Predicting Youth Risk Behaviors:

Modeling the YRBS for Relevant Discussions with Youth

Becky Peters, Data Scientist; September 2021

Topics for Discussion

- **Part 1**: Background and Motivation
- **Part 2**: Exploring and Modeling the Data
- **Part 3**: Predictions and Dashboard
- **Part 4**: Future Work

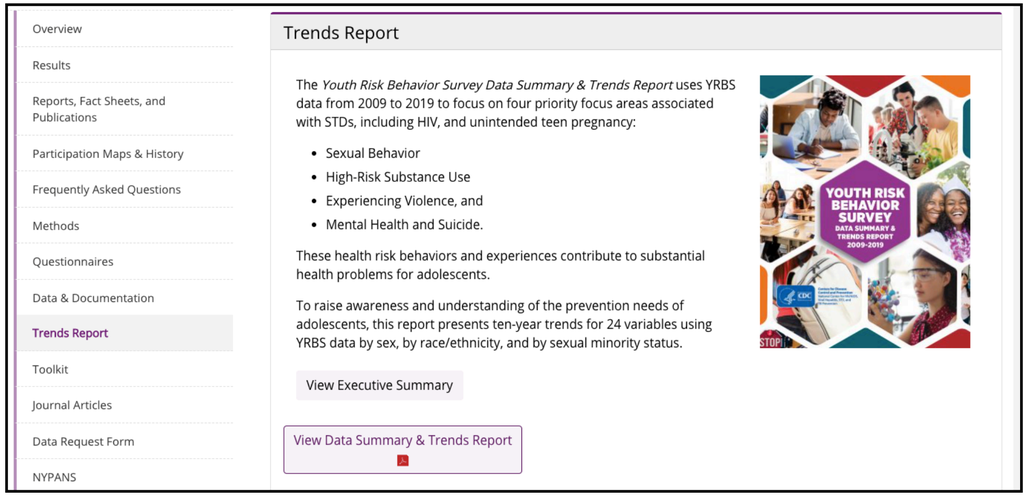
Part 1:

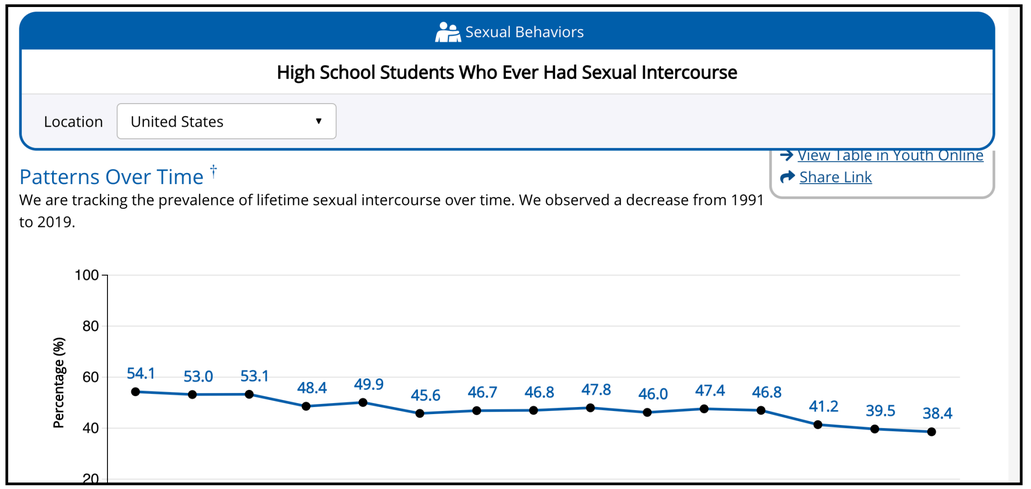
Background and Motivation


“...kids learn to make good
decisions by making decisions,
not by following directions.”
- Educator / Author, Alfie Kohn

Youth Risk Behavior Survey

- CDC Youth Risk Behavior Surveillance System, 1997-2019
  - Violence, sexual behaviors, alcohol / drug / tobacco use, diet, physical activity
- cdc.gov





Project Inquiries

- Can we use 10 y of aggregated data to predict youth risk behaviors on an individual basis? *(Supervised Multi-Label Classification Algorithms)*
  - *Q58: Have you ever had sex?*
  - *Q25: Have you felt sad or hopeless for 2 weeks in a row?*
  - *Q30: Have you ever tried cigarettes?*
- Which negative behaviors are most related? *(Graph Network)*

Potential Users

- Health Care Providers
  - 2018 data from Statista reports that the majority of pediatricians spend **13-16 minutes** with each patient
- Parents / Youth
  - Provide more targeted information for **relevant conversations**
  - (CO is one of 26 states without a sex ed mandate)
- Education Agencies
  - Implement outreach programs; **individual counseling**

