Evaluating Mental Health Status of Children

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Problem Statement

7.4%

Of children aged 3-17 years have a diagnosed behavior problem

3.2%

Of children aged 3-17 years have diagnosed depression

7.1%

Of children aged 3-17 years have diagnosed anxiety

9.4%

Of children aged 2-17 years have received an ADHD diagnosis

Source: CDC - https://www.cdc.gov/childrensmentalhealth/data.html

Problem Statement

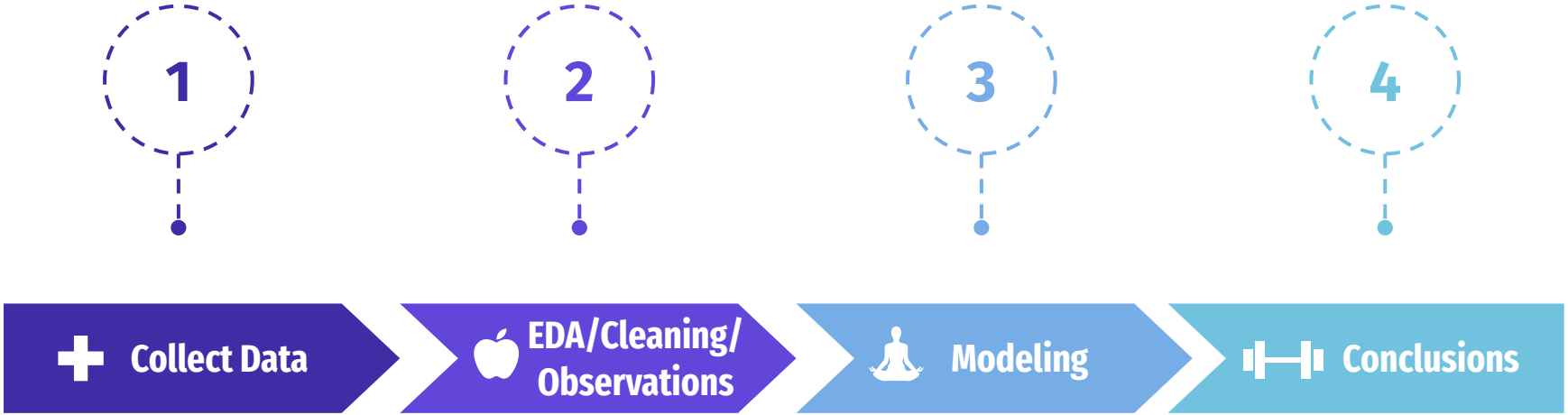
Mental health among children encompasses the way children learn, behave, and handle emotions.

Conditions that affect mental health include:
ADHD
Behavior Problems
Anxiety
Family, Community, and Healthcare factors

GOAL:

- Data analysis - To evaluate the different factors that put children at-risk for developing poor mental health.
- Predictive models - To predict unhappiness in children to help us identify important features that might be a sign of deteriorating mental health.

Data Science Workflow



Collecting Data

AHRQ Agency for Healthcare Research and Quality

RStudio®

2017 Survey Data

MEPS Medical Expenditure Panel Survey

.feather file

Government produced data set from a group of surveys, used to examine how individuals interact with medical care system: **health expenditures, individual's health status, health insurance coverage, etc.**

Collecting Data: On Children

MEPS
Medical Expenditure Panel Survey

Columbia Impairment Scale

Behavioral problems

- Getting along with mother
- Feeling nervous or afraid
- Getting involved in activities like sports or hobbies

Child Preventative Care

Amount of preventative care child received

- Whether a doctor ever checked a child's blood pressure in 2017
- Checked child's BMI
- Whether doctor every gave advice about how smoking in the house is bad for child's health

Children with Special Health Care Needs Screener

The use of healthcare related services more than other children the same age

- Child needs or uses prescribed medicines,
- Child is limited in ability to do things,
- Child gets special therapy

Consumer Assessment of Healthcare Providers and Systems (CAHPS)

Quality of healthcare from child's perspective

- How often child got care as soon as it was needed
- Whether a child needed to see a specialist
- How many times a child went to a doctor's office for healthcare in 2017

