USA Outbreak of Covid-19: Case Study with Python

Imports and Settings

In [ ]:
```
import pandas as pd
import numpy as np

import matplotlib
import matplotlib.pyplot as plt
plt.style.use('ggplot')
from matplotlib.pyplot import figure
from matplotlib import ticker

matplotlib.rcParams['figure.figsize'] = (30,10)

pd.set_option('display.max_rows', 100)
pd.set_option('display.max_columns', None)
pd.set_option('max_colwidth', 1000)


all_countries = pd.read_csv('owid-covid-data.csv')
```

Cleaning and Filtering Data Set

In [ ]:
```
usa = all_countries[all_countries['location']=='United States']
[usa['date'].min(),
usa['date'].max()]
```

Out[ ]:
```
['2020-01-22', '2022-02-22']
```

In [ ]:
```
usa.head()
```

Out[ ]:

	iso_code	continent	location	date	total_cases	new_cases	new_cases_smoothed	total_deaths
154826	USA	North America	United States	2020-01-22	1.0	NaN	NaN	NaN
154827	USA	North America	United States	2020-01-23	1.0	0.0	NaN	NaN
154828	USA	North America	United States	2020-01-24	2.0	1.0	NaN	NaN
154829	USA	North America	United States	2020-01-25	2.0	0.0	NaN	NaN
154830	USA	North America	United States	2020-01-26	5.0	3.0	NaN	NaN

In [ ]:
```
usa.columns
```

Out[ ]:
```
Index(['iso_code', 'continent', 'location', 'date', 'total_cases', 'new_cases',
       'new_cases_smoothed', 'total_deaths', 'new_deaths',
       'new_deaths_smoothed', 'total_cases_per_million',
       'new_cases_per_million', 'new_cases_smoothed_per_million',
       'total_deaths_per_million', 'new_deaths_per_million',
       'new_deaths_smoothed_per_million', 'reproduction_rate', 'icu_patients',
       'icu_patients_per_million', 'hosp_patients',
       'hosp_patients_per_million', 'weekly_icu_admissions',
       'weekly_icu_admissions_per_million', 'weekly_hosp_admissions',
       'weekly_hosp_admissions_per_million', 'new_tests', 'total_tests',
       'total_tests_per_thousand', 'new_tests_per_thousand',
       'new_tests_smoothed', 'new_tests_smoothed_per_thousand',
       'positive_rate', 'tests_per_case', 'tests_units', 'total_vaccinations',
       'people_vaccinated', 'people_fully_vaccinated', 'total_boosters',
       'new_vaccinations', 'new_vaccinations_smoothed',
       'total_vaccinations_per_hundred', 'people_vaccinated_per_hundred',
       'people_fully_vaccinated_per_hundred', 'total_boosters_per_hundred',
       'new_vaccinations_smoothed_per_million',
       'new_people_vaccinated_smoothed',
       'new_people_vaccinated_smoothed_per_hundred', 'stringency_index',
       'population', 'population_density', 'median_age', 'aged_65_older',
       'aged_70_older', 'gdp_per_capita', 'extreme_poverty',
       'cardiovasc_death_rate', 'diabetes_prevalence', 'female_smokers',
       'male_smokers', 'handwashing_facilities', 'hospital_beds_per_thousand',
       'life_expectancy', 'human_development_index',
       'excess_mortality_cumulative_absolute', 'excess_mortality_cumulative',
       'excess_mortality', 'excess_mortality_cumulative_per_million'],
      dtype='object')
```

In [ ]:
```
usa = usa[['location','date','total_cases','new_cases','total_deaths','new_deaths','icu
           'people_vaccinated','people_fully_vaccinated','total_boosters','new_vaccinati
```

In [ ]:
```
usa.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 763 entries, 154826 to 155588
Data columns (total 16 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   location                763 non-null    object
 1   date                    763 non-null    object
 2   total_cases             763 non-null    float64
 3   new_cases               762 non-null    float64
 4   total_deaths            725 non-null    float64
 5   new_deaths              725 non-null    float64
 6   icu_patients            587 non-null    float64
 7   hosp_patients           587 non-null    float64
 8   new_tests               717 non-null    float64
 9   total_tests             717 non-null    float64
 10  total_vaccinations      437 non-null    float64
 11  people_vaccinated       437 non-null    float64
 12  people_fully_vaccinated  437 non-null    float64
 13  total_boosters          194 non-null    float64
 14  new_vaccinations        436 non-null    float64
 15  population              763 non-null    float64
```

```
dtypes: float64(14), object(2)
memory usage: 101.3+ KB
```

