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

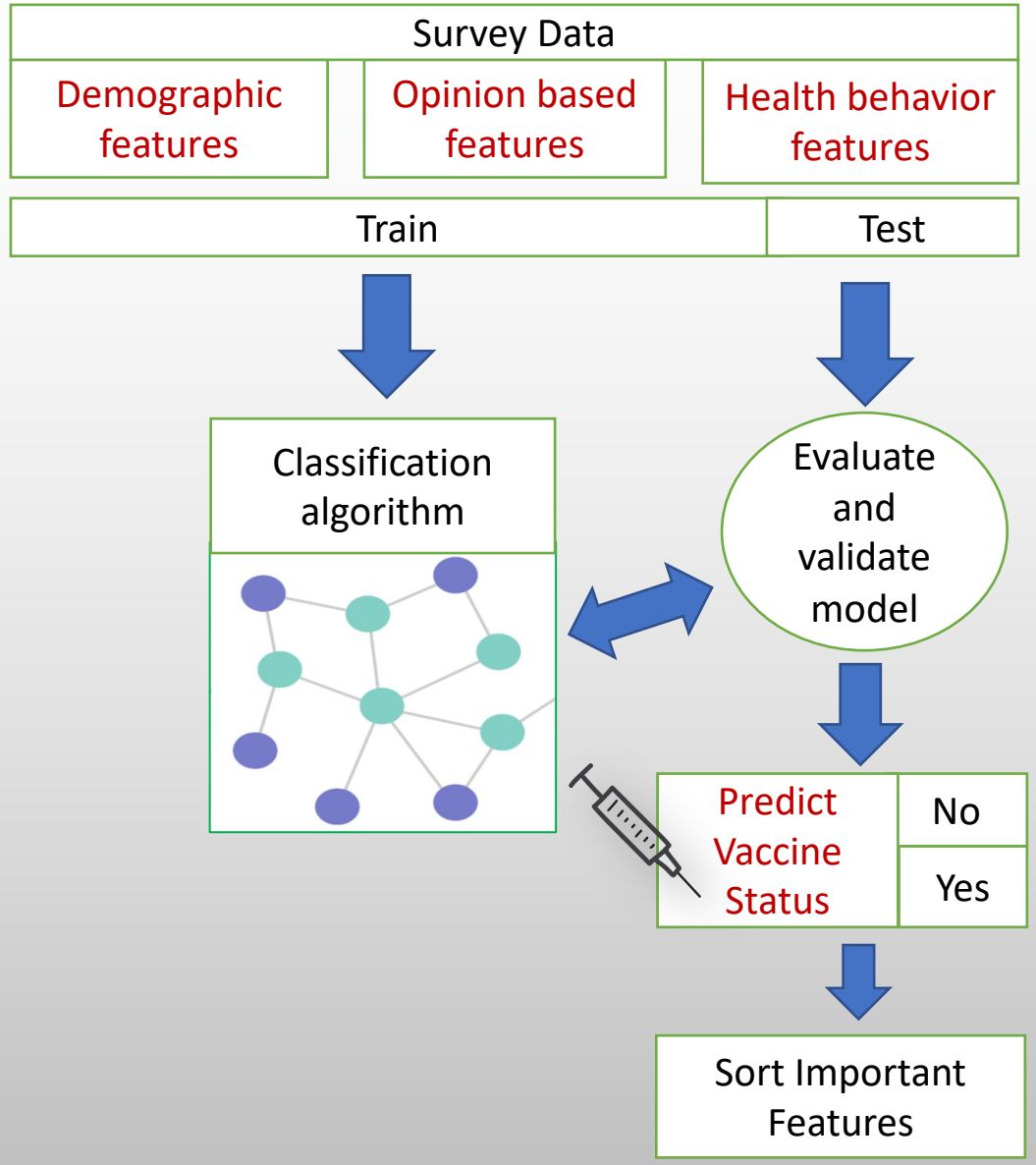
✓ their demographic background (e.g. age, sex, income)
✓ their opinions (e.g. is vaccine effective?),
✓ their health behaviors (e.g. wear mask, avoid crowds)

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:



