

```
In [1]:  
import pandas as pd, pickle, numpy as np, matplotlib.pyplot as plt, matplotlib.dates as mdates, matplotlib as mpl  
import matplotlib.lines as mlines  
from datetime import datetime, timedelta
```

Visual Analysis of the Coronavirus Pandemic (State and County Level)

- CDC cases and death information
- Safegraph county census data
- Google mobility data

Update Data and Import Graphing Functions

```
In [2]: %%run safegraph_census.ipynb
```

```
In [3]: %%run create_master_table.ipynb
```

```
In [4]: with open('covid_data.p', 'rb') as f:  
    data = pickle.load(f)
```

```
In [5]: %run graphFunctions.ipynb
```

```
In [6]: print("Total Deaths :", data[data.date == data.date.max() - timedelta(days=0)].deaths_cdc.sum())
```

Total Deaths : 423566.0

Section 1: Statewide Totals

Figure 1.1: Deaths by State

```
In [7]: plotStateTotals(data, 'deaths_cdc', 'deaths_cdc', 200)
```

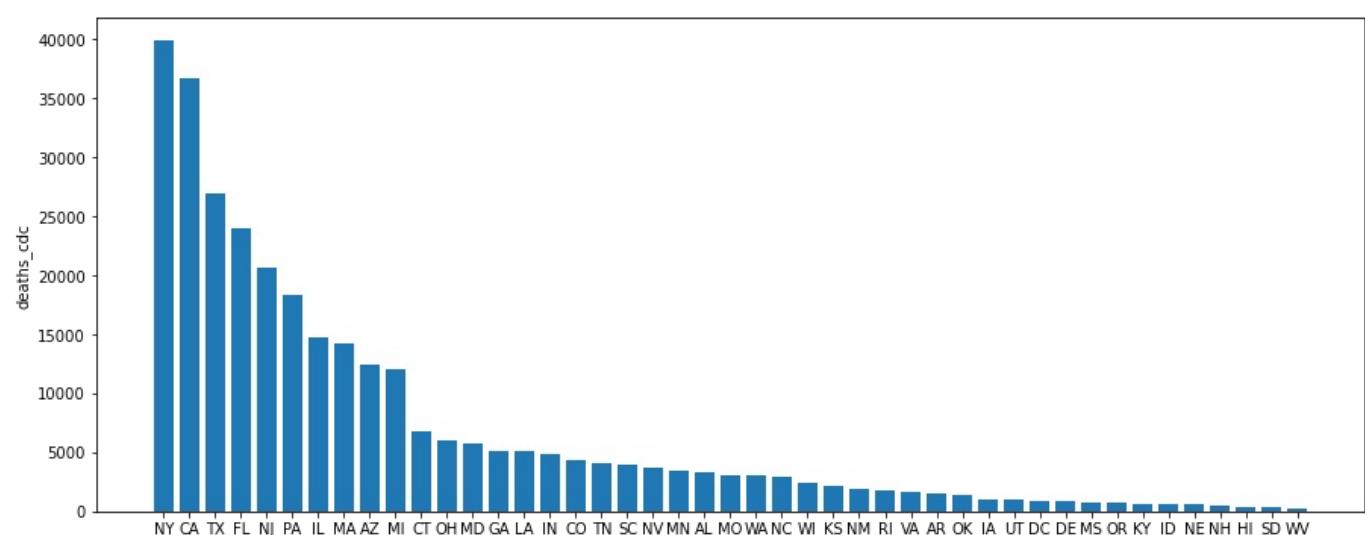
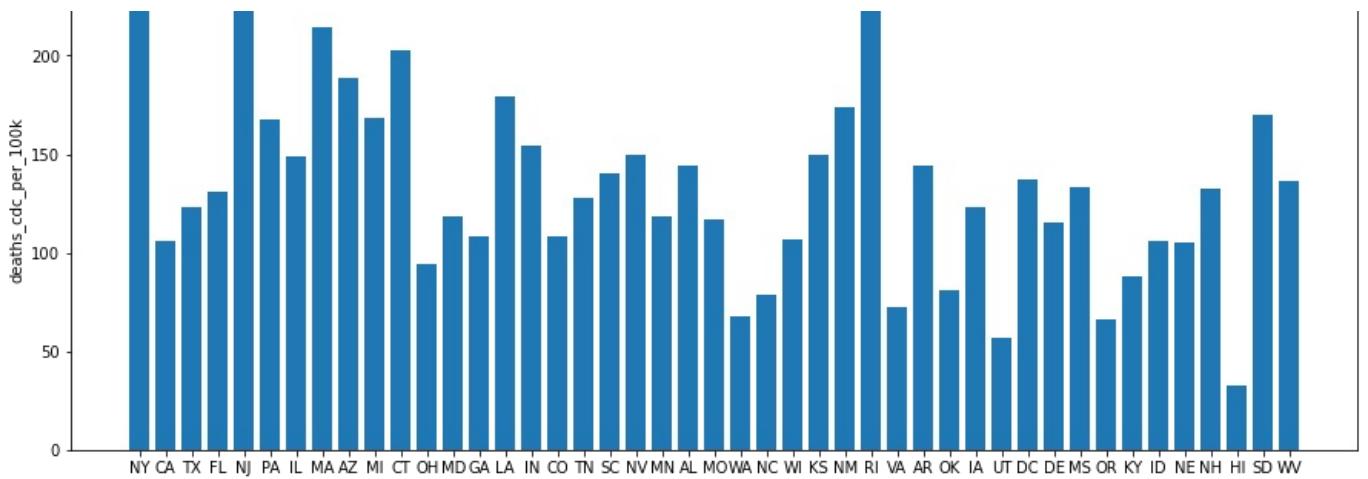


Figure 1.2: Deaths per 100,000 People

```
In [8]: plotStateTotals(data, 'deaths_cdc', 'deaths_cdc_per_100k', 200)
```





```
#
```

Section 2: Deep Dive on States with Top 10 Death Count

```
#
```

```
#
```

Section 2.1: New York

```
In [9]: state = 'NY'  
death_min = 500
```

Figure 2.1.1: Cases and Deaths (Total, Per 100k People)

```
In [10]: stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```

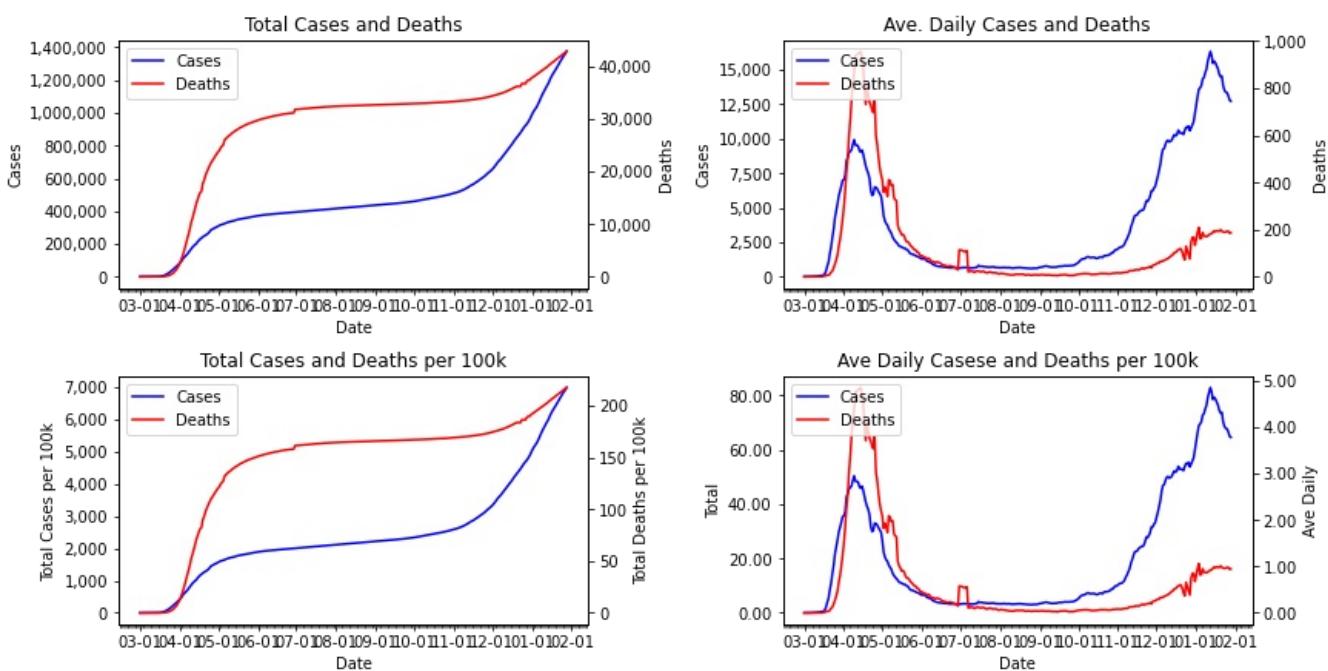
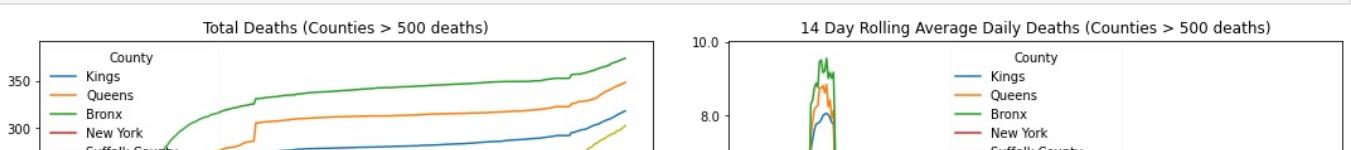
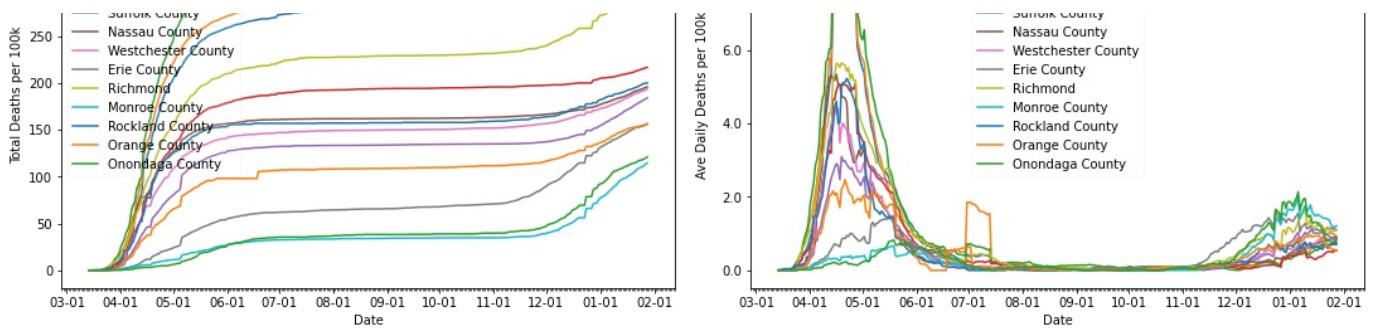


Figure 2.1.2: Deaths per 100k People - 14 Day Average

```
In [11]: plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')
```





Section 2.1.3: County Level Mobility Reduction

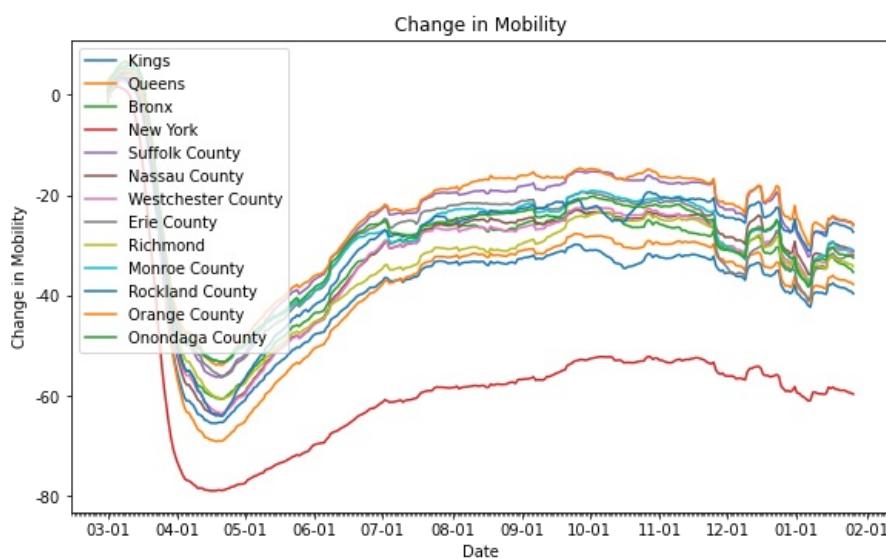
Mobility Reduction by County - Showing daily fluctuations

```
In [12]: graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)
```



Mobility Reduction by County - 14 Day Average

```
In [13]: graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)
```



Section 2.1.4: County Attributes Analysis

Figure 2.1.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [14]: plotInteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k',[state])
```

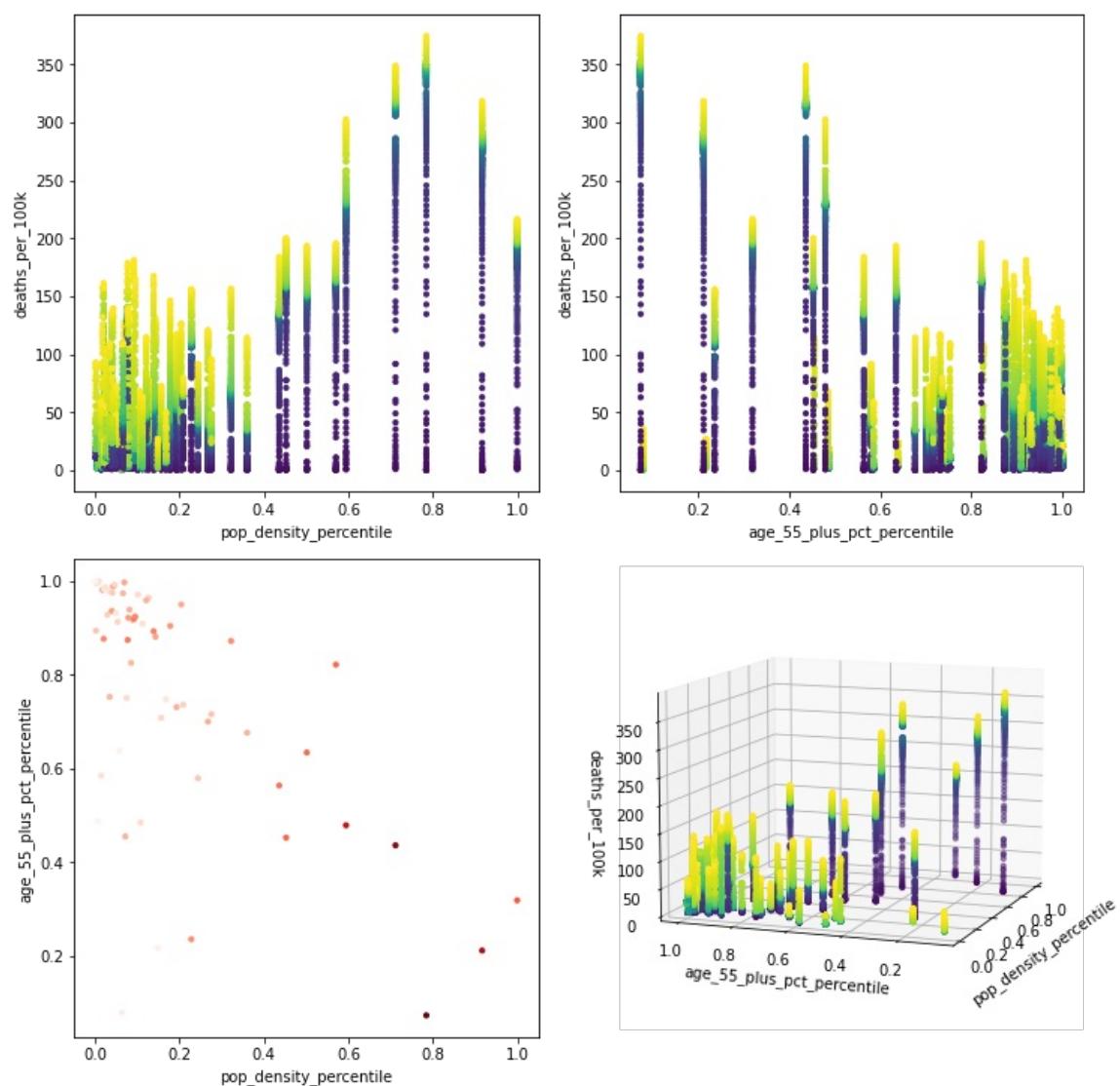
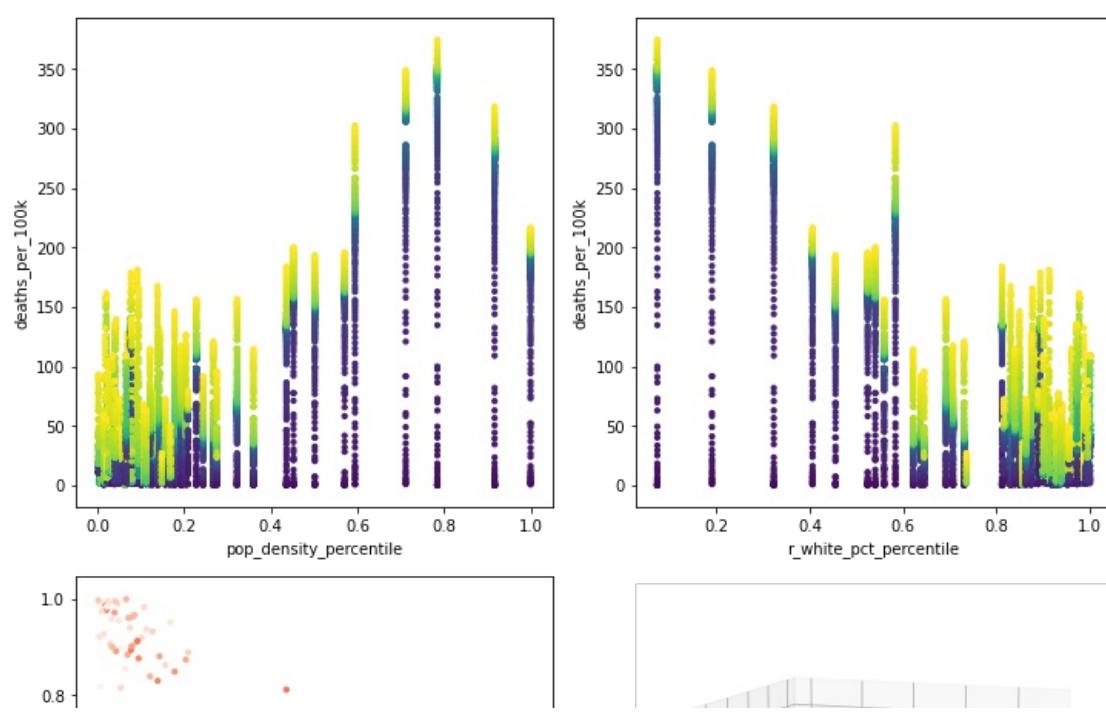


Figure 2.1.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [15]: plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k',[state])
```



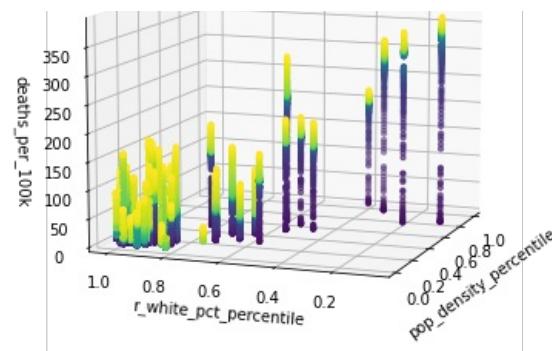
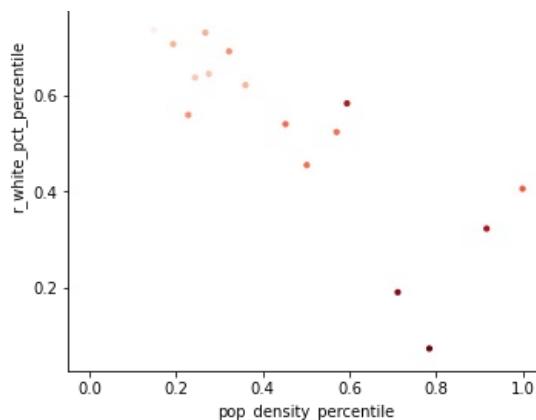


Figure 2.1.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [16]: plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k',[state])
```