Target Variable: UNHAP42

Whether the child reported feeling unhappy or sad

Cleaning Data

Target Variable: UNHAP42

- Filtered for those children who answered the question (0-4)
- Balanced Classes with SMOTE library in python

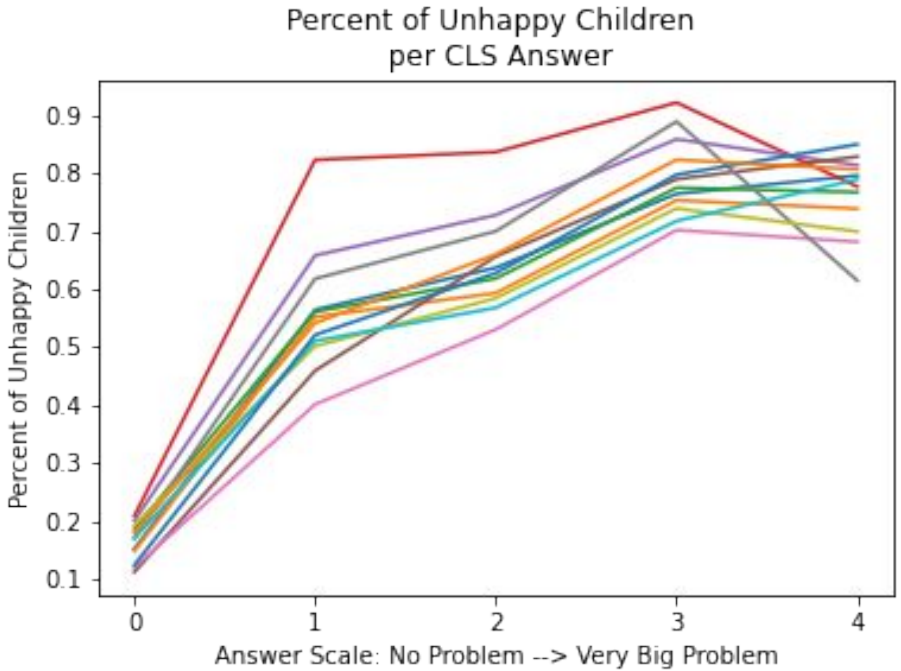
Variable: Age

- Subset data to include ages between 5-17 years old

Standard Scaled

- Negative numbers set by the statisticians in null values
- Did not want to necessarily get rid of them, - might be meaningful relationships as to why the child did not answer that part of the survey.

Columbia Impairment Scale



Purpose

Official survey designed to inquire about possible child behavioral problems. 13 total questions (target not included in chart). Range from “No Problem” to “Very Big Problem”

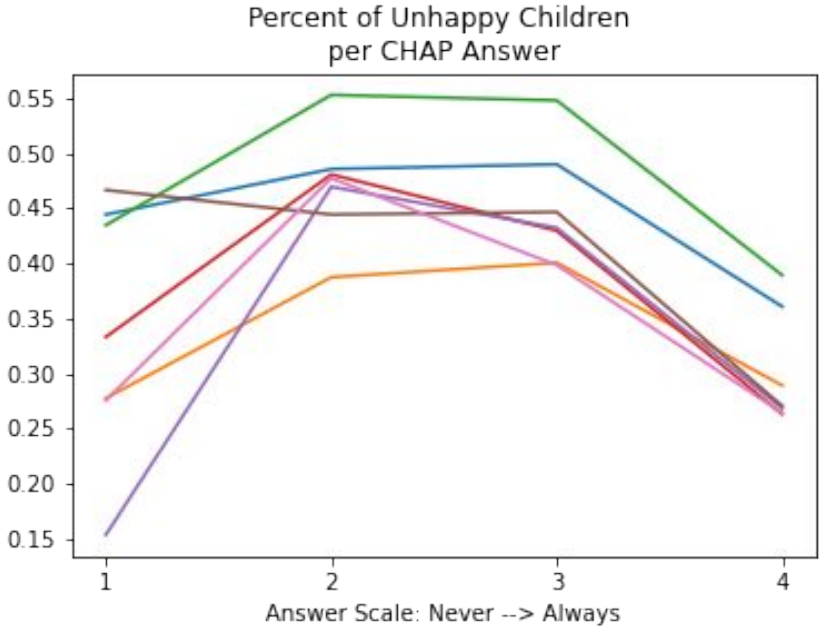
Questions

Getting along with mother/father, behavior at school, feeling nervous or afraid, getting along with siblings, behavior at home, staying out of trouble, getting along with other kids, etc.

