors
- - Gradient Boosting
- - XGBoost

- Gradient Boosting provided the best accuracy and precision.

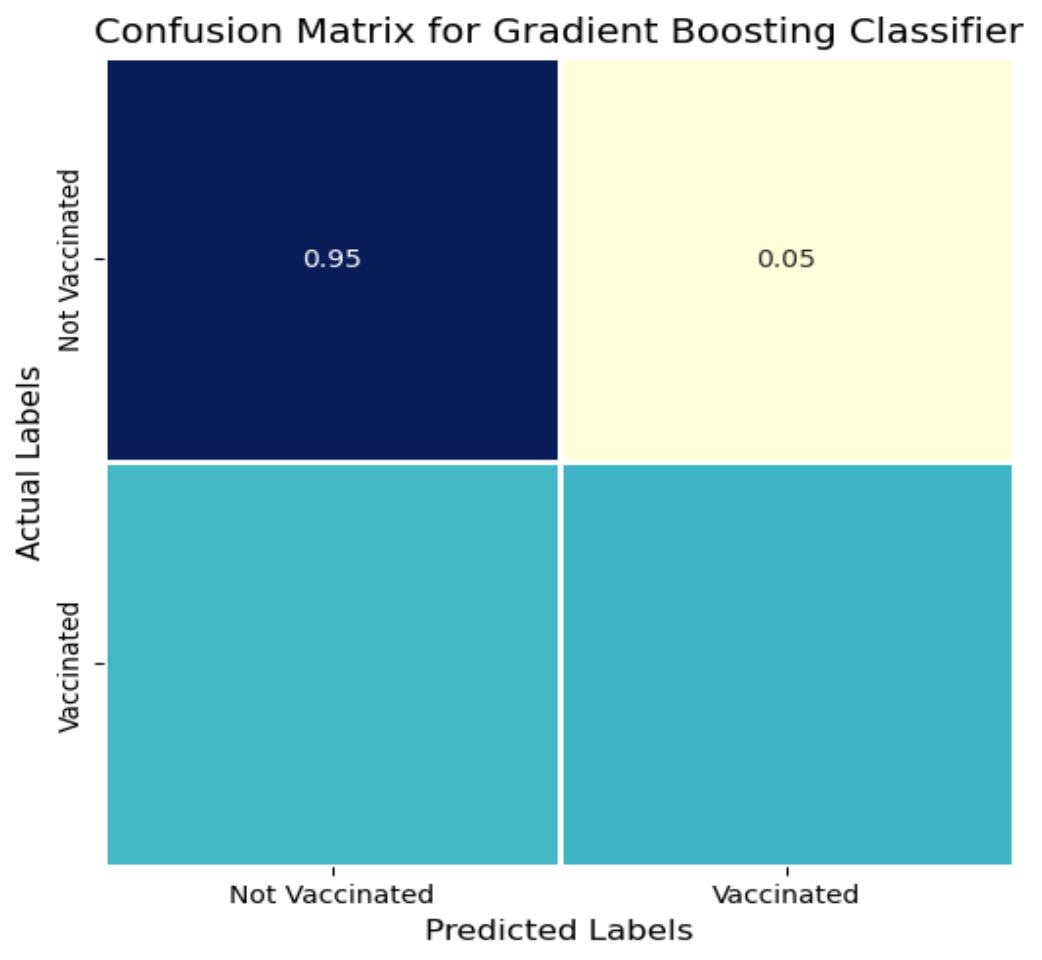
Evaluation

- 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



- Gradient Boosting score at **Accuracy: 85.6%**
- **Precision: 73.2% :**When the model predicts a person is hesitant, it is **correct 73.2% of the time.**
- **Recall: 50.6% :**the model correctly identifies **50.6% of hesitant individuals.**
- The F1-score balances **precision and recall**, ensuring the model does not overly favor one metric at the expense of the other.