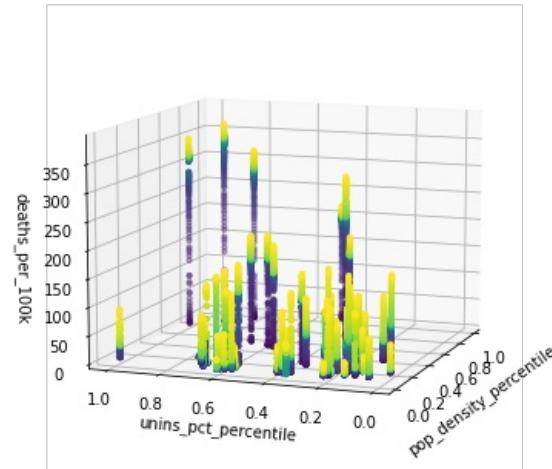
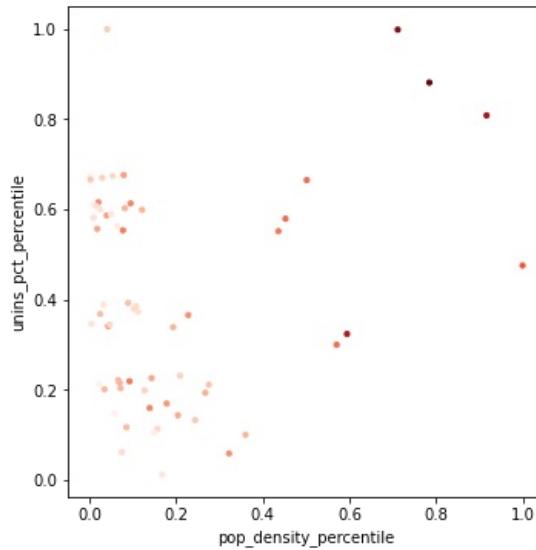
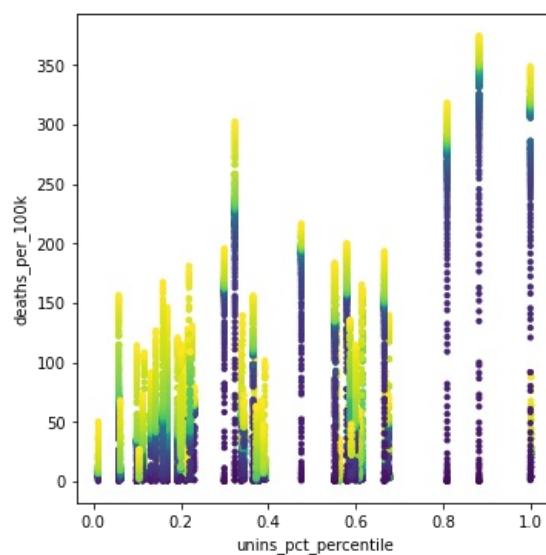
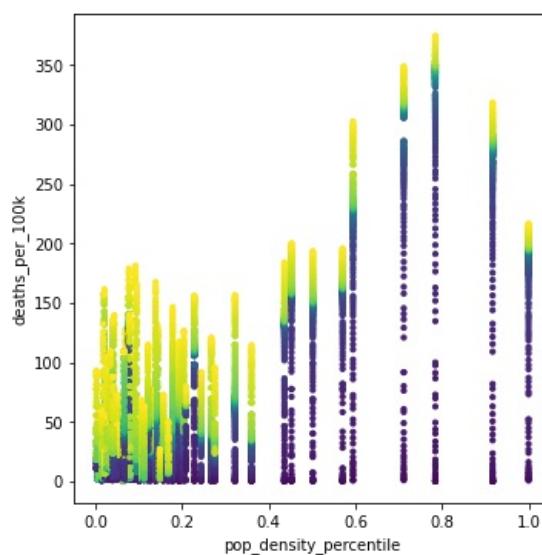
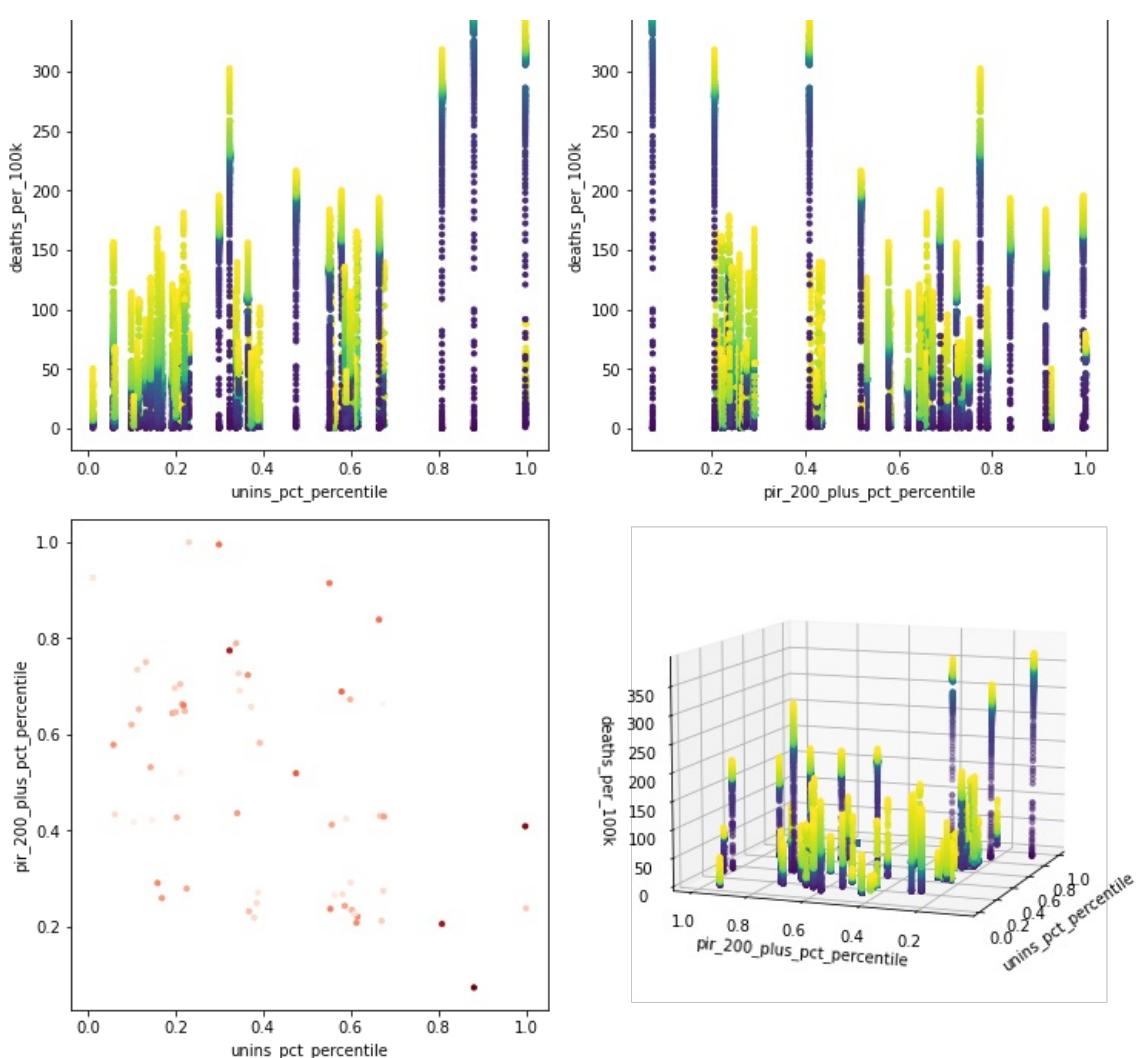


Figure 2.1.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [17]: plotInteractions(data, 'unins_pct_percentile', 'pir_200_plus_pct_percentile', 'deaths_per_100k',[state])
```





```
# # # #
```

Section 2.2: California

```
In [18]: state = 'CA'
death_min = 600
```

Figure 2.2.1: Cases and Deaths (Total, Per 100k People)

```
In [19]: stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```

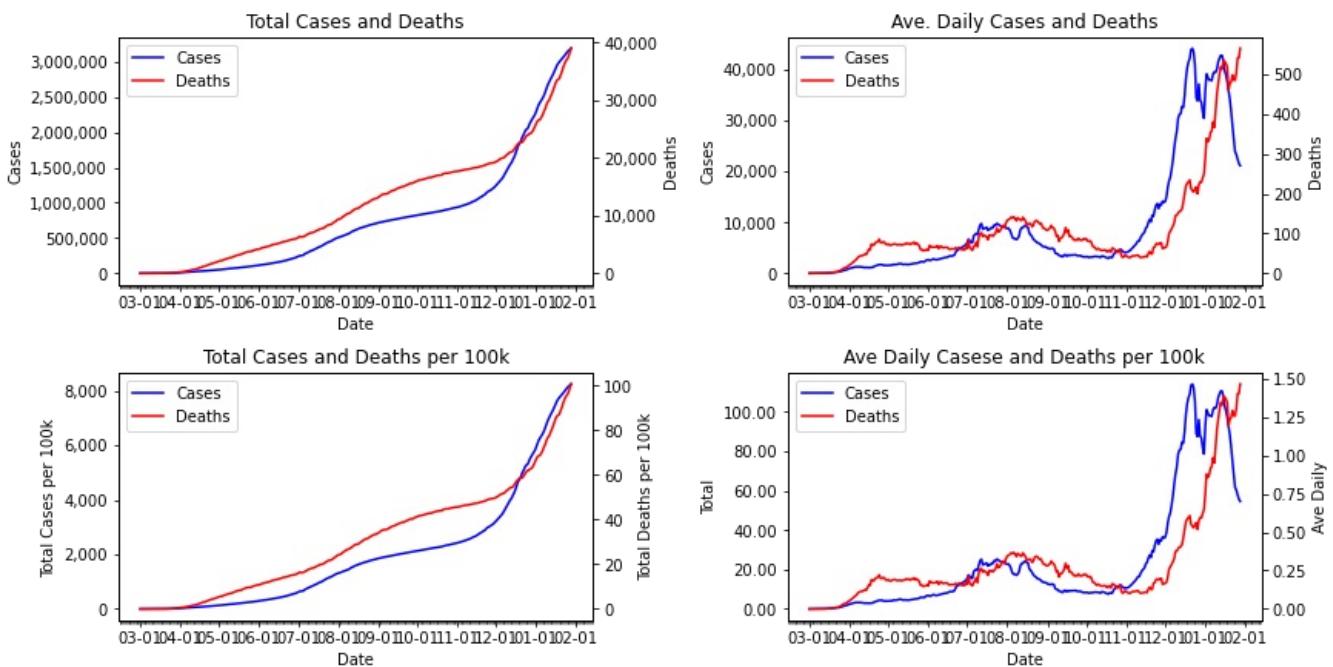
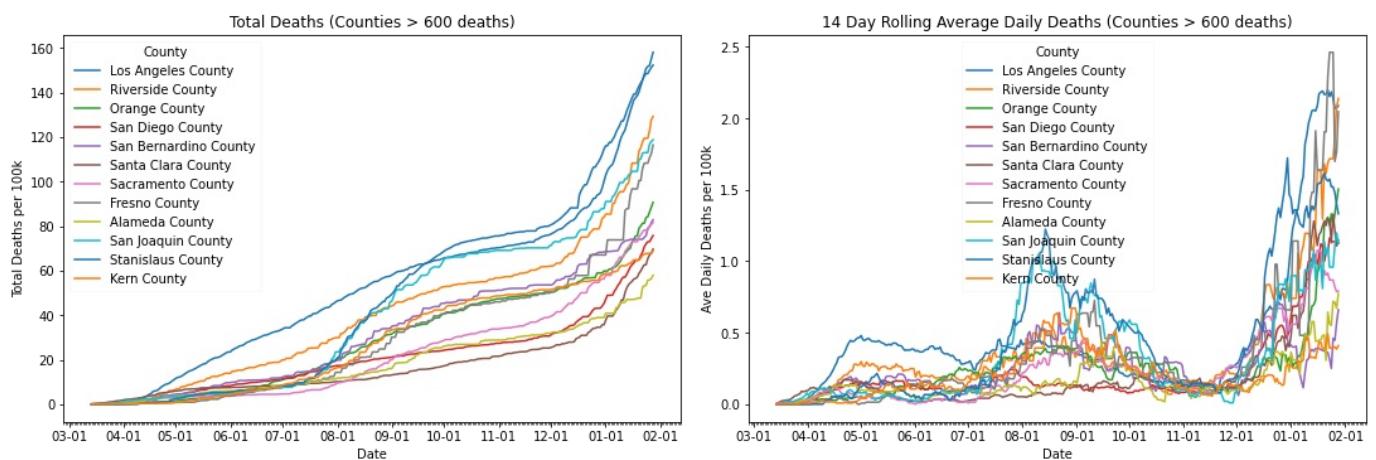


Figure 2.2.2: Deaths per 100k People - 14 Day Average

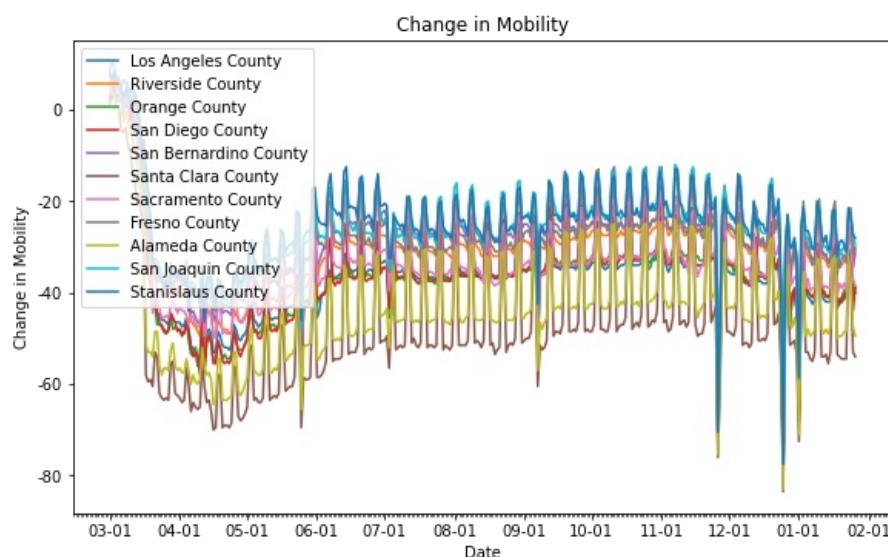
In [20]: `plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')`



Section 2.2.3: County Level Mobility Reduction

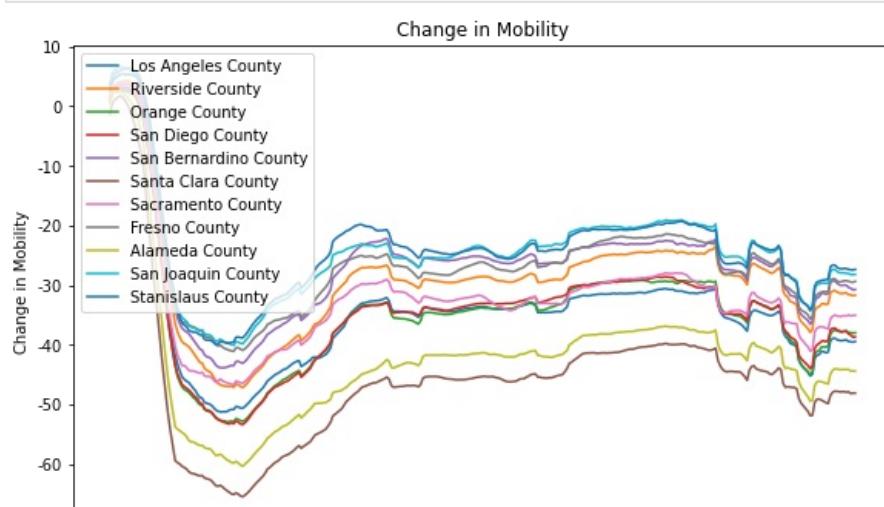
Mobility Reduction by County - Showing daily fluctuations

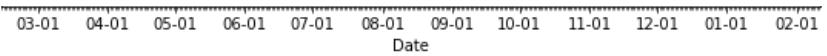
In [21]: `graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)`



Mobility Reduction by County - 14 Day Average

In [22]: `graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)`





Section 2.2.4: County Attributes Analysis

Figure 2.2.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [23]:

```
plotInteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k', [state])
```

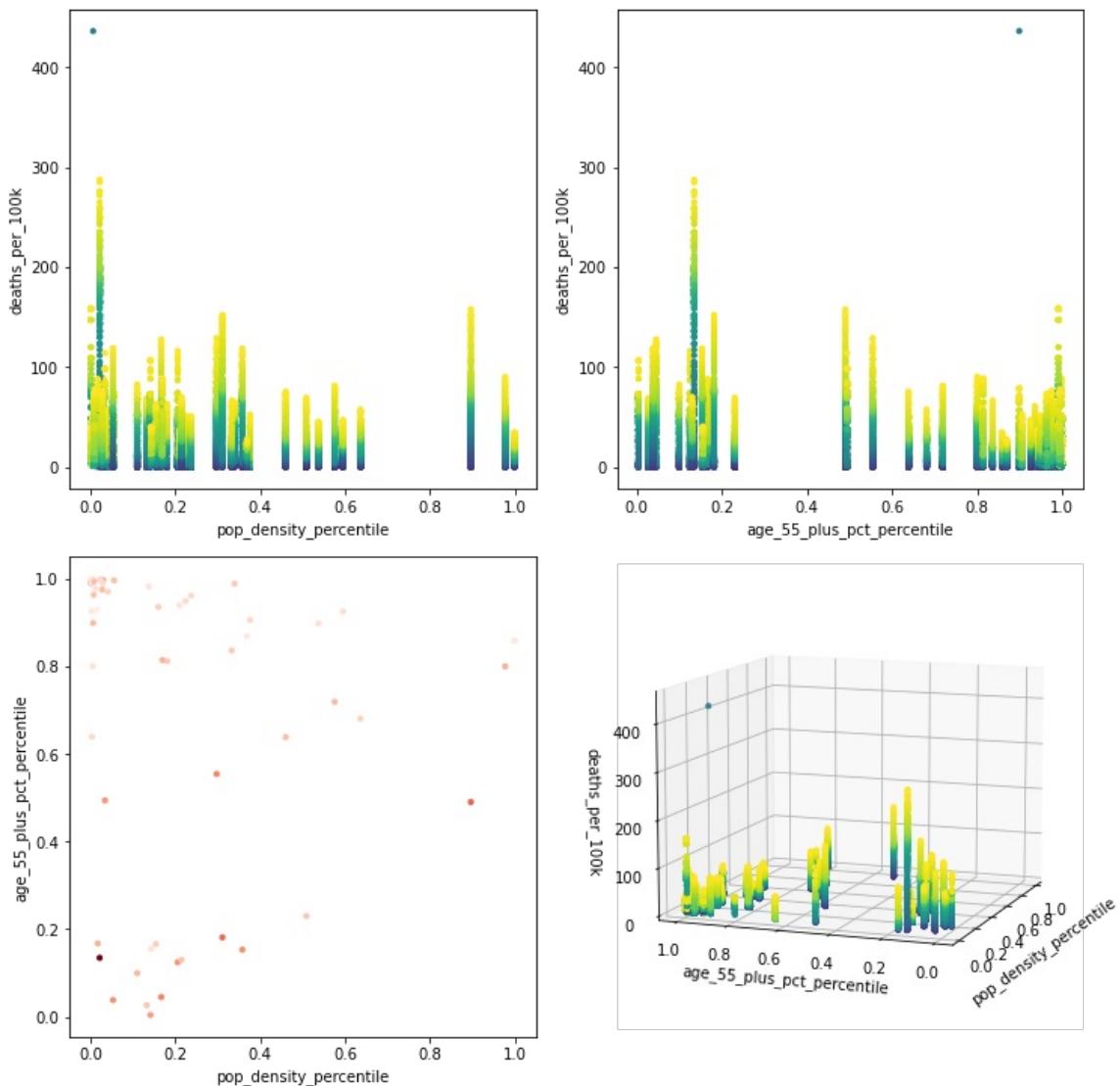
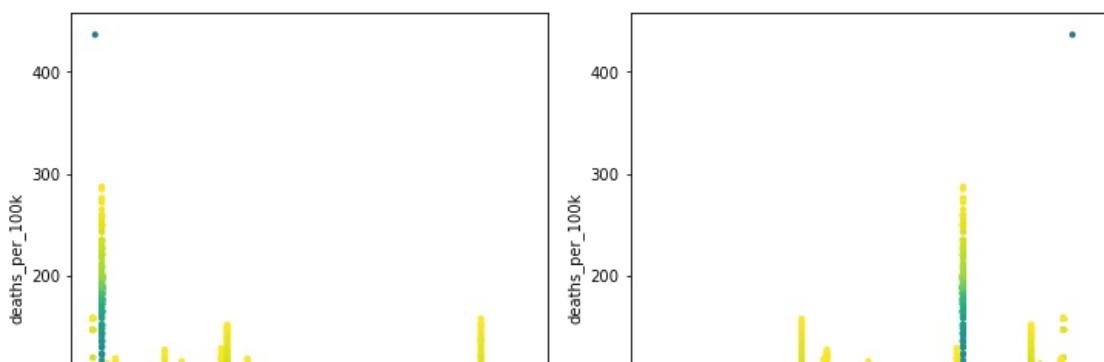


Figure 2.2.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [24]:

```
plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k', [state])
```