Analysis

All questions correlate highly with unhappy variable. Increasing from 0 --> 1 has largest jump in percent unhappy.

Consumer Assessment of Healthcare Providers and Systems



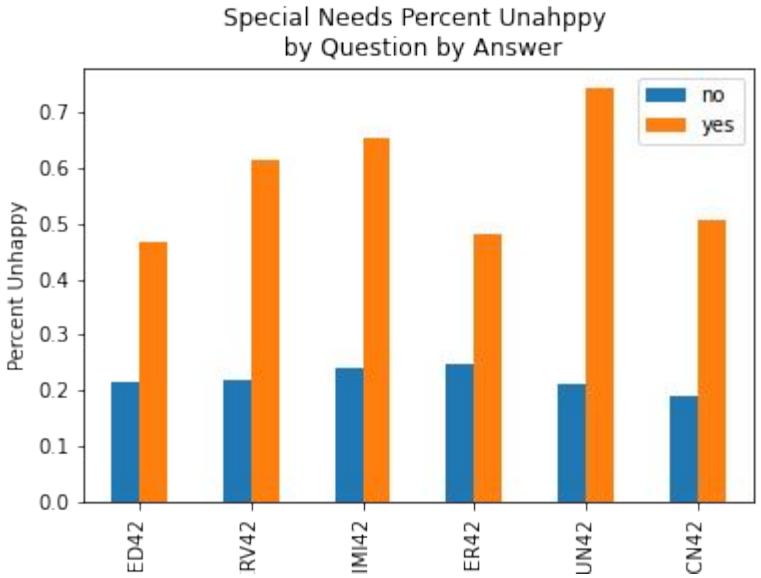
Purpose

AHRQ sponsored family survey. Designed to measure quality of care from the consumer's perspective.

Questions: How Often...

- Got health-care as soon as needed
- Got a health-care appointment as soon as needed
- Easy to get care doctor believed necessary
- Doctor listened carefully
- Doctor explained things in way parent could understand
- Doctor showed respect for parent
- Doctor spend enough time with patient

Special Health Care Needs



Purpose

Screener designed to identify children with special health care needs.

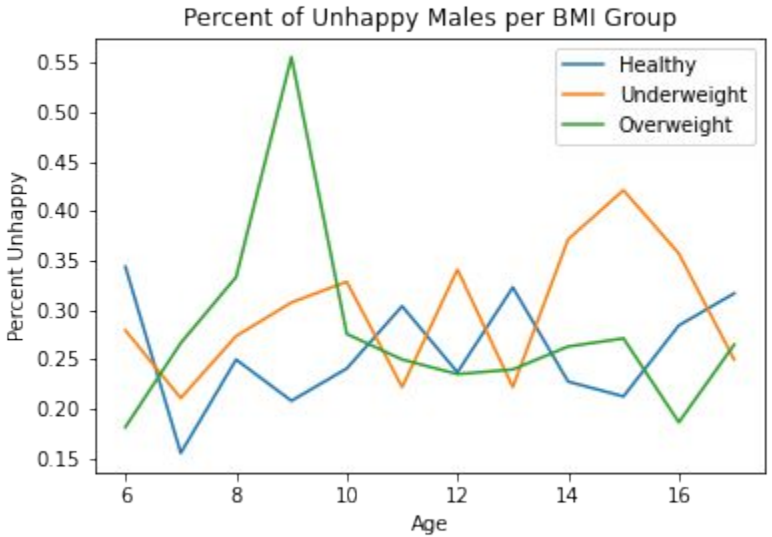
Questions:

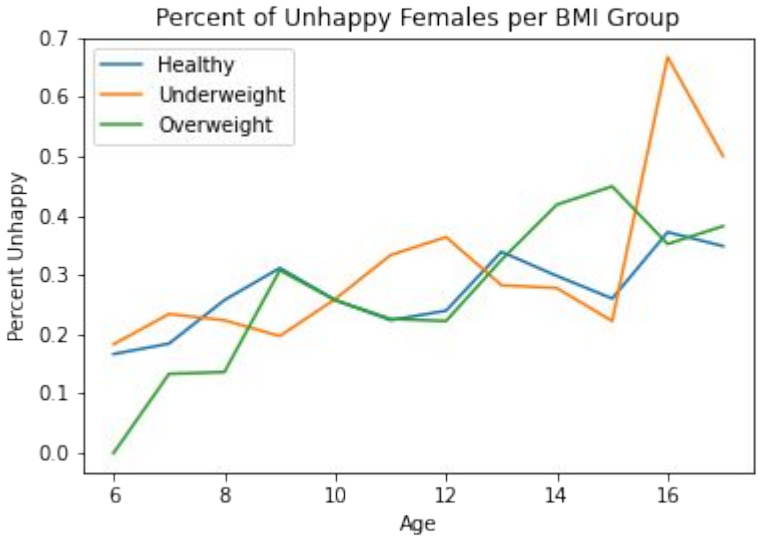
- Needs or uses prescribed medicines
- Needs or uses more medical care, mental health, or education services than is usual for most children of the same age
- Limited or prevented in any way in ability to do something children of same age can do
- Needs special therapy
- Needs treatment for emotional, developmental, or behavioral problem
- Special needs identifier