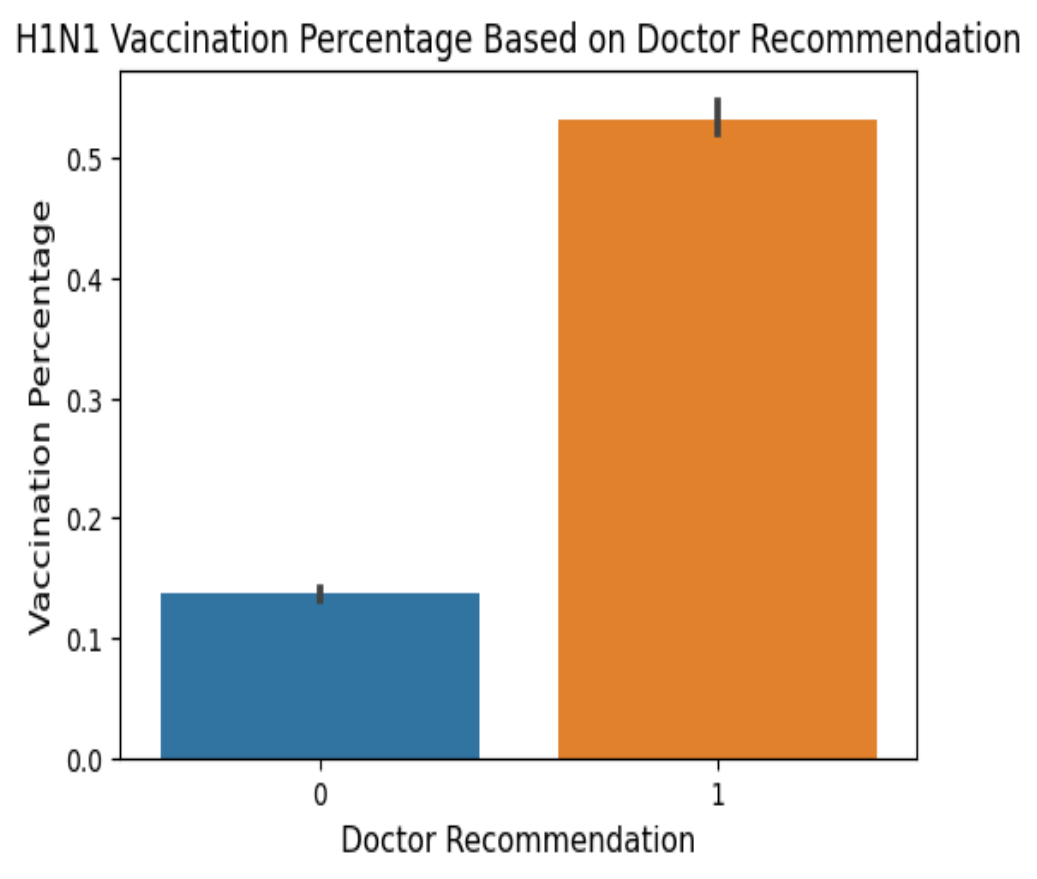
FINDINGS- CONT

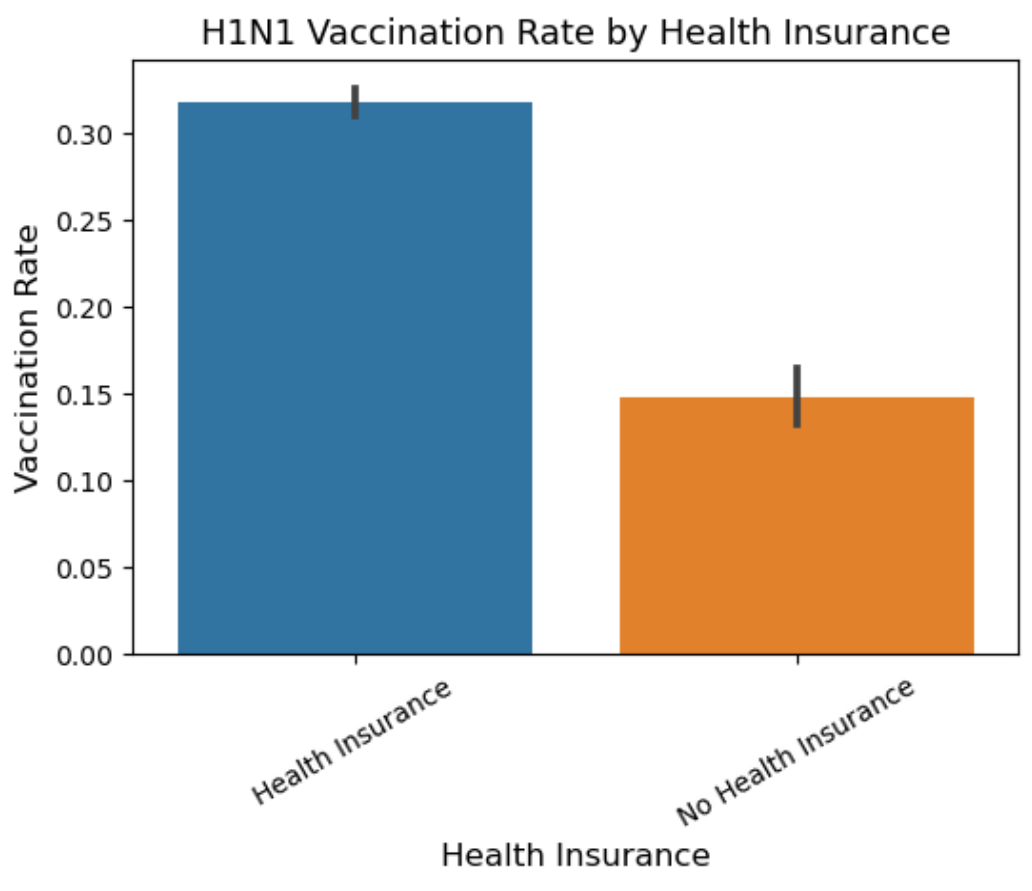
- **What This Means**
- ✅ The model is **fairly accurate** at identifying vaccine hesitancy.
  ✅ **Precision is strong**, meaning that when it predicts hesitancy, it's usually correct.
  ⚠️ **Recall is moderate**, meaning the model **misses some hesitant individuals**, which could affect outreach strategies.