In [ ]:
```
usa = usa.fillna(0)
```

In [ ]:
```
for col in usa.columns:
    if usa[col].dtype == 'float64':
        usa[col] = usa[col].astype('int64')
```

In [ ]:
```
usa
```

Out[ ]:

	location	date	total_cases	new_cases	total_deaths	new_deaths	icu_patients	hosp_patients
154826	United States	2020-01-22	1	0	0	0	0	0
154827	United States	2020-01-23	1	0	0	0	0	0
154828	United States	2020-01-24	2	1	0	0	0	0
154829	United States	2020-01-25	2	0	0	0	0	0
154830	United States	2020-01-26	5	3	0	0	0	0
...	...	...	...	...	...	...	...	...
155584	United States	2022-02-18	78421569	145871	935095	2459	11884	58558
155585	United States	2022-02-19	78455125	33556	935725	630	11252	54918
155586	United States	2022-02-20	78477178	22053	936109	384	10809	52935
155587	United States	2022-02-21	78548831	71653	936764	655	10455	51276
155588	United States	2022-02-22	78648651	99820	939064	2300	0	0

763 rows × 16 columns

In [ ]:
```
usa.describe()
```

Out[ ]:

	total_cases	new_cases	total_deaths	new_deaths	icu_patients	hosp_patients	new_t
count	7.630000e+02	7.630000e+02	763.000000	763.000000	763.000000	763.000000	7.630000e
mean	2.455143e+07	1.030782e+05	416934.243775	1230.752294	11361.239843	46114.625164	1.057341e
std	2.083694e+07	1.485498e+05	283135.649996	1001.916502	8770.166996	39735.079778	6.526564e

	total_cases	new_cases	total_deaths	new_deaths	icu_patients	hosp_patients	new_t
min	1.000000e+00	0.000000e+00	0.000000	0.000000	0.000000	0.000000	0.000000e
25%	4.511990e+06	2.820050e+04	153236.500000	461.500000	3765.000000	13005.000000	5.984740e
50%	2.708406e+07	5.656100e+04	467930.000000	964.000000	10437.000000	39012.000000	1.011967e
75%	3.692580e+07	1.249215e+05	621852.500000	1825.500000	17716.500000	69622.500000	1.531332e
max	7.864865e+07	1.368120e+06	939064.000000	4442.000000	28891.000000	154536.000000	3.116622e

In [ ]:
```
# Looking at sums of the 'new' columns to verify they match the 'total' columns they ar

[usa['new_cases'].sum(), usa['new_deaths'].sum(), usa['new_tests'].sum()]
```

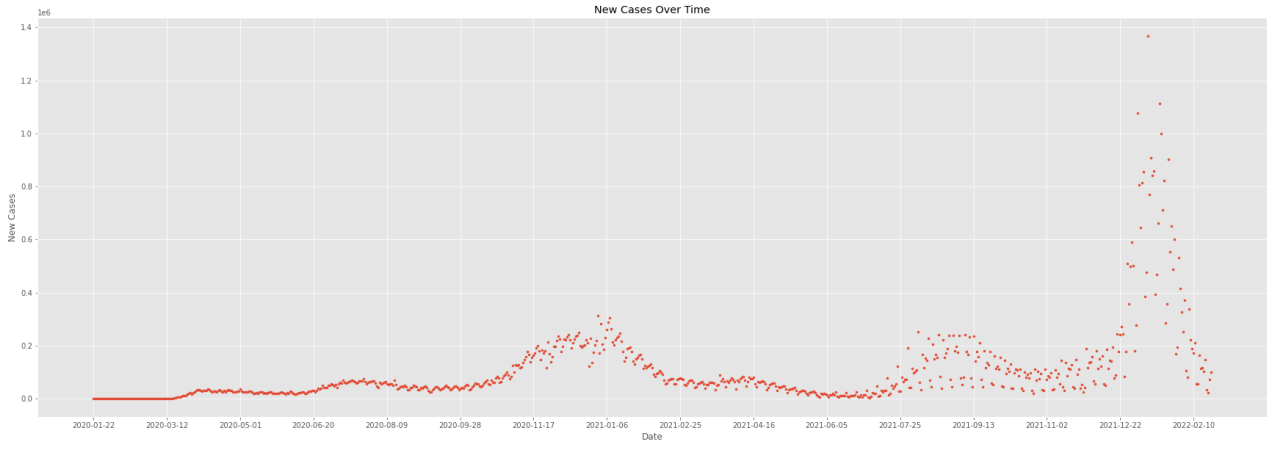
Out[ ]:
```
[78648650, 939064, 806751537]
```