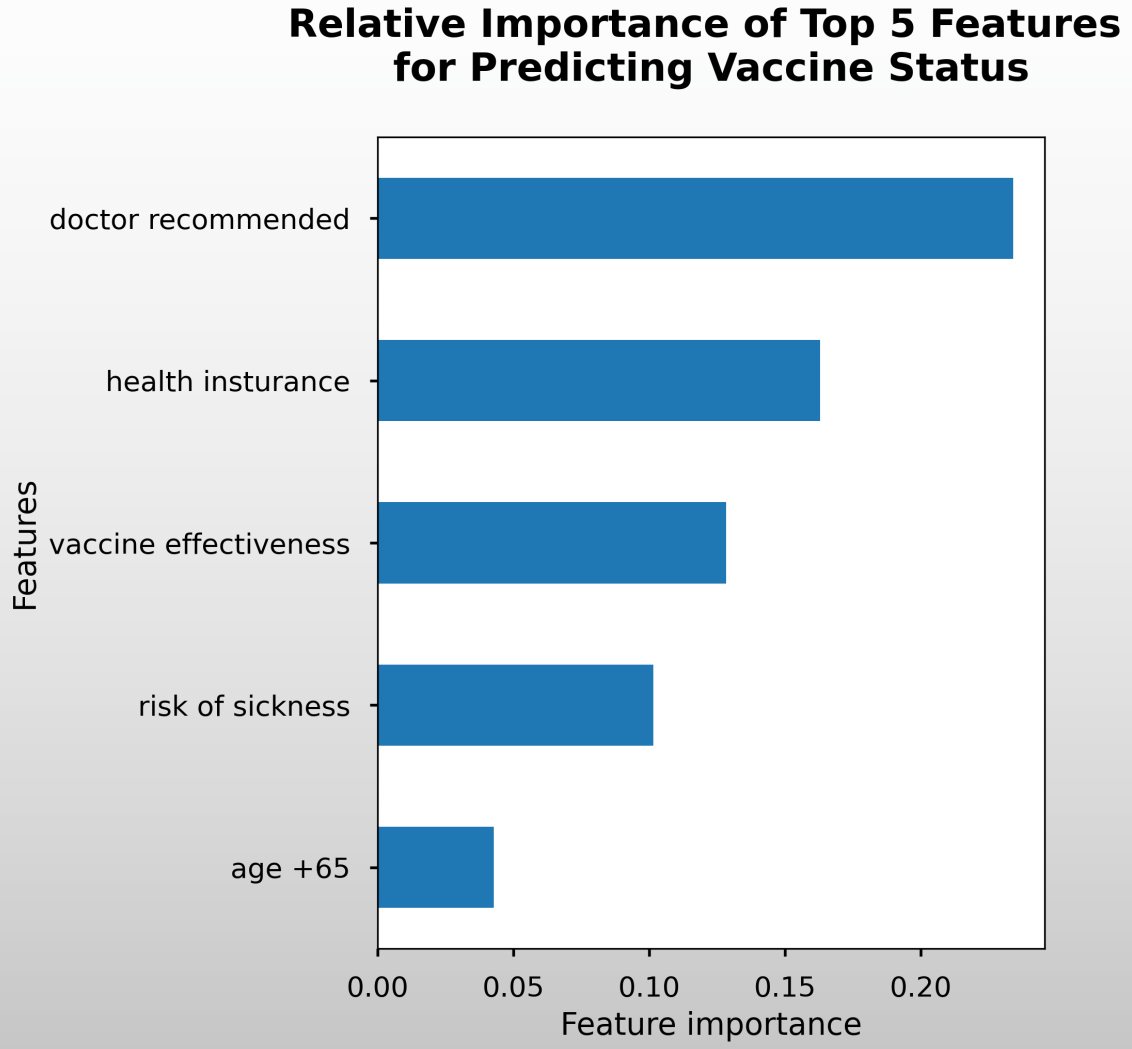
- Clean and preprocess the data.
- Build and tune a machine learning classifier.
- Evaluate and validate the model using the predictions.
- Sort most important features for predicting vaccine outcome.
- Make specific recommendations.