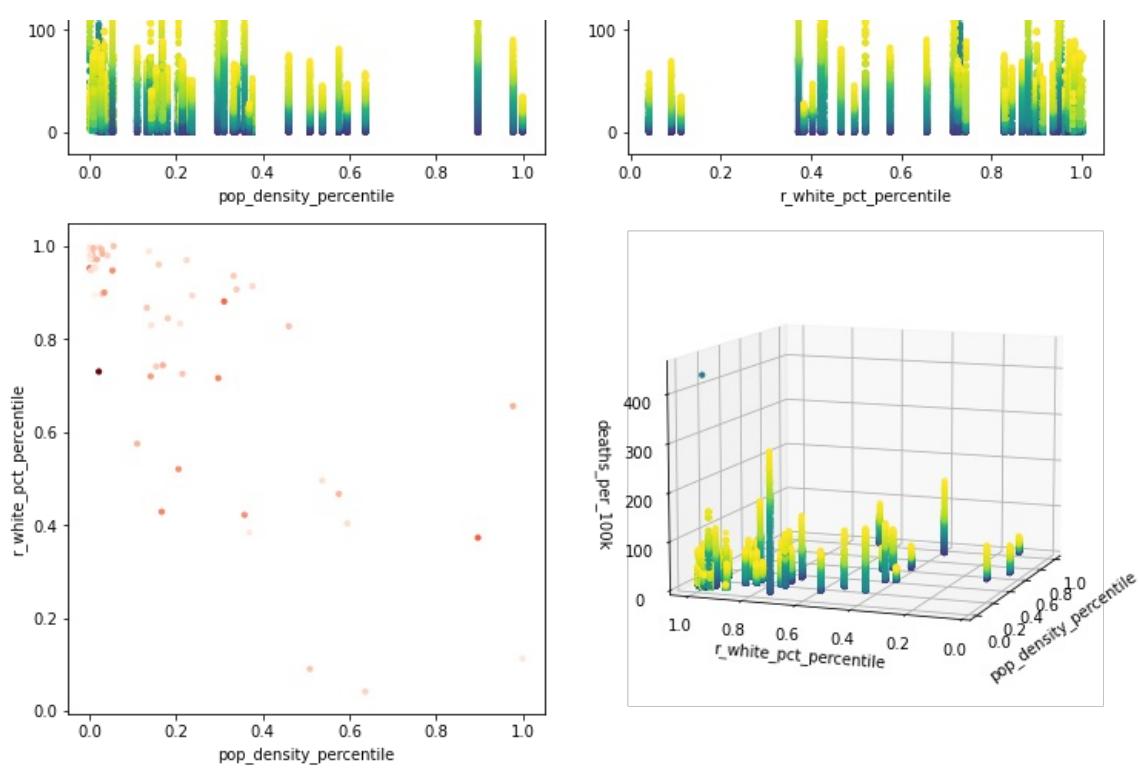


Figure 2.2.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [25]: plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k', [state])
```

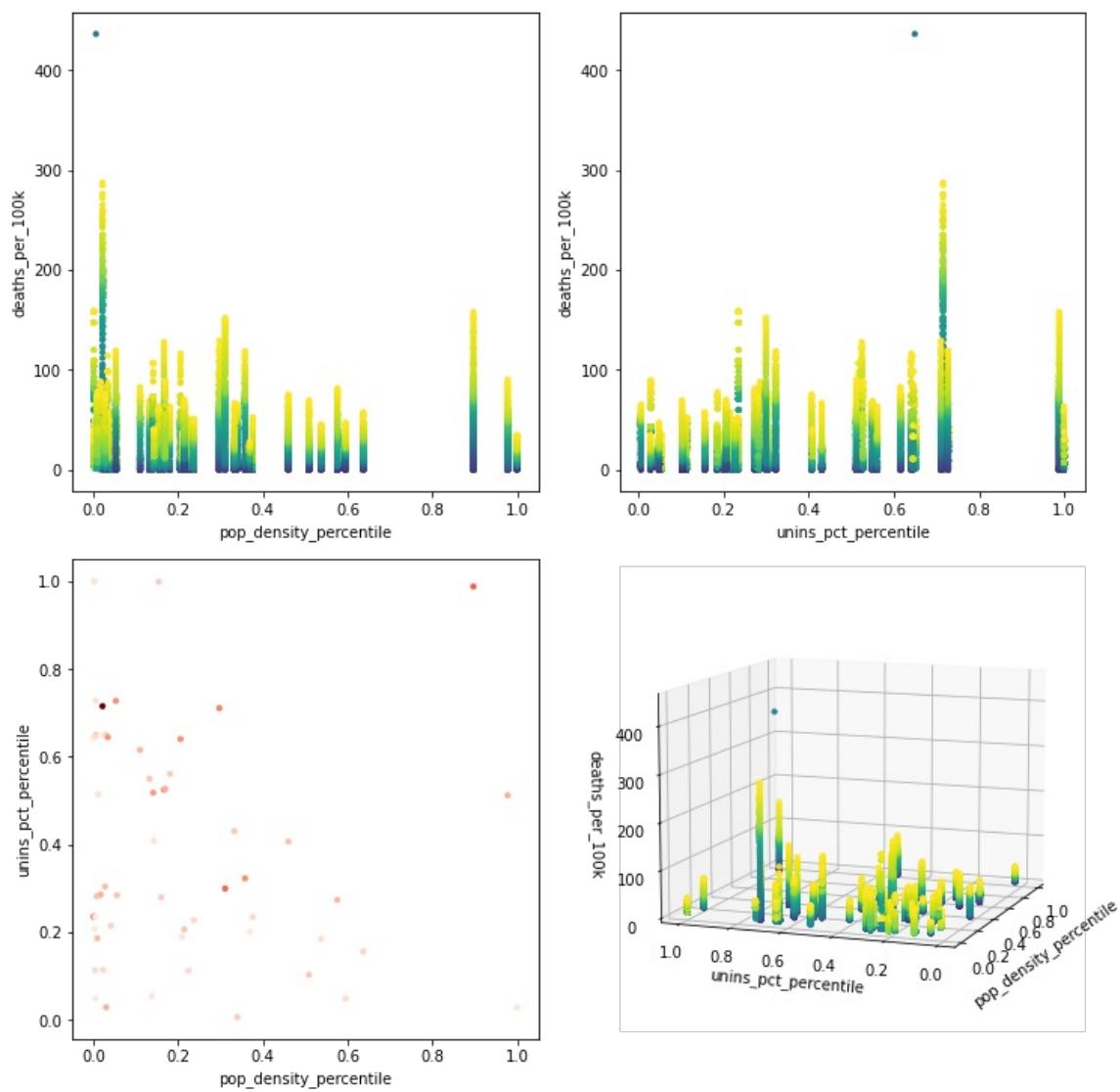
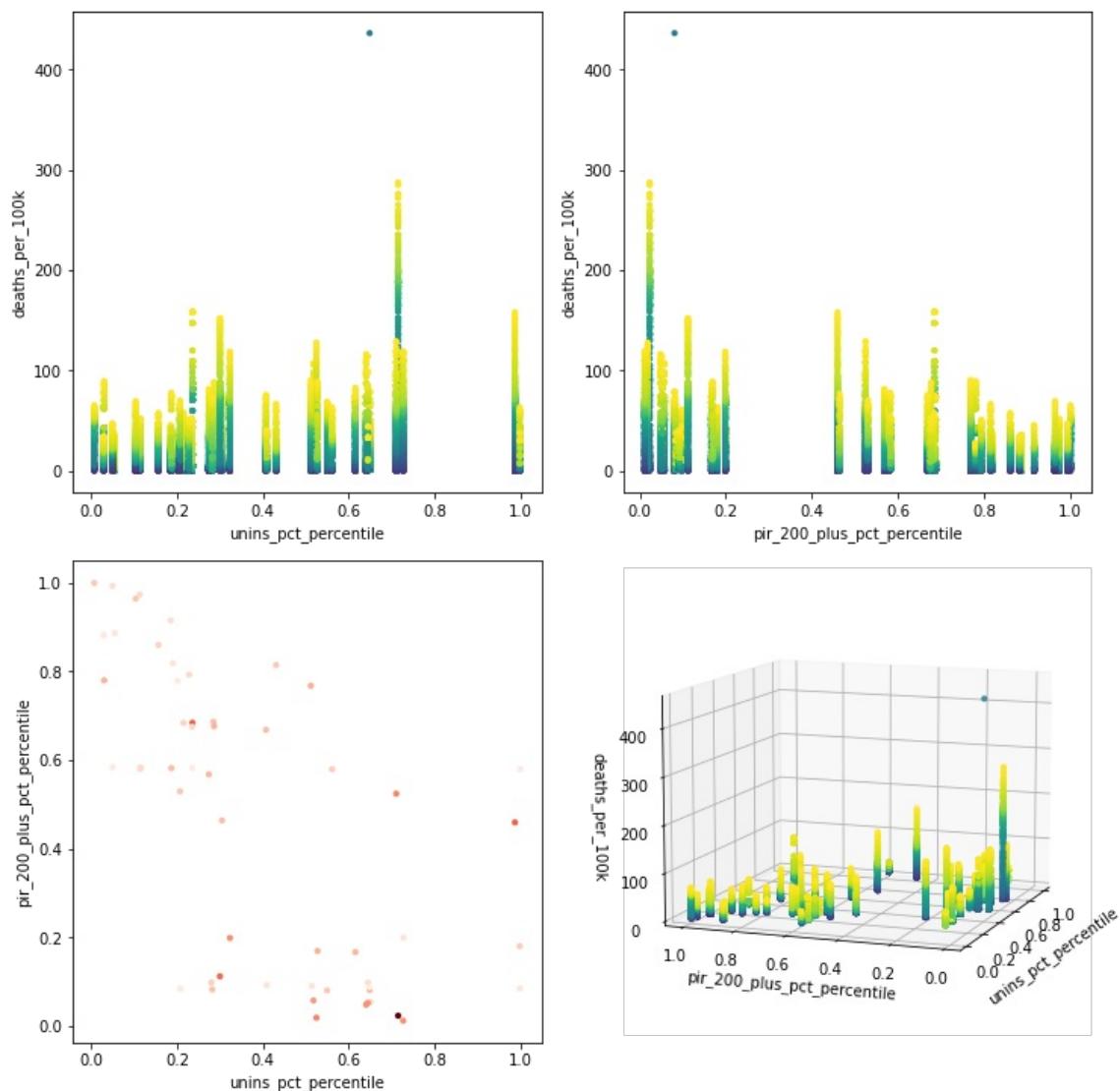


Figure 2.2.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [26]: plotInteractions(data, 'unins_pct_percentile', 'pir_200_plus_pct_percentile', 'deaths_per_100k',[state])
```



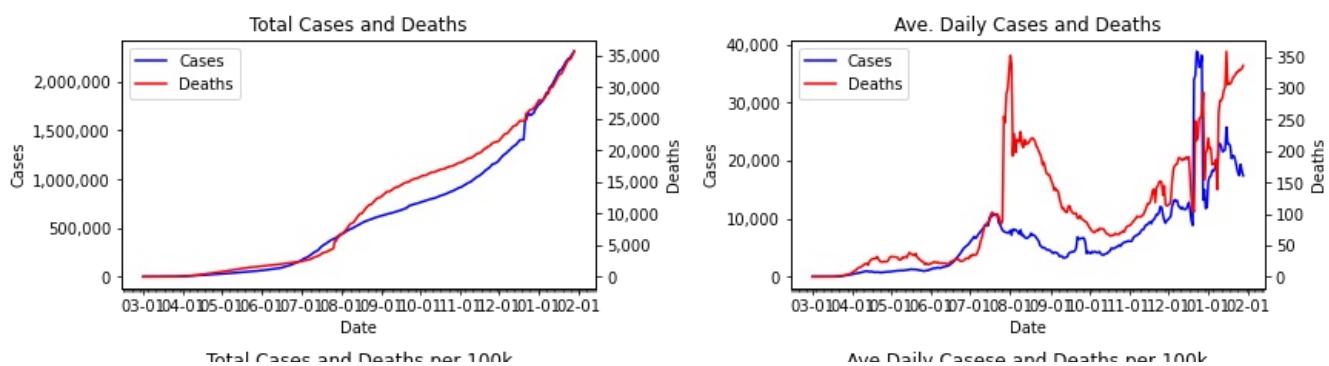
```
# # # #
```

Section 2.3: Texas

```
In [27]: state = 'TX'
death_min = 500
```

Figure 2.3.1: Cases and Deaths (Total, Per 100k People)

```
In [28]: stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```



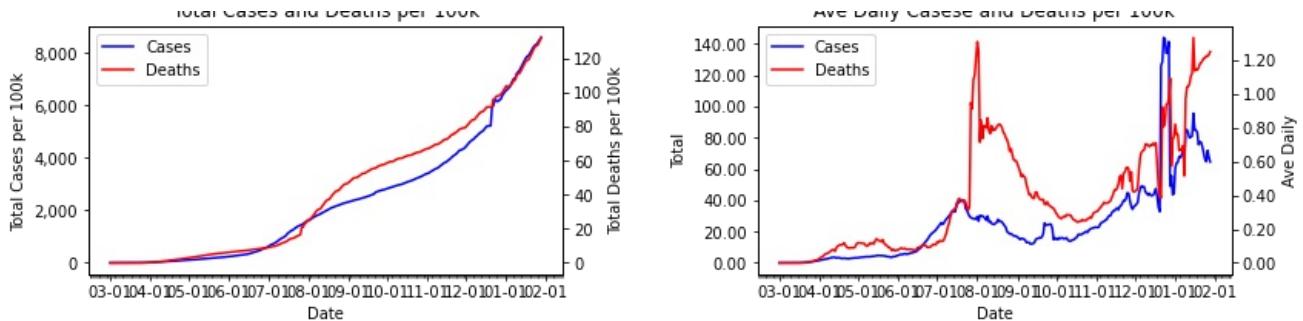
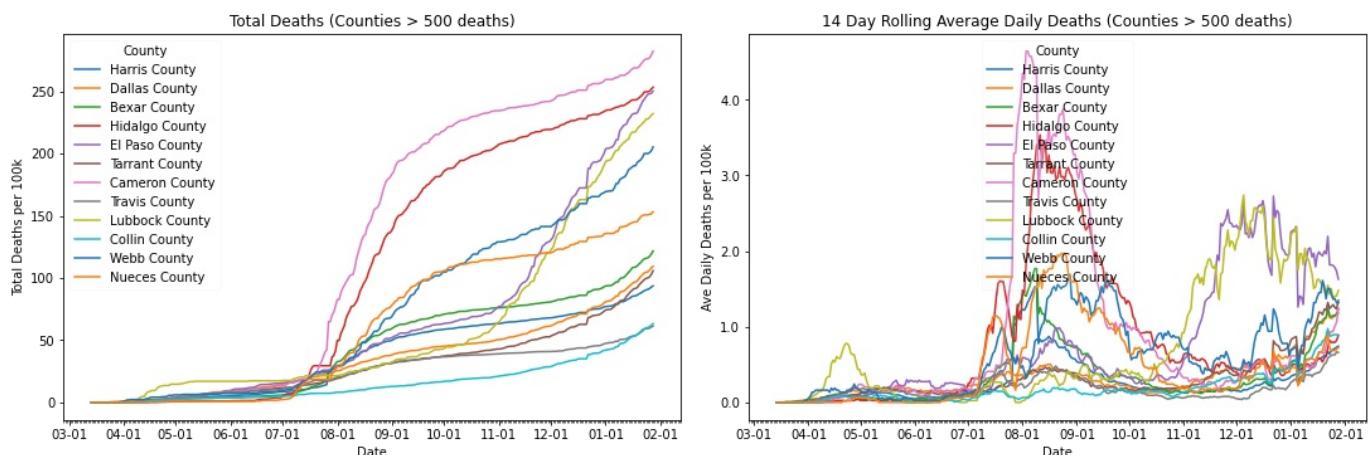


Figure 2.3.2: Deaths per 100k People - 14 Day Average

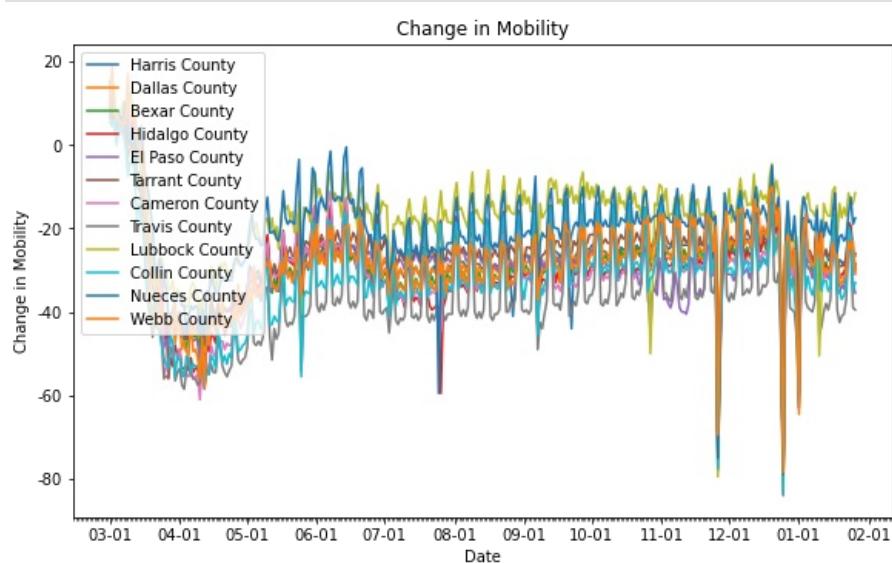
```
In [29]: plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')
```



Section 2.3.3: County Level Mobility Reduction

Mobility Reduction by County - Showing daily fluctuations

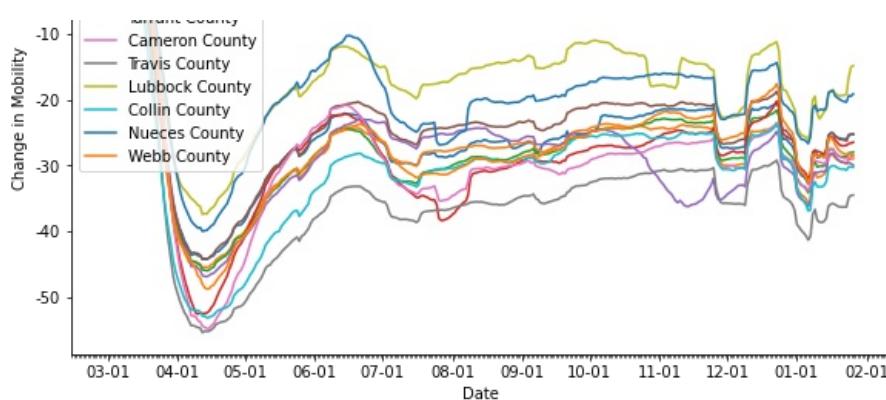
```
In [30]: graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)
```



Mobility Reduction by County - 14 Day Average

```
In [31]: graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)
```





Section 2.3.4: County Attributes Analysis

Figure 2.3.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [32]:

```
plotInteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k', [state])
```

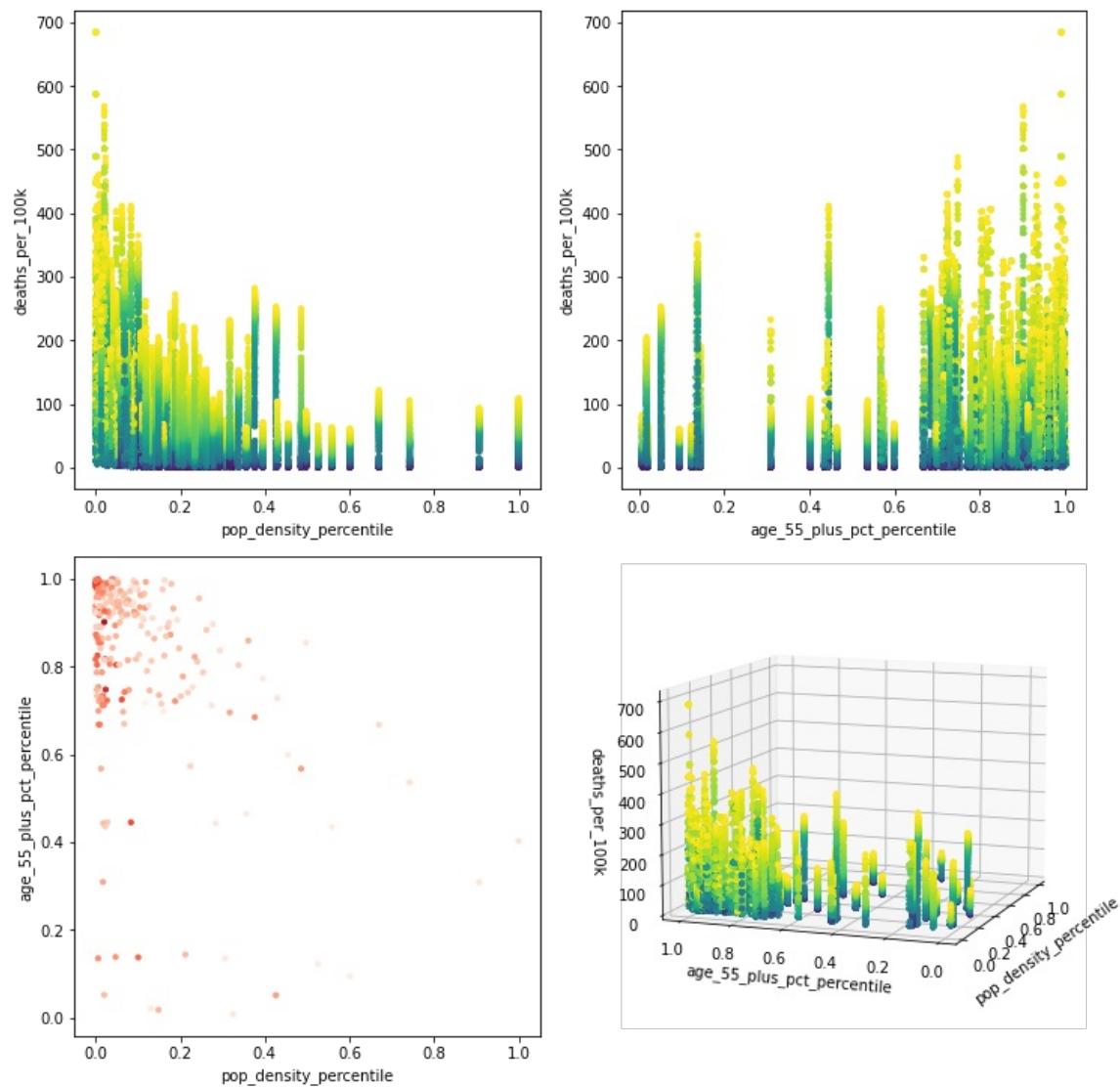


Figure 2.3.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [33]:

```
plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k', [state])
```

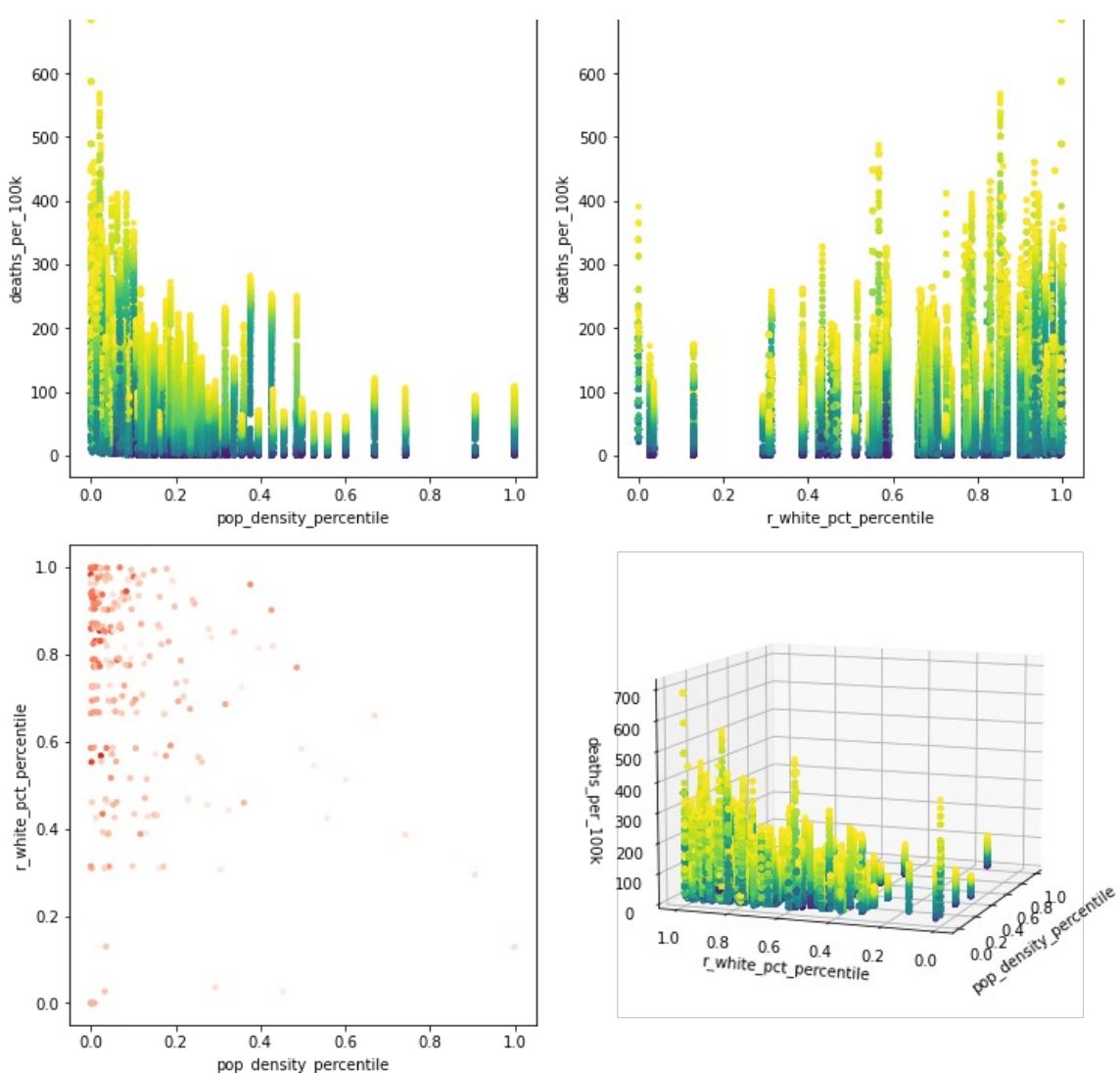
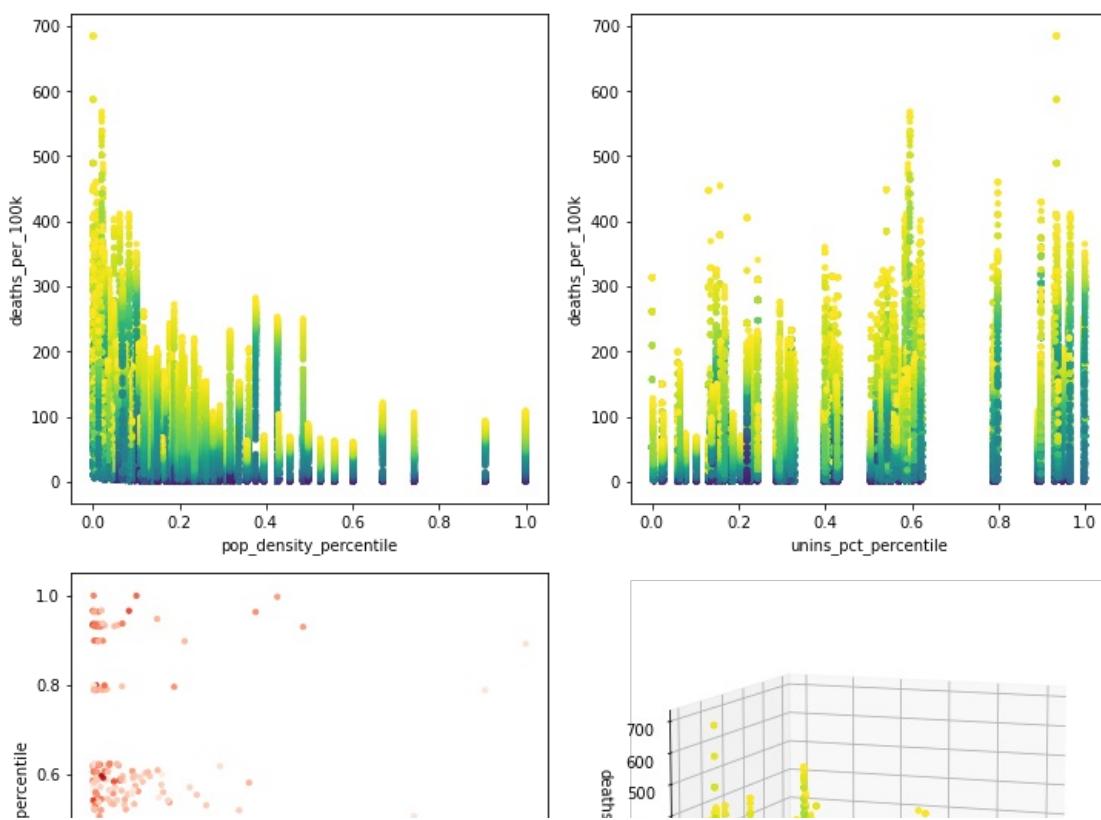


Figure 2.3.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [34]: plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k',[state])
```



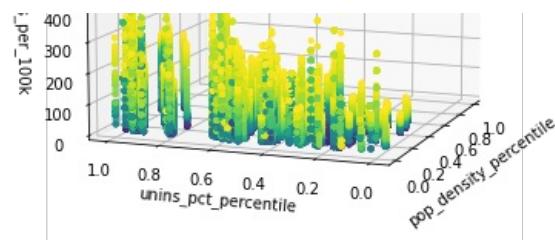
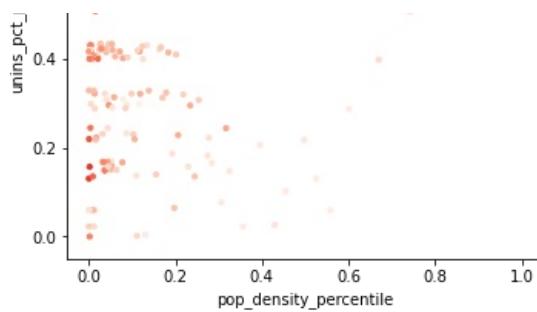
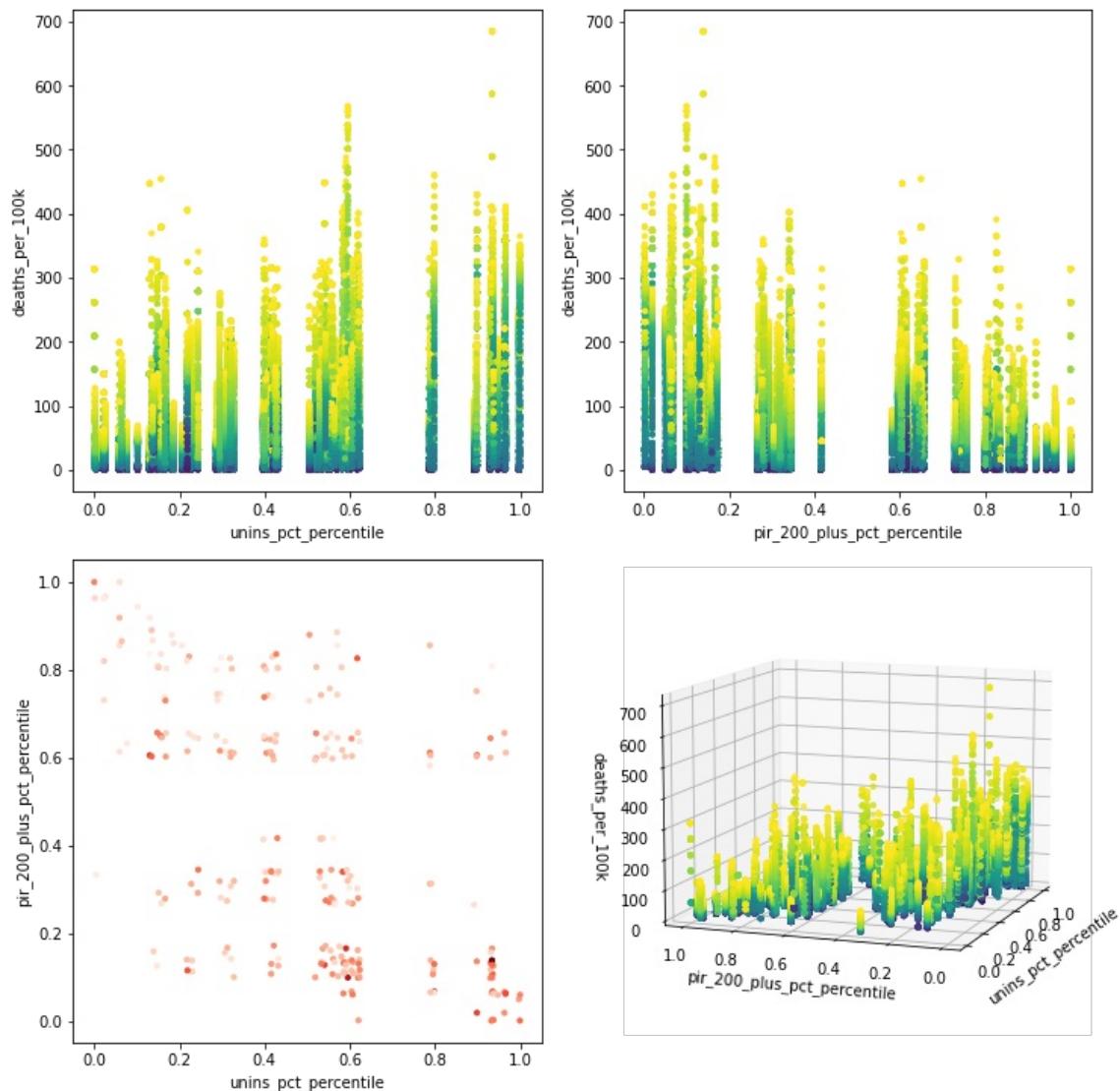


Figure 2.3.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [35]: plotInteractions(data, 'unins_pct_percentile', 'pir_200_plus_pct_percentile', 'deaths_per_100k',[state])
```



```
In [ ]:
```

```
In [ ]:
```

```
# # # #
```

Section 2.4: Florida

```
In [36]: state = 'FL'
death_min = 500
```

Figure 2.4.1: Cases and Deaths (Total, Per 100k People)

In [37]:

```
stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```

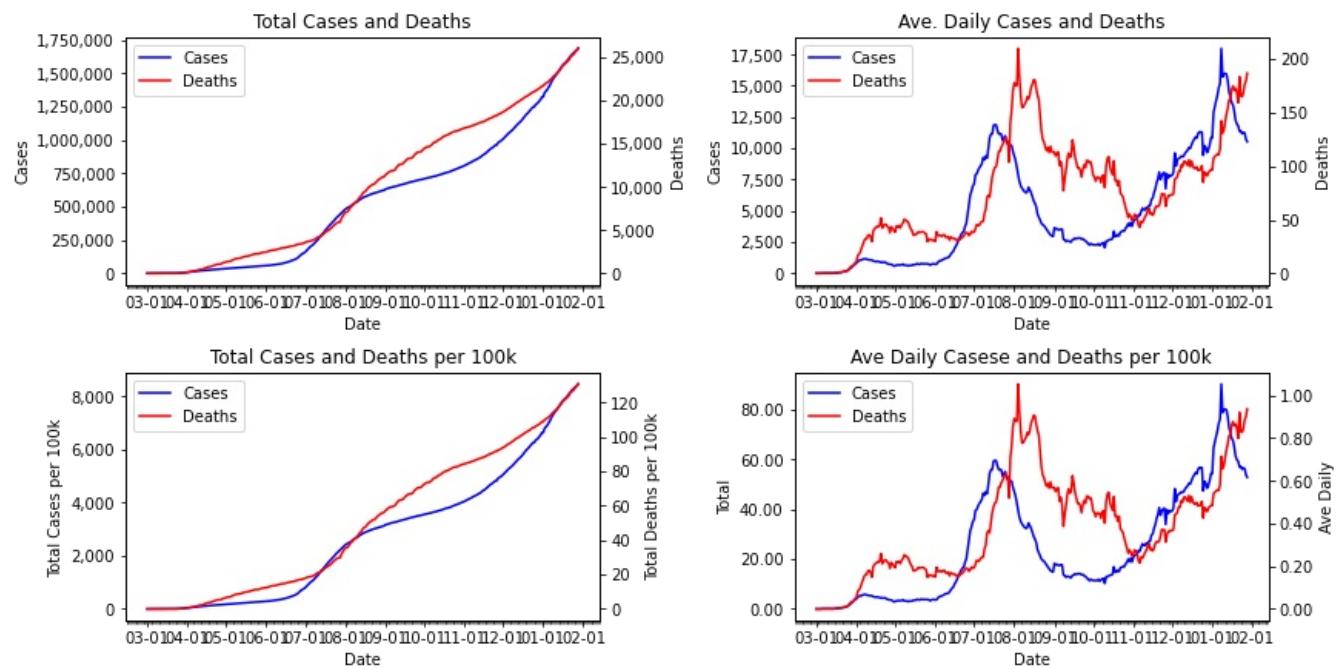
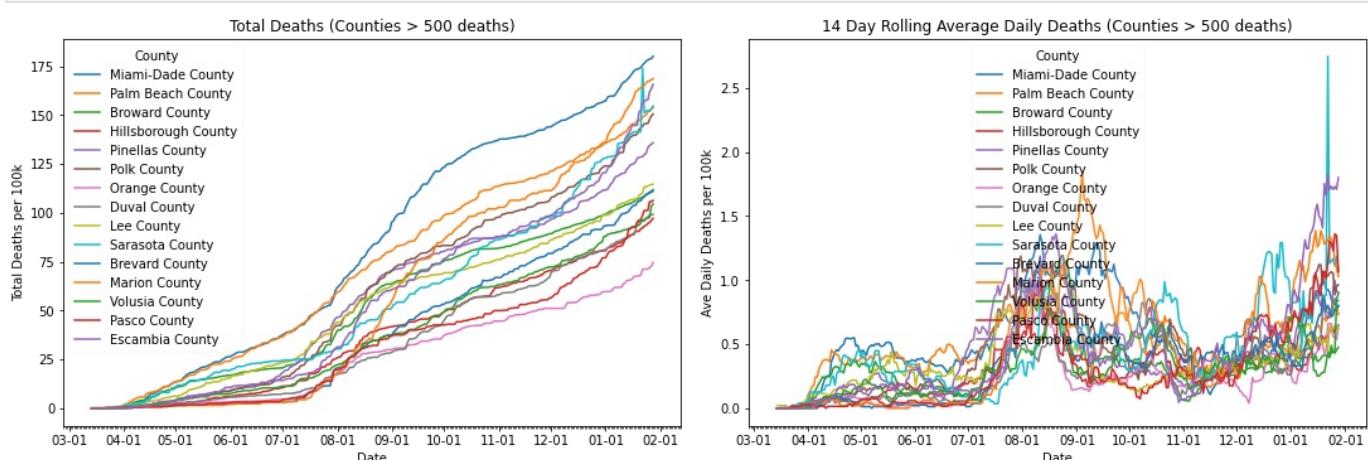


Figure 2.4.2: Deaths per 100k People - 14 Day Average

In [38]:

```
plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')
```

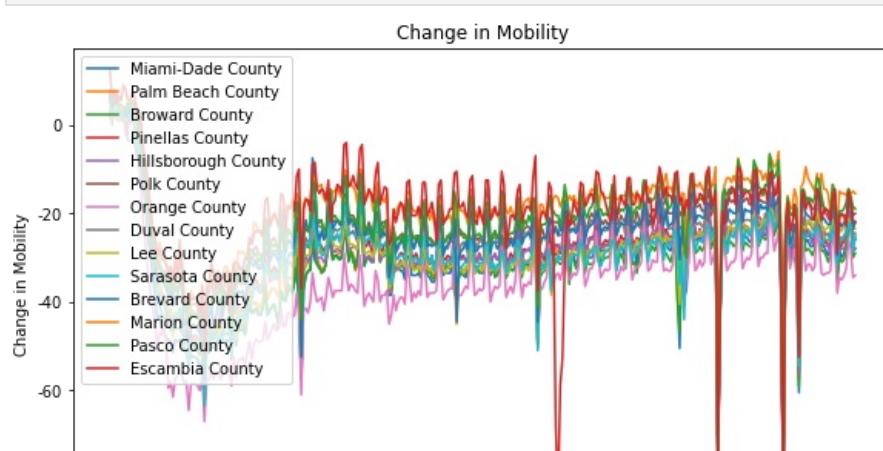


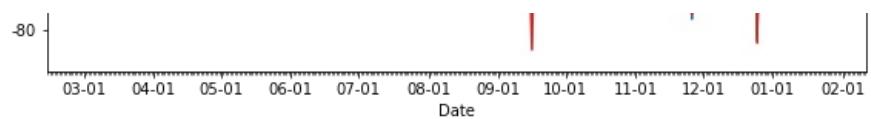
Section 2.4.3: County Level Mobility Reduction

Mobility Reduction by County - Showing daily fluctuations

In [39]:

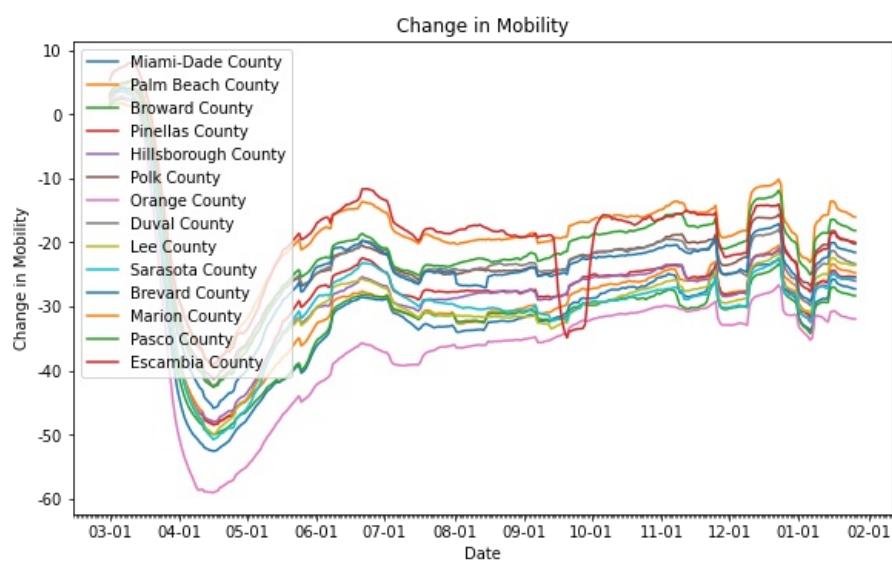
```
graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)
```





