COVID-19 EDA Sample Project

February 2, 2023

1 Covid-19 EDA (Exploratory Data Analysis)

1.1 Workflow Stages

1. Question or problem definition.
2. Accquire training and testing data.
3. Wrangle, prepare, cleanse the data.
4. Analyze, identify patterns, and explore the data.
5. Conclusion

1.1.1 Question or Problem Defination

Give the estimation of death statewise with all doses and population

1. Analyze the association between the number of doses taken and the number of deaths in each state.
2. Calculate the growth rate of confirmed cases and death rate by state.
3. Calculate the distribution of doses among the population of each state.
4. Compare the population of each state based on the different doses taken.

Estimate the relationship between following

- deaths with state, dose1, dose2, dose3, and precaution
- state with the highest and lowest of death,active, dose1, dose2, dose3, precaution dose, and population

[ ]:
```
# data analysis and wranglin
import pandas as pd
import numpy as np

# visualization
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
%reload_ext autoreload
%autoreload 2
```

1.1.2 Acquire data

```
[ ]: url = "https://raw.githubusercontent.com/ukantjadia/30-days-of-Mahcine-Learning/
      ↪Main/DAY-11/covid.csv"
     # covid = pd.read_csv('covid.csv')
     covid = pd.read_csv(url)
```

1.1.3 Analyze by describing data

```
[ ]: # Which features are available in the dataset?
     print(covid.columns.values)
```

```
['state' 'confirmed' 'active' 'passive' 'deaths' 'dose1' 'dose2' 'dose3'
 'precaution_dose' 'total_doses' 'population']
```

Categorical features are

- Our data is statewise so has no categorical features.so Categorical Values: None

Numerical feature are

- Continous Values: confirmed, active, passive, deaths, dose1, dose2, dose3, precaution_dose, total_doses, population

```
[ ]: # preview the data
     covid.head()
```

```
[ ]:                 state  confirmed  active  passive  deaths     dose1  \
     0  Andaman and Nicobar      10742       1    10612     129    313284
     1       Andhra Pradesh    2339067       3  2324331   14733  40643161
     2    Arunachal Pradesh      66890       0    66594     296    860442
     3                Assam     746100       0   738065    8035  22549957
     4                Bihar     851379      15   839062   12302  62944633

           dose2     dose3  precaution_dose  total_doses  population
     0    320383    236936            53427       991263      426251
     1  43549055  11703273          6579565    110556756    52883163
     2    747177     72403            58618      1911760     1528296
     3  20561790   2082670          1259853     50284713    34586234
     4  59144387  11983504          3868082    157197041   119461013
```

Which features are mixed data types?

- There is no feature of mixed data type.

Which features may contain error or typos?

- State feature may contain error or typos as there are several ways used to describe a name including titles, round brackets, and quotes used for alternative or short names.

Which features contain blank, null or empty values?

- There is no such feature.

What are the data types for various features?

- 10 features are integer
- 1 feature is string(object)

[ ]:
```
covid.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 36 entries, 0 to 35
Data columns (total 11 columns):
 #   Column           Non-Null Count  Dtype
---  ------           --------------  -----
 0   state            36 non-null     object
 1   confirmed        36 non-null     int64
 2   active           36 non-null     int64
 3   passive          36 non-null     int64
 4   deaths           36 non-null     int64
 5   dose1            36 non-null     int64
 6   dose2            36 non-null     int64
 7   dose3            36 non-null     int64
 8   precaution_dose  36 non-null     int64
 9   total_doses      36 non-null     int64
 10  population       36 non-null     int64
dtypes: int64(10), object(1)
memory usage: 3.2+ KB
```

Assumptions based on the data analysis following assumptions based on the data analysis done so far.

Correlating - We want to know how well does each feature correlate with Deaths.

Completing

1. We may want to complete the dose feature as it is definitely correlated with death.
2. We may want to complete the active feature as it my also correlate with death.

Correcting

1. state feature is relatively non-standard, may not contribute directly to deaths, so maybe droped.

Creating

1. We may want to create a new feature called real_total_dose based on the dose1, dose2, dose3, precaution_dose to get the total count of all 3 doses.

Classifying

We may also add to our assumptions based on the probelm description noted earlier.

1. Population range of state

2. total_doses
3. active cases in each state

1.1.4 Analyze by pivoting features

To confirm some of our observations and assumption, we can analyze our feature correlation by pivoting features against each other.