CONCLUSIONS

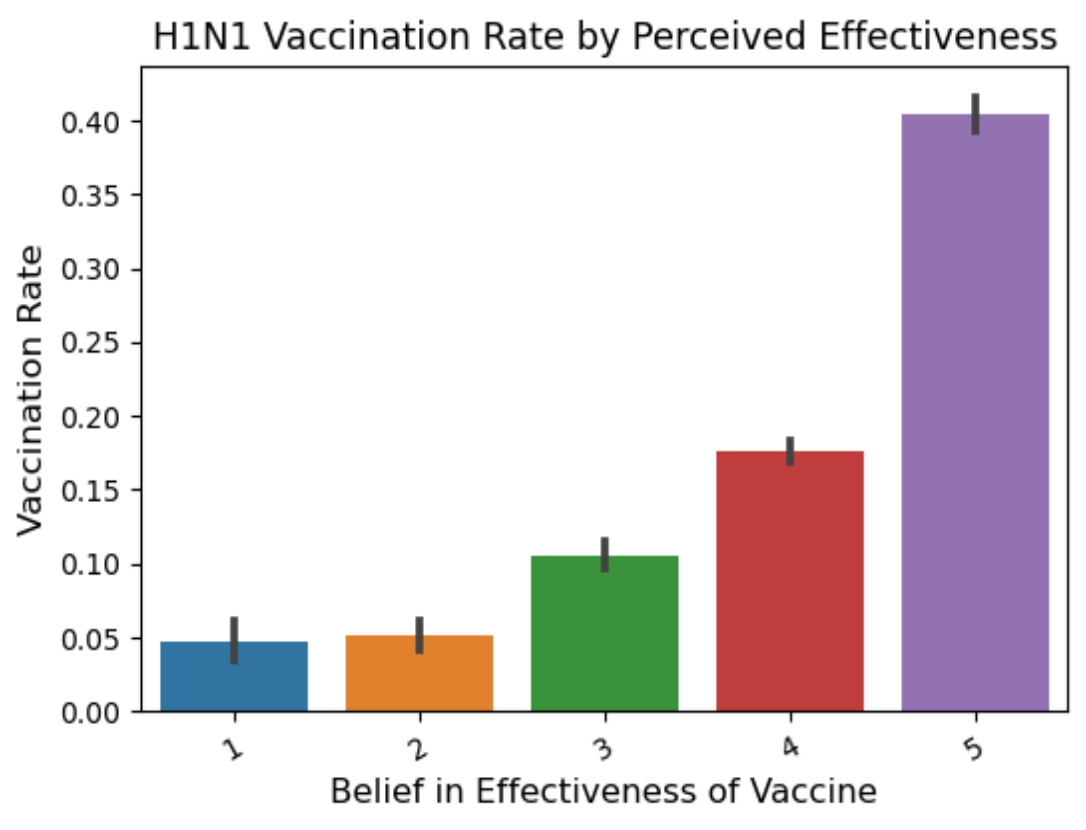
- The analysis identified **key factors** influencing **H1N1 vaccine hesitancy as follows:**
- Doctor recommendations, **insurance status**, and **perceived vaccine effectiveness** are strong predictors.
- The insights can help **public health officials** develop **targeted interventions** to improve vaccine uptake.

