PREDICTING H1N1 VACCINE UPTAKE

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An Overview

The Problem

Learning from the Past

- The 2009 H1N1 pandemic led to over 150,000+ deaths. We must learn from history.

Understanding Human Behaviour

- Do opinions, behaviors, and demographics actually predict vaccine decisions? We need answers.

Our Solution

Designing for Impact

- How can healthcare professionals design more effective campaigns for vaccine acceptance?

A Data-Driven Approach

- We used machine learning to analyze survey data from 26,707 People to find these answers

What We Aimed To Discover

- **Predict Vaccine Uptake** → Build a machine learning model that can classify who is likely to receive the H1N1 vaccine.
- **Identify At-Risk Groups** → Detect populations with a high probability of remaining unvaccinated.
- **Uncover Key Drivers** → Highlight the main factors influencing vaccine acceptance and hesitancy.

Let's Meet The Data

Data Overview

- **Source**: CDC / 2009
- **Sample**: 26,707 U.S. Respondents
- **Goal**: Predict H1N1 Vaccine Uptake

Key Predictors

- **Opinions & Knowledge** → Concern, knowledge
- **Behaviors** → Mask use, handwashing
- **Demographics** → Age, income, race
- **External Influence** → Doctor recommendations, healthcare employment

How We Cleaned The Mess

1

Missing Data

Dropped columns with too many gaps, and filled the rest with common or average values.

2

Feature Creation

Combined related columns into simpler scores (e.g., opinion score, prevention index).

3

Column Cleanup

Removed IDs, duplicates, and less useful or redundant features.

4

Data Split

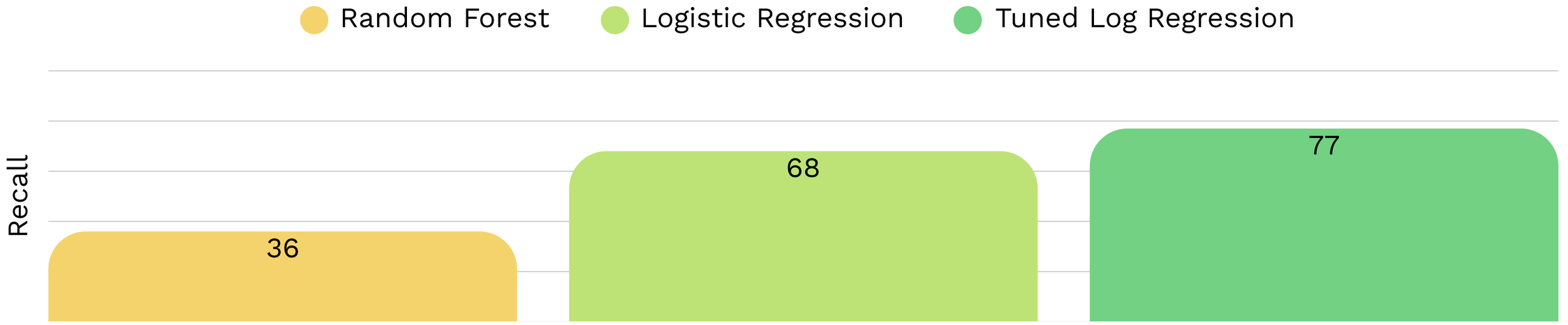
Divided into training (80%) and testing (20%) while keeping class balance.