[ ]:
```
# relationship between death and state
data = pd.DataFrame()
data['deaths'] = covid.sort_values('deaths',ascending=False).deaths.values[:10]
data['state'] = covid.sort_values('deaths',ascending=False).state.values[:10]
```

[ ]:
```
# relationship between death and population
population = pd.DataFrame()
population['population'] = covid.sort_values('population',ascending=False).
 ↪population.values[:10]
population['state'] = covid.sort_values('population',ascending=False).state.
 ↪values[:10]
```

[ ]:
```
cases = pd.DataFrame()
cases['state'] = covid.sort_values(by='confirmed',ascending=False).state.
 ↪values[:10]
cases['case1'] = covid.sort_values(by='confirmed',ascending=False).confirmed.
 ↪values[:10]
```

[ ]:
```
dose = pd.DataFrame()
dose['total_dose'] = covid['dose1'] + covid['dose2'] + covid['dose3'] +␣
 ↪covid['precaution_dose']
covid[['dose1','dose2','dose3','precaution_dose','total_doses','deaths']].corr()
```

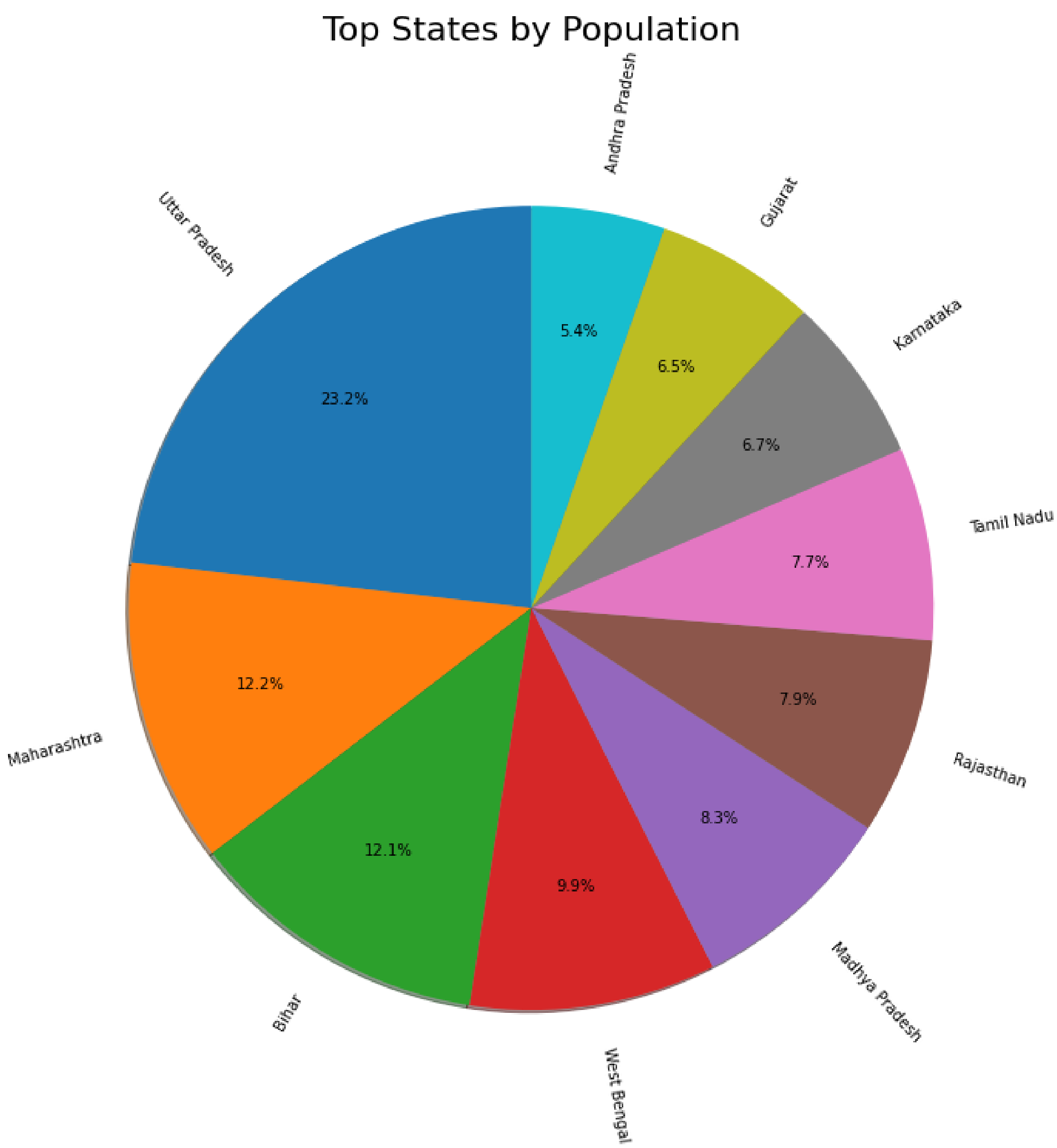
[ ]:
```
                    dose1     dose2     dose3  precaution_dose  total_doses  \
dose1            1.000000  0.997478  0.886536         0.913766     0.995872
dose2            0.997478  1.000000  0.908188         0.930180     0.998916
dose3            0.886536  0.908188  1.000000         0.897297     0.922680
precaution_dose  0.913766  0.930180  0.897297         1.000000     0.928383
total_doses      0.995872  0.998916  0.922680         0.928383     1.000000
deaths           0.501551  0.461720  0.157094         0.403252     0.439675

                   deaths
dose1            0.501551
dose2            0.461720
dose3            0.157094
precaution_dose  0.403252
total_doses      0.439675
deaths           1.000000
```