Creating Aggregates of Other Columns for Analysis

In [ ]:
```
usa['vaccinated_percent'] = usa['people_vaccinated']/usa['population']*100
usa['infected_percent'] = usa['total_cases']/usa['population']*100
usa['death_percent'] = usa['total_deaths']/usa['population']*100
usa['icu_percent'] = usa['icu_patients']/usa['total_cases']*100
usa['hosp_percent'] = usa['hosp_patients']/usa['total_cases']*100
```

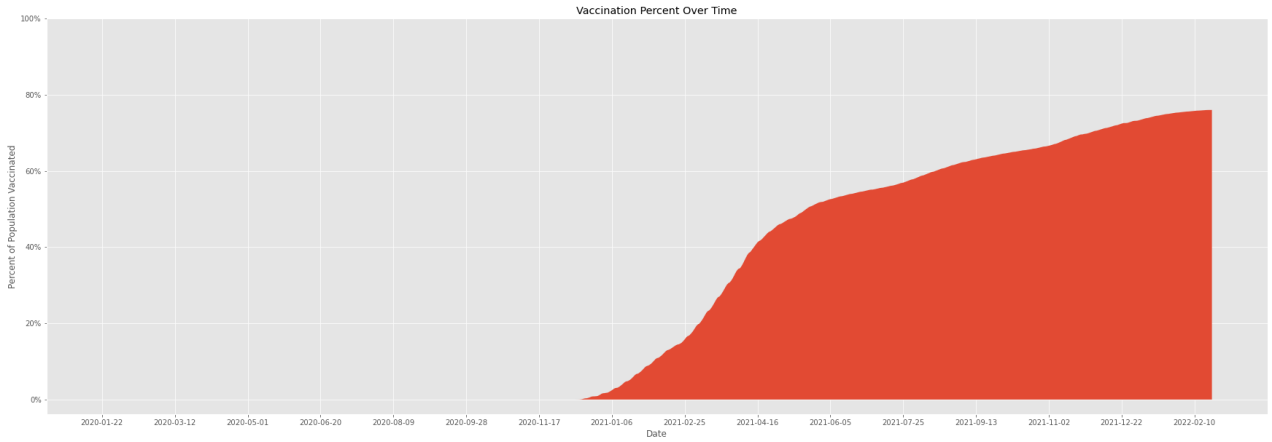
Visual Analysis of Covid-19 Progression Over Time

In [ ]:
```
plt.scatter(x=usa['date'], y=usa['new_cases'], marker='.')
plt.title('New Cases Over Time')
plt.xlabel('Date')
plt.ylabel('New Cases')
plt.xticks(np.arange(0,len(usa['date']),50))

plt.show()
```



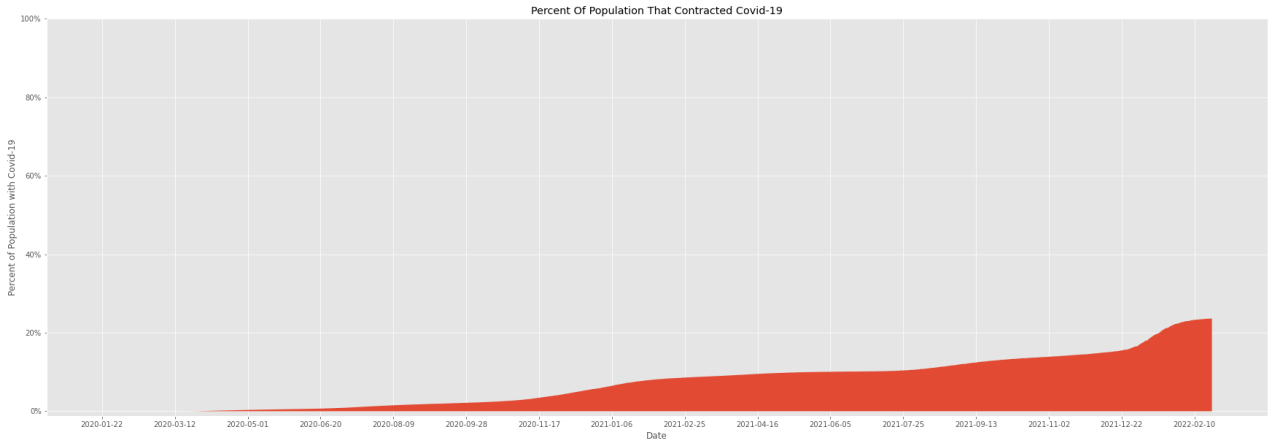
In [ ]:
```
plt.fill_between(x=usa['date'],y1= 0, y2=usa['vaccinated_percent'])
plt.title('Vaccination Percent Over Time')
```

```
plt.xlabel('Date')
plt.ylabel('Percent of Population Vaccinated')
plt.xticks(np.arange(0,len(usa['date']),50))
plt.yticks(np.arange(0,101,20),['0%','20%','40%','60%','80%','100%'])

plt.show()
```