Sex-Age-BMI

Groups

- Healthy: 18 - 25
- Underweight: 0-17
- Overweight: 25+

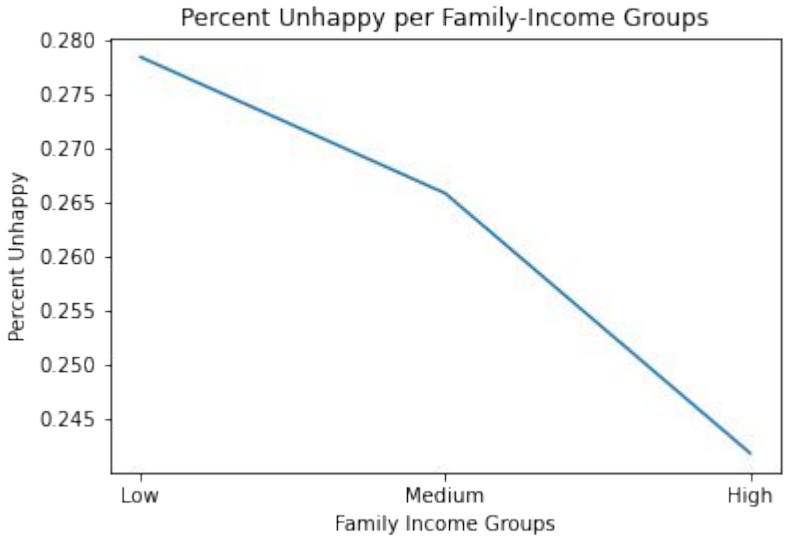


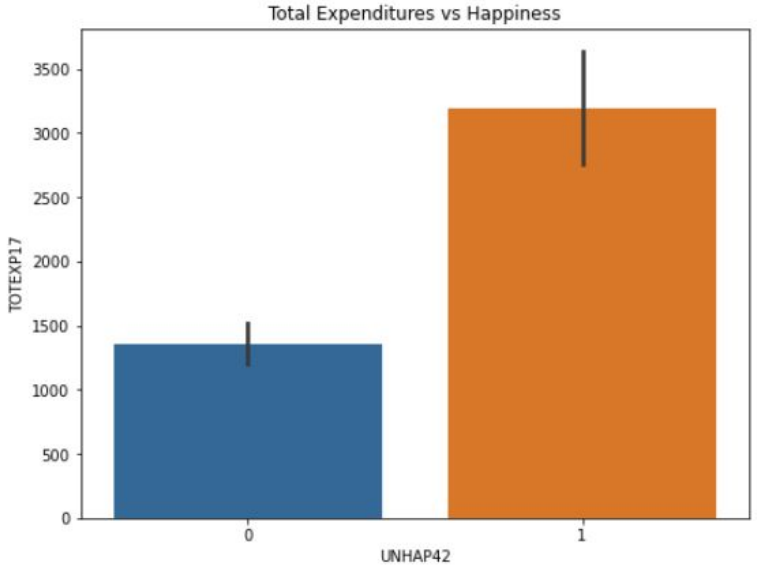


Family Income & Total Expenditures

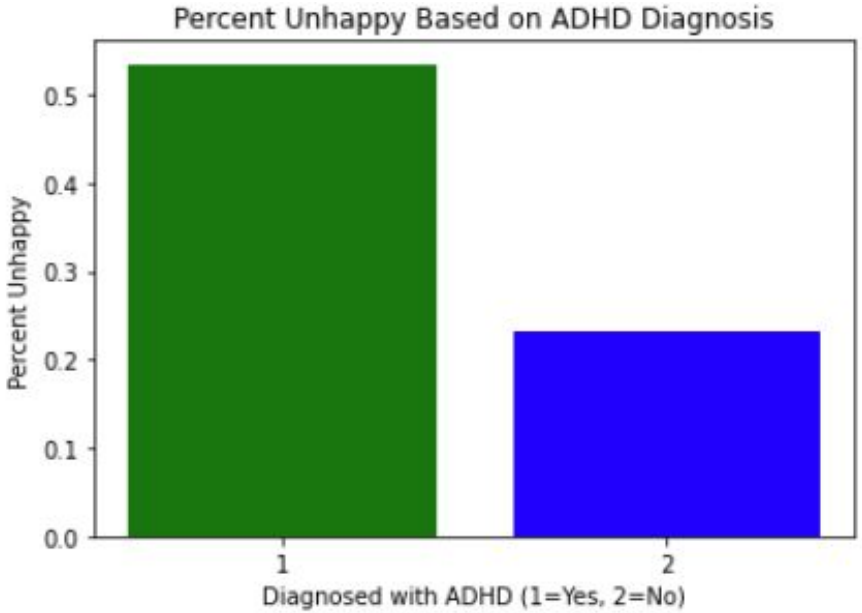
Groups

- Low: $0 - $50,000
- Medium: $50,000 - $100,000
- High: $100,000 - $200,000 +





ADHD



Background:

- Children with ADHD have more frequent and more intense negative emotions.
- These emotions tend to last longer and get in the way of everyday life (www.understood.org)

Modeling

	train_score	test_score	acc_score	recall_score
LogisticRegression()	0.831306	0.833108	0.833108	0.546154
KNeighborsClassifier()	0.827027	0.775676	0.775676	0.284615
SVC()	0.819595	0.799324	0.799324	0.323077
RandomForestClassifier()	1.000000	0.849324	0.849324	0.589744
DecisionTreeClassifier()	1.000000	0.786486	0.786486	0.620513
AdaBoostClassifier()	0.847973	0.848649	0.848649	0.612821
BaggingClassifier()	0.987162	0.833108	0.833108	0.574359

- The first step in the modeling process involved the use of a modeling function.
- This function was passed our data, split, and a list of classifiers used to predict or target variable ‘UNHAP42.’
- The results of this function can be seen in the figure, on the left, the modeling function only produces models with default parameters.
- Thus, the top 2 models from this output were chosen for further investigation.

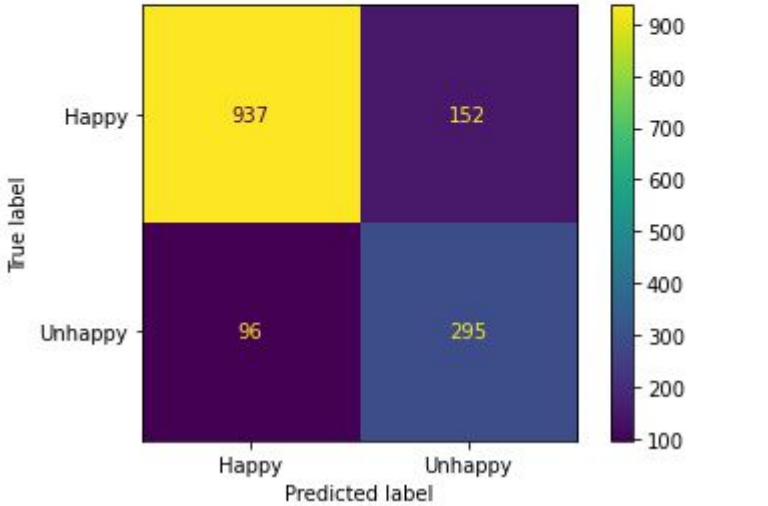
```
0    0.736149
1    0.263851
Name: UNHAP42,
```