1.1.5 Analyze by visualizing data

Now we can continue confirming some of our assumptions using visualization for analyzing the data

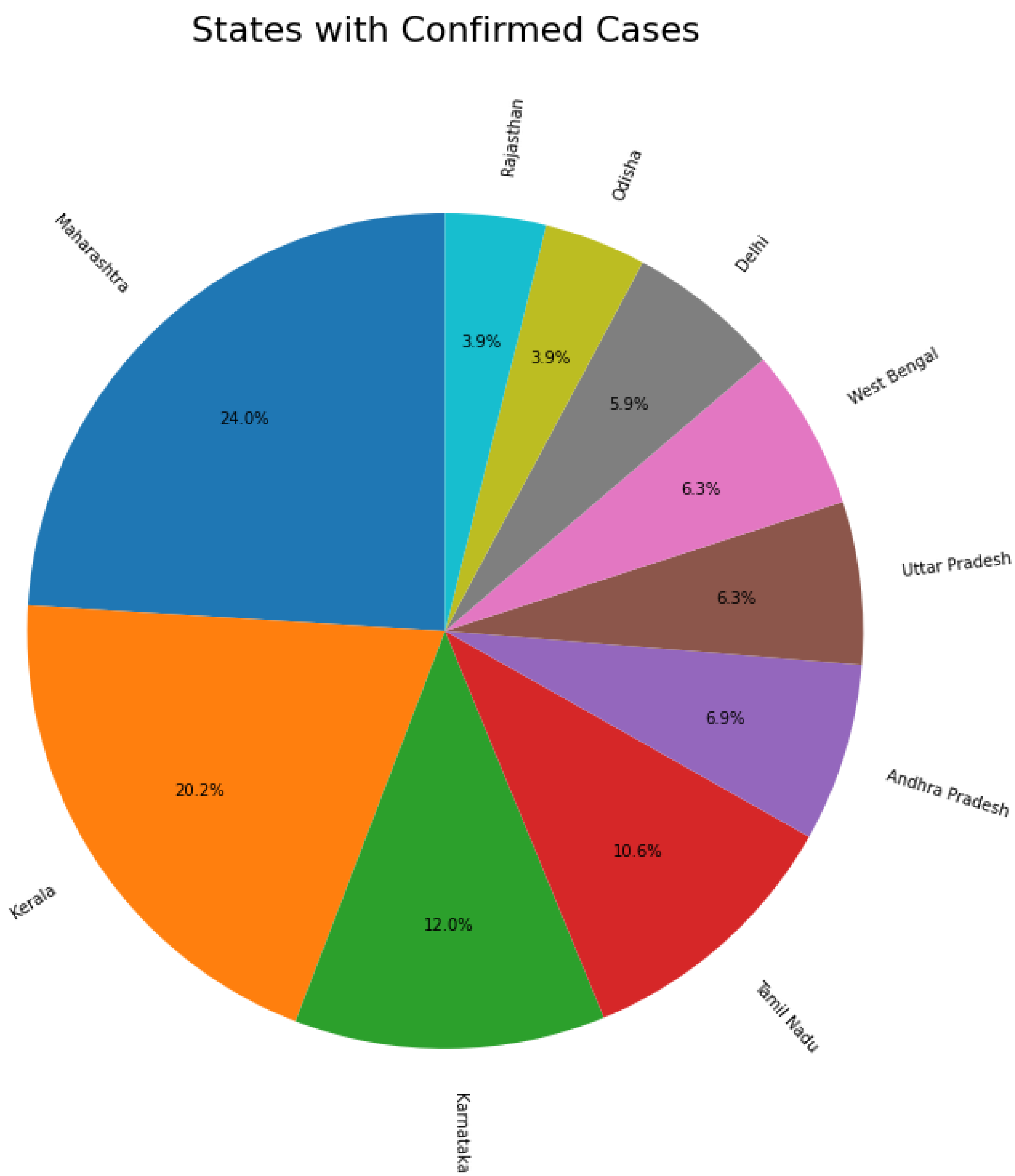
[ ]:
```
# Top 10 states having the higest population
states,values = population['state'],population['population']
plt.figure(figsize=(14,8))
fig,ax1 = plt.subplots()
title={'fontsize':22,'fontweight':55,'horizontalalignment':'center'}
plt.title("Top States by Population",fontdict=title,pad=260)
ax1.pie(values,labels=states,autopct='%1.1f%%',pctdistance=.
 ↪7,rotatelabels=40,shadow=True,radius=3,startangle=90)
plt.show()
```

```
<Figure size 1008x576 with 0 Axes>
```



