PREDICTION OF H1N1 OR SEASONAL FLU VACCINATION

Design a cost-effective data-driven vaccination campaign

H1N1 VACCINE PREDICATION

Problem Statement

Identify key factors associated with vaccine uptake

Predict vaccination probability for individuals or populations

Inform targeted public health messaging and interventions

Scope and Evaluation

1. Identify groups with lower vaccination rates
2. Design more effective, data-driven vaccination campaigns
3. Allocate resources efficiently to increase overall vaccine coverage

Business Understanding

Problem Statement

To predict whether an individual received the H1N1 vaccine based on the demographic characteristics.

Data Understanding

- **Analyzed**

26,708 from H1N1 Data.csv file

- **Data Management**

1. Data cleaning – Missing values, inconsistency
2. Exploratory Data Analysis
3. Descriptive statistics

- **Feature engineering**

1. Preprocessing
2. One-hot encoding
3. Train-test split

- **Model evaluation**

1. Logistics Regression
2. Random Forest
3. Decision Tree

Summary Statistics

	Count	Mean
H1n1_concern	**26708**	**1.62**
H1n1_Knowledge	**26708**	**1.26**
behavioral_antiviral_meds	**26708**	**0.05**
behavioral_avoidance	**26708**	**0.73**
behavioral_face_mask	**26708**	**0.07**
behavioral_wash_hands	**26708**	**0.38**
behavioral_large_gatherings	**26708**	**0.34**

Overall, while most respondents expressed moderate concern about H1N1, their knowledge was low.

Key results - Logistics Regression

Outcome	ROC-AUC Score	Interpretation
H1N1 Vaccine	0.84	Strong discrimination ability
Seasonal Flu Vaccine	0.85	Very strong predictive power

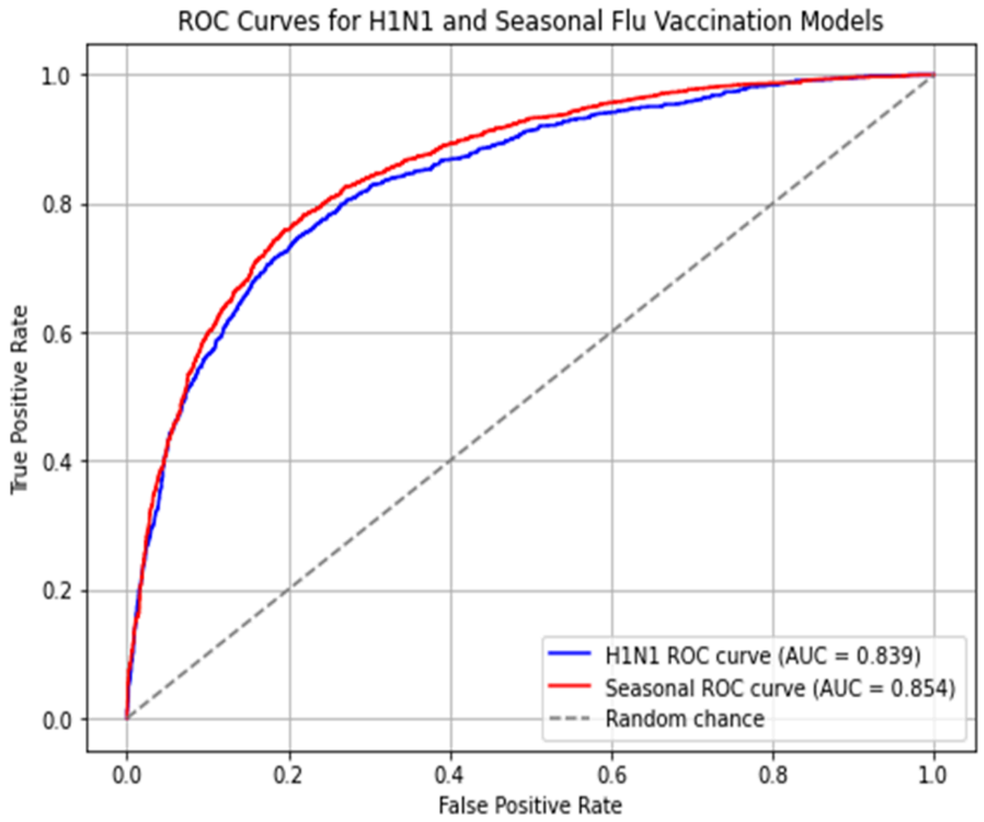
- **H1N1 Vaccine (AUC = 0.84):**

The model shows intense discrimination, meaning it can accurately differentiate between those likely and unlikely to receive the H1N1 vaccine.