0 = Happy
1 = Unhappy

Modeling - Logistic Regression

Logistic Regression Models	Train Score	Test Score	Recall
Default	.8313	.8331	.5461
GridSearchCV	.8354	.8223	.4923
Smote Default	.8093	.8007	.6982
Smote GridsearchCV	.8021	.8324	.7544

	precision	recall	f1-score	support
0	0.91	0.86	0.88	1089
1	0.66	0.75	0.70	391
accuracy			0.83	1480
macro avg	0.78	0.81	0.79	1480
weighted avg	0.84	0.83	0.84	1480



```
0    0.736149
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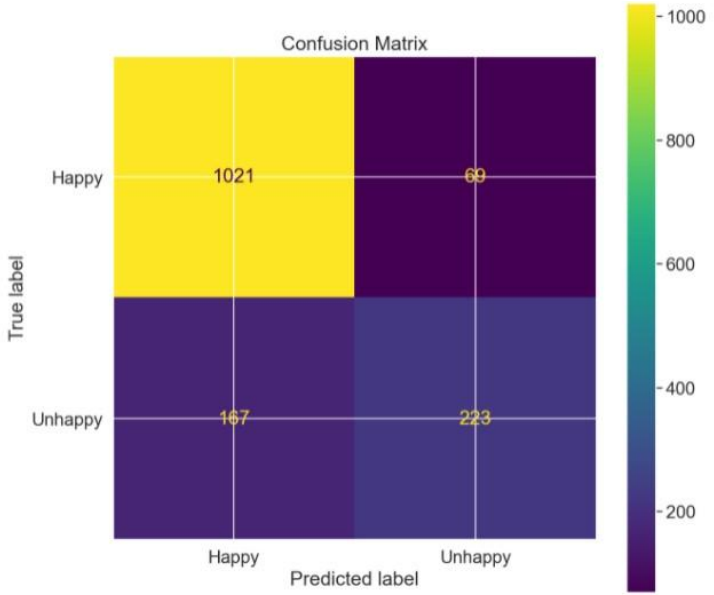
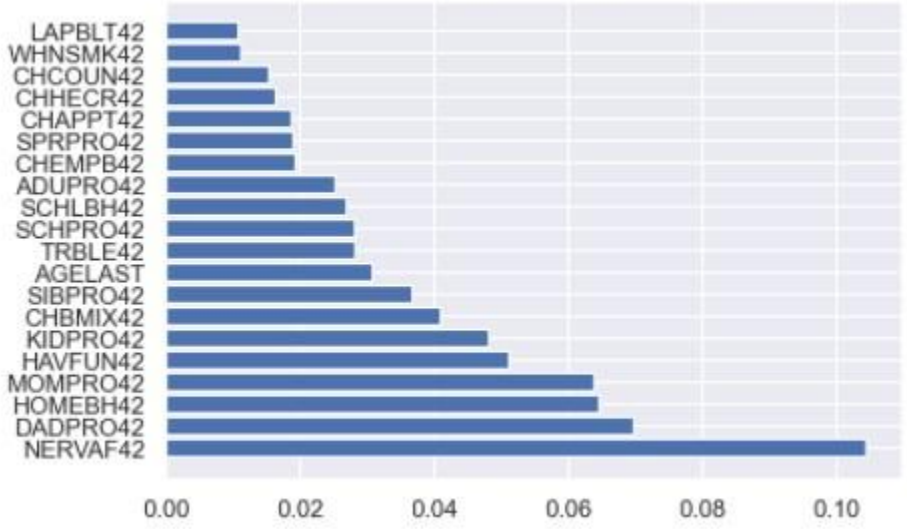
Modeling - Random Forest

	precision	recall	f1-score	support
0	0.86	0.94	0.90	1090
1	0.76	0.57	0.65	390
accuracy			0.84	1480
macro avg	0.81	0.75	0.78	1480
weighted avg	0.83	0.84	0.83	1480



Model

- Performed a random forest model, with the goal of optimizing the Recall Score
- Pruned random forest:
  - Max depth = 20
  - Number estimators = 180



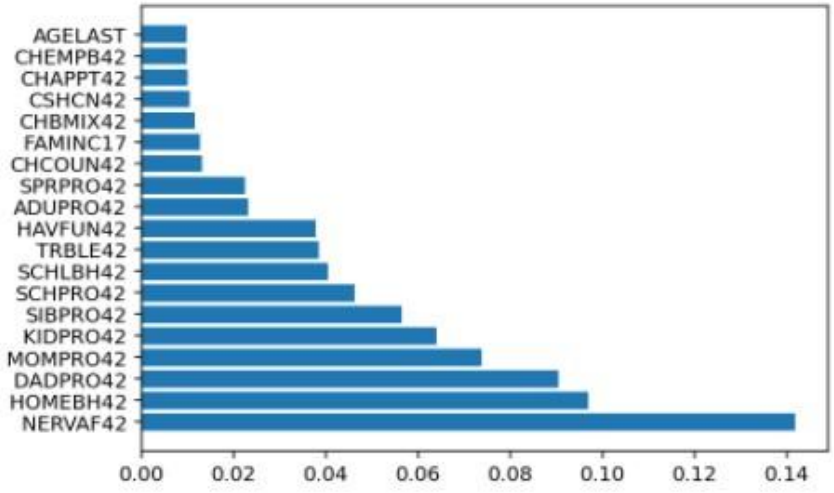
```
0    0.736149
1    0.263851
Name: UNHAP42,
```
0 = Happy
1 = Unhappy