Results from the top model:

Model Performance:

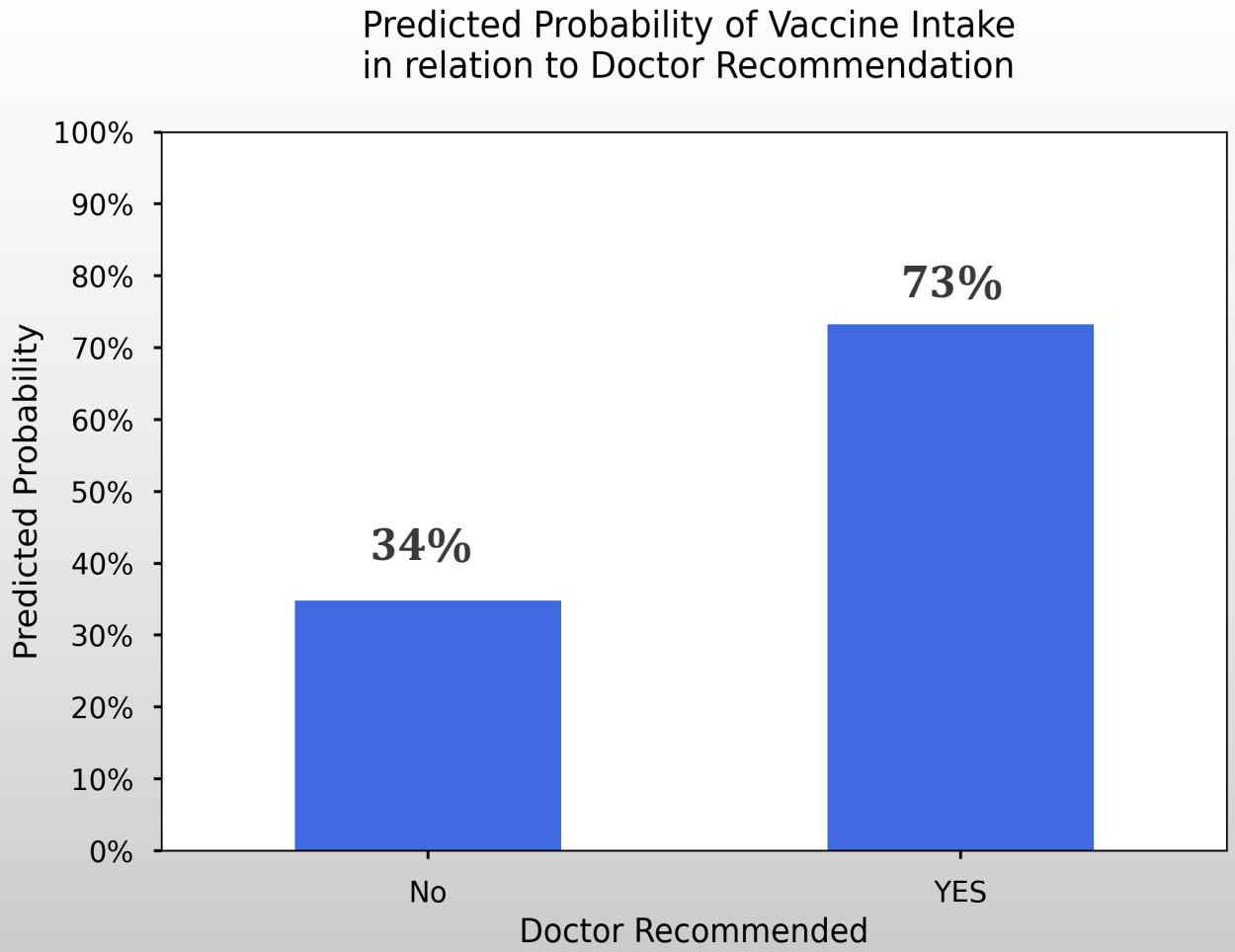
Roc_Auc	**87 %**
Accuracy	**79 %**
Sensitivity / Recall (True positive rate)	**77 %**
Specificity (True negative rate)	**81 %**

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



The most important predictive feature:

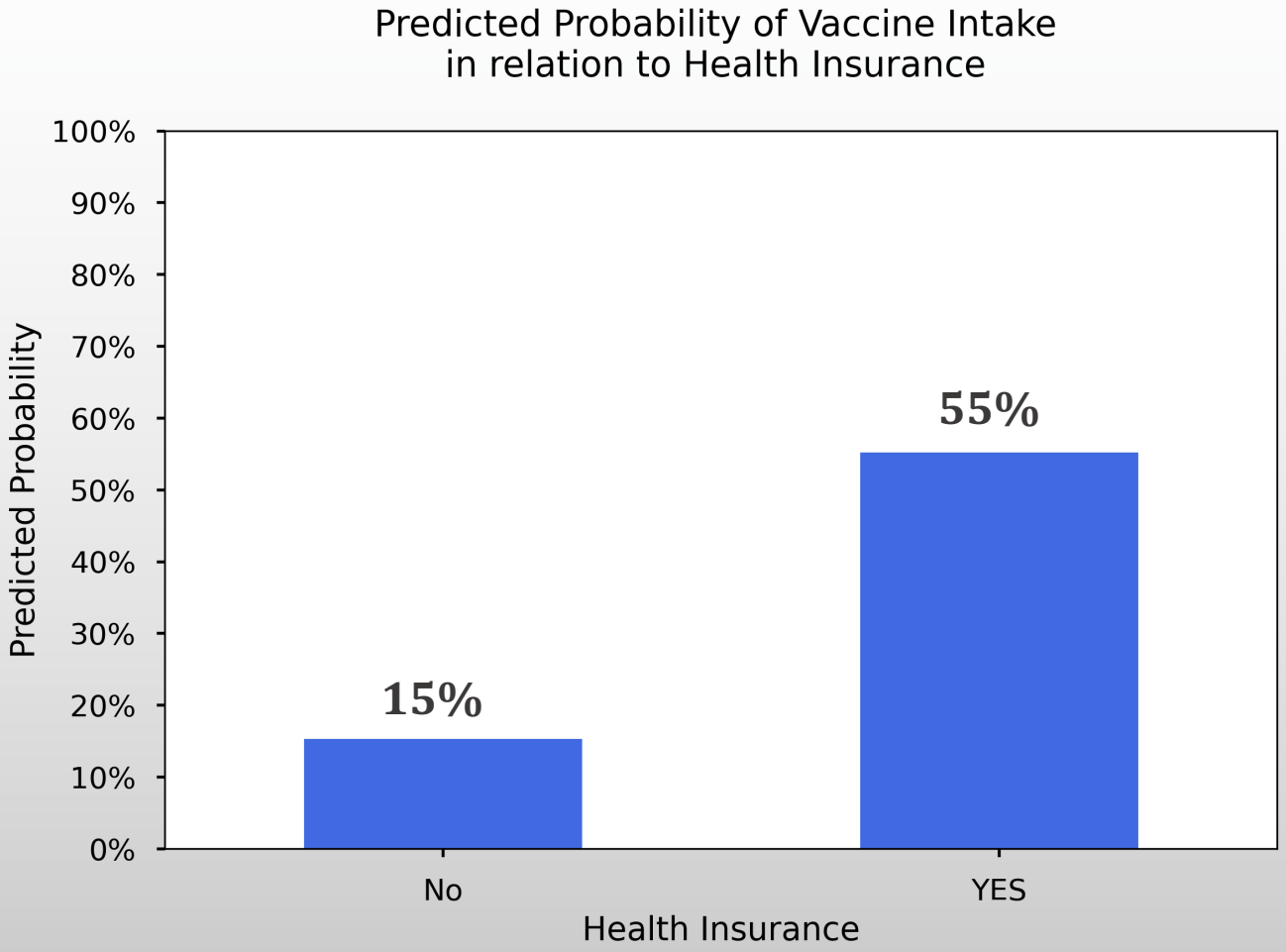
Doctor recommendation of flu vaccine



- 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.

Educate the physicians on the importance of vaccination. Make sure they recommend it to their patients.

