Flu Vaccine Intake Classification

Aysu Erdemir

November, 2022

Stakeholder: **CDC** – Center for Disease Control and Prevention

Business Problem:

- CDC is up for a vaccine campaign to maximize vaccine intake for the upcoming flu season.
- They want to know what factors are most important in predicting whether a person would take the vaccine or not.

Data:

National 2009 H1N1 Flu Phone Survey from 26707 participants, which contains information about:

✓ whether people had received the **seasonal flu vaccine** or not, AND

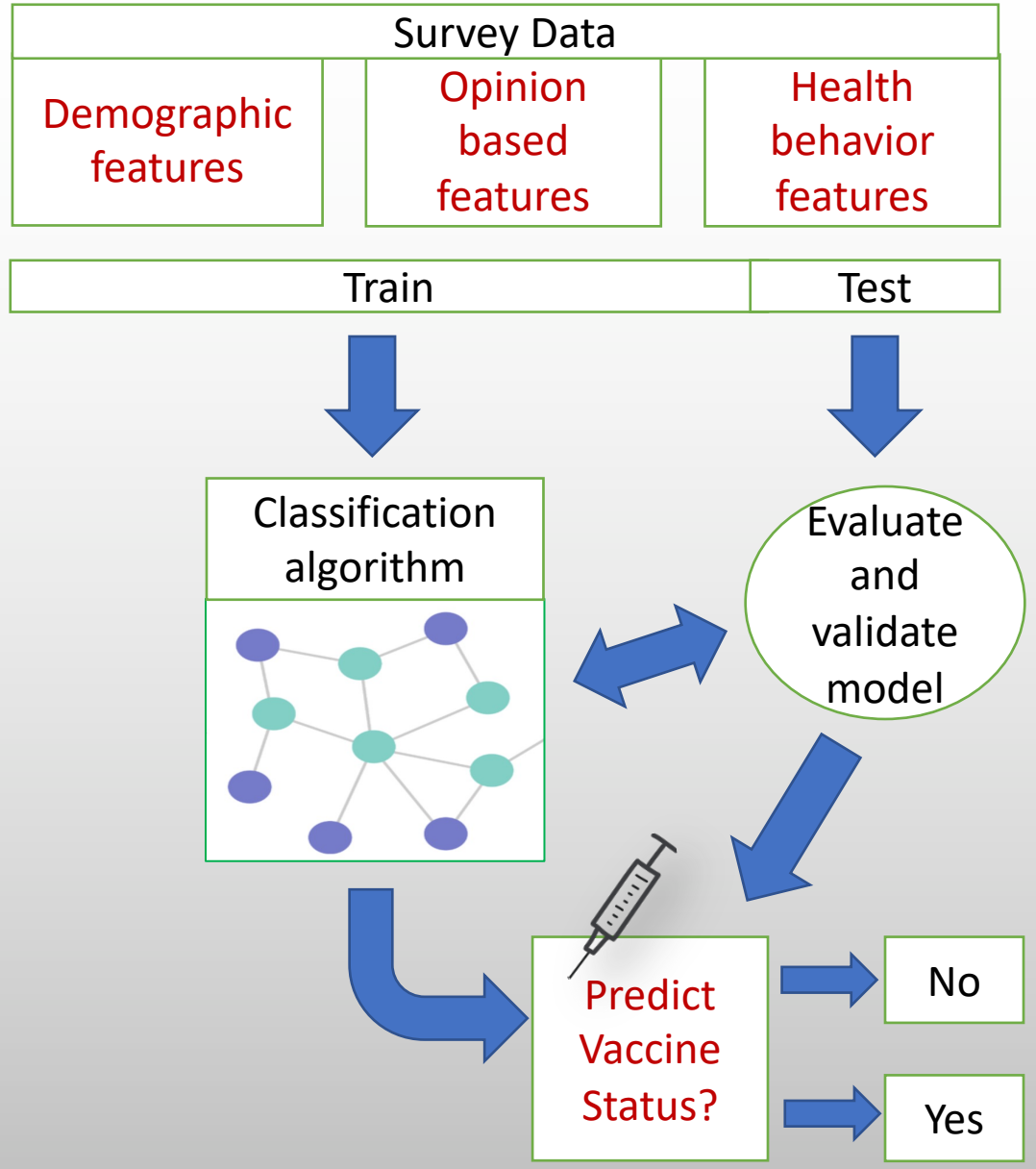
✓ their demographic background (e.g. age, sex, income)
✓ their opinions (e.g. is vaccine effective?),
✓ their health behaviors (e.g. wear mask, avoid crowds)