Mobility Reduction by County - 14 Day Average

```
In [40]: graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)
```

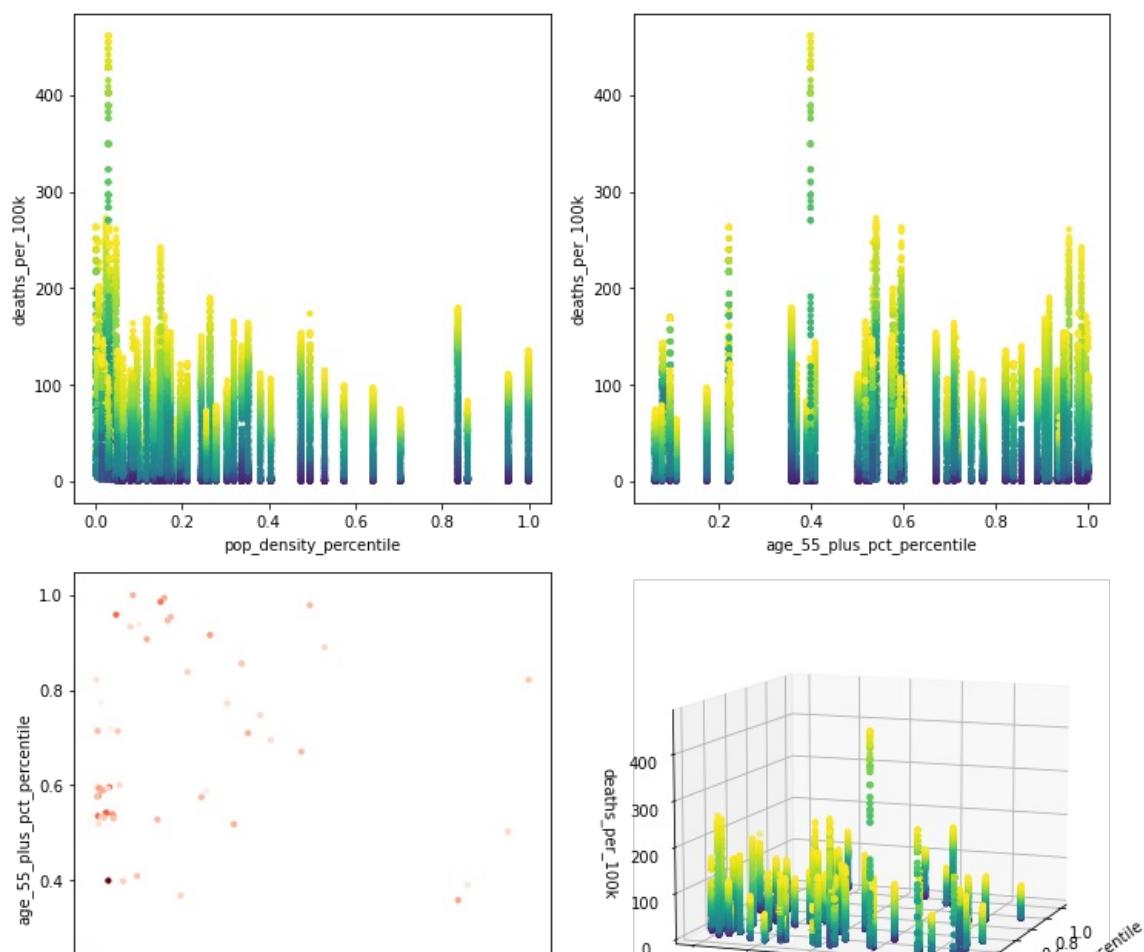


Section 2.4.4: County Attributes Analysis

Figure 2.4.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [41]: plotInteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k', [state])
```



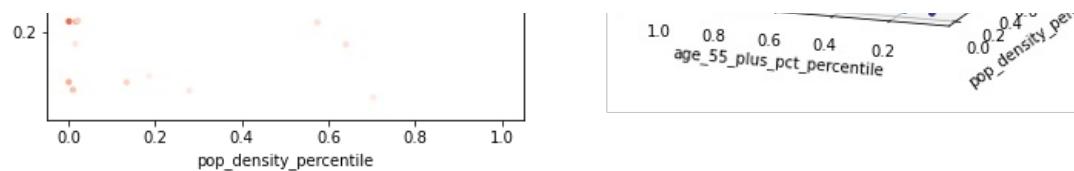


Figure 2.4.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [42]: plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k',[state])
```

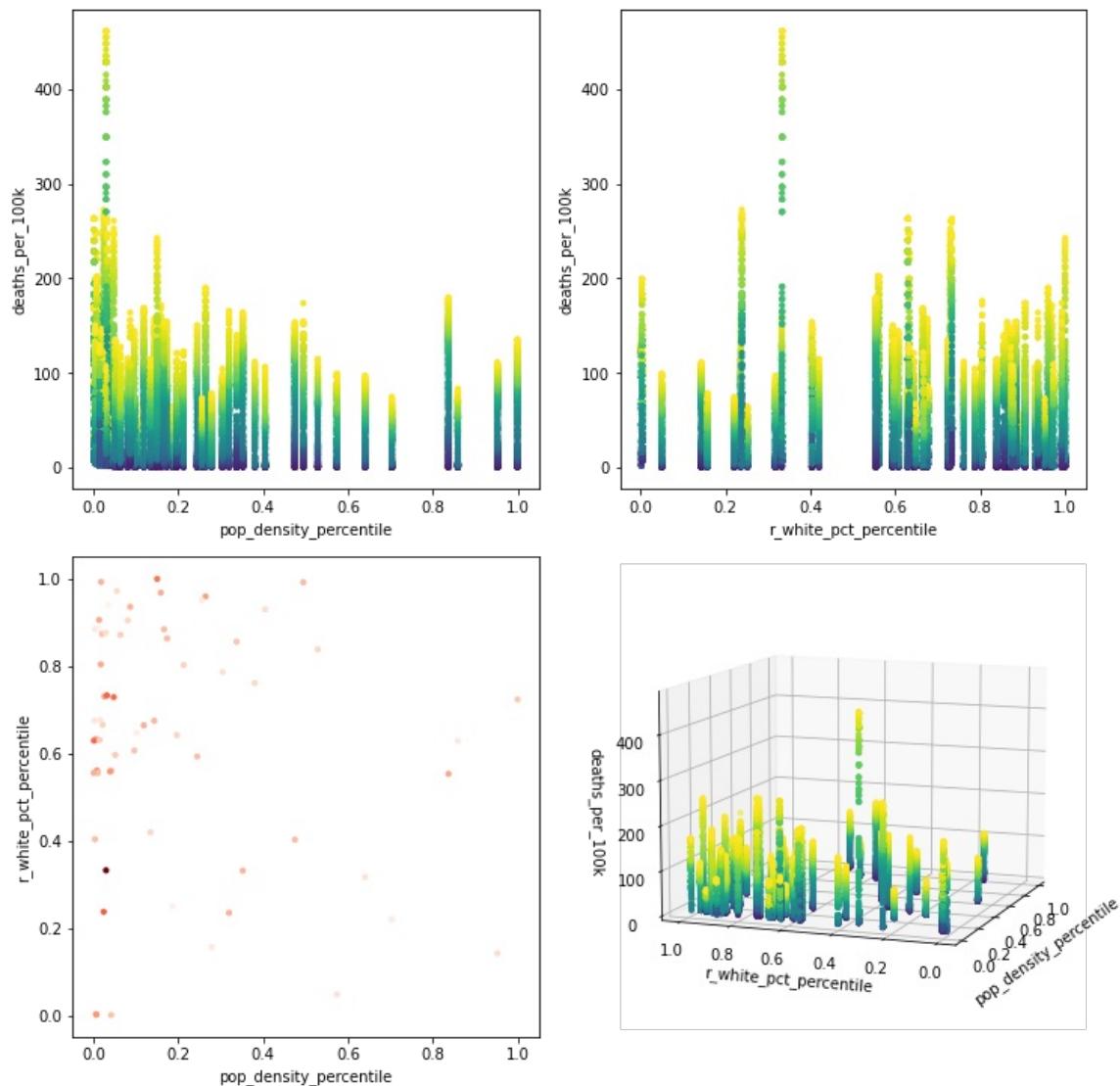
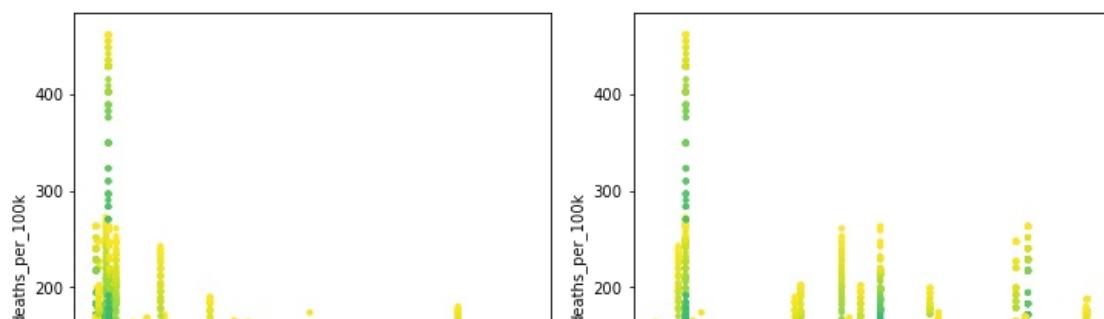


Figure 2.4.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [43]: plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k',[state])
```



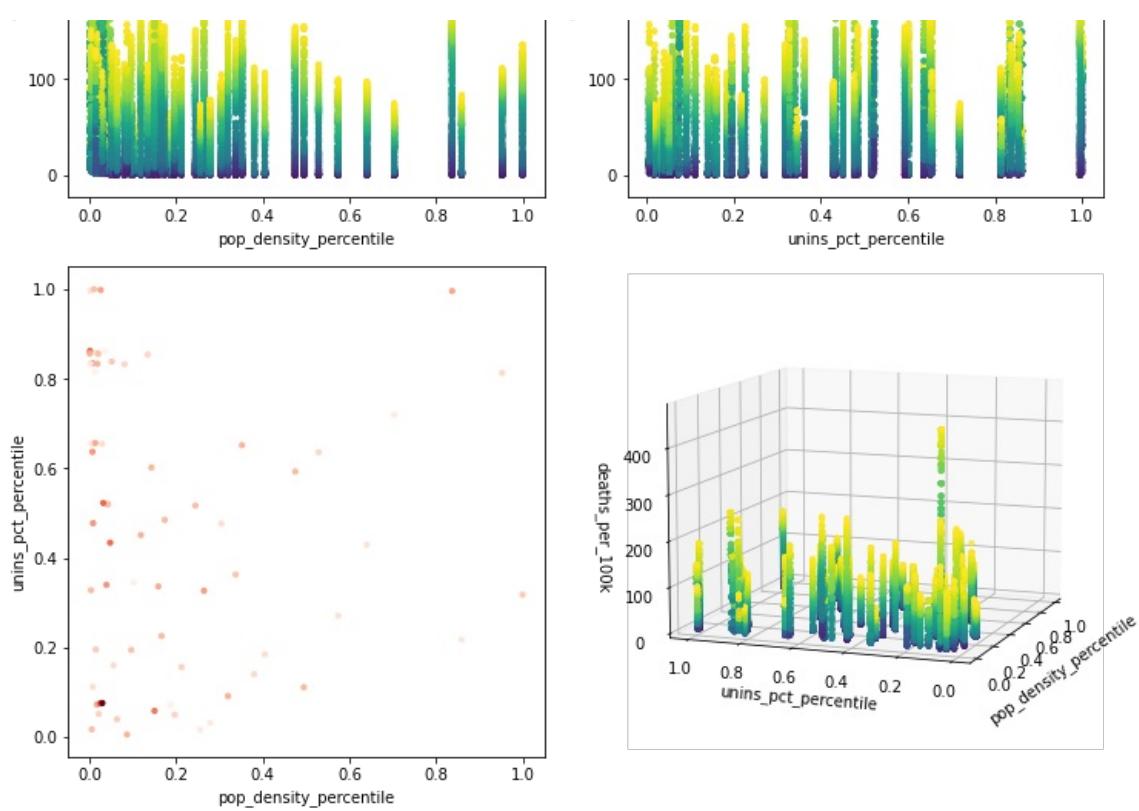
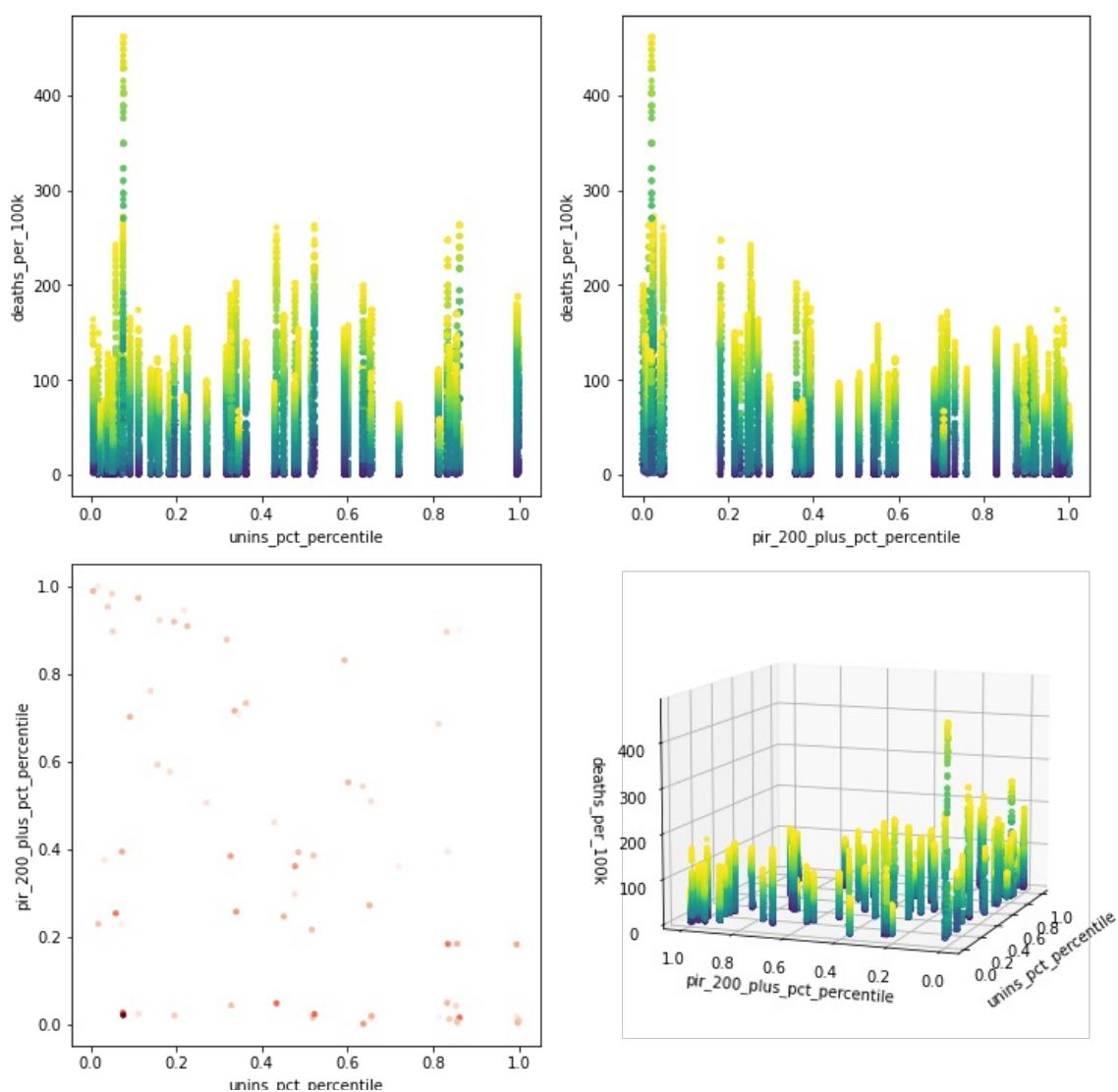


Figure 2.4.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [44]: plotInteractions(data, 'unins_pct_percentile', 'pir_200_plus_pct_percentile', 'deaths_per_100k',[state])
```



```
# # # #
```

Section 2.5: New Jersey

```
In [45]: state = 'NJ'  
death_min = 500
```

Figure 2.5.1: Cases and Deaths (Total, Per 100k People)

```
In [46]: stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```

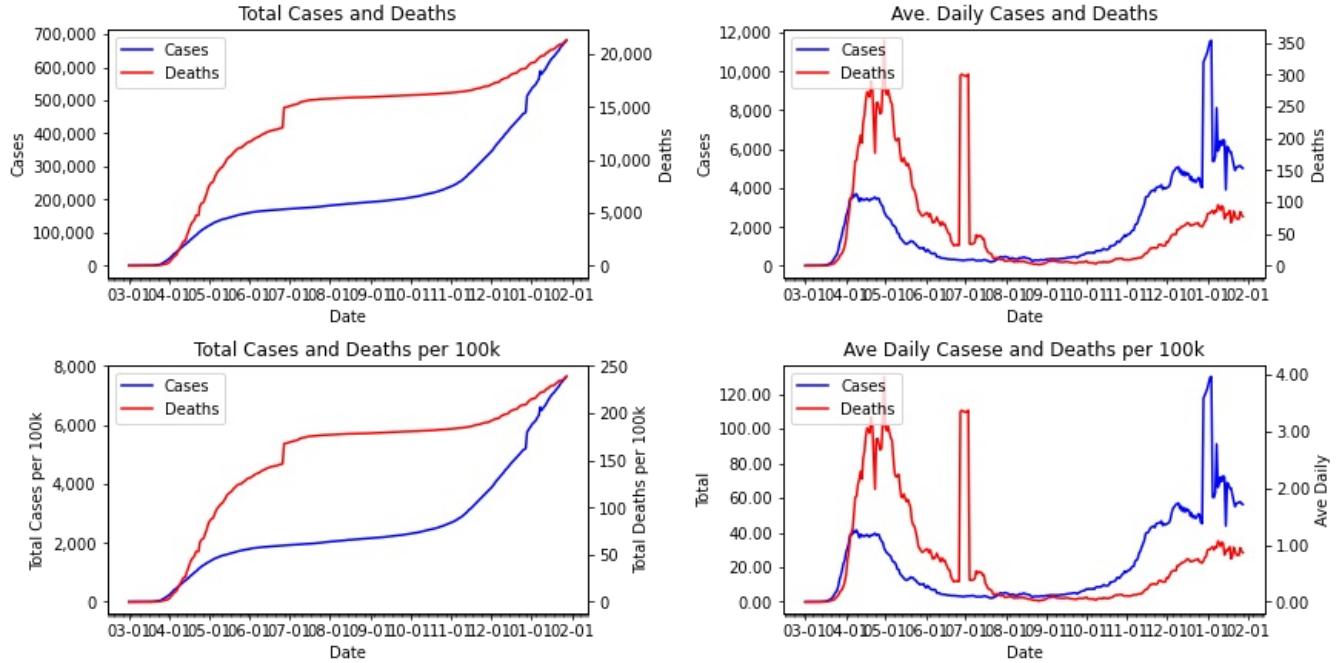
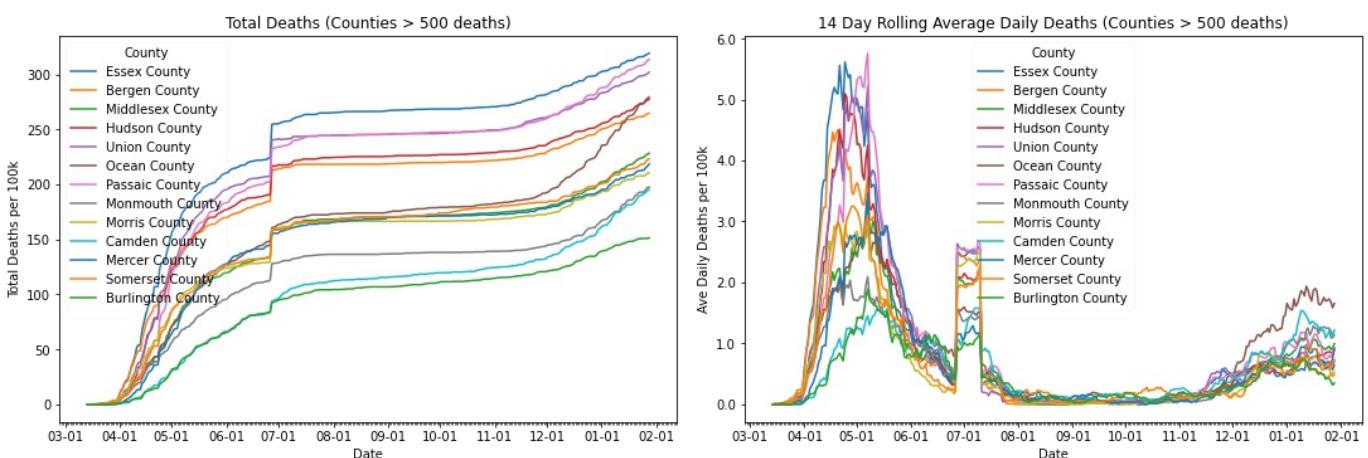


Figure 2.5.2: Deaths per 100k People - 14 Day Average