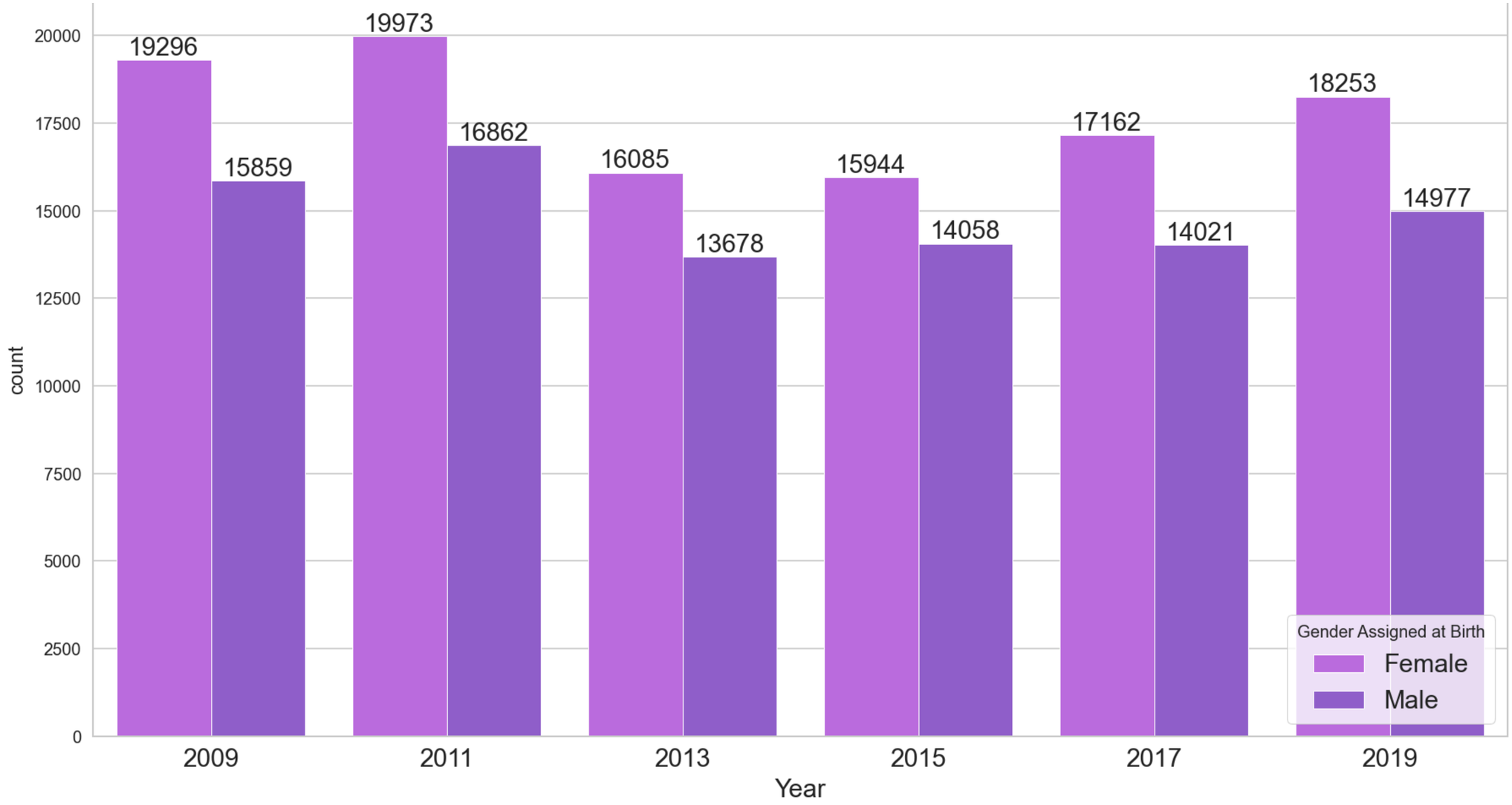
Other Important Considerations

- Insights over Answers