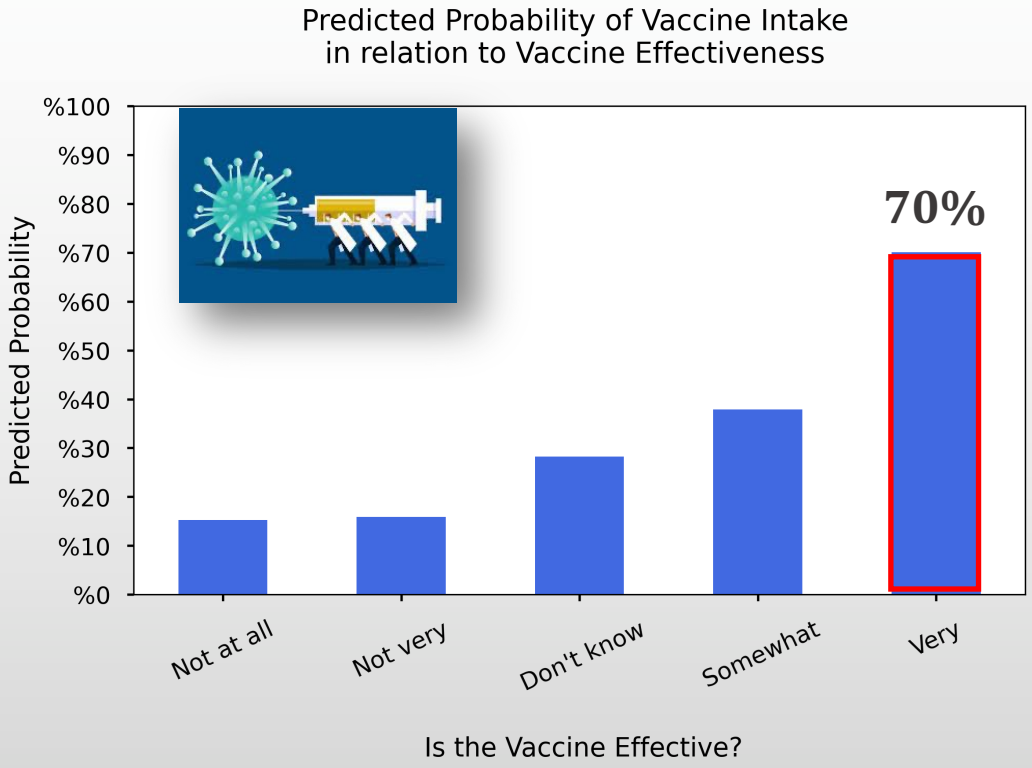
Having health insurance

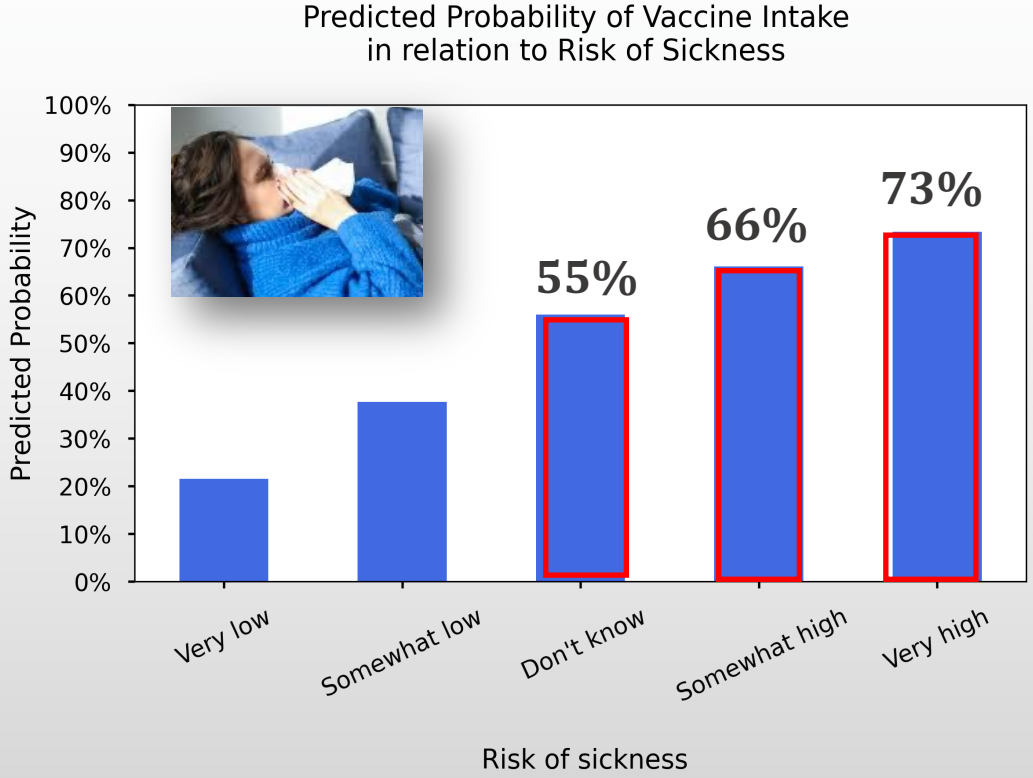


- People with health insurance are substantially more likely to get the vaccine (**%55** compared to **%15**).