```
In [47]: plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')
```

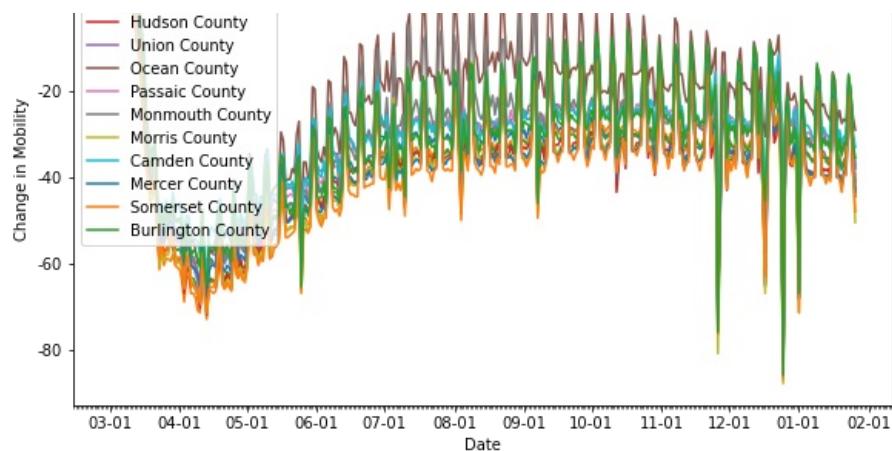


Section 2.5.3: County Level Mobility Reduction

Mobility Reduction by County - Showing daily fluctuations

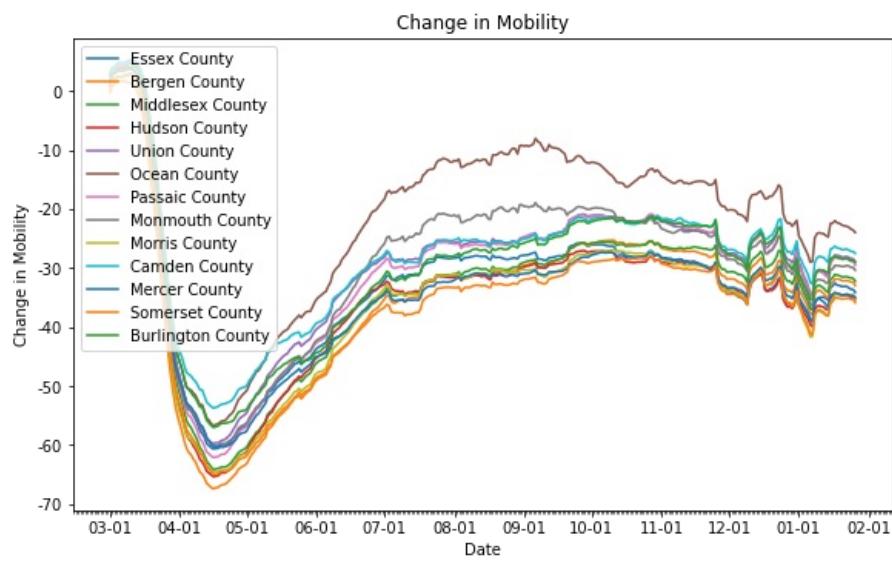
```
In [48]: graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)
```





Mobility Reduction by County - 14 Day Average

In [49]: `graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)`

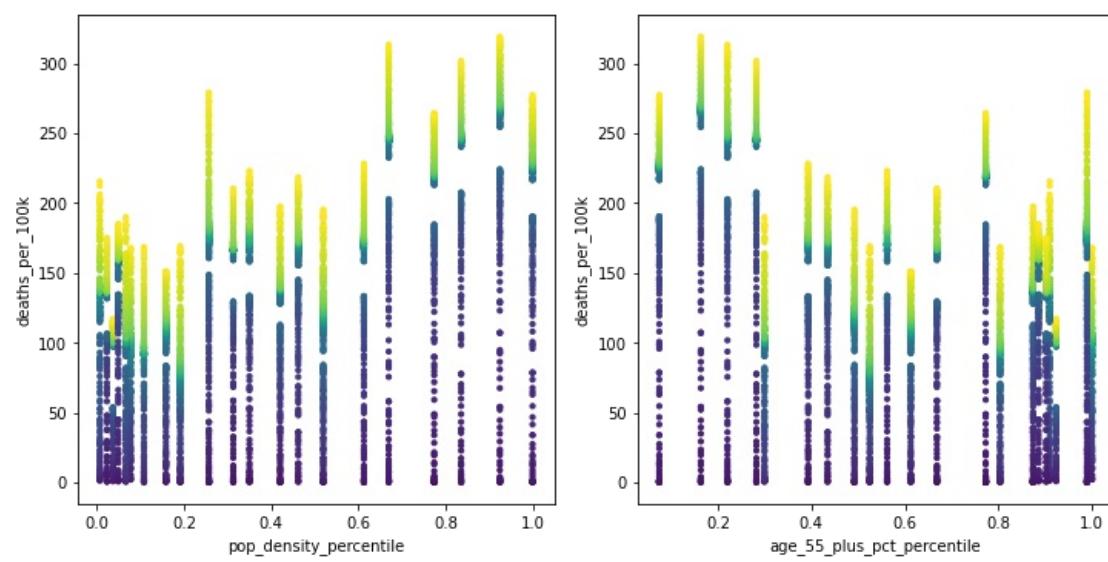


Section 2.5.4: County Attributes Analysis

Figure 2.5.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [50]: `plotInteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k', [state])`



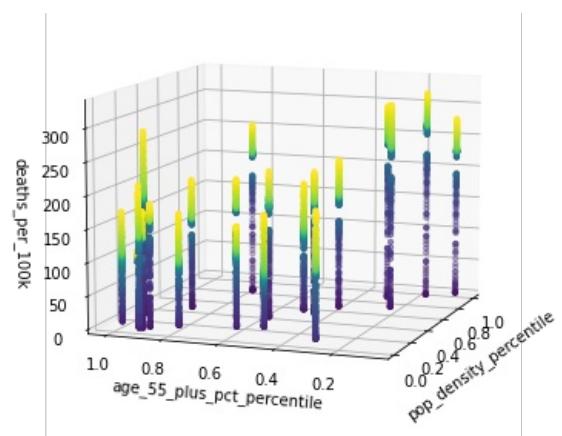
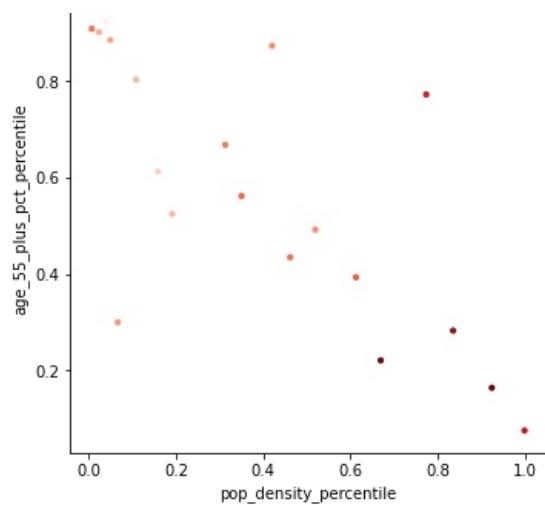


Figure 2.5.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [51]: plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k',[state])
```

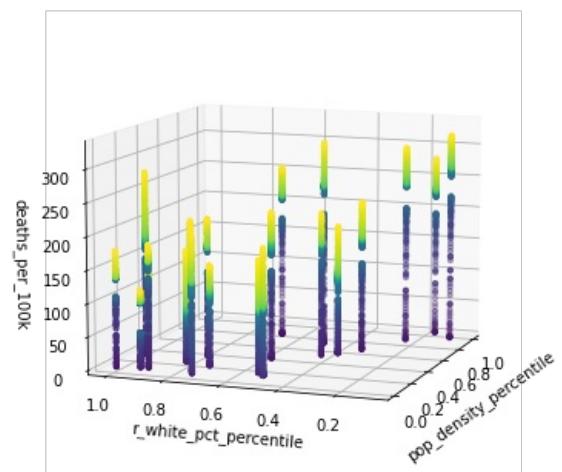
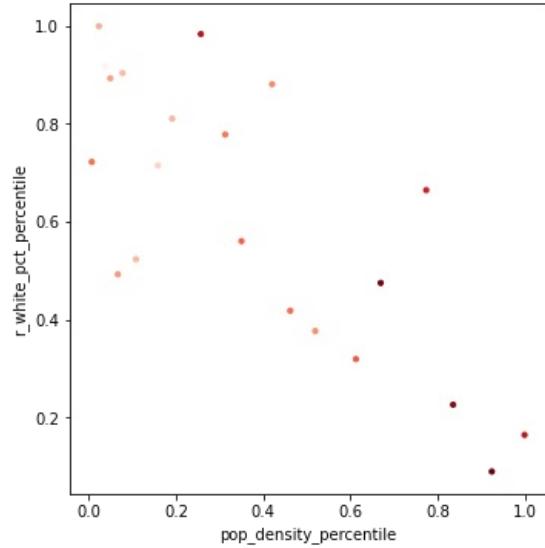
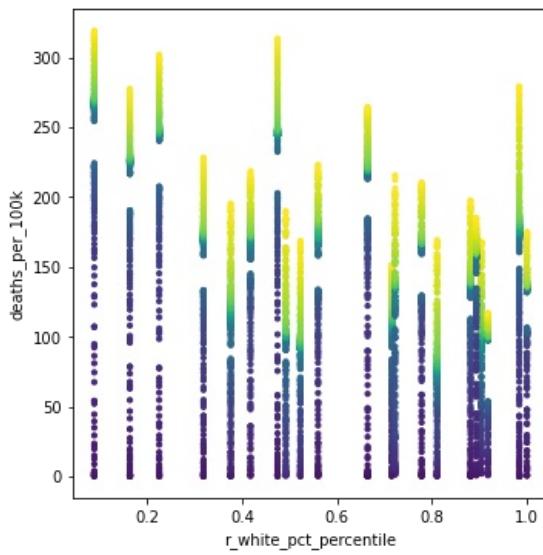
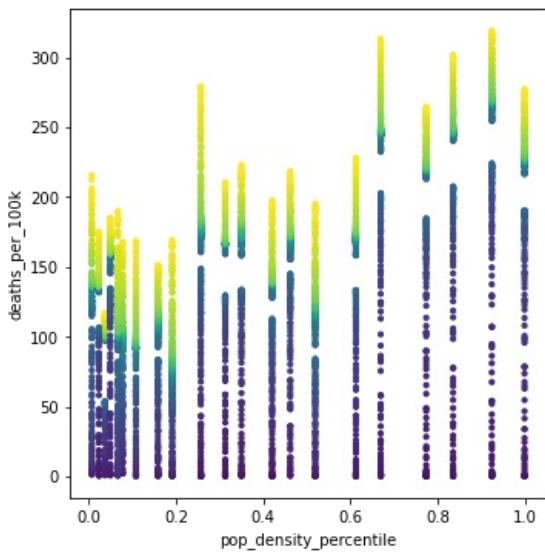


Figure 2.5.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [52]: plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k',[state])
```

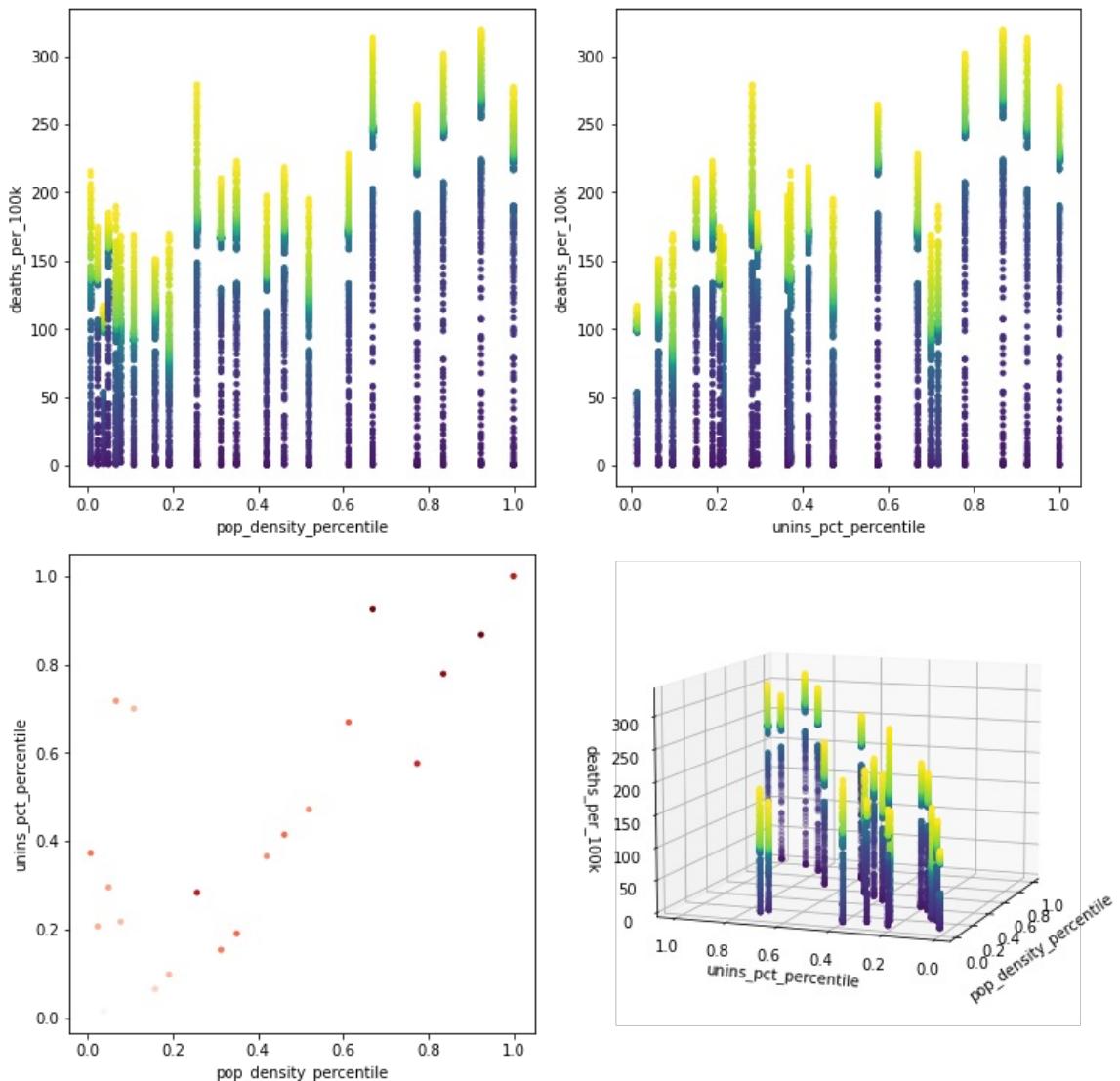
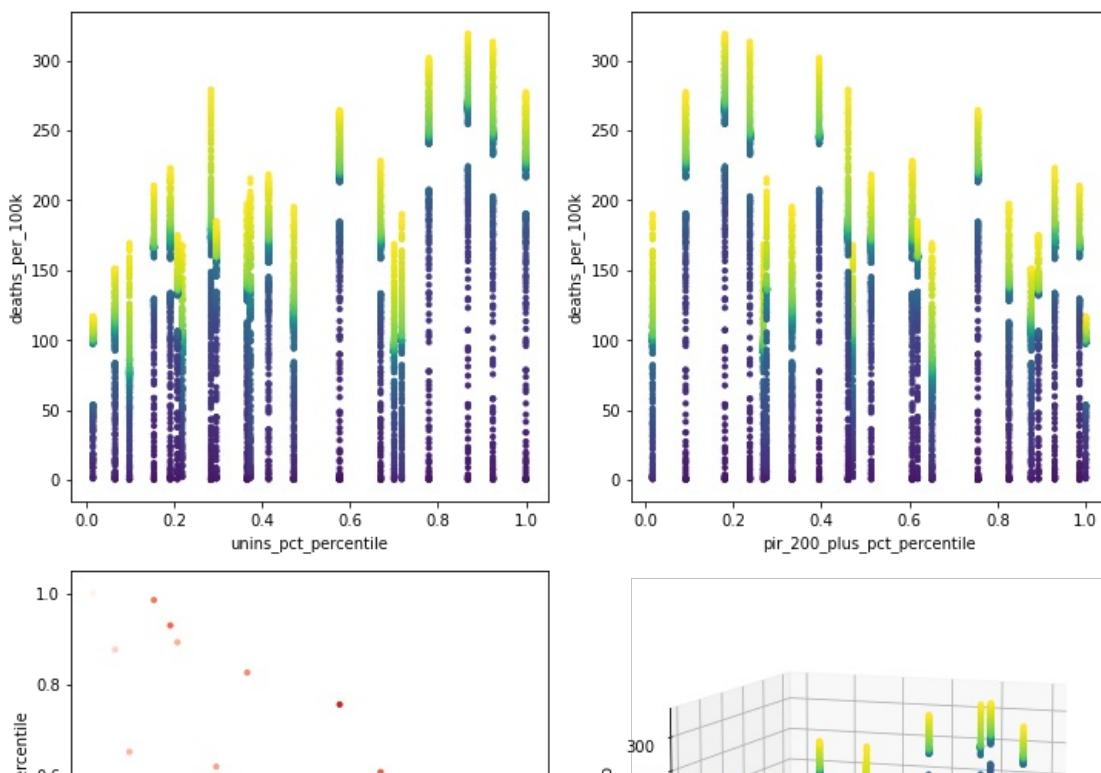
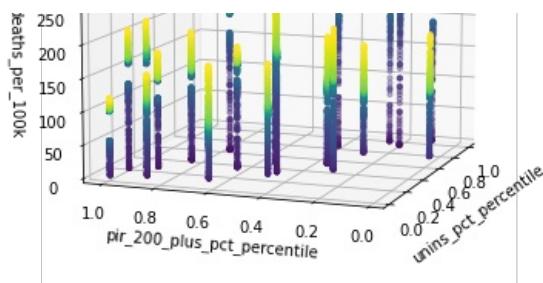
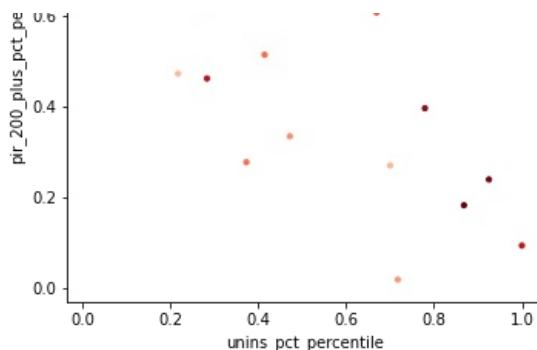


Figure 2.5.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [53]: plotInteractions(data, 'unins_pct_percentile', 'pir_200_plus_pct_percentile', 'deaths_per_100k',[state])
```





```
# # # #
```