- Discussions over Discipline
- Reality over Determinism

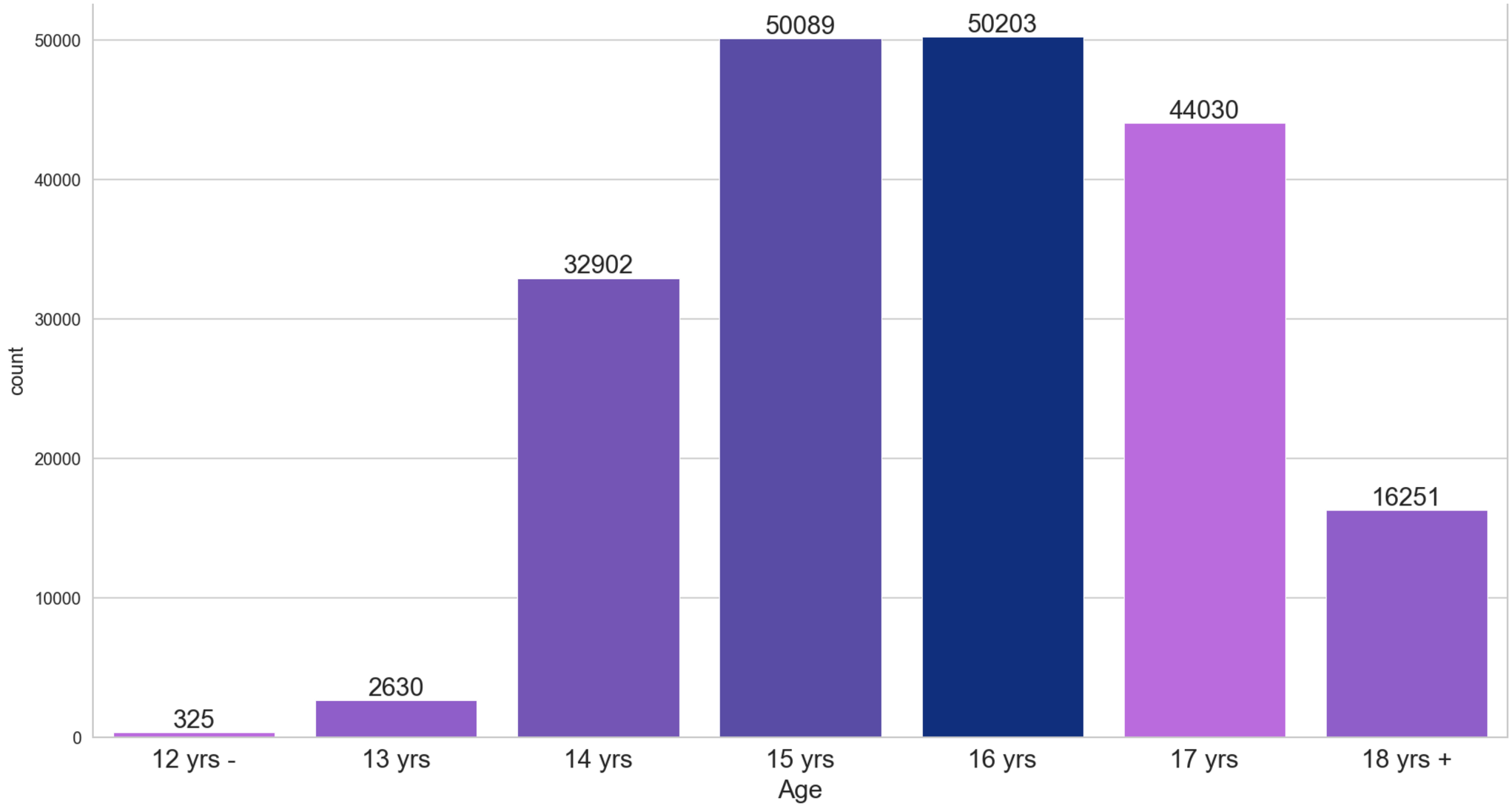
Part 2:

Exploring and Modeling the Data

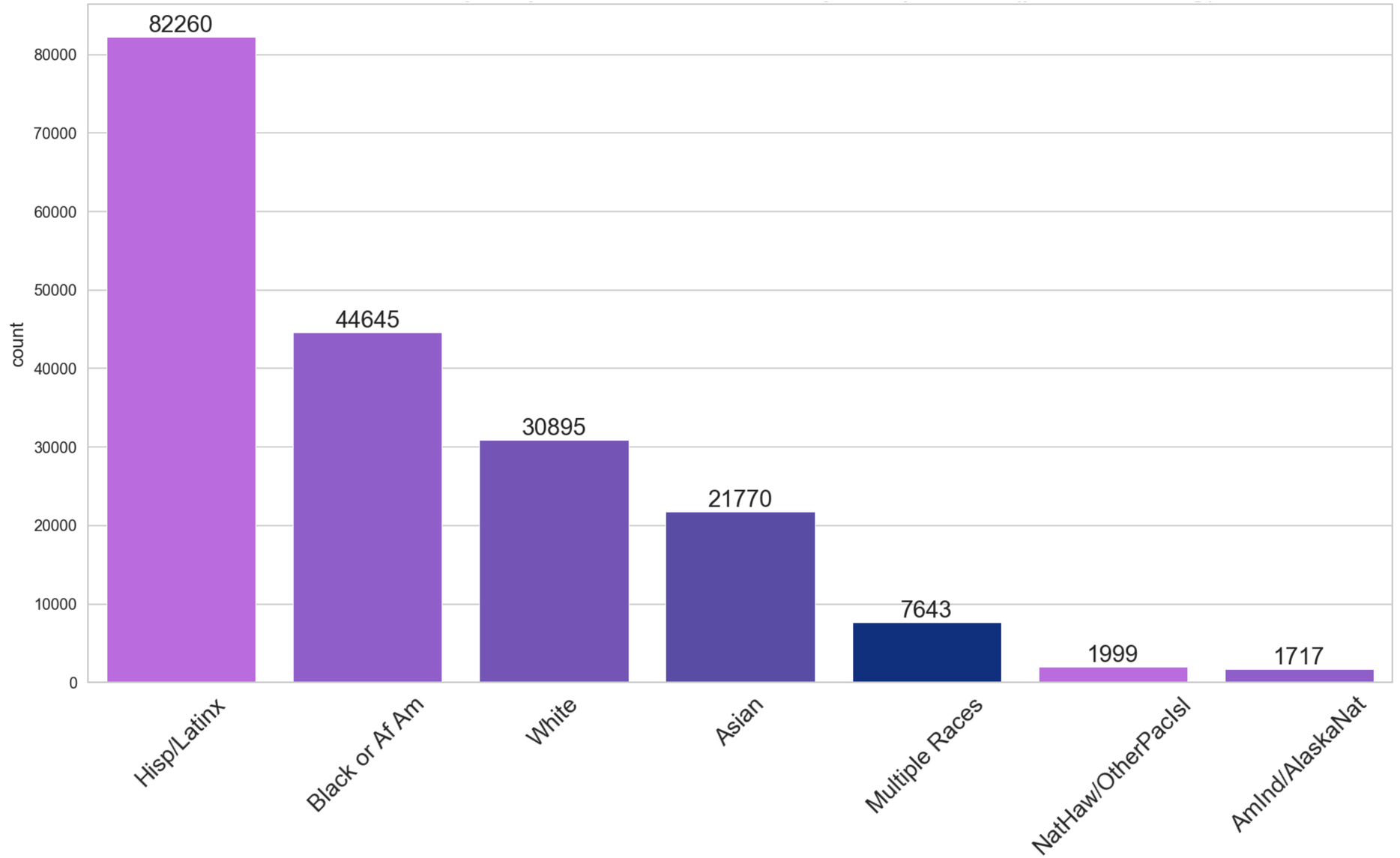
Dataset: Number of Surveys per Year



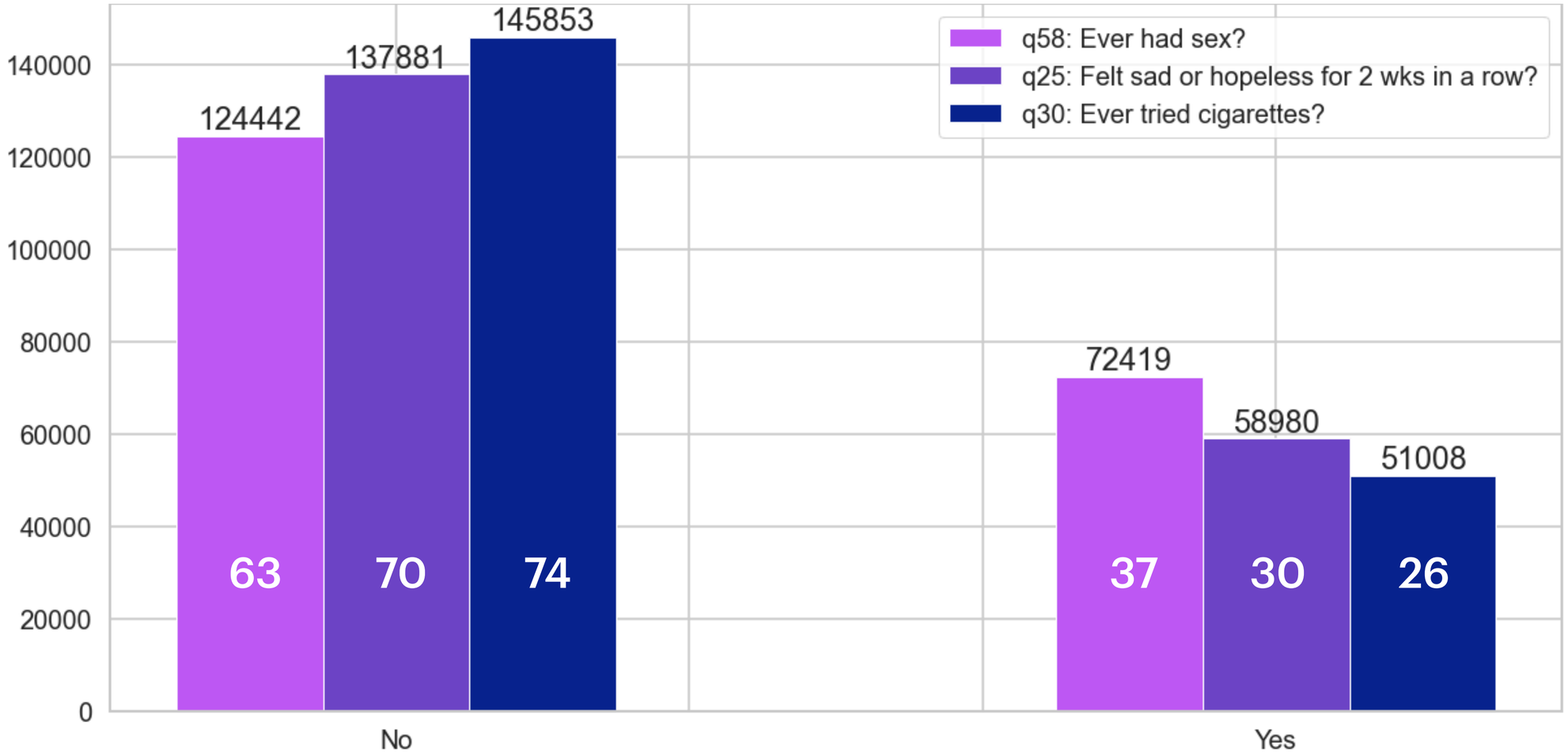
Dataset: Ages of Respondents



Dataset: Race / Ethnicity of Respondents



Distribution of Three Classification Targets



Baseline Metrics: Assume all YES Responses:

Accuracy and Precision = 37% | 30% | 26%

Hamming Loss: 0.69

Experimenting with Algorithms

scikit-multilearn

Trained and Compared different Multi-Label Classification Algorithms