Goal:

- Build a **classifier** that predicts vaccination status using available information.
- Extract the likelihood of getting vaccinated for each important feature to be able to make recommendations.

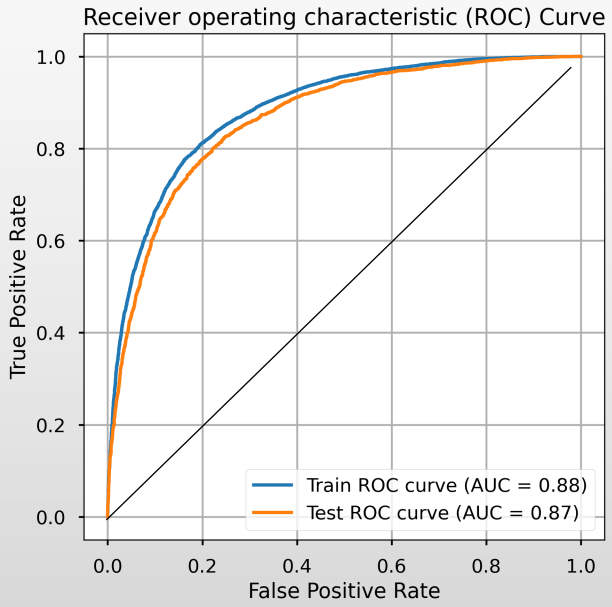
Modeling:

- Clean and preprocess the data.
- Build, tune and validate several types of machine learning classifiers:
  - ✓ Logistic Regression
  - ✓ Decision Tree
  - ✓ Random Forest
  - ✓ XGradient Boosted
  - ✓ Stacking Classifier
- Sort most important features for predicting vaccine outcome.
- Make specific recommendations.



