A close-up, slightly blurred photograph of medical equipment. In the foreground, a white syringe with a needle is visible, with the text 'AFTER USE' printed on its side. Below the syringe, a blue and white striped bandage or label features the text 'H1N1'. In the background, a silver stethoscope is partially visible. The overall image has a blue tint and is used as a background for the title.

H1N1 Vaccine Uptake:

**Learning from the Past to
Inform the Future**

**Lou Hines
6.22.2023**

Background Study:

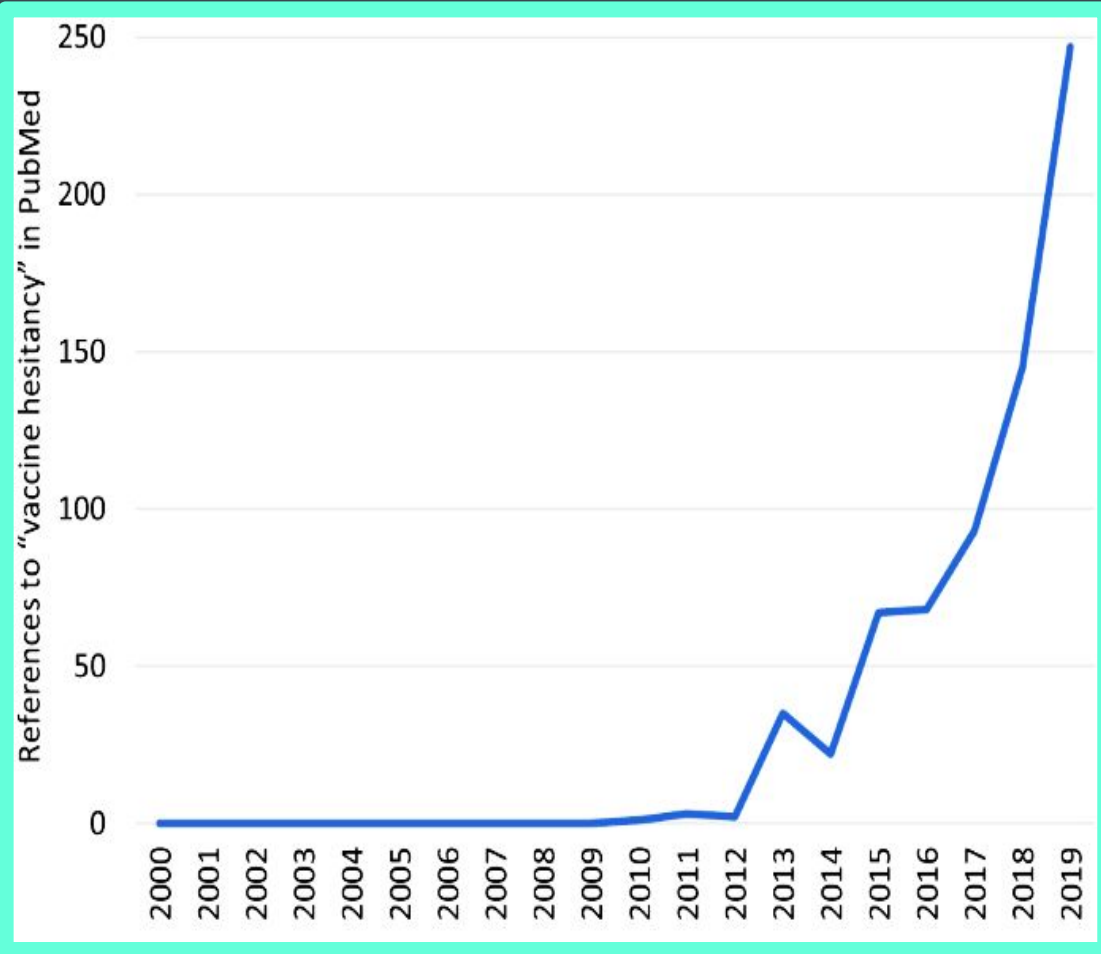
- Conducted 2009-2010 by the CDC
- Approximately 1.4 million participants
- Behavioral and opinion-based