- Logistic Regression
- Multi-label kNN
- Binary Relevance
- Classifier Chain
- Gaussian Naive Bayes
- Neural Network
- **Random Forest**

	Q58 (Sex)	Q25 (Sad)	Q30 (Cigarettes)
Baseline	37%	30%	26%
Precision (TP / TP + FP)	66.1%	70.6%	66.0%
Accuracy (TP + TN) / ALL	72.3%	74.2%	76.6%
Hamming Loss (TP + TN) / ALL	0.25 *(fraction of labels incorrectly predicted)*		

Part 3:

Predictions and Dashboard

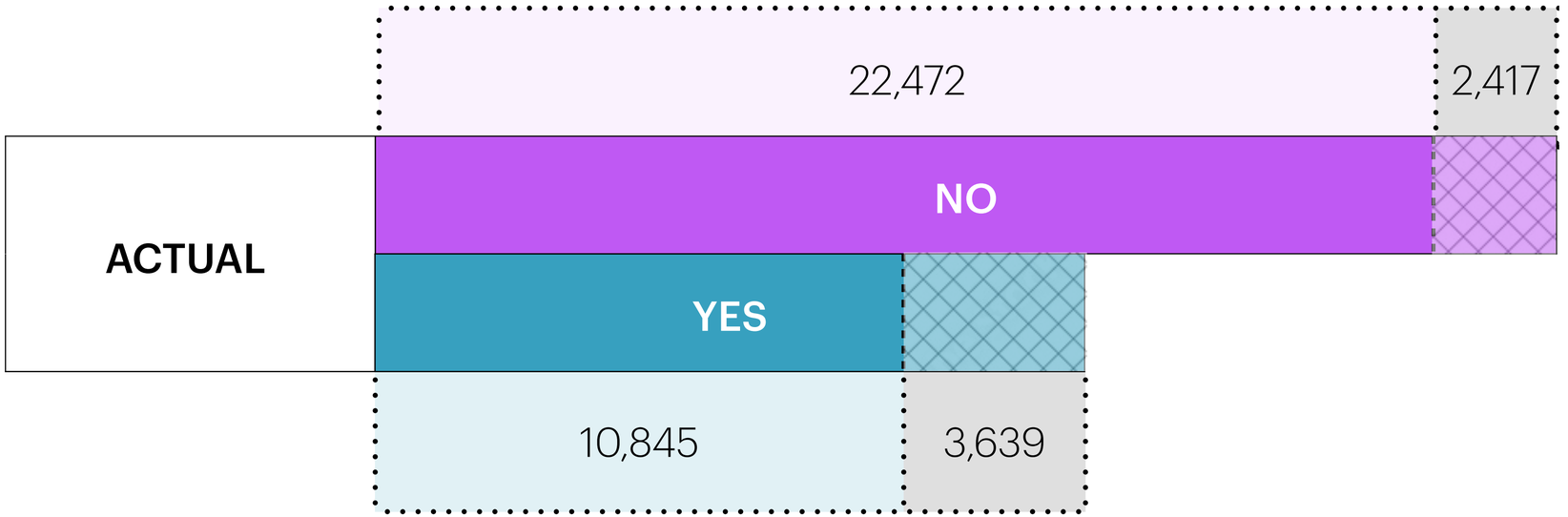
How did we do?