[ ]:
```
# Top 10 states having the confirmed cases
case1,state = cases['case1'],cases['state']
plt.figure(figsize=(14,8))
fig,ax2 = plt.subplots()
title={'fontsize':22,'fontweight':55,'horizontalalignment':'center'}
plt.title("States with Confirmed Cases",fontdict=title,pad=260)
ax2.pie(case1,labels=state,radius=3,autopct='%1.1f%%',pctdistance=.
↪7,rotatelabels=30,startangle=90)
plt.show()
```

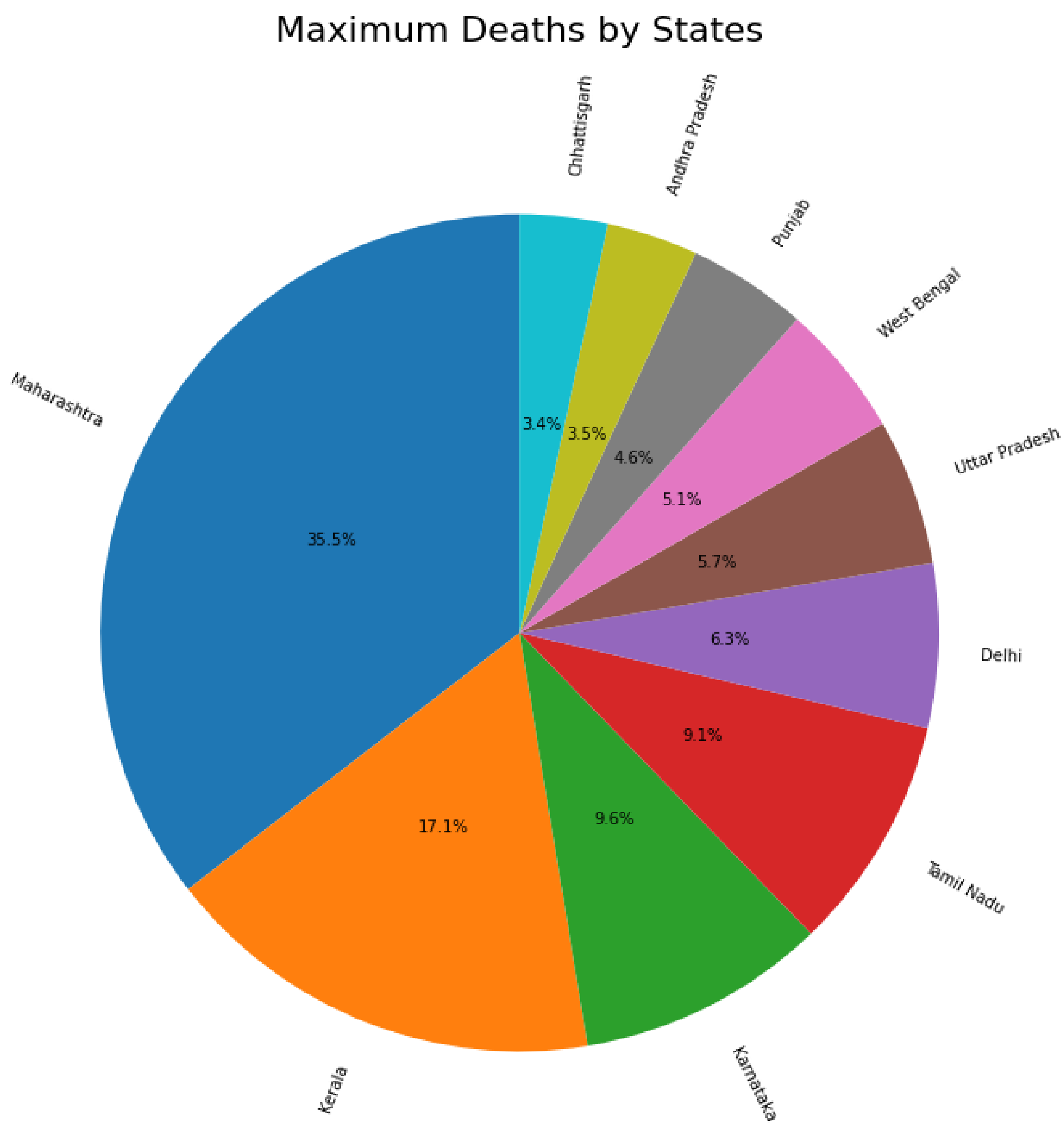
```
<Figure size 1008x576 with 0 Axes>
```




```
[ ]: # Top 10 states having the higest death count
     deaths,state=data['deaths'],data['state']
     plt.figure(figsize=(14,8))
     fig,ax3 = plt.subplots()
     title={'fontsize':22,'fontweight':55,'horizontalalignment':'center'}
     plt.title("Maximum Deaths by States",fontdict=title,pad=260)
     ax3.pie(deaths,labels=state,radius=3,autopct='%1.1f%%',pctdistance=.
      ↪5,counterclock=True,rotatelabels=30,startangle=90)
```