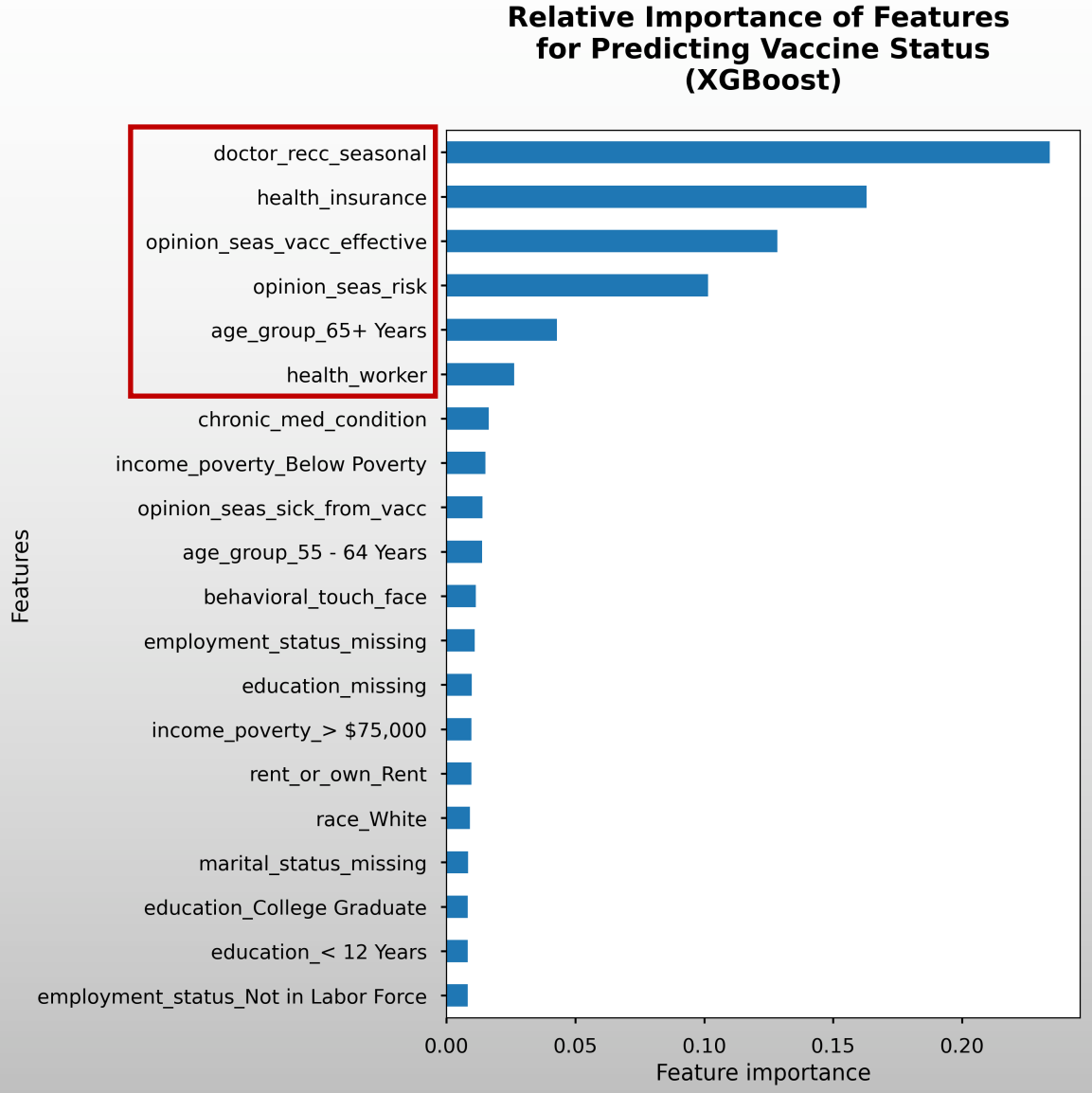
Results from top model:

Model Performance:



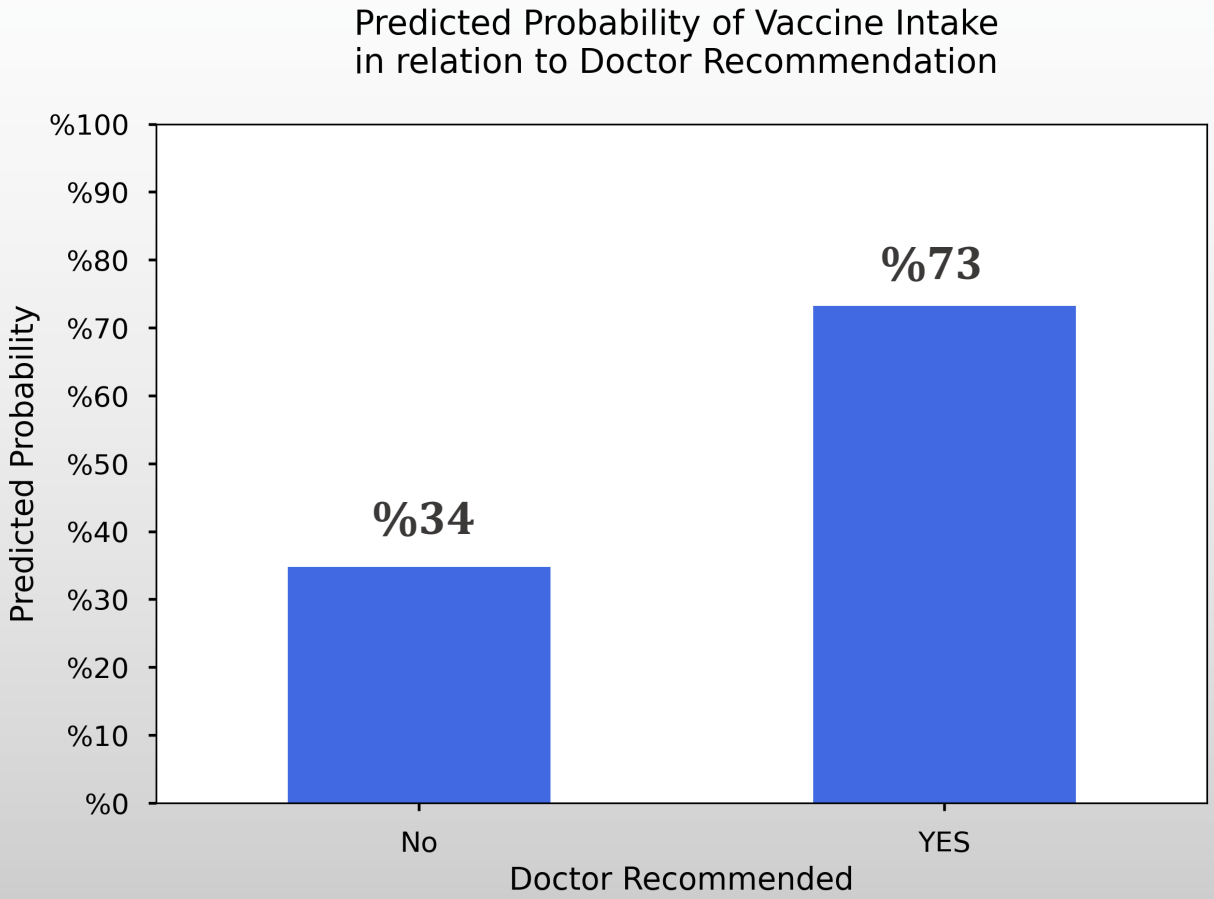
Test Set	
Accuracy	**% 78**
Sensitivity / Recall (True positive rate)	**% 77**
Specificity (True negative rate)	**% 81**

