



# **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

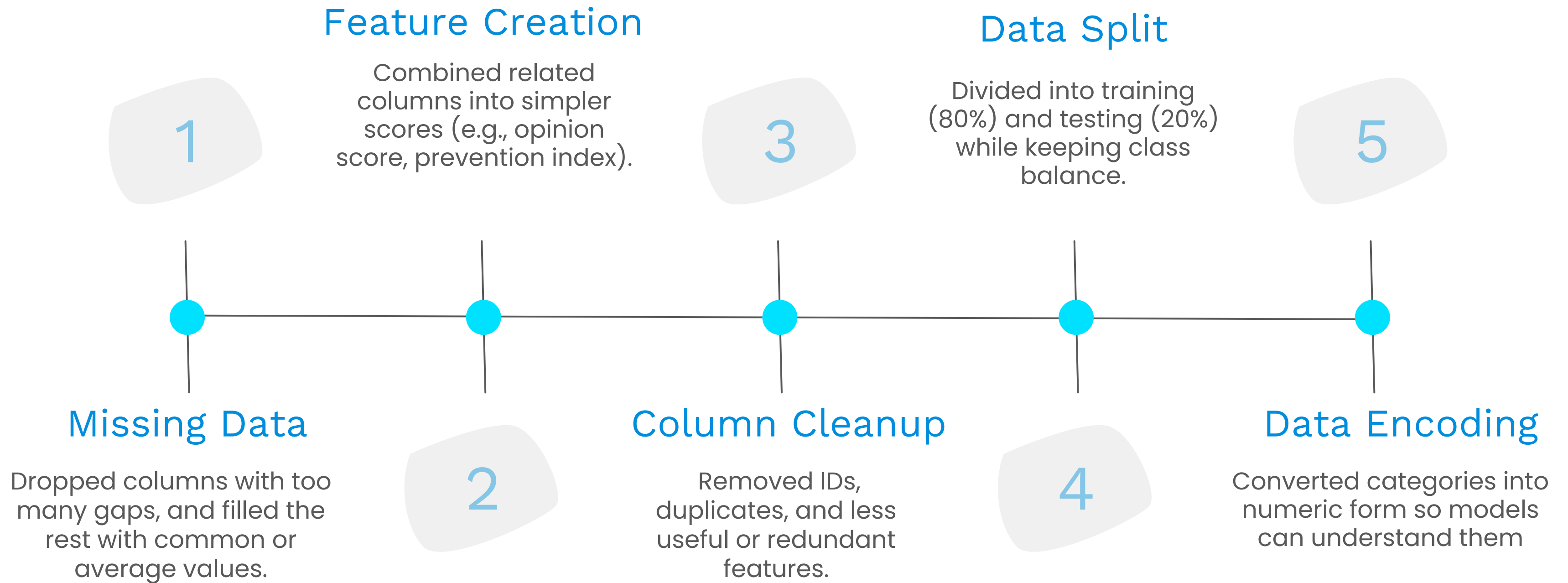
- **Source:** CDC / 2009
- **Sample:** 26,707 U.S. Respondents
- **Goal:** Predict H1N1 Vaccine Uptake