Modeling - Random Forest with SMOTE oversampling/undersampling

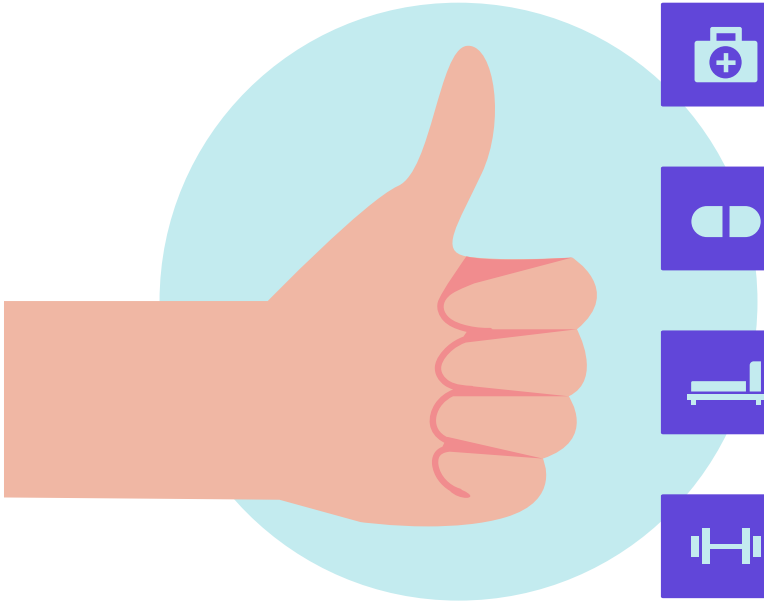
	precision	recall	f1-score	support
0	0.92	0.83	0.87	1090
1	0.63	0.81	0.70	390
accuracy			0.82	1480
macro avg	0.77	0.82	0.79	1480
weighted avg	0.84	0.82	0.83	1480

Model

- Performed a pruned random forest model, using SMOTE to balance classes
  - Grid-Searched over sample sizes
  - Oversample the minority class
  - Undersample the majority class
- Optimized for Recall Score



Conclusions



- Age, Sex and BMI groups show distict trends in unhappiness
- Children with special health care needs are more likely to be unhappy
- A healthy home environment is crucial, income not so much
- Nervous variable strongest indicator of unhappiness

Recommendations

	Coefficient Value
WHNSAF42	0.392549
CHLIMI42	0.495004
KIDPRO42	0.714989
HOMEBH42	0.719754
NERVAF42	1.022416

- Researchers should group children by sex, age and BMI
- Aim to improve relationship with family and classmates
- Identify and manage anxiety, promote positive environment

Thank You!

Questions?