- **Seasonal Flu Vaccine (AUC = 0.85):**

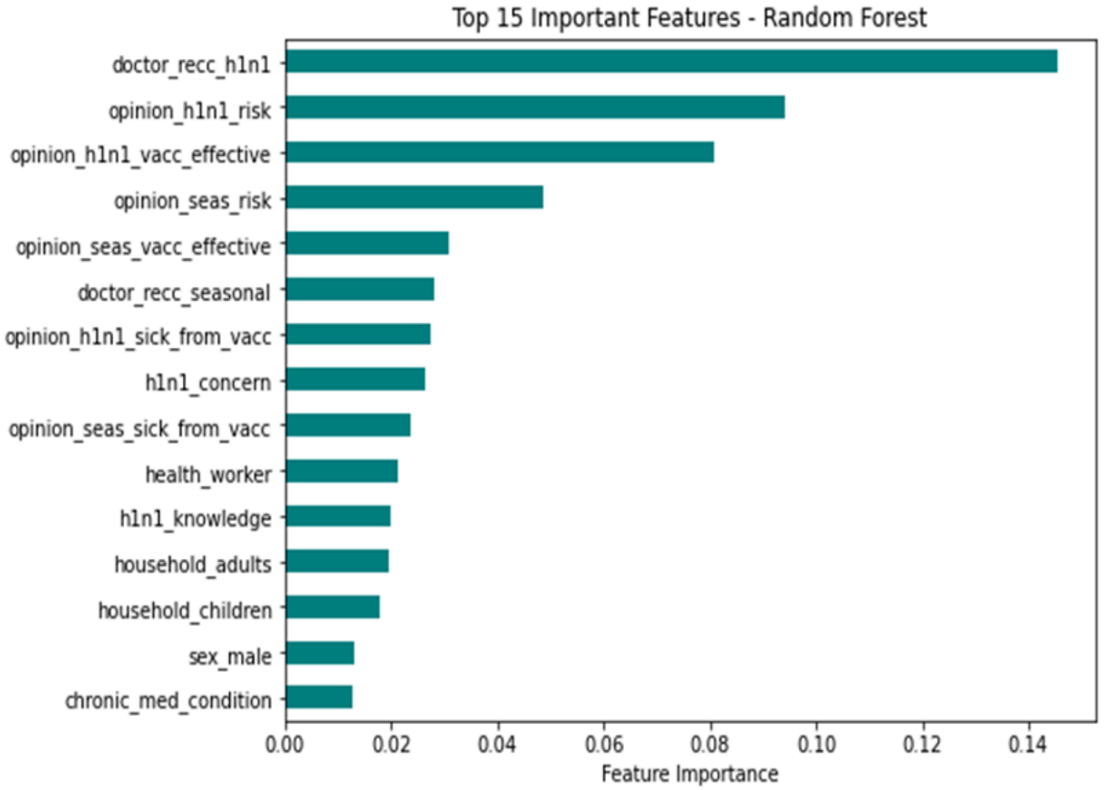
The model demonstrates extreme predictive power, indicating slightly better performance than the H1N1 vaccine model. It effectively distinguishes between vaccinated and unvaccinated individuals.

ROC curve for H1N1 and Seasonal flu



- Both models demonstrate strong discriminative ability, with the seasonal flu vaccine model showing a modest performance advantage.
- This suggests that the predictors included in models effectively explain vaccination behavior for both H1N1 and seasonal flu.