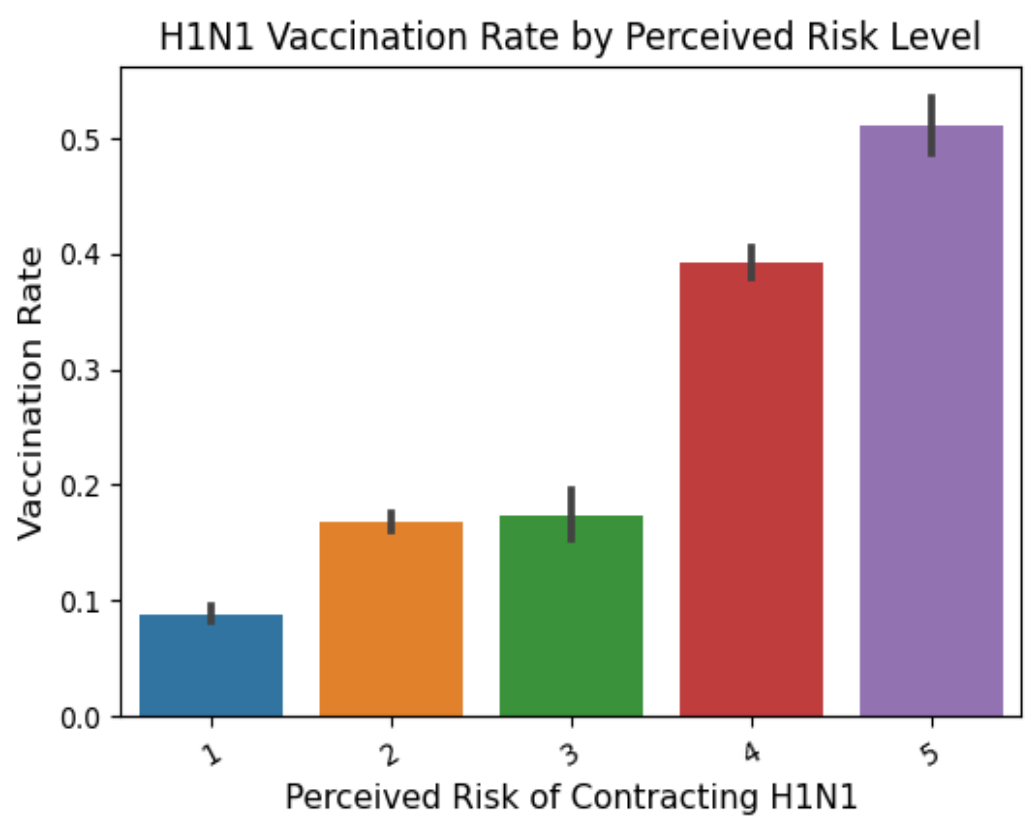
CONCLUSIONS: HEALTH FACTOR FINDINGS





CONCLUSIONS: CLIENT FACTOR FINDINGS





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.

ASANTE

THANKYOU