Size of Test Set: 39,373

Q58: ‘Have you ever had sexual intercourse?’

Baseline Precision = 0%

Model Precision = 81.2%



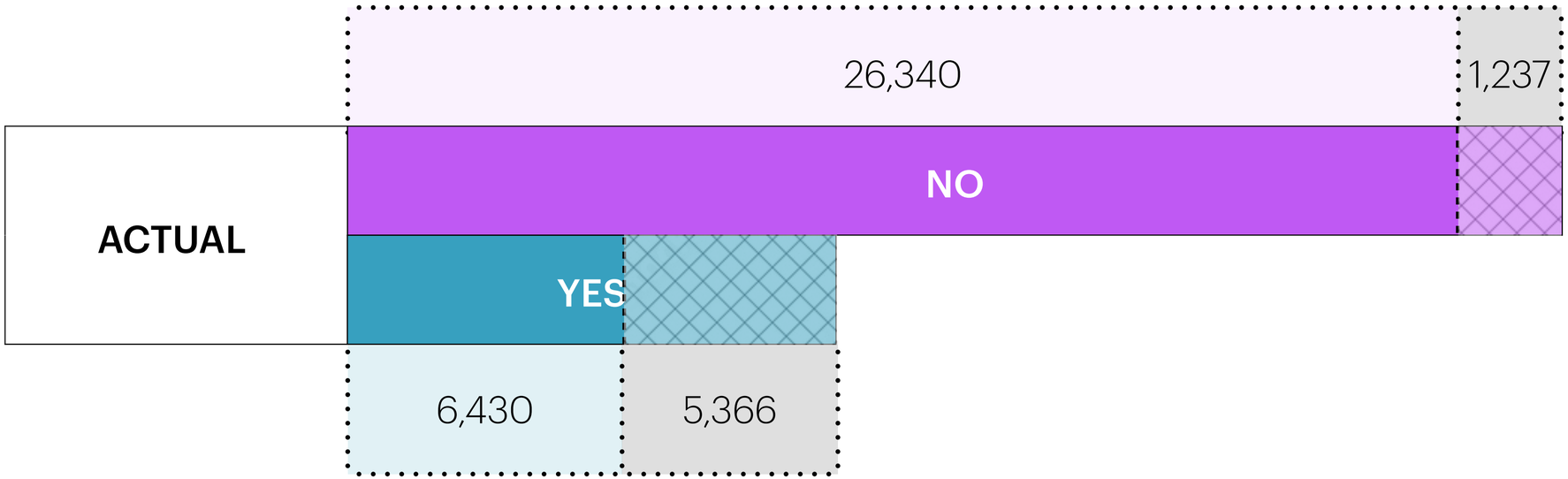
How did we do?

Size of Test Set: 39,373

Q25: ‘Felt sad or hopeless for 2 weeks in a row?’

Baseline Precision = 0%

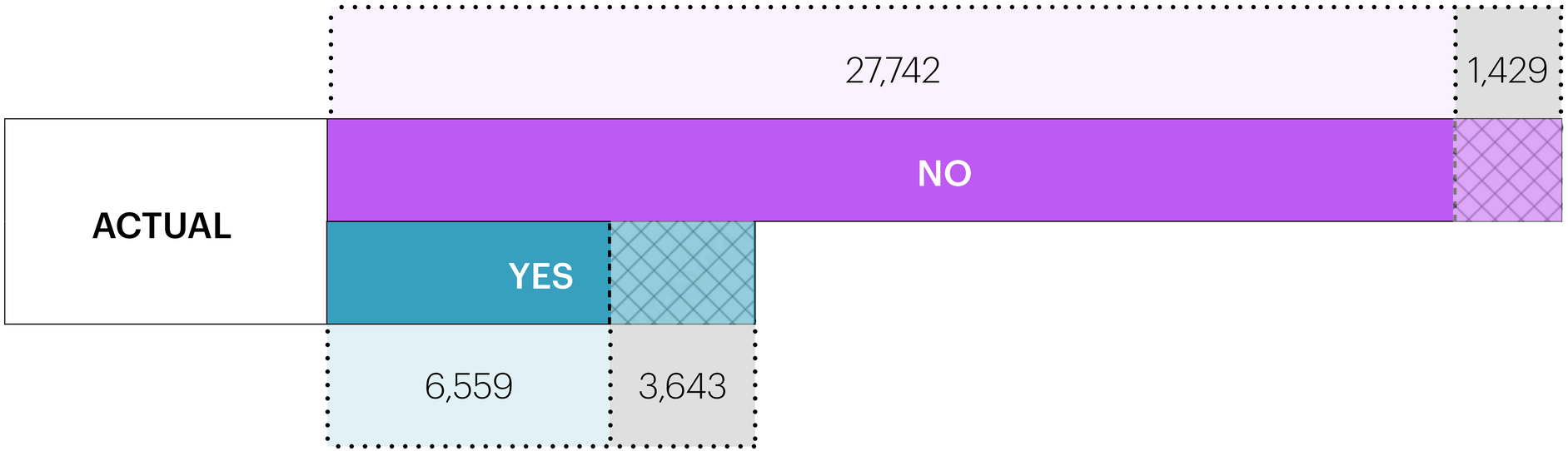
Model Precision =83.9%



How did we do?