Source:
https://www.cdc.gov/flu/fluview/cov_0910estimates.htm

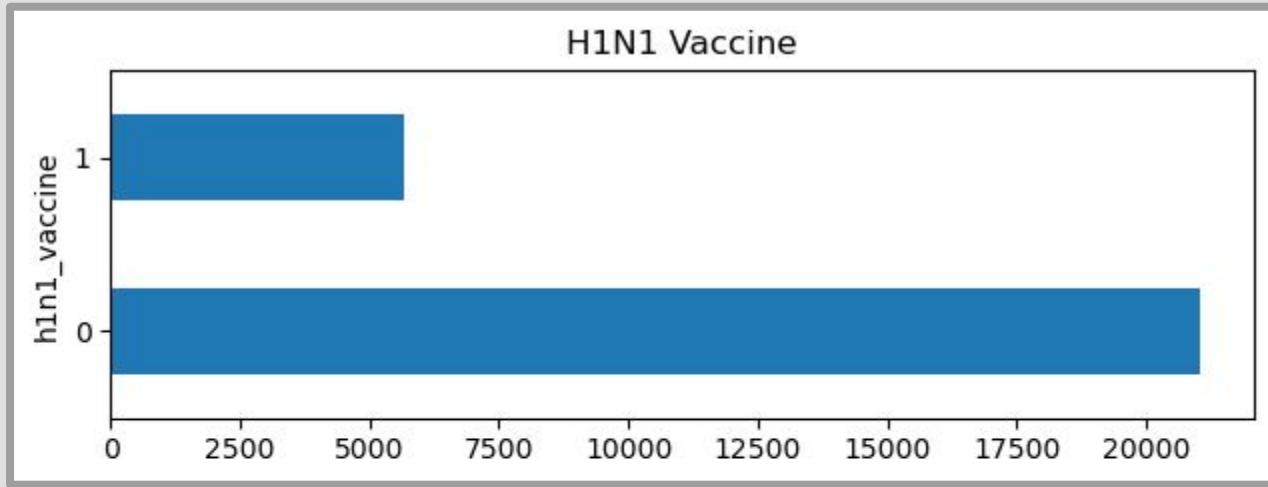


A Brief History of Vaccine Hesitancy

Source: Kennedy, J. Vaccine Hesitancy: A Growing Concern. *Pediatr Drugs* 22, 105–111 (2020).
<https://doi.org/10.1007/s40272-020-00385-4>



The Data / Approach



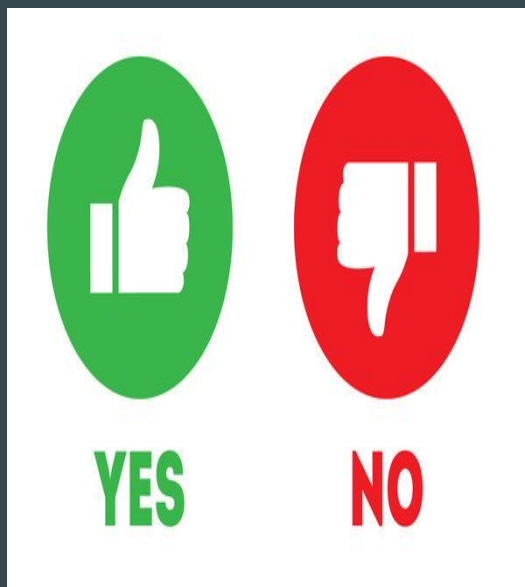
Low Uptake = Imbalanced Data!

Modeling Considerations:

Imbalanced Data



Binary Classifications



Missing Values

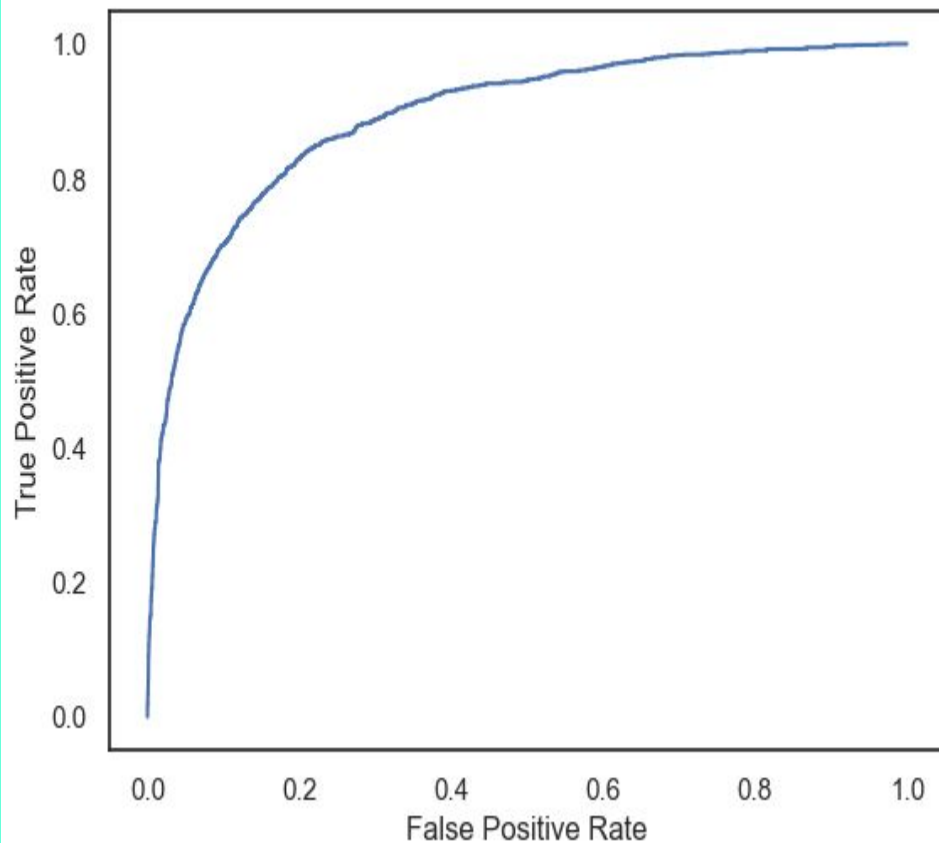


Best Model:

Sci-Kit Learn's
GradientBoostingClassifier
tuned with GridSearchCV

Cross-validation score: 0.8761564187522387

Test score (ROC): 0.8385255829391853



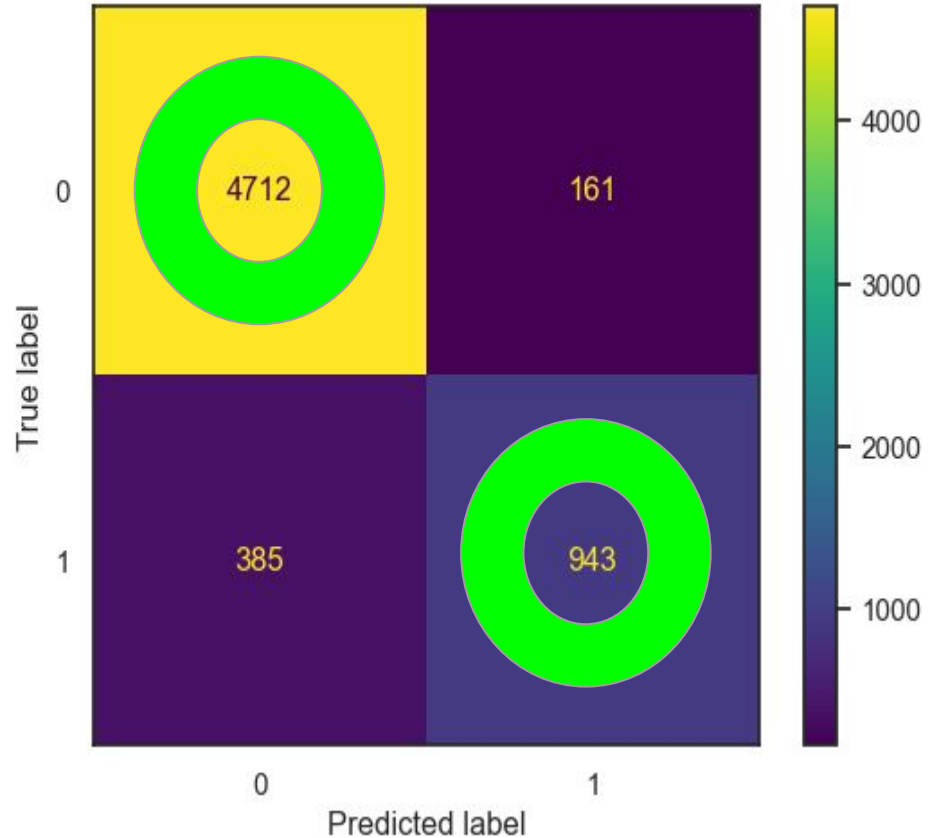
More Model Evaluation Metrics:

Training Scores:

Train Accuracy: 0.8881303085689711
Train Precision: 0.7958294428882664
Train Recall: 0.6421396283274736
Train F1-Score: 0.7107713690062543

Testing Scores:

Test Accuracy: 0.8717948717948718
Test Precision: 0.7530864197530864
Test Recall: 0.5971385542168675
Test F1-Score: 0.6661066778664426



Key Determinants of Uptake:

Role of Doctors

- Doctors recommending the vaccine was one of the highest predictors of uptake across all models

Health Insurance Status

- Insured

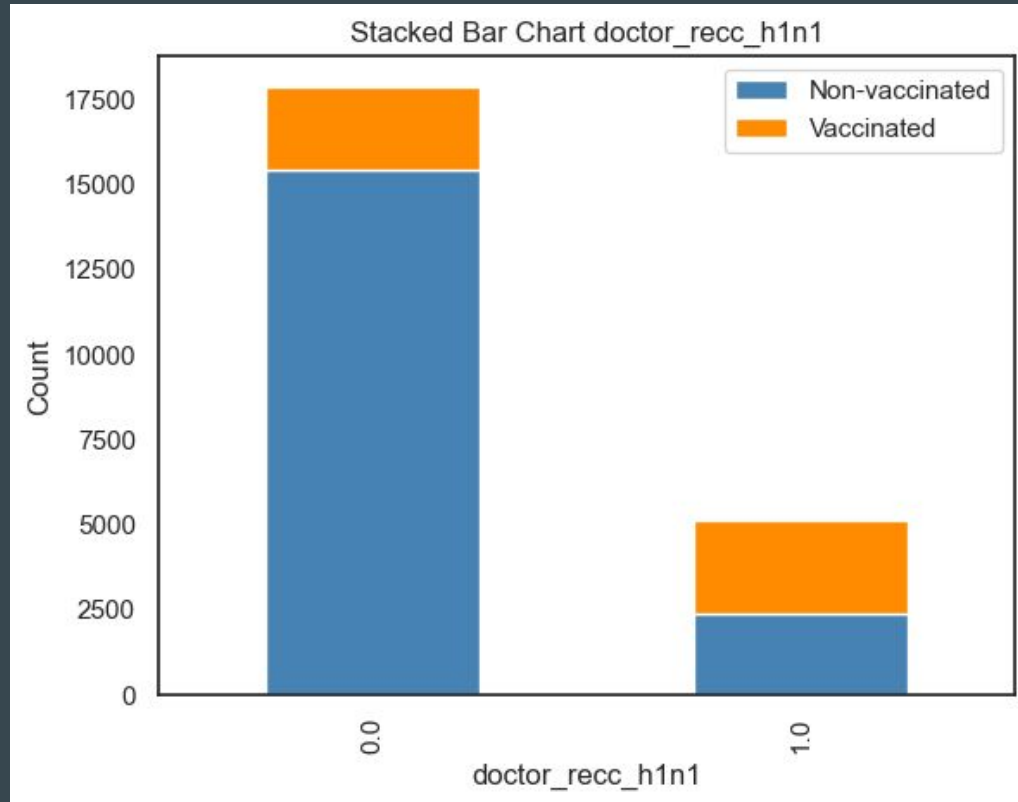
Age

- Middle-aged (45-54)

Knowledge of H1N1 and Vaccine

- Those with concern about the virus and a favorable opinion of the vaccine

Doctors Critical!



Other Takeaways and Surprises:

Job Type*

- Aside from one industry, field of employment and particular job had little or negative impact

Chronic Illness

- Had little or negative effect

Labor Force Participation*

- Being in or out of the labor force played little or negative role

* Demographic data was often sparse, and collected at the end of the survey, when people are more likely to get off the phone.

Recommendations:

Maximize Public Campaigns

Knowledge is key! Specifically target younger audiences who lack health insurance or who do not visit the doctor often. Also pay close attention to those with chronic health issues, regardless of age!

Hot tip: Make Tiktok your friend! Court Hank Green!

Keep Doctors Near

Maintain close ties to primary caregivers; they are your most trusted allies against mis-info!

Identify key players in health networks and best ways to keep in touch with primary care providers. Host events, produce hand-outs and other visual aides to help their patients understand vaccines.

More Recommendations:



Target sites of misinformation:

- Work within and across agencies and entities to stop the spread of vaccine mis-info
- Consider lobbying, enhancing social media savvy and presence. Find trustworthy public figures you can engage with.

Further Research:

Integrate this survey with more recent data, especially for underserved populations.

Utilize other modelling techniques to extract more granular insights (ex: MultiOutputClassifier).

Combine classes to look for specific patterns in those who also did or did not receive the flu vaccine.

Enhanced data cleaning, imputation, and feature engineering.

Questions?

Contact Info



Lou Hines, Data Scientist

lou.m.hines@gmail.com

<https://www.linkedin.com/in/lou-hines-data-scientist/>