Consider offering universal health coverage. Inform the public that flu vaccine is covered by insurance.

Thinking flu vaccine is effective
Believing you can get sick from flu



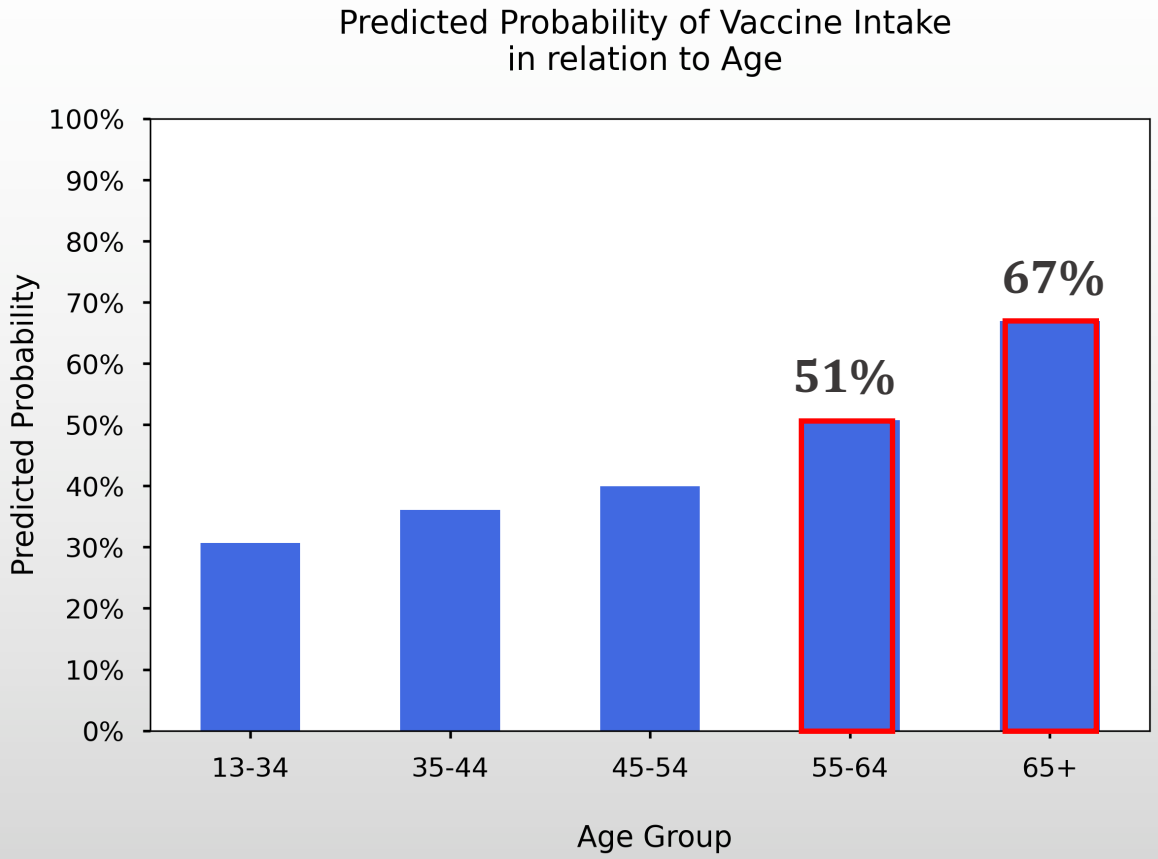


- Only people who rated the vaccine as very effective were more likely to receive the vaccine (**%70**)

- As people's worry about getting sick increased their likelihood to receive the vaccine also increased.

Inform people about the effectiveness and safety of the vaccine, and their risk of falling ill and developing complications if not vaccinated.

Age



- **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**).

Keep focusing on older age groups, because they are at more risk of developing flu–related complications.

Also target younger people since their vaccination rates are much lower.