Section 2.6: Pennsylvania

```
In [54]: state = 'PA'
death_min = 500
```

Figure 2.6.1: Cases and Deaths (Total, Per 100k People)

```
In [55]: stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```

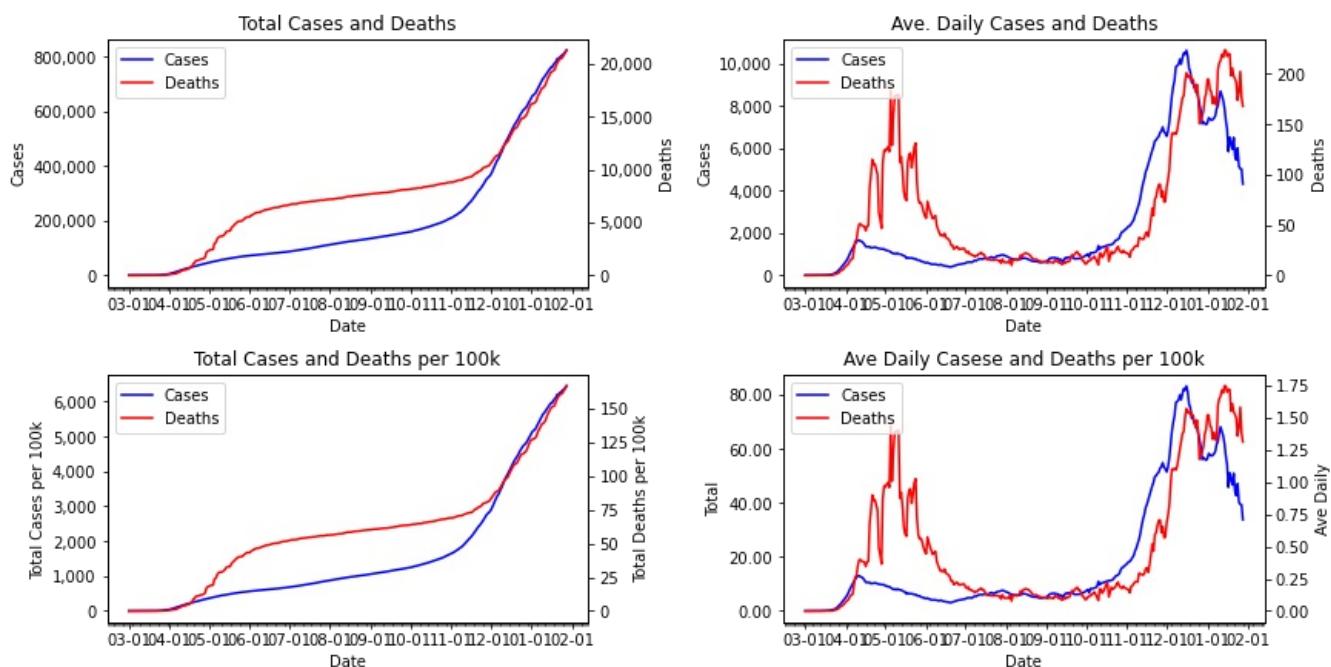
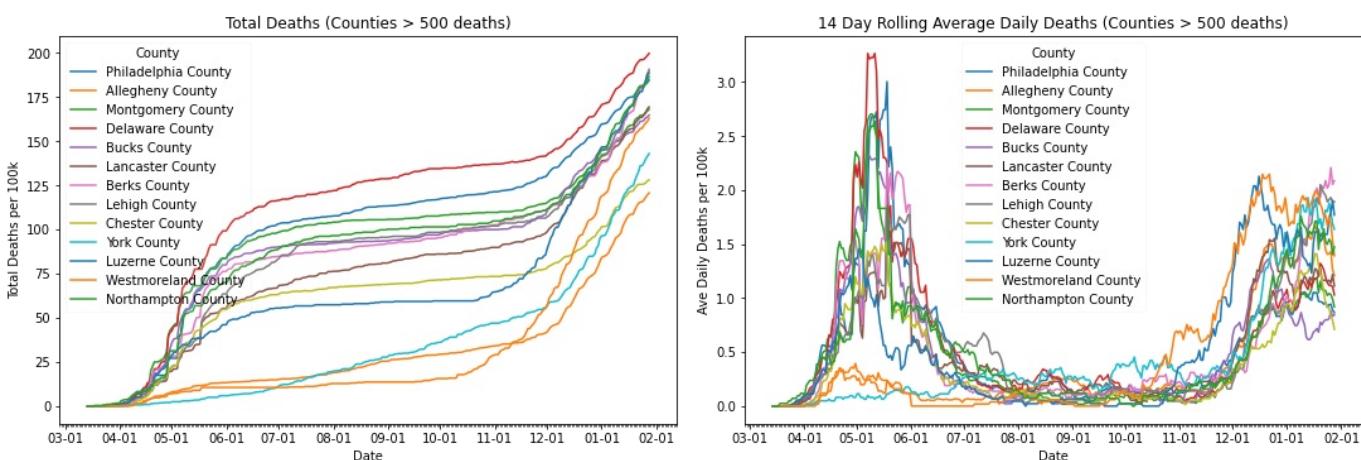


Figure 2.6.2: Deaths per 100k People - 14 Day Average

```
In [56]: plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')
```

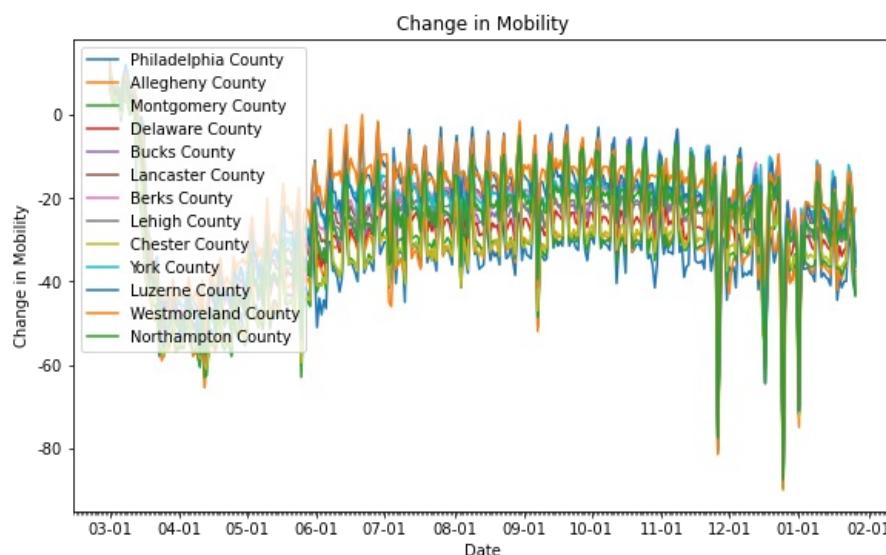


Section 2.6.3: County Level Mobility Reduction

Mobility Reduction by County - Showing daily fluctuations

In [57]:

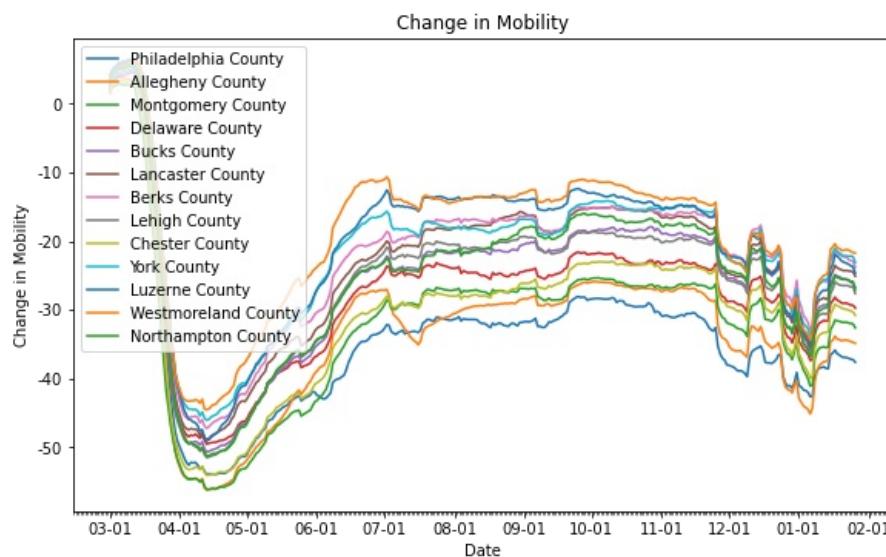
```
graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)
```



Mobility Reduction by County - 14 Day Average

In [58]:

```
graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)
```



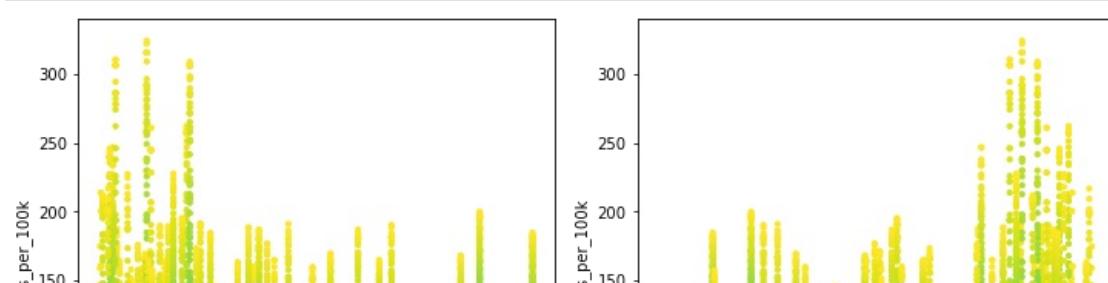
Section 2.6.4: County Attributes Analysis

Figure 2.6.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [59]:

```
plotInteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k', [state])
```



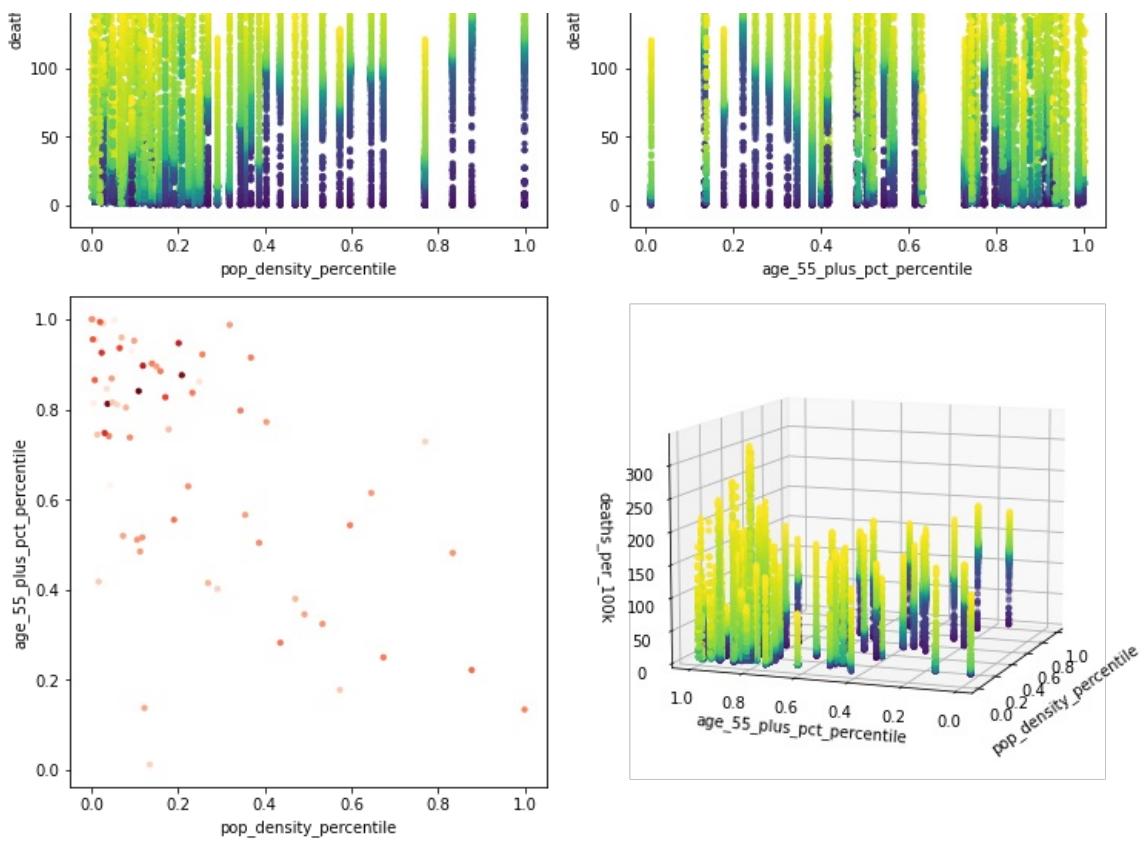


Figure 2.6.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [60]: plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k',[state])
```

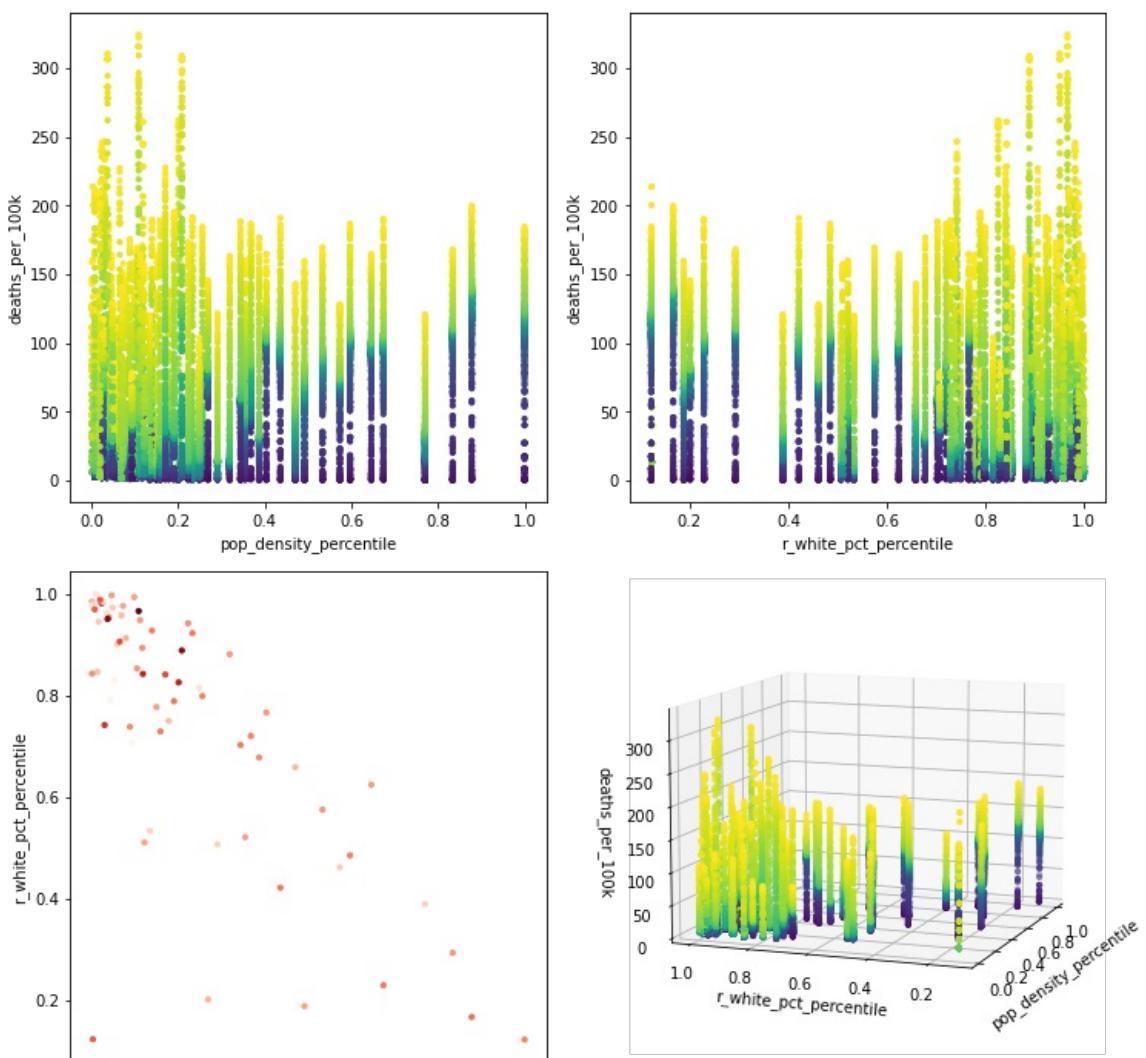




Figure 2.6.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [61]:

```
plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k',[state])
```

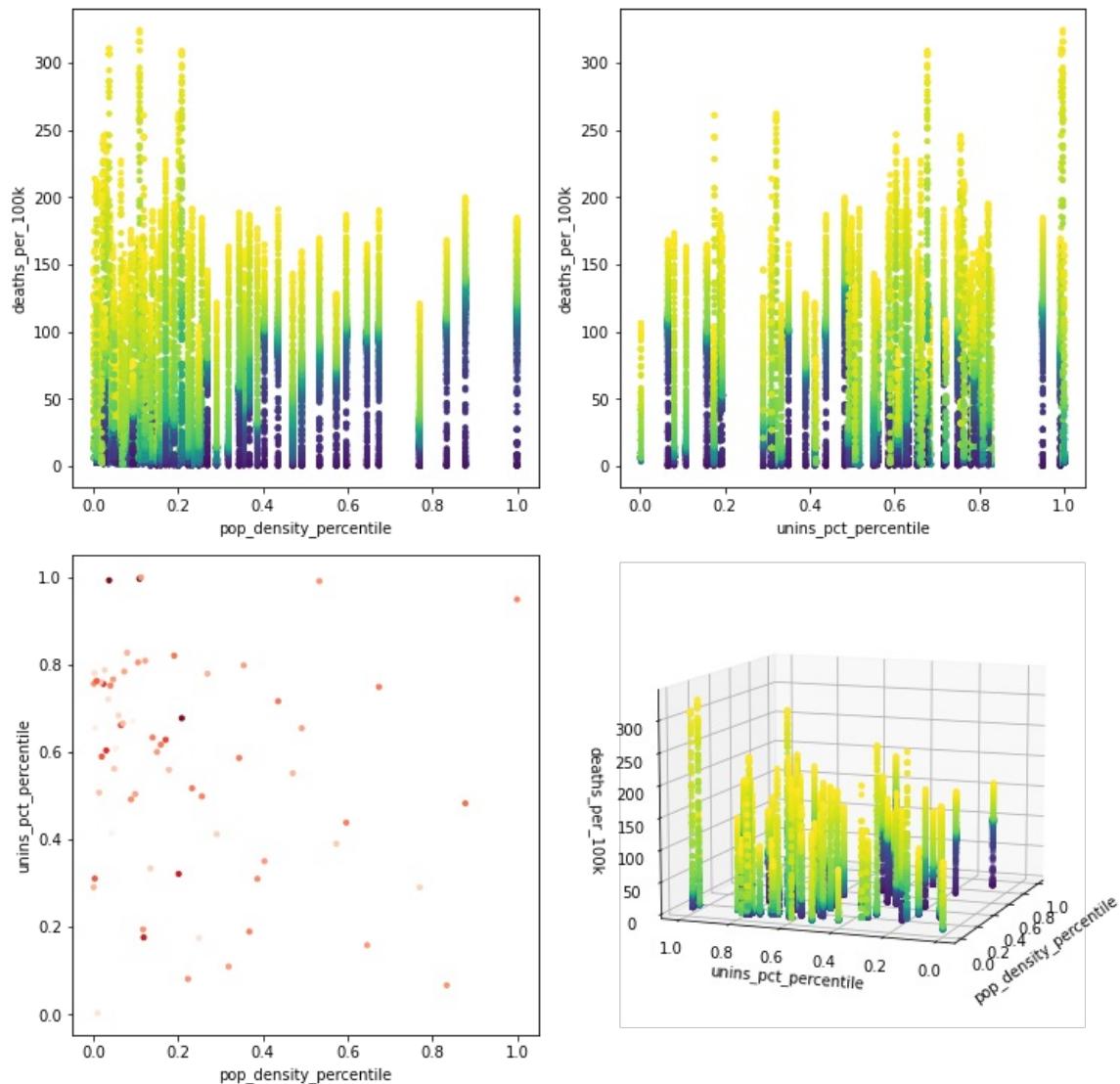
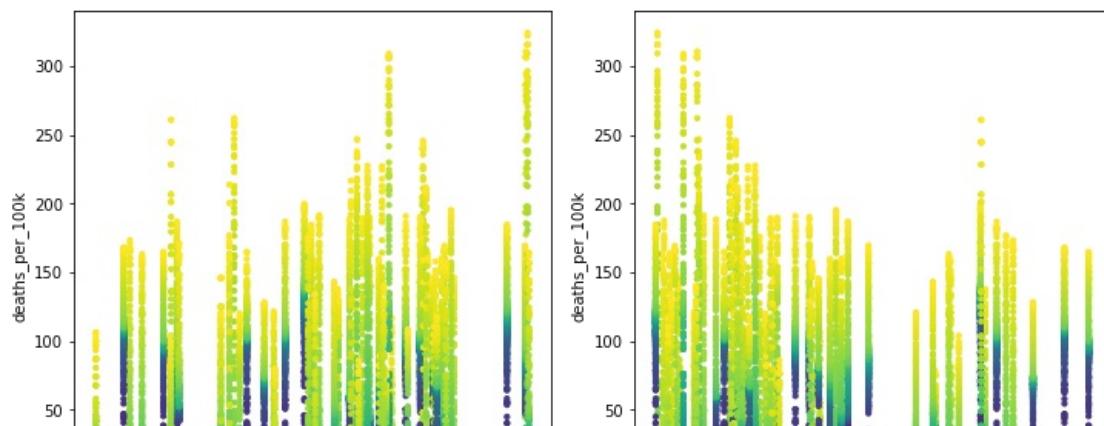