"**Good**" performance in discriminating vaccine takers and deniers.



The most important predictive feature:

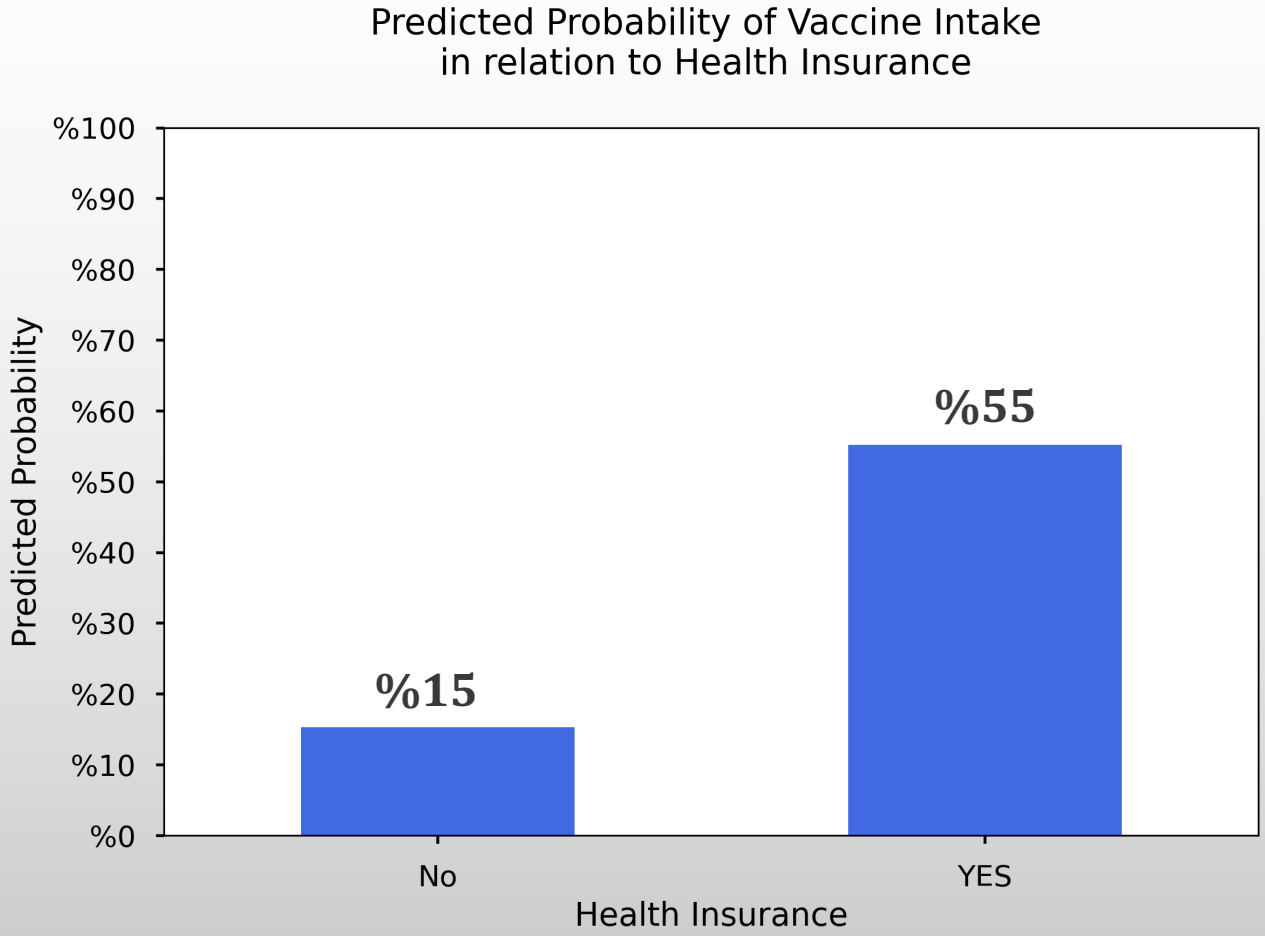
Does your doctor recommend getting flu vaccine?