## 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






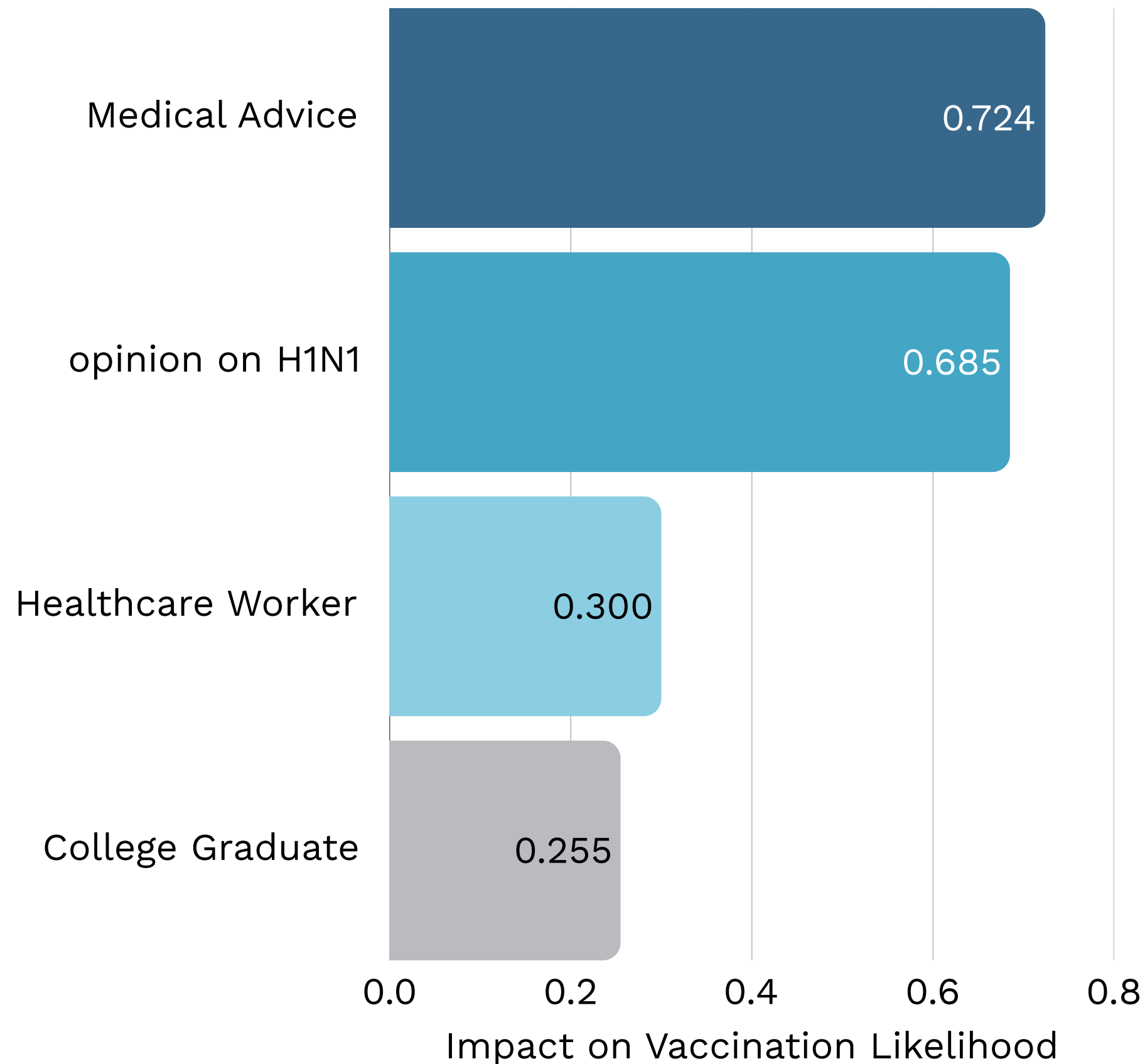
# Finding Our Best Predictor

● Random Forest    ● Logistic Regression    ● Tuned Log Regression



	<h2>Random Forest</h2> <ul style="list-style-type: none"><li>• Powerful but Overfit</li><li>• Caught only 1 in 3 true cases</li></ul>
	<h2>Logistic Regression</h2> <ul style="list-style-type: none"><li>• A strong, interpretable baseline</li><li>• Correctly identified 2 out of 3 people who were vaccinated.</li><li>• Provided a reliable benchmark</li></ul>
	<h2>Tuned Logistic Regression</h2> <ul style="list-style-type: none"><li>• Our champion Model</li><li>• Correctly identifies 3 of 4 people who get vaccinated</li><li>• The right balance of sensitivity and stability</li></ul>