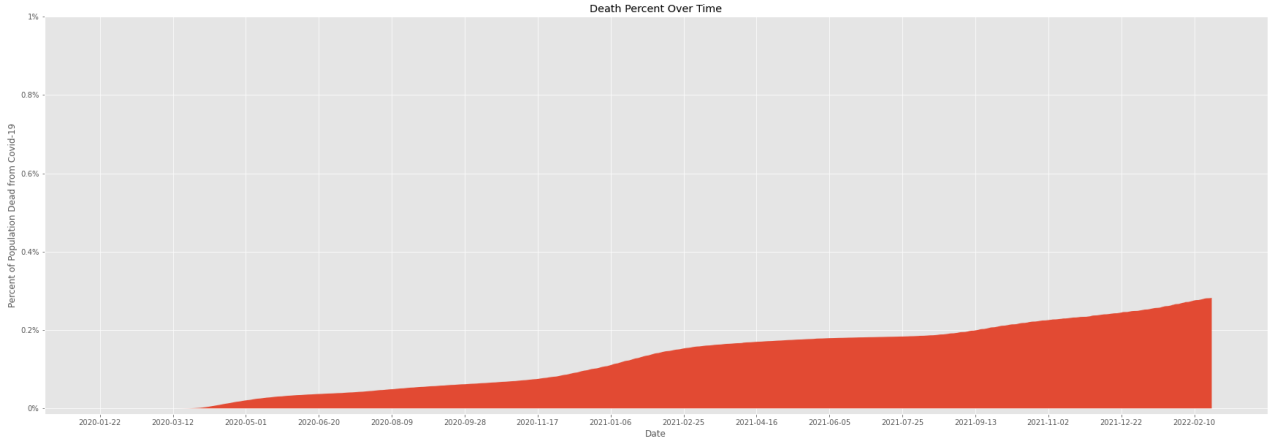
In [ ]:

```
plt.fill_between(x=usa['date'],y1= 0, y2=usa['infected_percent'])
plt.title('Percent Of Population That Contracted Covid-19')
plt.xlabel('Date')
plt.ylabel('Percent of Population with Covid-19')
plt.xticks(np.arange(0,len(usa['date']),50))
plt.yticks(np.arange(0,101,20),['0%','20%','40%','60%','80%','100%'])

plt.show()
```