- People are **%73** likely to receive the vaccine if it was recommended by their doctor.
- People are only **%34** likely to receive the vaccine if it was **NOT** recommended by their doctor.

Target physicians by educating them on the importance of vaccination & recommending it to their patients!

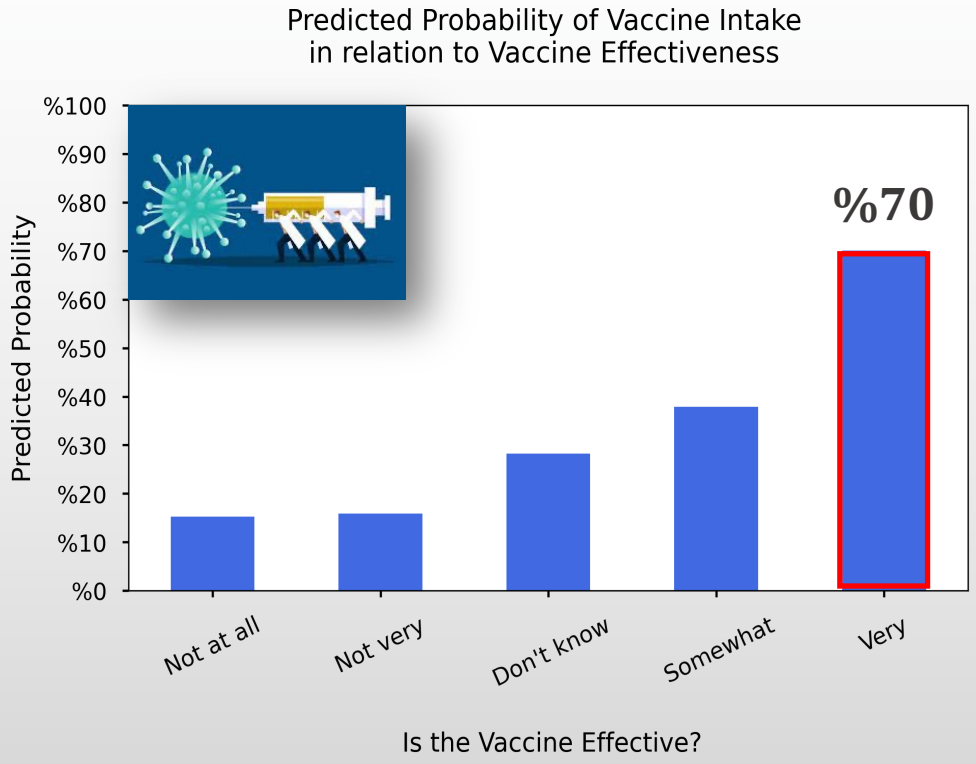
Do you have health insurance?