# 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.

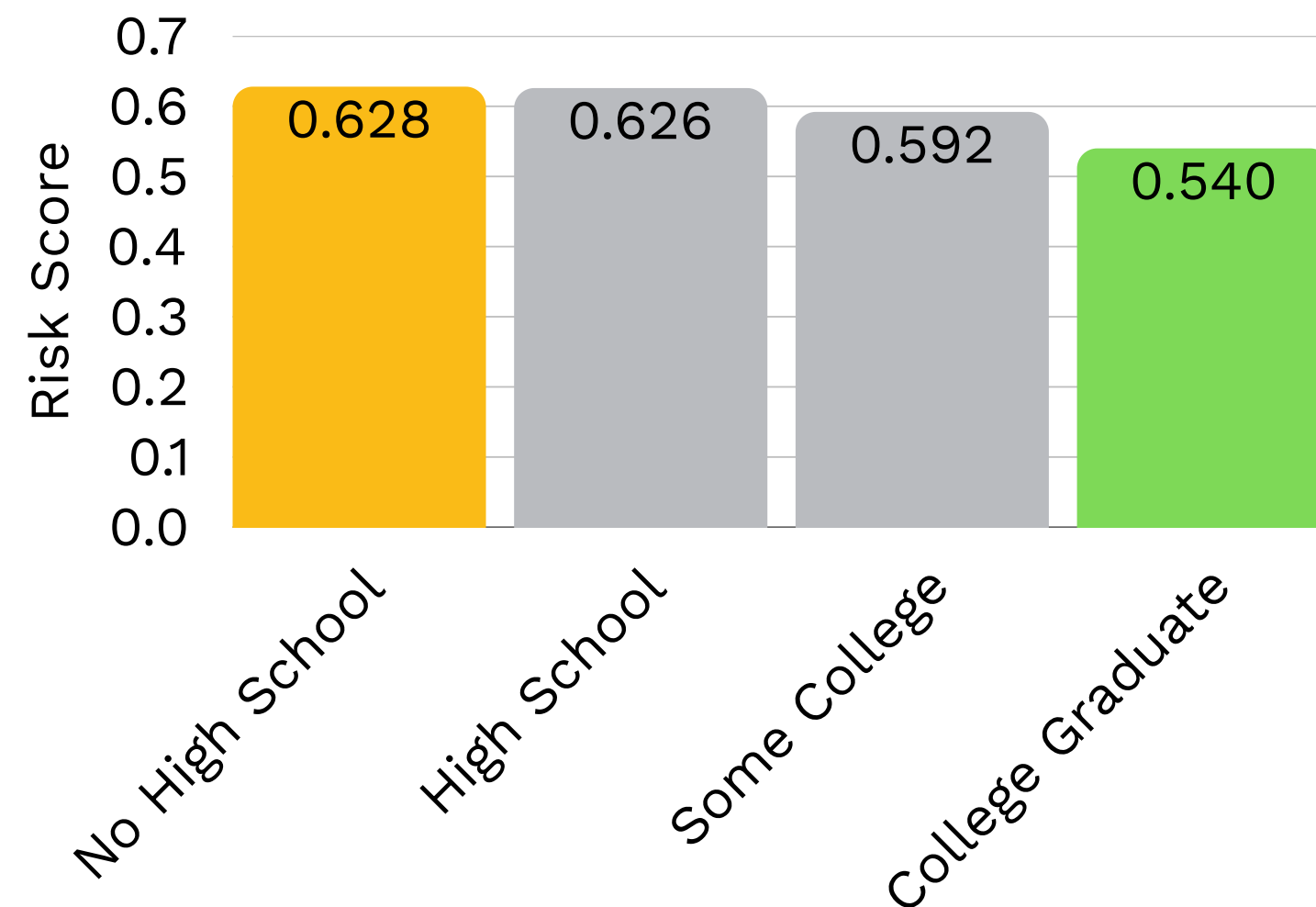


## Simplify Access and