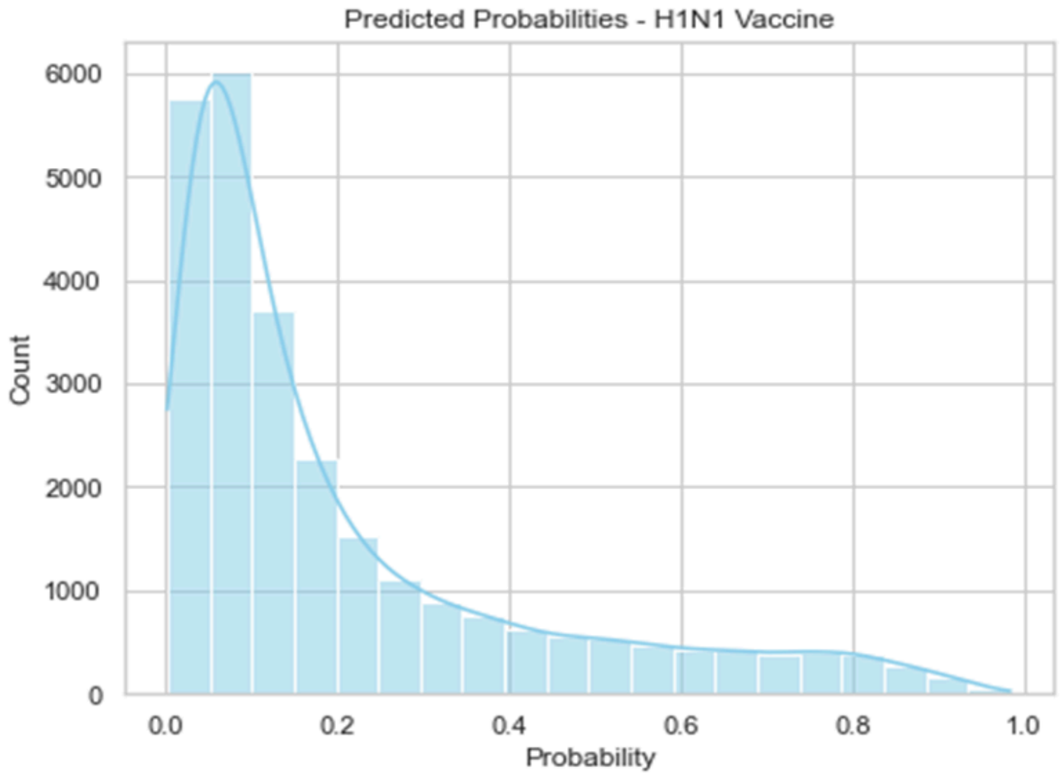
Top 15 features - Random Forest



Key Insights: Random Forest

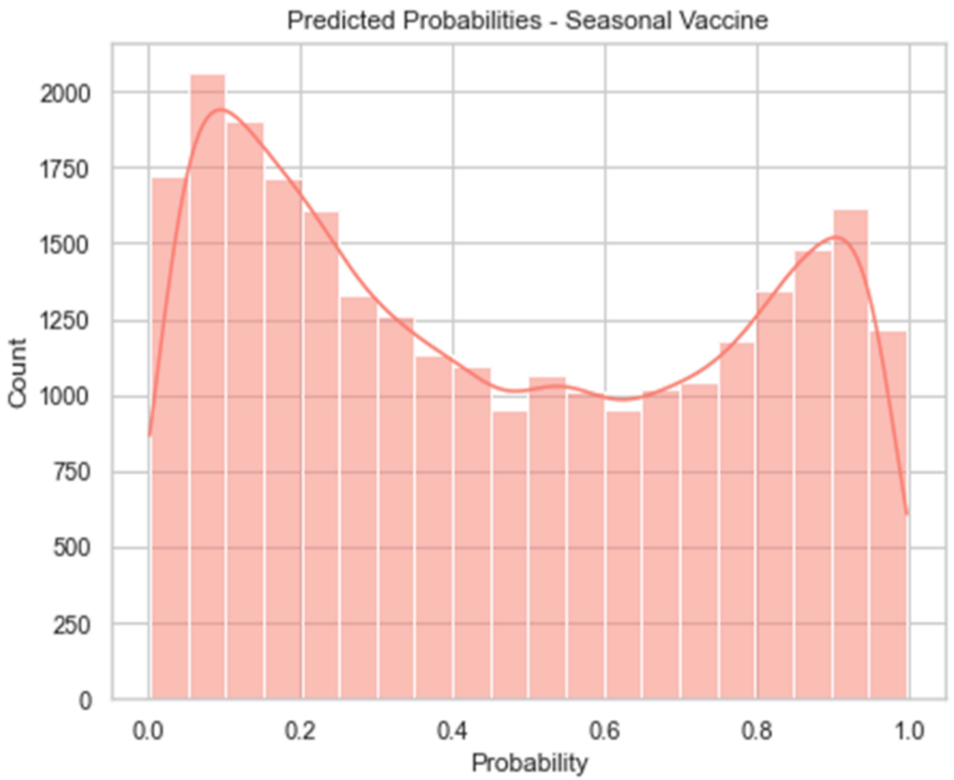
- A doctor’s recommendation for the H1N1 vaccine is the strongest predictor of vaccination behavior.
- Perceived H1N1 risk and belief in vaccine effectiveness are also major drivers.
- Demographic and occupational factors (Sex, health workers’ status, household size) have a relatively minor impact.

Key finding - Predicted Probabilities H1N1 Vaccine



- The figure shows that most individuals have a low predicted probability of receiving the H1N1 vaccine, indicating a generally low likelihood or uptake within the population

Key Finding -Predicted Probabilities Seasonal vaccine



- The figure shows a bimodal distribution of predicted probabilities of receiving the seasonal vaccine, with distinct peaks at 0 and 1.
- The model effectively distinguishes between individuals with a high likelihood of vaccination and those with a low probability, indicating strong predictive discrimination.

Recommendation

1. **Strengthen Provider Engagement** - Public health authorities should therefore prioritize strategies that enhance healthcare providers' capacity and motivation to recommend vaccination.
2. **Address Perceptual and Attitudinal Barriers** – Targeted health communication campaigns should emphasize accurate information on vaccine effectiveness and safety, particularly among individuals who perceive low risk or are skeptical.
3. **Focus on high-risk, low-uptake populations -** Tailored outreach and community-specific interventions, such as mobile vaccination units, peer advocacy, or localized campaigns, can help bridge access and awareness gaps among these populations.
4. **Utilize Predictive Analytics for Strategic Planning** – Health authorities can apply these insights to optimize the geographic and demographic targeting of vaccination campaigns, improve resource allocation, and monitor progress toward coverage goals.

Conclusion

- The predictive model achieved strong performance (ROC-AUC > 0.83) in predicting individuals' likelihood of receiving H1N1 and seasonal flu vaccines, confirming the feasibility of using machine learning for real-time monitoring of vaccination behavior.
- Doctor recommendations and risk perceptions emerged as the most influential predictors of vaccine uptake, highlighting the need for provider-centered communication strategies to increase vaccination coverage in future public health campaigns.

THANK YOU