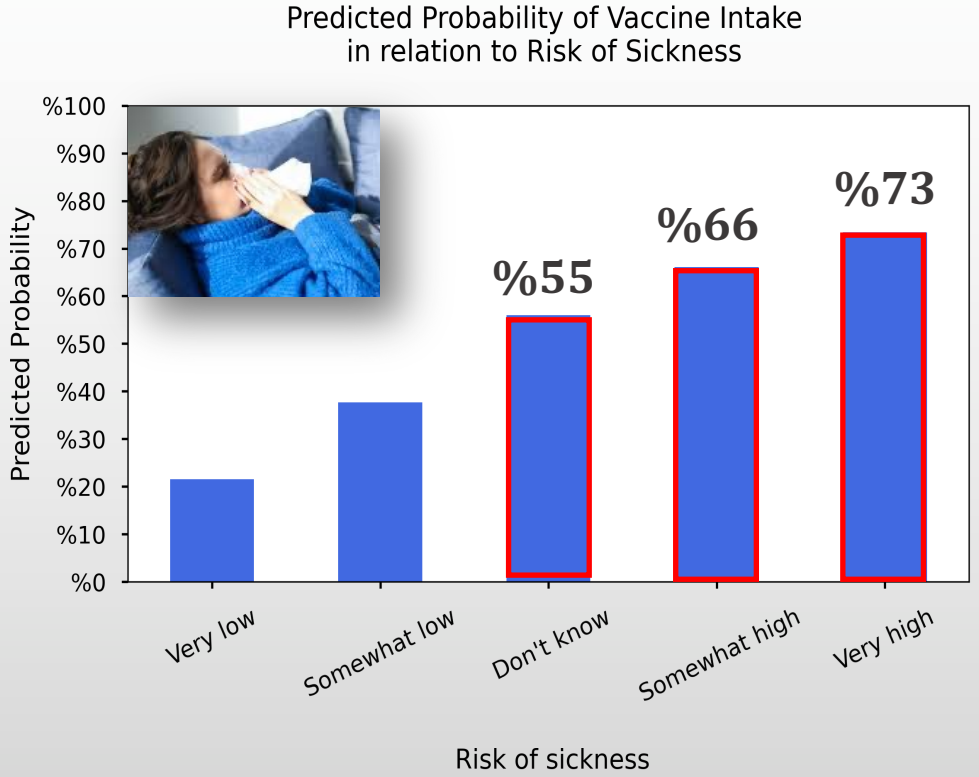


- People with health insurance are substantially more likely to get the vaccine (**%55** compared to **%15**).

Target uninsured populations in the campaign, but better yet work on universal health coverage for all individuals and communities.

Do you think flu vaccine is effective?
Are you worried about getting sick if not vaccinated?