Messaging

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

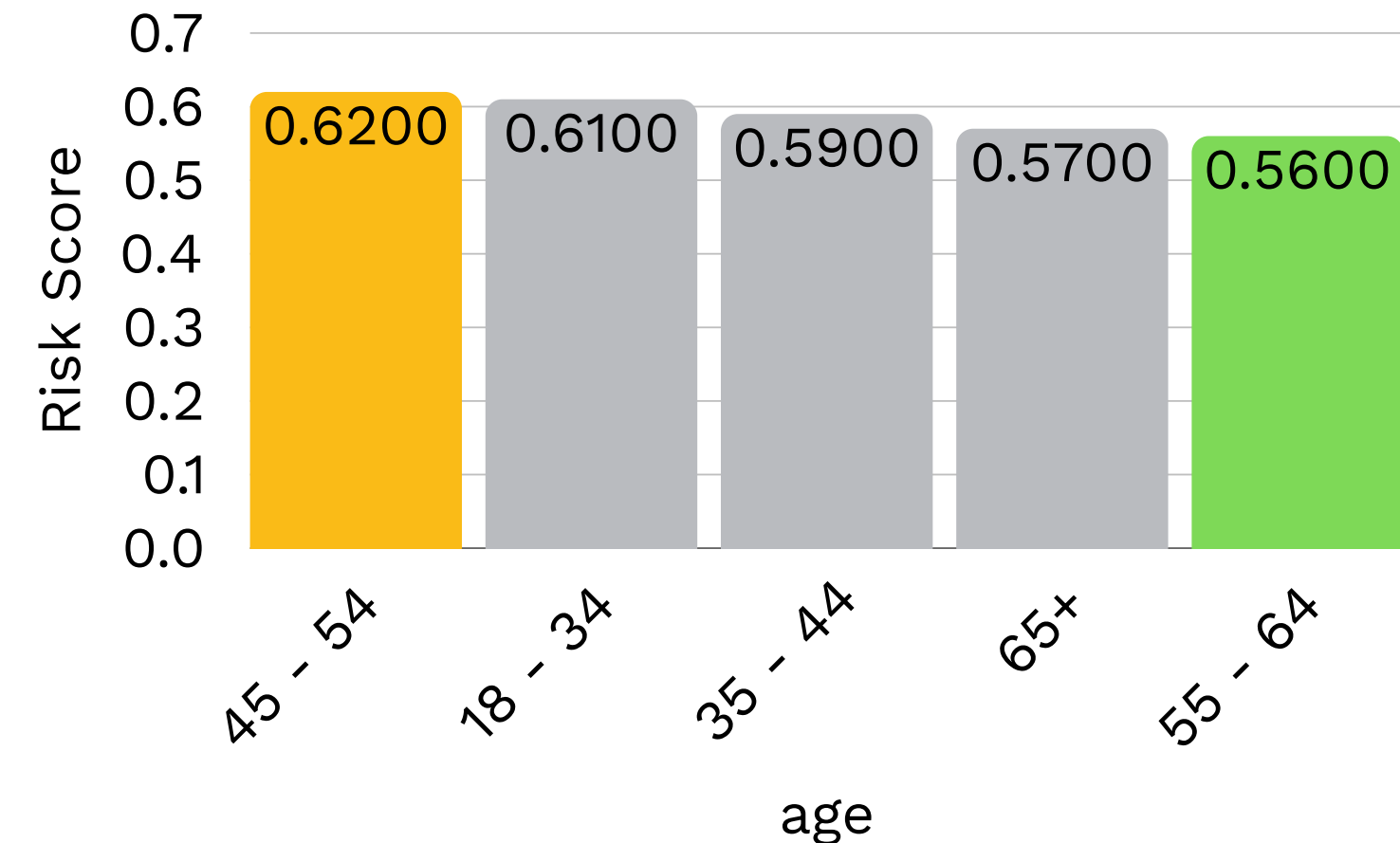
# Who's Most At Risk?