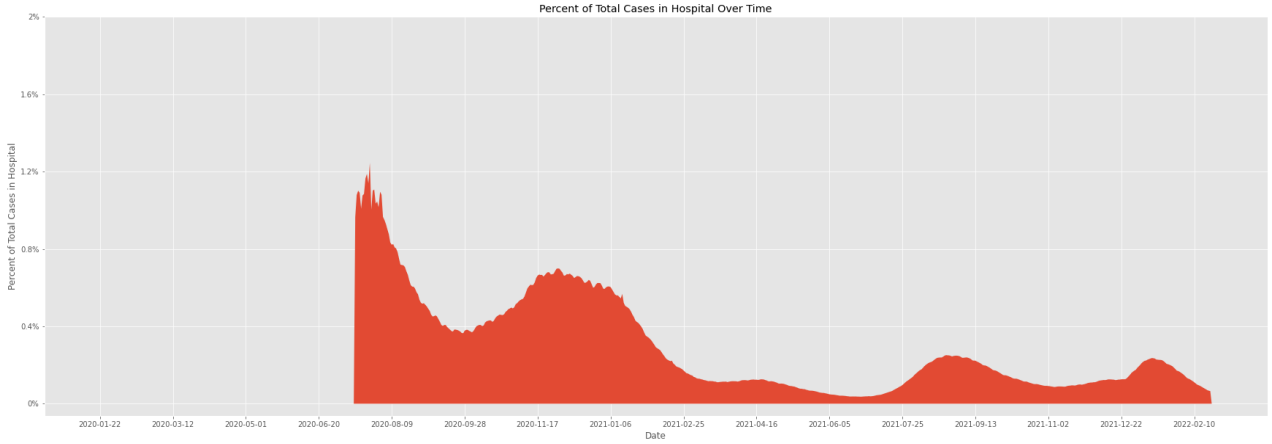
In [ ]:

```
plt.fill_between(x=usa['date'],y1= 0, y2=usa['death_percent'])
plt.title('Death Percent Over Time')
plt.xlabel('Date')
plt.ylabel('Percent of Population Dead from Covid-19')
plt.xticks(np.arange(0,len(usa['date']),50))
plt.yticks(np.arange(0,1.1,.2),['0%','0.2%','0.4%','0.6%','0.8%','1%'])

plt.show()
```



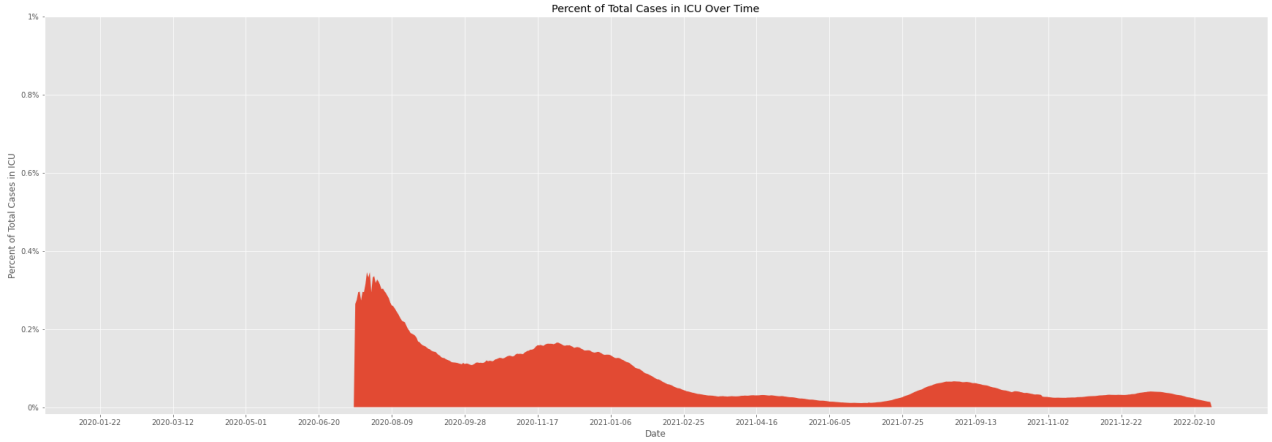
In [ ]:

```
plt.fill_between(x=usa['date'],y1= 0, y2=usa['hosp_percent'])
plt.title('Percent of Total Cases in Hospital Over Time')
plt.xlabel('Date')
plt.ylabel('Percent of Total Cases in Hospital')
plt.xticks(np.arange(0,len(usa['date']),50))
plt.yticks(np.arange(0,2.1,.4),['0%','0.4%','0.8%','1.2%','1.6%','2%'])

plt.show()
```



In [ ]:

```
plt.fill_between(x=usa['date'],y1= 0, y2=usa['icu_percent'])
plt.title('Percent of Total Cases in ICU Over Time')
plt.xlabel('Date')
plt.ylabel('Percent of Total Cases in ICU')
plt.xticks(np.arange(0,len(usa['date']),50))
plt.yticks(np.arange(0,1.1,.2),['0%','0.2%','0.4%','0.6%','0.8%','1%'])

plt.show()
```


Percent of Total Cases in ICU Over Time
1%
0.8%
0.6%
0.4%
0.2%
0%
Percent of Total Cases in ICU
2020-01-22
2020-03-12
2020-05-01
2020-06-20
2020-08-09
2020-09-28
2020-11-17
2021-01-06
2021-02-25
2021-04-16
2021-06-05
2021-07-25
2021-09-13
2021-11-02
2021-12-22
2022-02-10
Date