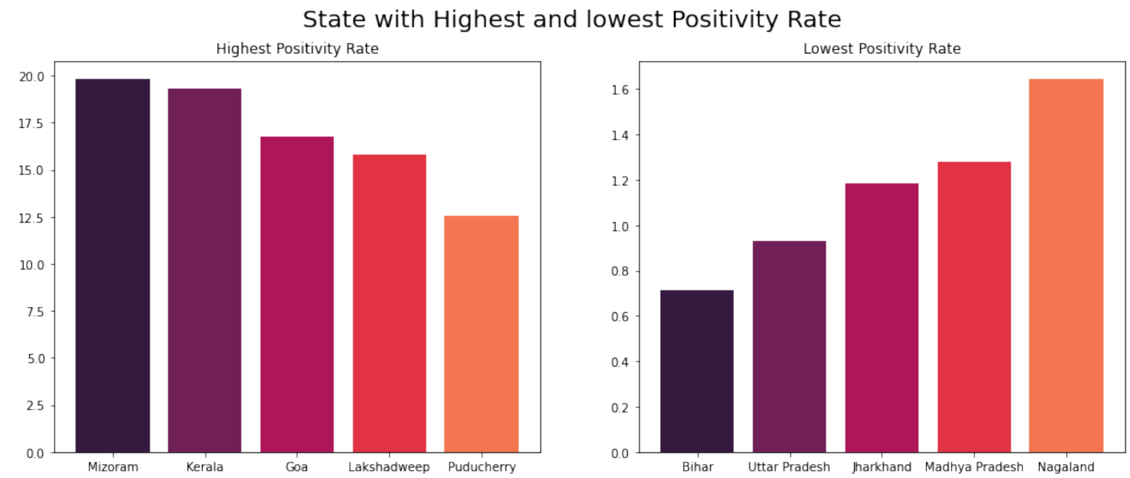
```
plt.show()
```

<Figure size 1008x576 with 0 Axes>



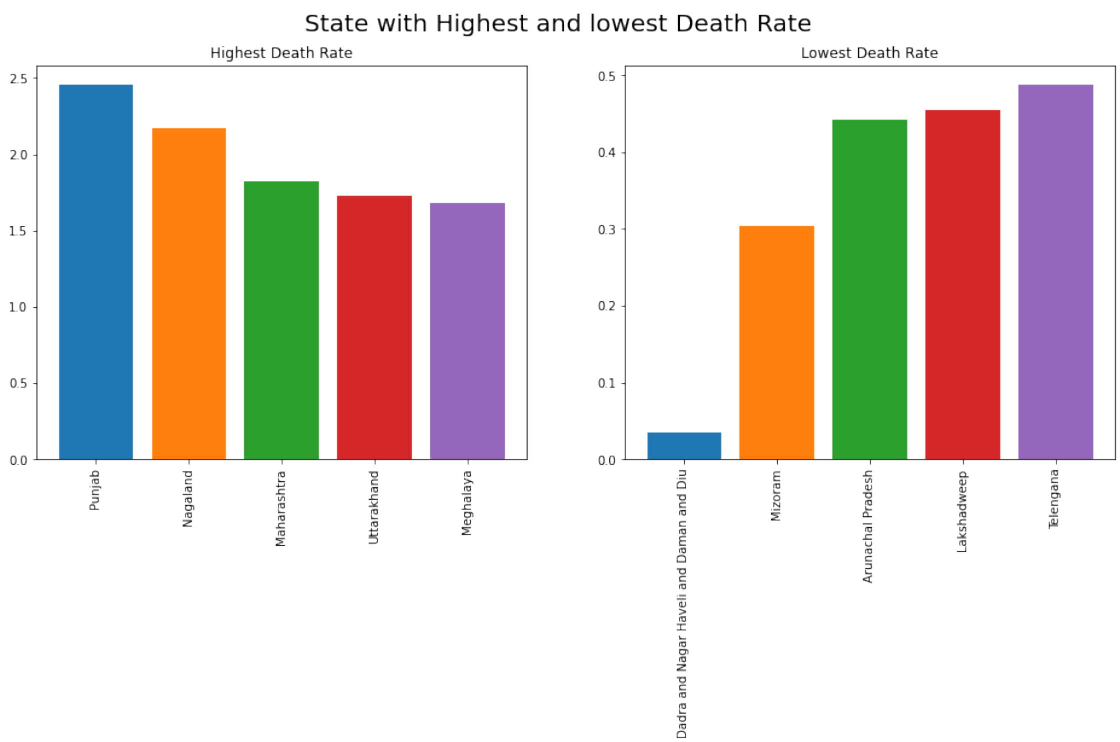
[ ]:
```
# Which states have highest and lowest Postivity Rate
covid['Positivity rate'] = covid['confirmed']*100/covid['population']
states_pos_high = covid.sort_values(by='Positivity␣
 ↪rate',ascending=False)['state'].values[:5] #
states_pos_least = covid.sort_values(by='Positivity␣
 ↪rate',ascending=True)['state'].values[:5]
```

```python
high_PR = []
low_PR = []
for i,a in zip(states_pos_high,states_pos_least):
  high_PR.append(covid[covid['state'] == str(i)]['Positivity rate'].values[0])
  low_PR.append(covid[covid['state'] == str(a)]['Positivity rate'].values[0])

# chart
fig,ax4 = plt.subplots(nrows=1,ncols=2,figsize=(16,6))
fig.suptitle("State with Highest and lowest Positivity Rate",fontsize=20)
ax4[0].set_title("Highest Positivity Rate")
ax4[1].set_title("Lowest Positivity Rate")
colr = sns.color_palette('rocket')
ax4[1].bar(states_pos_least,low_PR,color=colr)
ax4[0].bar(states_pos_high,high_PR,color=colr)
plt.show()
```