Size of Test Set: 39,373

Q30: ‘Have you ever tried cigarettes?’
Baseline Precision = 0%
Model Precision =82.1%



Dashboard Demonstration (Local Development)

Predicting Youth Risk Behavior

Helping parents and professionals have relevant discussions with youth.

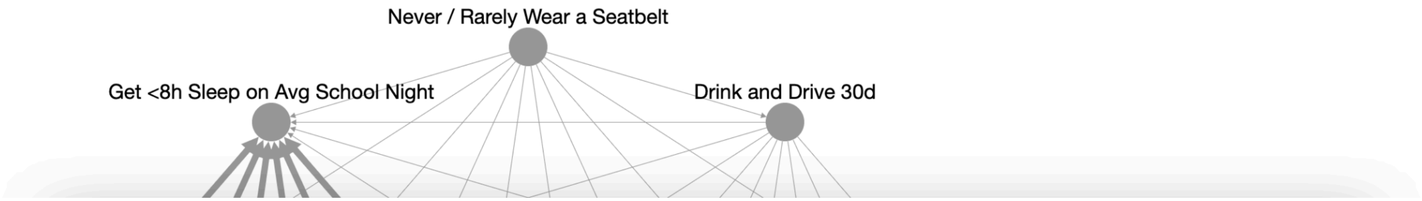
About the Youth Risk Behavior Survey

About this Dashboard and Project

Important Considerations

Explore the Data | Make Predictions | Visualize the Connections

The graph network shown below is based on a subsample of 10,000 surveys from the original dataset, maintaining the proportions of target classifications. Each node is a negative risk behavior and the directional edges between the nodes represent the proportion of survey respondents who answered affirmatively to any of those questions. For example, 31.5 percent of respondents who reported feeling sad or hopeless for more than 2 weeks in a row also reported getting less than 8 hours of sleep on an average school night. This graph may provide some further direction to dashboard users about potentially relevant discussions with youth. Numbers listed are percentages.



Dashboard Screenshot 1: Explore the Data

Predicting Youth Risk Behavior

Helping parents and professionals have relevant discussions with youth.

About the Youth Risk Behavior Survey

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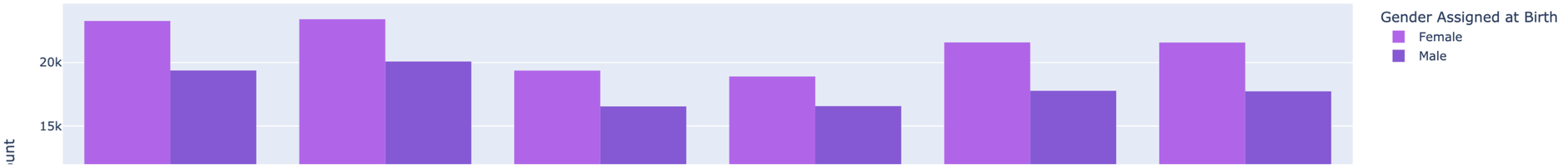
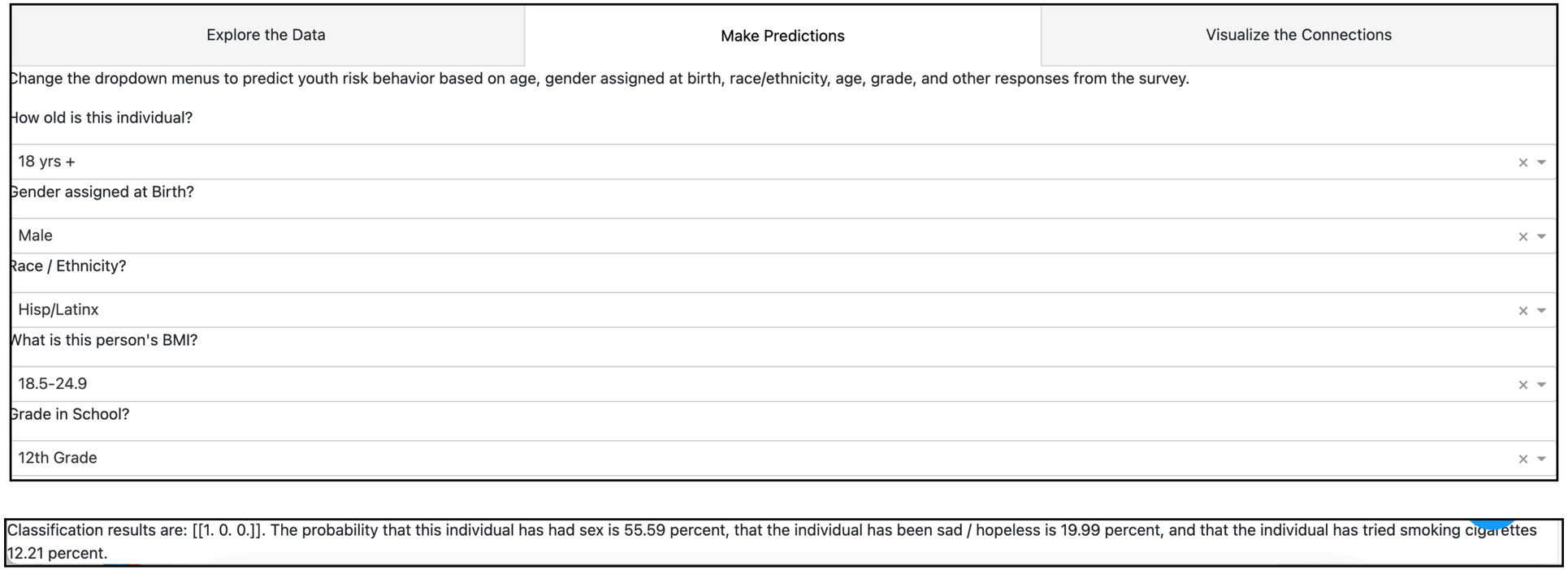
Explore the Data | Make Predictions | Visualize the Connections