Conclusions

You are more likely to get the vaccine if you:

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

Recommendations

For maximizing vaccine intake:

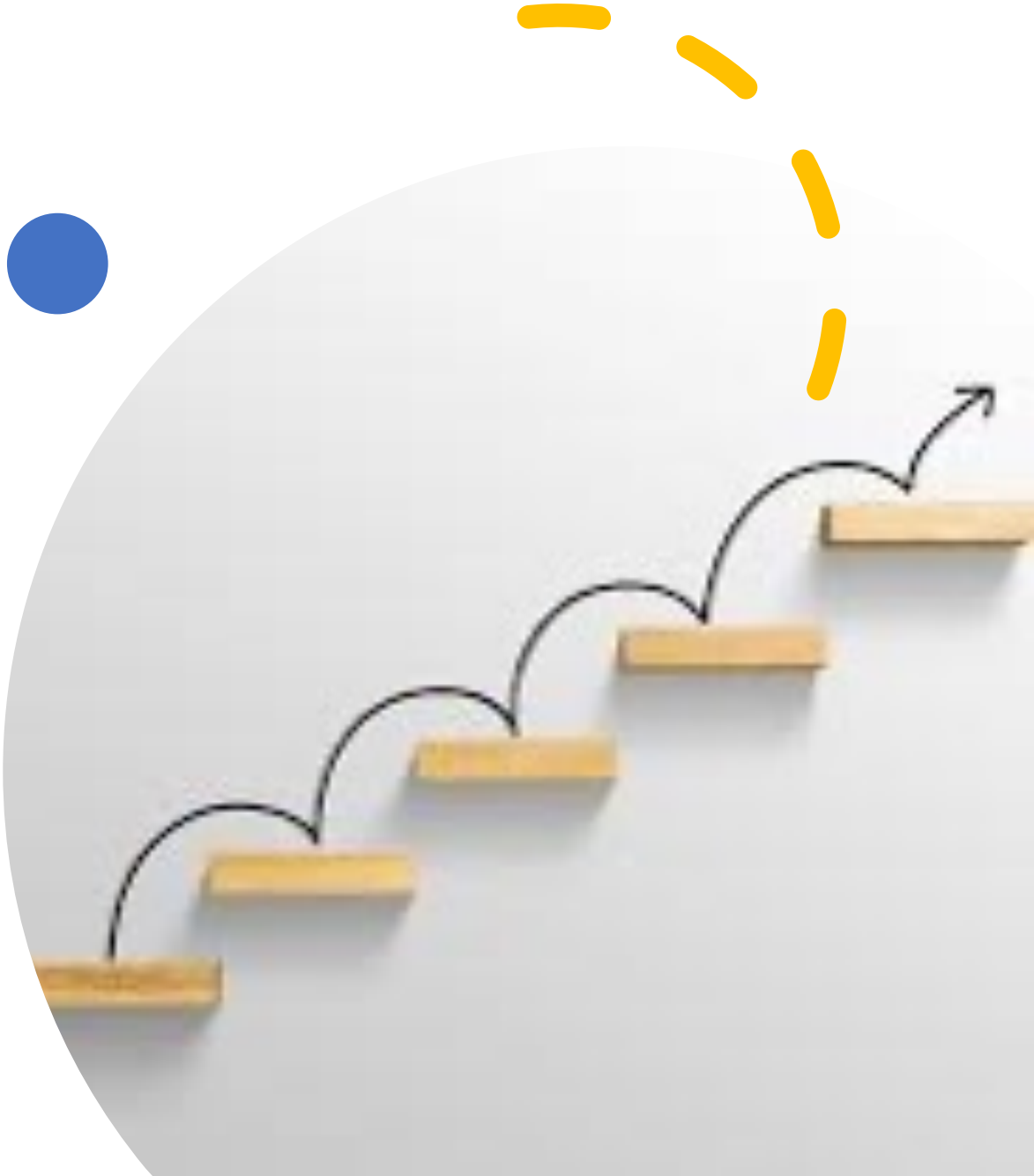
- ❑ Educate the **physicians** on the importance of vaccination. Make sure they recommend it to their patients.
- ❑ Consider offering universal **health coverage**. Inform the public that flu vaccine is covered by insurance.
- ❑ Inform people about the **effectiveness** and safety of the vaccine, and their **risk** of falling ill and developing complications if not vaccinated.
- ❑ Keep focusing on **older age** groups, because they are at more risk of developing flu-related complications. Also target **younger** people since their vaccination rates are much lower.

Limitations and Improvements

- Encrypted **employment industry**, **employment occupation**, and **geographical region** info, impossible 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/