5

Data Encoding

Converted categories into numeric form so models can understand them

Finding Our Best Predictor



Random Forest

- Powerful but Overfit
- Caught only 1 in 3 true cases

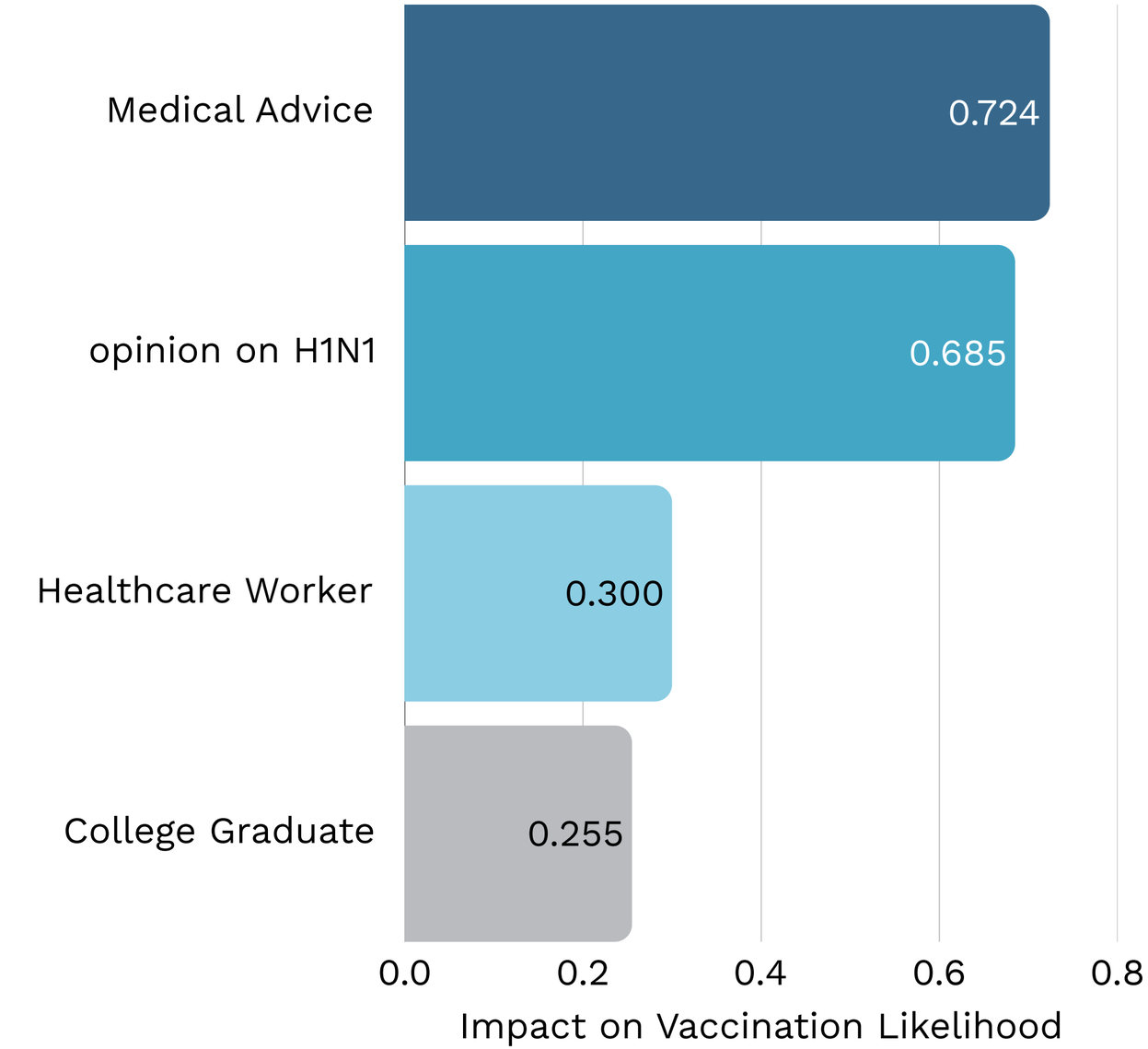
Logistic Regression

- A strong, interpretable baseline
- Correctly identified 2 out of 3 people who were vaccinated.
- Provided a reliable benchmark

Tuned Logistic Regression

- Our champion Model
- Correctly identifies 3 of 4 people who get vaccinated
- The right balance of sensitivity and stability

Unlocking Vaccine Acceptance



Empower Physicians

- Equip doctors with talking points to proactively recommend vaccination.

Build Trust, Not Just Awareness

- Campaigns must directly address safety concerns to shift opinions.