## 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.



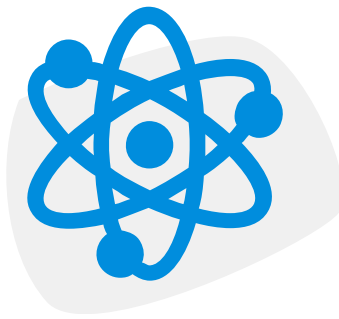
# What We Learned

## What Drives Vaccinations?

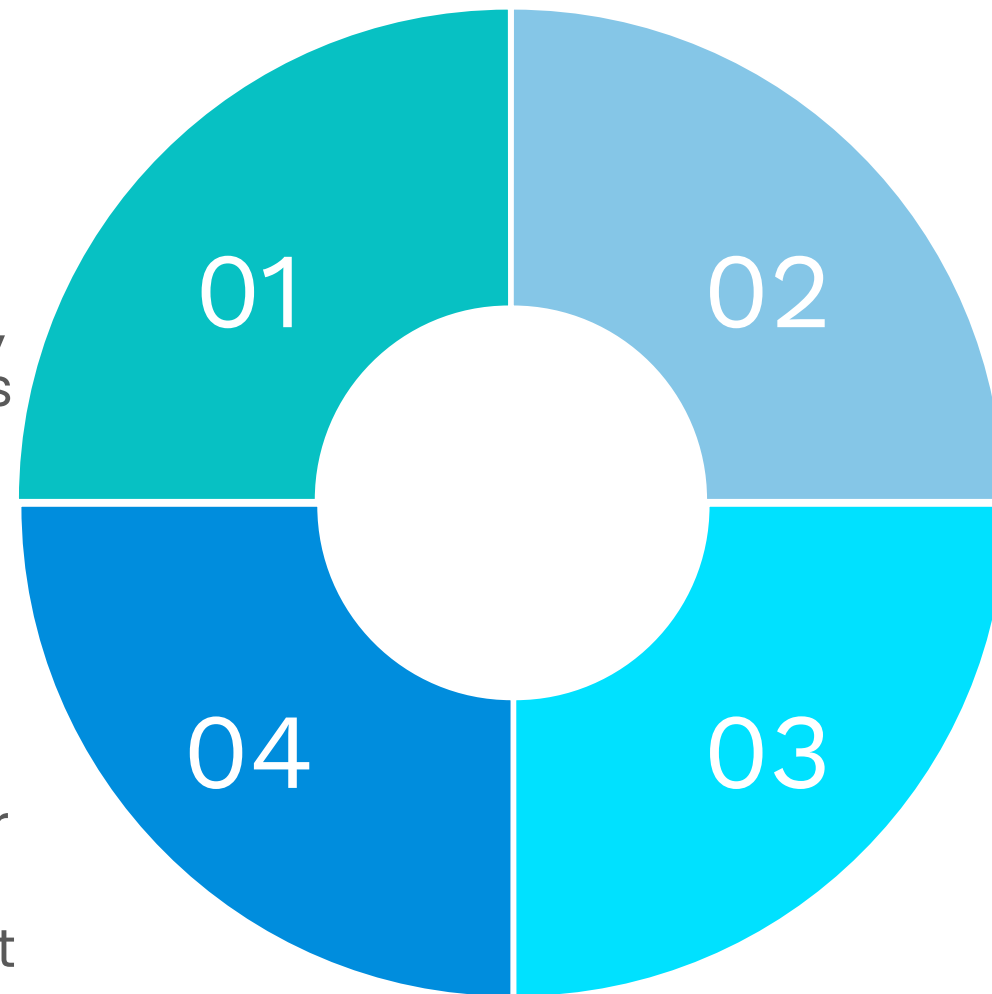


Doctor's advice matters, people believe vaccines work, healthcare workers are more likely to vaccinate, and feeling at risk motivates action.

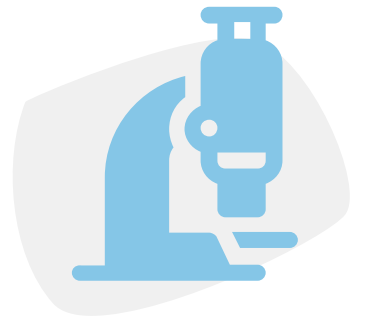
## Public Health Impact



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.