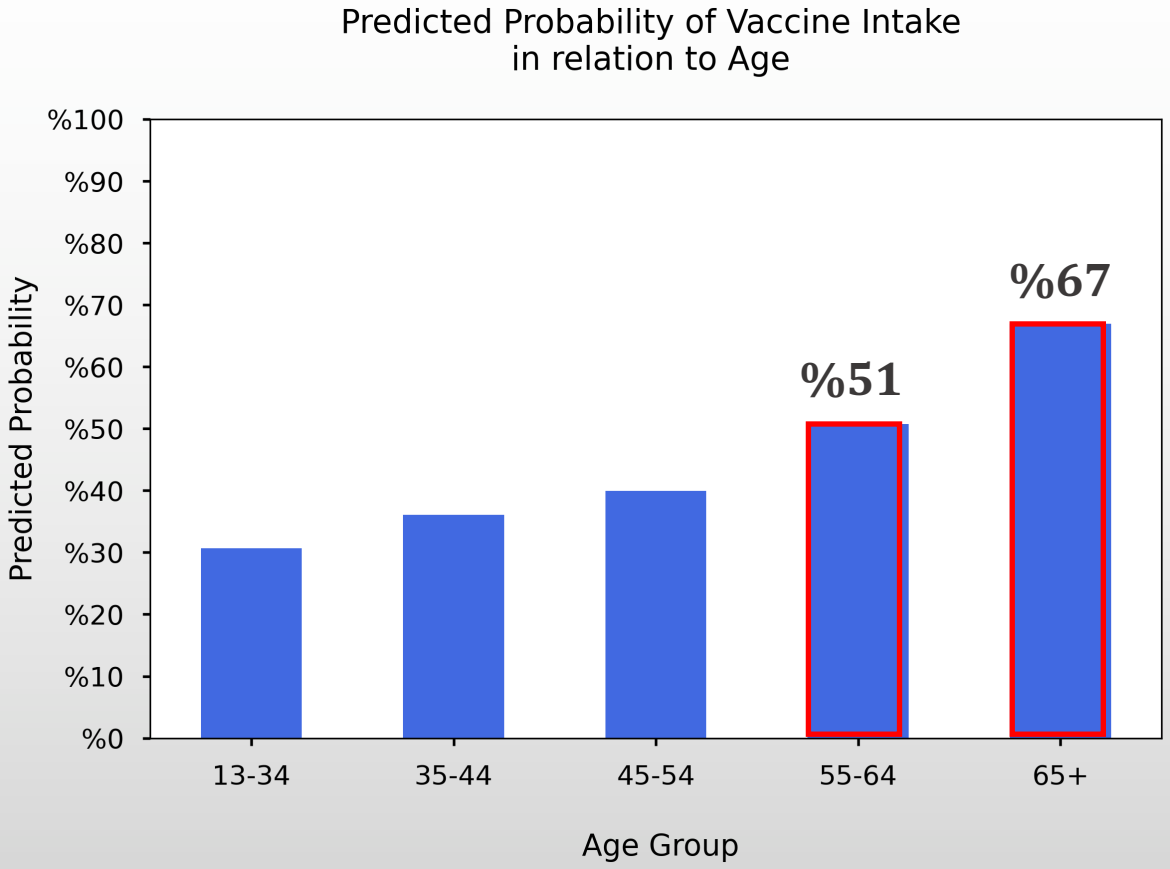




- Only people who rated the vaccine as very effective were more likely to have gotten the vaccine (**%70**)
- As people's worry about getting sick increased their likelihood to get the vaccine also increased.

Focus your campaign on informing the people about the effectiveness and safety of the vaccine or their risk of falling ill and developing complications if not vaccinated.

How old are you?



- **65+ year old** people are much more likely to get the flu vaccine (**%67**).
- **55–64 year** olds are slightly more likely to receive the vaccine (**%51**).

As a priority keep focusing your campaign on older age groups, because they are at more risk of developing flu–related complications compared to younger age groups. There is still room for progress!

Also target younger people as a key demographic population since their vaccination rates are much lower.

Conclusions

You are more likely to get the vaccine if:

- ✓ your doctor recommends the vaccine
- ✓ you have health insurance
- ✓ you think the vaccine is effective
- ✓ you believe you can get sick from flu
- ✓ you are +65 years old

Recommendations

For maximizing vaccine intake:

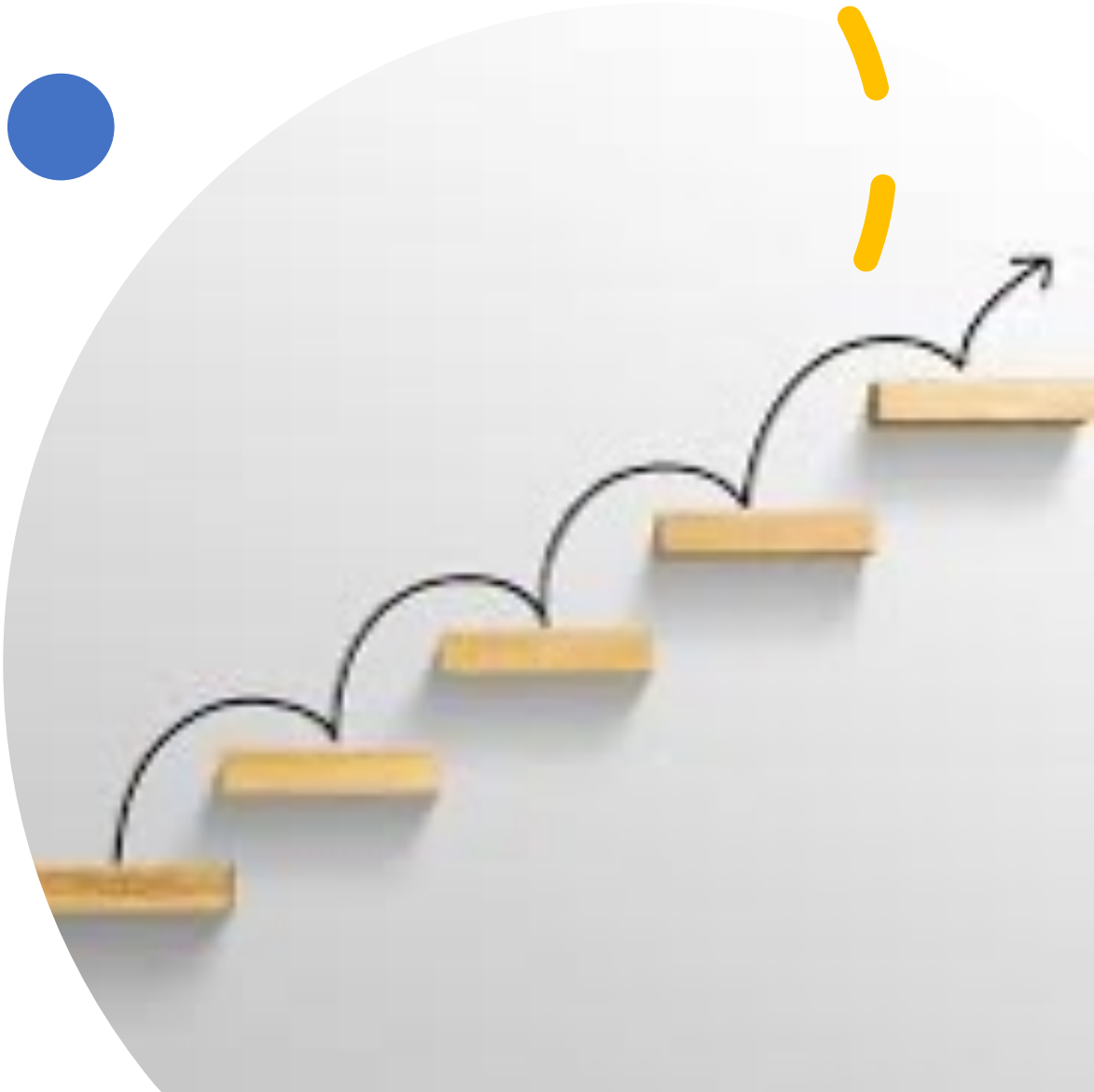
- Target **physicians** by educating them on the importance of vaccination & recommending it to their patients.
- Target **uninsured** populations, but better yet work on universal health coverage.
- Inform the people about the **effectiveness** and safety of the vaccine and their **risk** of falling ill and developing complications if not vaccinated.
- Keep focusing on **older** age groups as they are at more risk of developing complications from flu. But also target **younger** people to maximize the benefits of herd immunity since they are much less likely to receive the vaccine.

Limitations and Improvements

- Encrypted **employment industry**, **employment occupation**, and **geographical reg**ion info, hard to make any specific suggestions based on these features.

- Results on **health insurance** are not very reliable due to having %40 missing data which was encoded using predictive modeling. Emphasis needs to be given to this variable next time the survey is conducted.

- More recent data needs to be collected after the Covid–19 **pandemic** since the pandemic might have altered people's attitude towards flu vaccine as well.



Email: erdemiraysu@gmail.com

GitHub: @erdemiraysu

LinkedIn: linkedin.com/in/aysuerdemir/