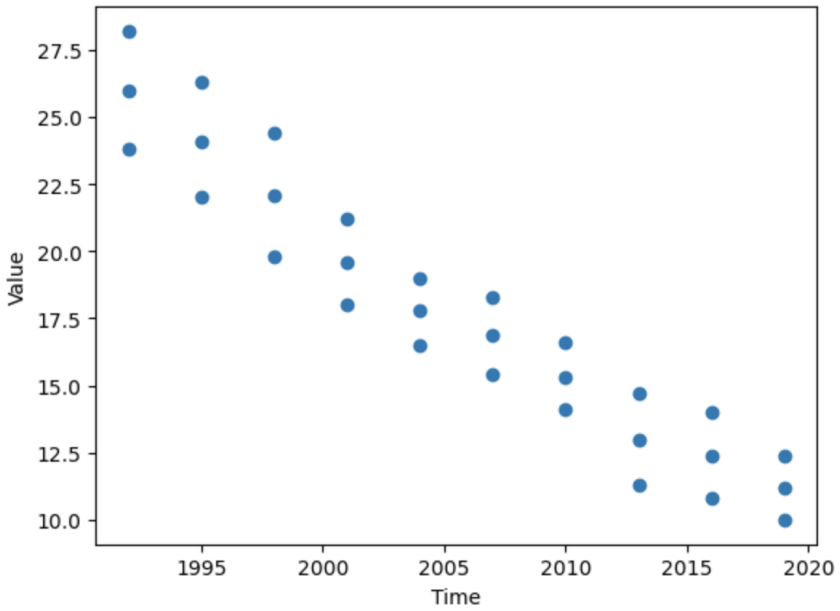
The aim of our project is to develop a model to predict suicide rates in 1, 3, and 5 years Organisation for Economic Co-operation and Development (OECD) countries while also identifying determinants with the most impact. The purpose is to hopefully gain insight on major determinants that heavily increase or decrease suicide rates in these countries. To achieve this goal, our team has decided to utilise a Supervised Learning Multiple Linear Regression Model. A Supervised Learning Regression Model strengths exhibiting the relationships between variables while also being able to predict values. We feel this type of model is the best fit to accomplish our goal of creating a model for predicting suicide risk in the next 1, 3, and 5 years across select countries. In addition to our Regression Model our team has decided to add a Random Forest component to find the importance of each variable our team is testing for. This will not only add analytical depth, but also make our model useful when identifying role players in suicide rates. This will make our model a valuable tool in not only forecasting a trends of suicide rates, but also spotlighting the potential characters that will have a lasting effect on people's health.

Training the model:

At first we start with an exploratory data analysis of our datasets. We used our smoking_clean.csv dataset as an example. After loading the data we filtered it on a specific country. In this case Australia. AUS.

	LocationTime	LOCATION	INDICATOR	TIME	Value
0	AUS-1992	AUS	SMOKERS	1992	26.0
1	AUS-1995	AUS	SMOKERS	1995	24.1
2	AUS-1998	AUS	SMOKERS	1998	22.1
3	AUS-2001	AUS	SMOKERS	2001	19.6
4	AUS-2004	AUS	SMOKERS	2004	17.8
5	AUS-2007	AUS	SMOKERS	2007	16.9

With the filtered data on a country we plotted a graph with the TIME as independent variable and the VALUE as dependent variable.



Here we can see that in Australia the number of smokers is decreasing in our chosen time between 1990 and 2020.

In our further analysis we want to do a similar exploratory analysis for our other datasets. (Education, Alcohol, Healthy Spending, …)

After the analysis we know and understand the trends in the countries. Now we can start our supervised machine learning regression model and use the data to train it. The supervised model will give us an outlook and will predict until the year 2025 how the features like alcohol or smoking are impacting the society.

With this trends discovered and predicted and also the suicide rate predicted we can merge the charts and see which factors are correlating with an increasing or decreasing suicide rate in the countries.

Independent Variable:

- Time

Dependent Variables:

- Alcohol
- Smoking
- Education
- Employment
- Healthy_Spending
- Suicide_Rate
- Obesity
- Poverty_Rate
- Social_Support
- Social_Spending

Technology: Jupyter Notebook / Google Colab

Mock up Code of Multiple Linear Regression Model:

```
#Importing dependencies/library
Import pandas as pd
from pathlib import Path
import matplotlib.pyplot as plt
From sklearn.linear_model import LinearRegression
import statsmodels.api as sm

#Load Data
Df = pd.read_csv(“ csv path”)

#Split data
X = df.([‘time_column’]).values.reshape(-1,1)
y = df.([‘suicide_column’]), df.([‘alcohol_column’]), …

#Model
model = LinearRegression()
model.fit(X,y)
y_pred = model.predict(X)

#Plotting
plt.scatter(X, y)
plt.plot(X, y_pred, color='red')
plt.show()

#Slope and intercept
print(model.coef_)
print(model.intercept_)

#summary
print_model = model.summary()
print(print_model)

#statsmodels

X = sm.add_constant(X)
model = sm.OLS(y, X).fit()
predictions = model.predict(X)


print_model = model.summary()
print(print_model)
```

Random Forest Model:

```
# import dependencies
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.ensemble import RandomForestClassifer
from sklearn.model_selection import train_test_split
from sklearn.metrics import confusion_matrix, accuracy_score, classification_report

# Loading the data
suicide_data_df = pd.read_csv('suicide_data.csv')
alcohol_data_df = pd.read_csv('alcohol_data.csv')

# Merging the data
data_df = pd.merge(suicide_data, alcohol_data, on='country')

# Splitting the data into features and target
X = data.drop(['suicide_rate'], axis=1)
y = data['suicide_rate']

# Splitting the data into training and test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=0)

# Creating the model and training on the data
rf = RandomForestRegressor(n_estimators=100, random_state=0)
rf.fit(X_train, y_train)

# Making predictions on the test set
y_pred = rf.predict(X_test)

# Evaluating the model's performance
mae = mean_absolute_error(y_test, y_pred)
print('Mean Absolute Error:', mae)

# Scatter plot to visualize relationship between suicide rate and alcohol consumption
plt.scatter(data['alcohol_consumption'], data['suicide_rate'])
plt.xlabel('Alcohol Consumption')
plt.ylabel('Suicide Rate')
plt.show()
```