Mobilize Healthcare Champions

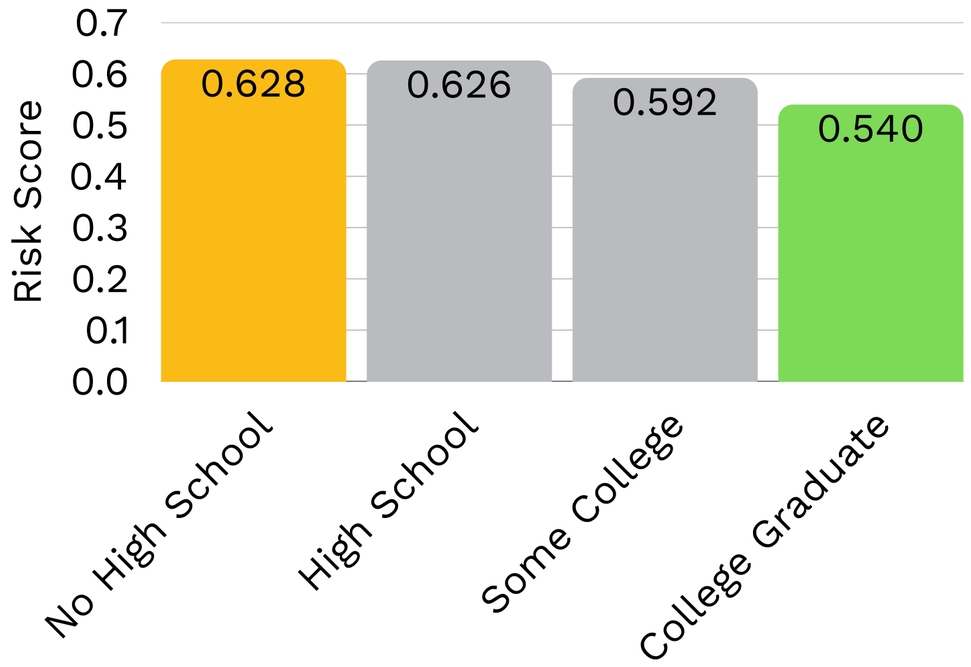
- Leverage staff as trusted messengers within their communities.

Simplify Access and Messaging

- For less educated groups, remove practical barriers like cost and access.

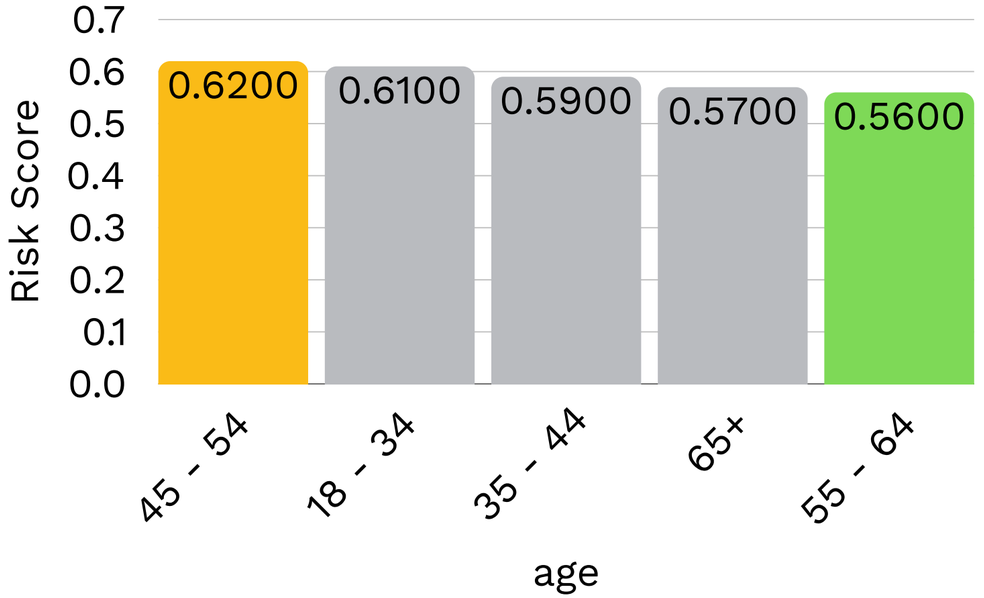
Who’s Most At Risk?

Vaccine Likelihood Rises with Education



- **Key Finding:** The least educated are the most vulnerable.

Middle-aged Adults Are the Most Hesitant Group



- **Key Finding:** Middle-aged adults show the highest hesitancy.

Conclusion:
Campaigns must target specific barriers:
health literacy & access for the less educated and risk perception for middle-aged adults.