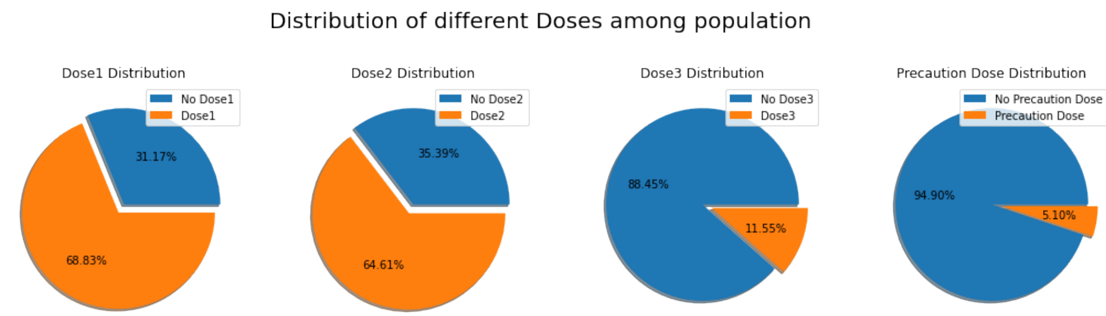
[ ]:
```python
# Which states have highest and lowest Death Rate
covid['Death rate'] = covid['deaths']*100/covid['confirmed']
states_death_high = covid.sort_values(by='Death rate',ascending=False)['state'].
 ↪values[:5] #
states_death_least = covid.sort_values(by='Death rate',ascending=True)['state'].
 ↪values[:5]

high_DR = []
low_DR = []
for i,a in zip(states_death_high,states_death_least):
  high_DR.append(covid[covid['state'] == str(i)]['Death rate'].values[0])
  low_DR.append(covid[covid['state'] == str(a)]['Death rate'].values[0])

# chart
```

```
fig,ax4 = plt.subplots(nrows=1,ncols=2,figsize=(16,6))
fig.suptitle("State with Highest and lowest Death Rate",fontsize=20)
ax4[0].set_title("Highest Death Rate")
ax4[1].set_title("Lowest Death Rate")
colr = sns.color_palette('tab10')
ax4[0].bar(states_death_high,high_DR,color=colr)
ax4[0].set_xticklabels(states_death_high,rotation=90)
ax4[1].set_xticklabels(states_death_least,rotation=90)
ax4[1].bar(states_death_least,low_DR,color=colr)

plt.show()
```