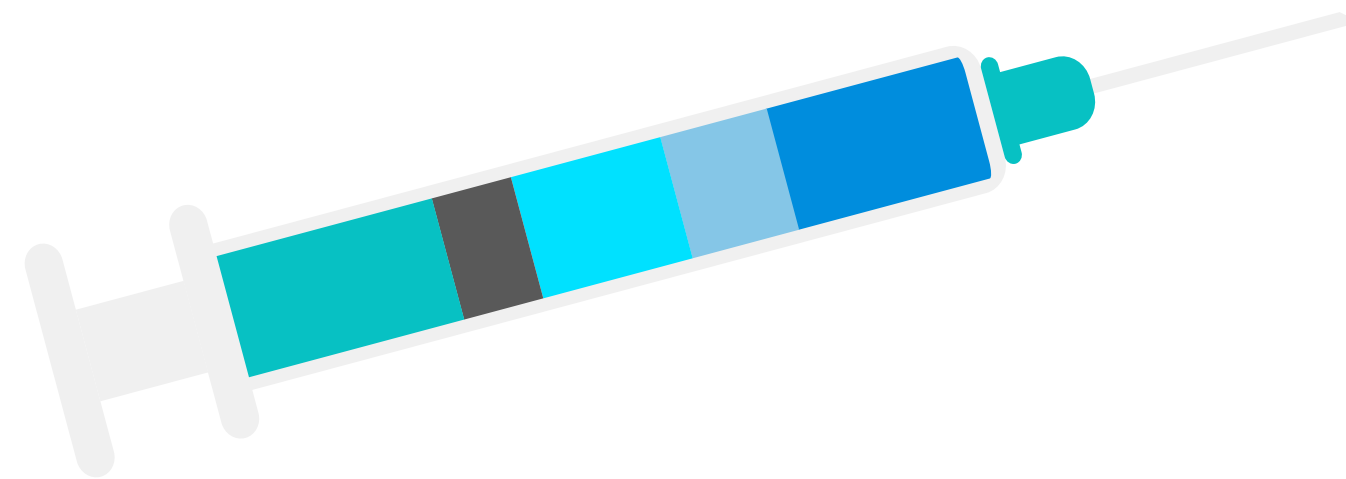
# Implications & Strategy

## 6. Key Limitation

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

## 5. Predictive Intervention

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



## 3. Efficient Resource Use

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

## 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.



# 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.



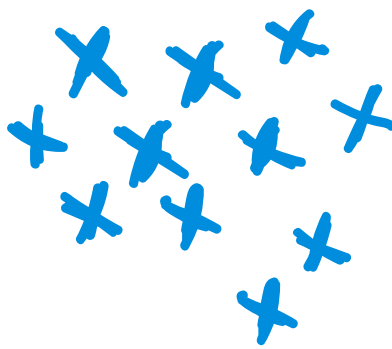
## Pilot Before Scaling

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

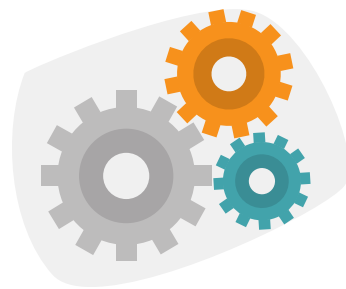


## Improve Data Collection

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



# The Final Word



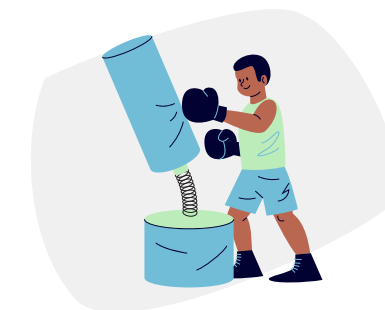
## Prediction Power

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:**  
**Tableau:**