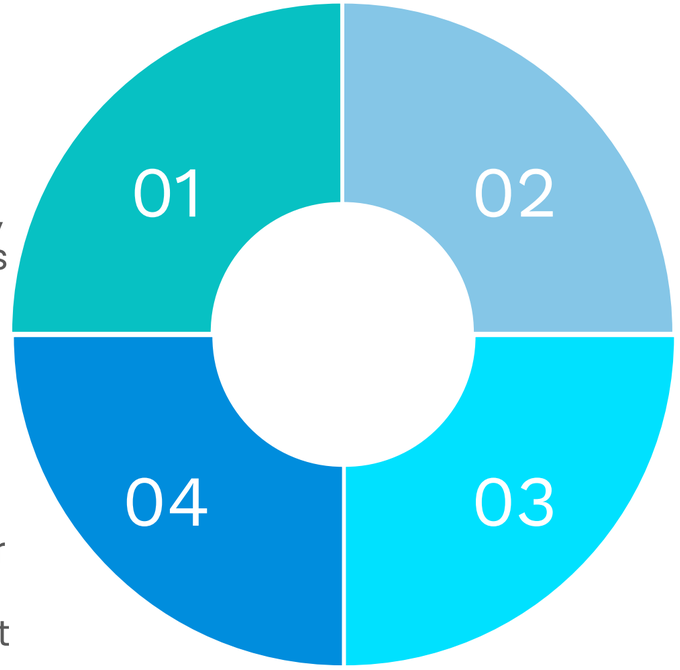
What We Learned

What Drives Vaccinations?

Doctor’s advice matters, people believe vaccines work, healthcare workers are more likely to vaccinate, and feeling at risk motivates action.

Public Health Impact

Better models lead to wider coverage and help target outreach to build trust, fight fear, and close access gaps.



Why Do Some Say No?

Fear of side effects, lack of health insurance, and lower income or education prevent some people from vaccinating.

Big Takeaway

Models reveal human behavior, not just numbers.

Implications & Strategy

1. Focused Outreach

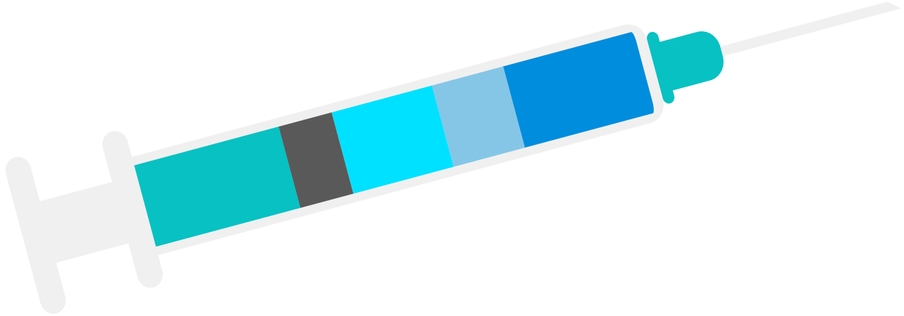
Target the top 77% most likely to vaccinate with personalized messaging for better impact.

2. Tailored Campaigns

Design campaigns by age, health condition, or education instead of one-size-fits-all approaches.

3. Efficient Resource Use

Deploy resources like mobile vaccination units to areas predicted to have lower uptake.



5. Predictive Intervention

Prioritize outreach for individuals unlikely to vaccinate and address misinformation strategically.

6. Key Limitation

The model may not generalize to other contexts, relies on specific features, and should support but not replace human judgment.

Insights Into Action

Explore & Enhance Models

Use advanced models like XGBoost and create new features for better predictions.

Target Key Individuals

Focus on people with high opinion scores and strong doctor recommendations.

Pilot Before Scaling

Test the model in a small region to validate its effectiveness.

Improve Data Collection

Collect real-time vaccine attitude data to enhance model accuracy.

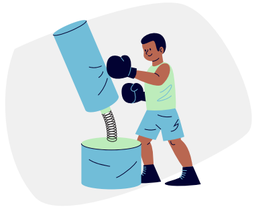
The Final Word

Prediction Power

Machine learning can predict vaccine uptake using health and behavioral data.

Key Drivers

Key drivers include doctor recommendations, risk perception, and knowledge.



Guided Action

Insights guide targeted campaigns and better resource use. Models must be applied carefully and support, not replace, human judgment.

“An ounce of prevention is worth a pound of cure” *-Benjamin Franklin*

Q&A Session

Thank You!

GitHub: https://shorturl.at/IUCdv
Tableau: https://shorturl.at/ICZft