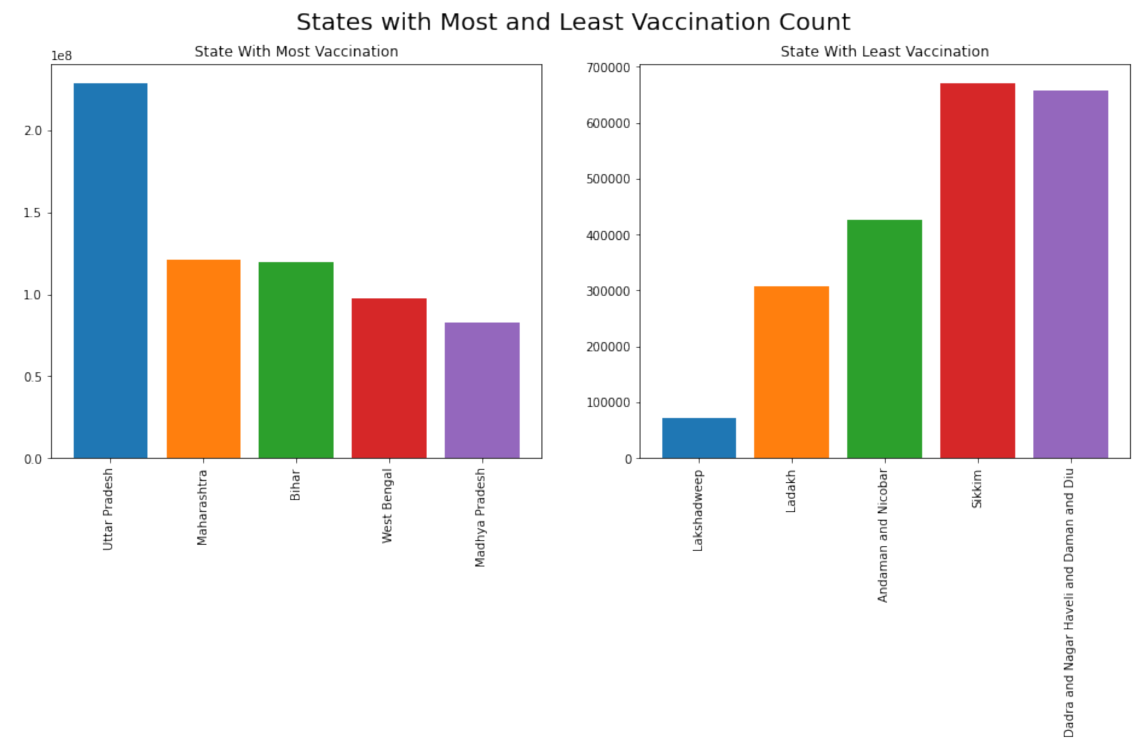

```
[ ]: # Population vaccinated according to the doses

pop = covid.sum()['population']
dose1 = covid.sum()['dose1']
dose2 = covid.sum()['dose2']
dose3 = covid.sum()['dose3']
dose4 = covid.sum()['precaution_dose']

fig, ax1 = plt.subplots(1,4,figsize=(18,5.1))
fig.suptitle("Distribution of different Doses among population",fontsize=20)
ax1[0].pie(x=[pop - dose1,dose1],shadow=True,autopct='%1.2f%%',explode=(0,0.1))
```

```
ax1[0].set_title('Dose1 Distribution')
ax1[0].legend(['No Dose1','Dose1'],loc=1)

ax1[1].pie(x=[pop - dose2,dose2],autopct='%1.2f%%',shadow=True,explode=(0,0.1))
ax1[1].set_title('Dose2 Distribution')
ax1[1].legend(['No Dose2','Dose2'])

ax1[2].pie(x=[pop - dose3,dose3],autopct='%1.2f%%',explode=(0,0.1),shadow=True)
ax1[2].set_title('Dose3 Distribution')
ax1[2].legend(['No Dose3','Dose3'],loc=0)

ax1[3].pie(x=[pop - dose4,dose4],autopct='%1.2f%%',explode=(0,0.1),shadow=True)
ax1[3].set_title('Precaution Dose Distribution')
ax1[3].legend(['No Precaution Dose','Precaution Dose'],loc=0)

plt.show()
```