Figure 1: Number of Completed Surveys by Year



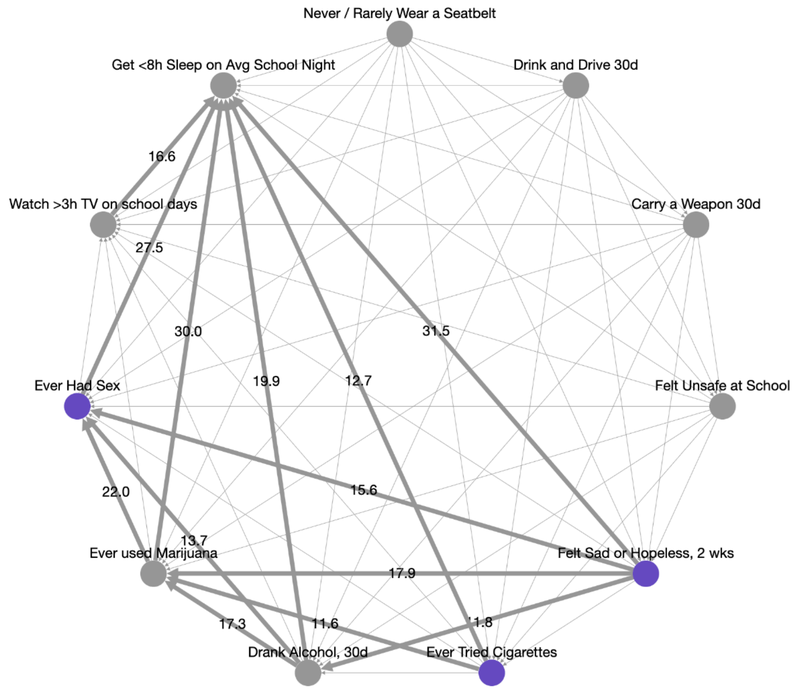
Dashboard Screenshot 2: Make Predictions



Dashboard Screenshot 3: Visualize the Connections

Explore the Data | Make Predictions | Visualize the Connections

The graph network shown below is based on a subsample of 10,000 surveys from the original dataset, maintaining the proportions of target classifications. Each node is a negative risk behavior and the directional edges between the nodes represent the proportion of survey respondents who answered affirmatively to any of those questions. For example, 31.5 percent of respondents who reported feeling sad or hopeless for more than 2 weeks in a row also reported getting less than 8 hours of sleep on an average school night. This graph may provide some further direction to dashboard users about potentially relevant discussions with youth. Numbers listed are percentages.



Part 4:

Future Work

Future Work

- Dashboard option to “Find a metro area like mine” (possibly match by size, population, political leanings, etc. to possibly refine predictions with geography)
- Consultation with experts in clinical settings for utility of predictions; dashboard creation for specific clinics based on their own survey data
- Tailor the inputs on the dashboard to different audiences
- Clean up prediction page of app / Live deployment through AWS

Tech Stack


python


scikit
learn


matplotlib


plotly | Dash


pandas


SciPy


scikit
multilearn


jupyter


seaborn


Joblib


XGBoost


Flask
web development,
one drop at a time


NumPy


NetworkX
Network Analysis in Python


MDB
TOOLS

Thank you

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