# Adverse Reactions to Covid-19 Vaccines

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# Introduction

COVID-19 World Vaccine Adverse Reactions

The Food and Drug Administration (FDA) and Centers for Disease Control and Prevention (CDC) established the Vaccine Adverse Event Reporting System (VAERS) to receive reports about adverse events that may be associated with vaccines.

The dataset(s) we are utilizing are provided by this organization and consist of (3) related .CSV files, each indexed by a patient ID and consisting of 5,000+ records providing various details about the adverse event experienced by the vaccine recipients of the Covid-19 vaccine from PFizer and Moderna.

Recent reports from Europe indicate that approved vaccine from AstraZeneca has been suspended in many countries due to adverse reactions, although “experts” say that there is no link between the vaccine and blood clot problems.

With so many still considering whether or not to receive the vaccine, a study of adverse reactions is of interest to many.

# Summary: Questions from the Data

*VAERS data released today showed 38,444 reports of adverse events following COVID vaccines, including 1,739 deaths and 6,286 serious injuries since Dec. 14, 2020.*

Background Article

Our data source is https://vaers.hhs.gov/data.html and include updates from the above to February 2021.

From the data it is hoped to find answers or indications to the following questions:

1) Assuming an adverse reaction to one of the Covid-19 vaccines from PFizer or Moderna, does having a pre-existing condition, taking additional medications or having allergies increase the likelihood of death or hospitalization for age group or sex?

As we proceed through the project, we believe there will be other questions that we will want to pursue in more depth.

# Machine Learning Model

Model:  Supervised Learning - Logistic Regression

Using data from adverse reactions to the Covid-19 vaccines, we used logistic regression to attempt to predict whether a patient with an adverse reaction would die based on the features shown in the dataframe to the right.

We plan to repeat the process for other severe adverse reactions such as thrombosis or other reactions that require hospitalization.

In [606]:
```
### Logistic Regression Model to predict death
y = VAERS_DATA_VAX_all_df["DIED"]
X = VAERS_DATA_VAX_all_df.drop(["DIED"], axis=1)
X.head()
```

Out[606]:

| VAERS_ID | AGE_YRS | HOSPITAL | OTHER_MEDS | CUR_ILL | HISTORY | ALLERGIES | GENDER_0 | GENDER_1 |
|---|---|---|---|---|---|---|---|---|
| 855017 | 55 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 855018 | 68 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 855019 | 50 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 855020 | 67 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 855021 | 73 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

In [607]:
```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X,
   y, random_state=1, stratify=y)
```

In [608]:
```
from sklearn.linear_model import LogisticRegression
classifier = LogisticRegression(solver='lbfgs',
   max_iter=200,
   random_state=1)
```

In [609]:
```
classifier.fit(X_train, y_train)
```

Out[609]:
```
LogisticRegression(max_iter=200, random_state=1)
```

In [610]:
```
y_pred = classifier.predict(X_test)
```

In [611]:
```
from sklearn.metrics import accuracy_score
print(accuracy_score(y_test, y_pred))
```

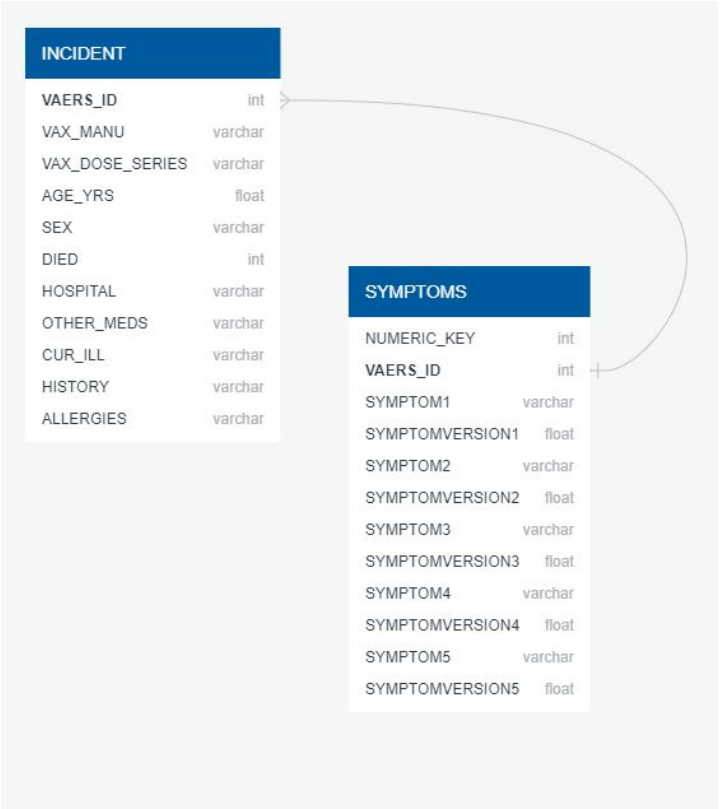
```
0.9826657912015758
```

# Database Mockup

This ERD references two primary tables that we will utilize for multiple analyses.

After cleaning data, the Incident Table is the primary table we are doing initial analysis and machine learning for in order to evaluate predictability of death as an adverse reaction when pre-existing conditions are a factor.

The Symptoms table will need further development and may serve as an opportunity to perform unsupervised learning to see if there are any clusters based on symptom type that result in death or hospitalization.



# Technologies

Data Cleaning:  Python

Data Storage:  PostgreSQL (AWS)

Visualization:  Tableau