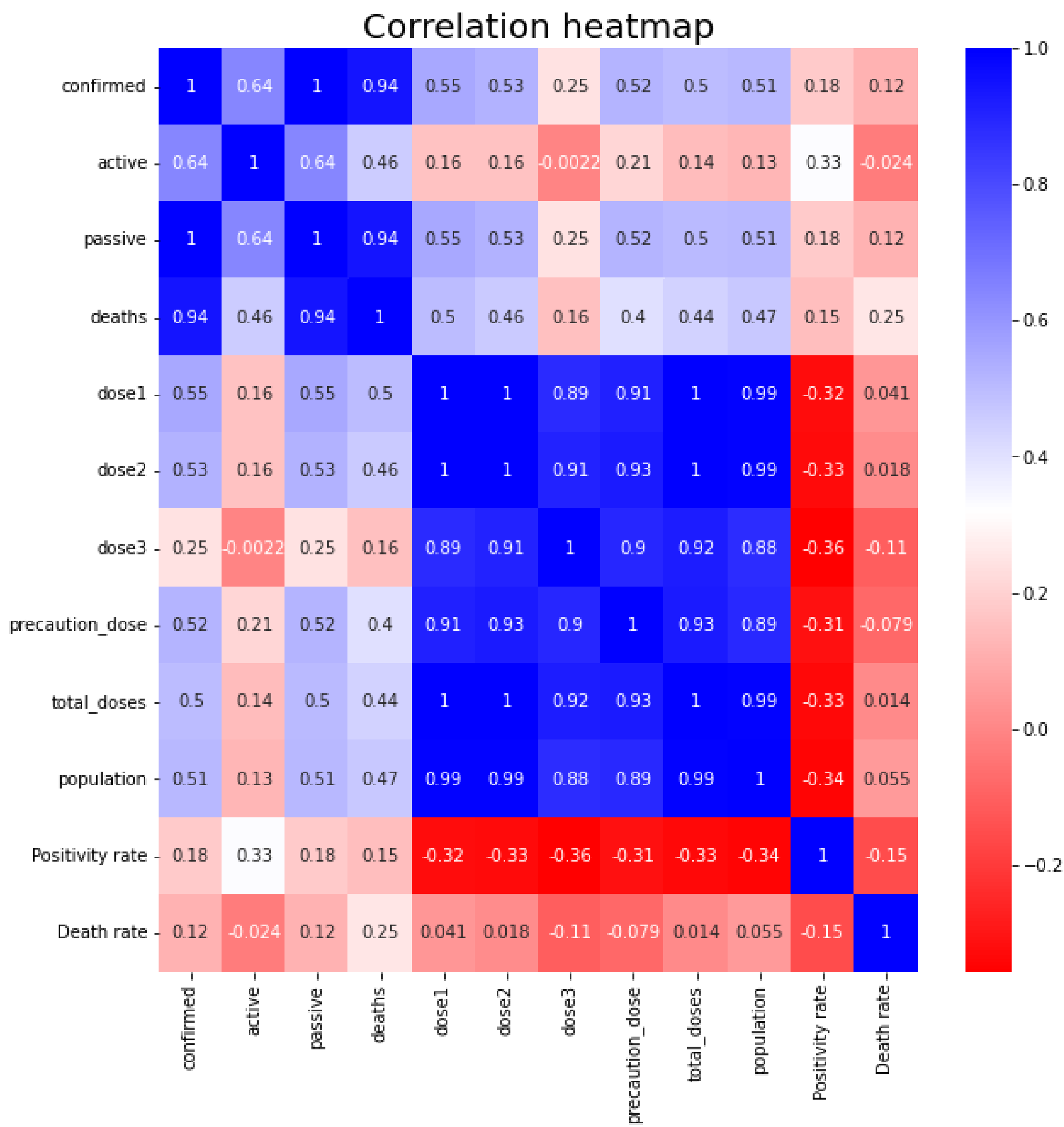


[ ]:
```
# States according to the doses
state_dose_most = covid.sort_values(by='total_doses',ascending=False)['state'].
  ↪values[:5]
state_popu_most = covid.
  ↪sort_values(by='total_doses',ascending=False)['population'].values[:5]

state_popu_least = covid.sort_values(by='total_doses')['population'].values[:5]
state_dose_least = covid.sort_values(by='total_doses')['state'].values[:5]

fig,ax = plt.subplots(1,2,figsize=(16,6))
fig.suptitle("States with Most and Least Vaccination Count",fontsize=20)
colr = sns.color_palette('tab10')
ax[0].set_title('State With Most Vaccination')
ax[0].bar(state_dose_most,state_popu_most,color=colr)
ax[1].set_title('State With Least Vaccination')
ax[1].bar(state_dose_least,state_popu_least,color=colr)
ax[1].set_xticklabels(state_dose_least,rotation=90)
```

```
ax[0].set_xticklabels(state_dose_most,rotation=90)

plt.show()
```



[ ]:
```
# heatmap
plt.figure(figsize=(10,10))
sns.heatmap(covid.corr(),cmap='bwr_r',annot=True)
plt.title('Correlation heatmap',fontsize=20)
plt.show()
```



1.1.6 Conclusion

- The state with the dense population have the higher confirmed cases and higher death ratio in comparision to others state
- The state with higher population have the higher amount of the vaccination
- Vaccination of Dose1, Dose2 is done among the approx 65% of population
- Vaccination of Dose3, Precaution Dose is done among the only 20% of population

- Dose1 and Dose2 is highly correlated to the population