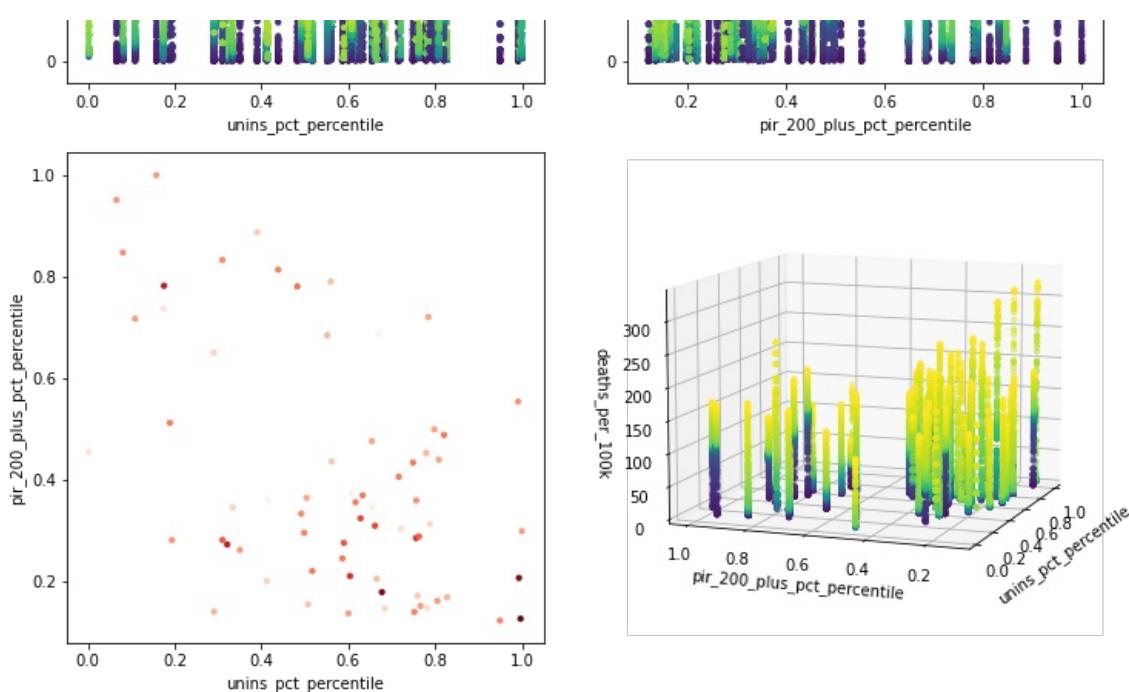
Figure 2.6.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [62]:

```
plotInteractions(data, 'unins_pct_percentile', 'pir_200_plus_pct_percentile', 'deaths_per_100k',[state])
```





```
# # # #
```

Section 2.7: Illinois

```
In [63]: state = 'IL'
death_min = 300
```

Figure 2.7.1: Cases and Deaths (Total, Per 100k People)

```
In [64]: stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```

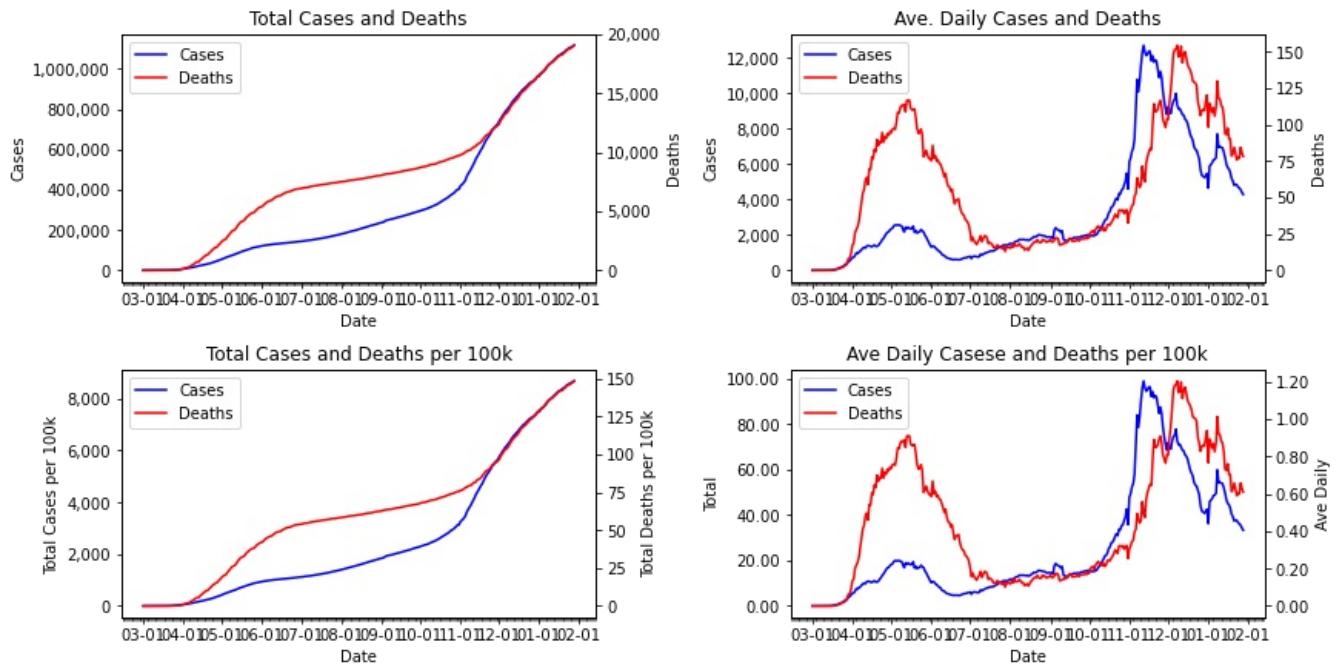
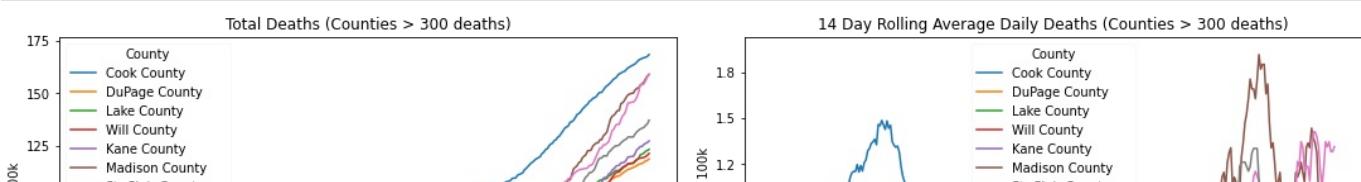
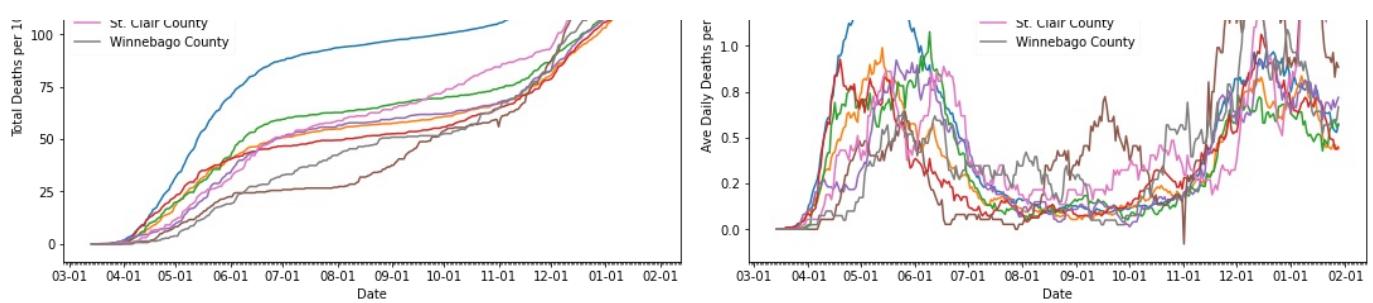


Figure 2.7.2: Deaths per 100k People - 14 Day Average

```
In [65]: plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')
```

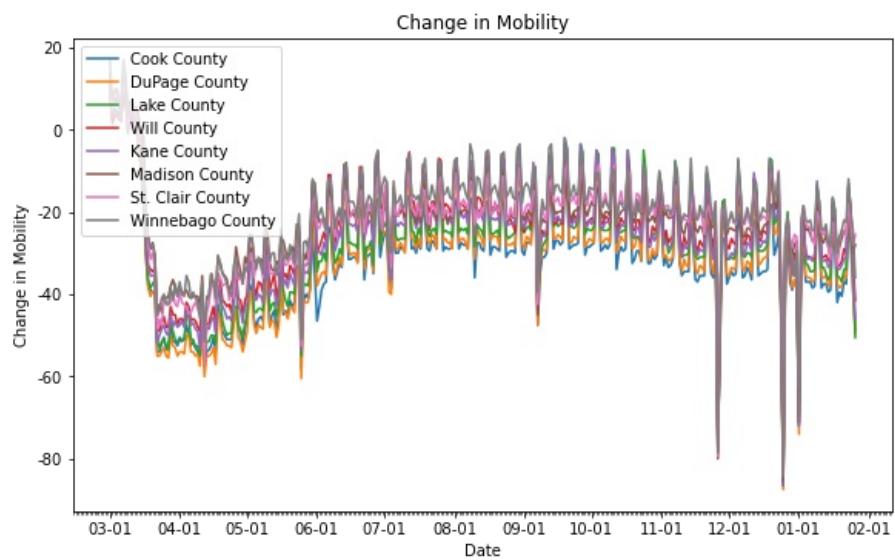




Section 2.7.3: County Level Mobility Reduction

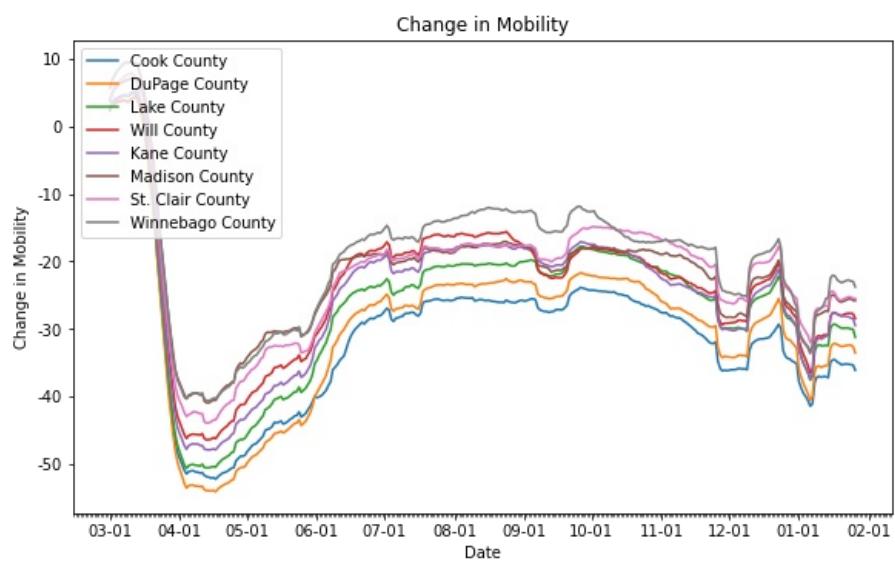
Mobility Reduction by County - Showing daily fluctuations

```
In [66]: graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)
```



Mobility Reduction by County - 14 Day Average

```
In [67]: graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)
```



Section 2.7.4: County Attributes Analysis

Figure 2.7.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [68]:
```

```
plotinteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k',[state])
```

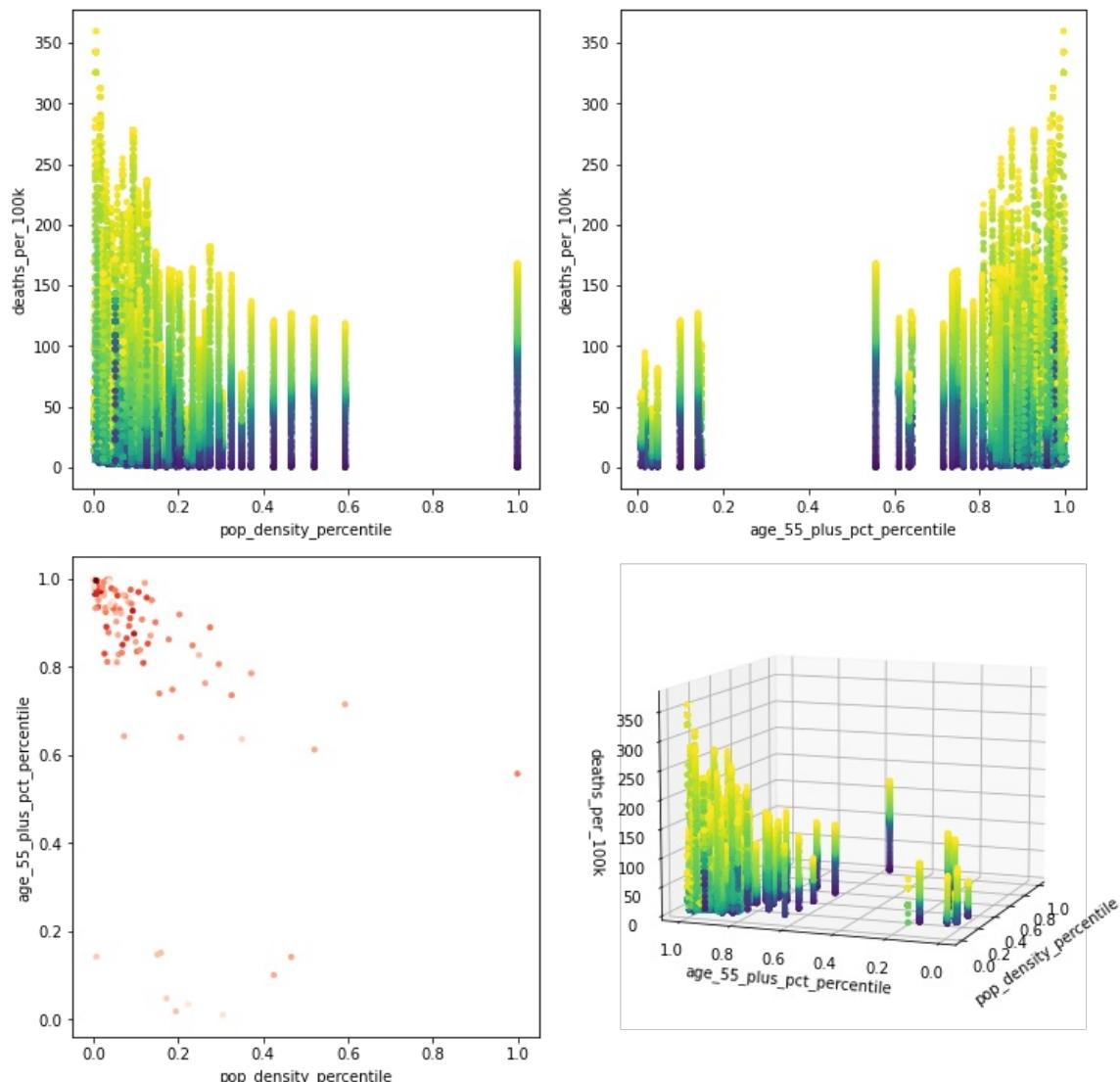
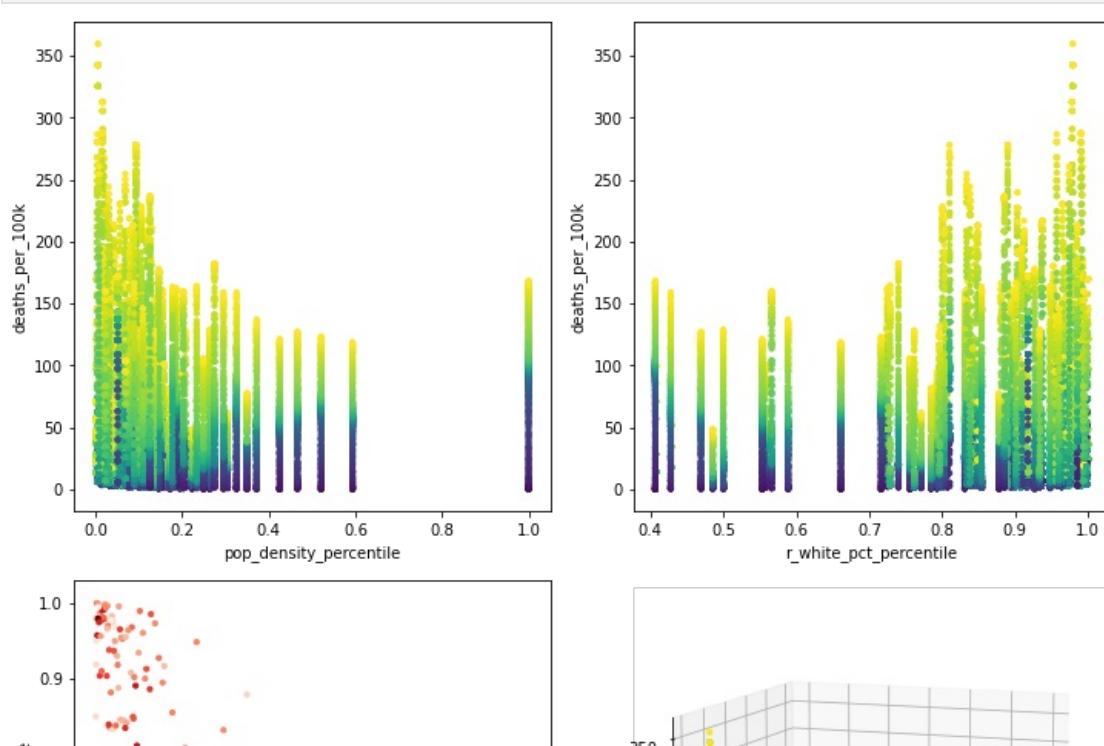


Figure 2.7.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [69]:

```
plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k',[state])
```



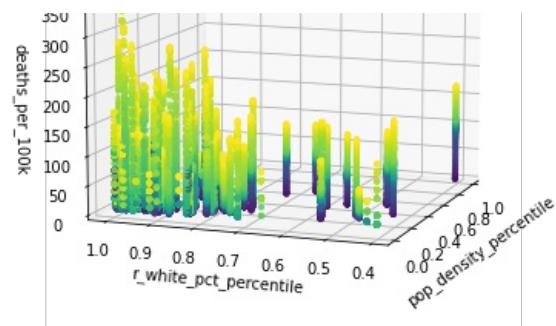
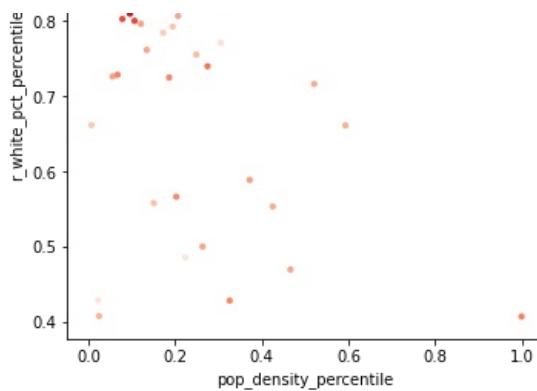


Figure 2.7.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [70]: plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k',[state])
```

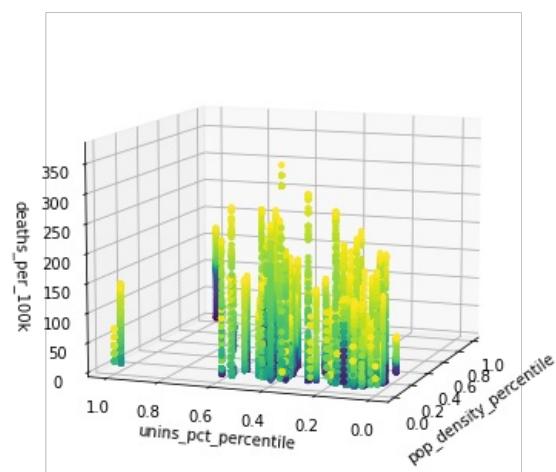
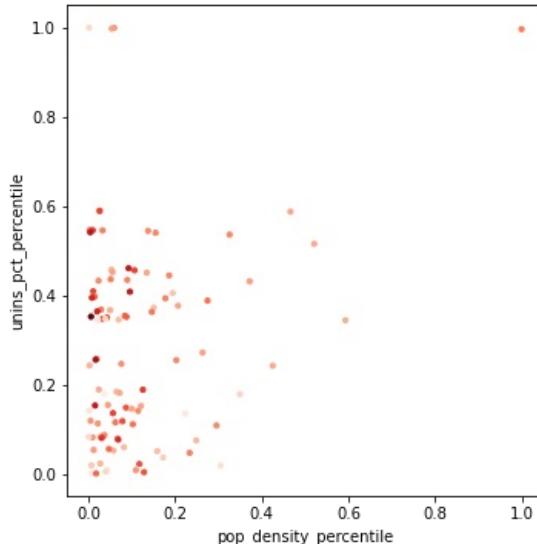
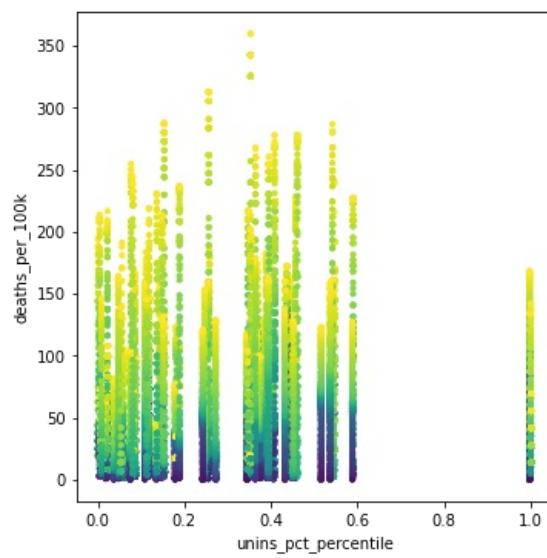
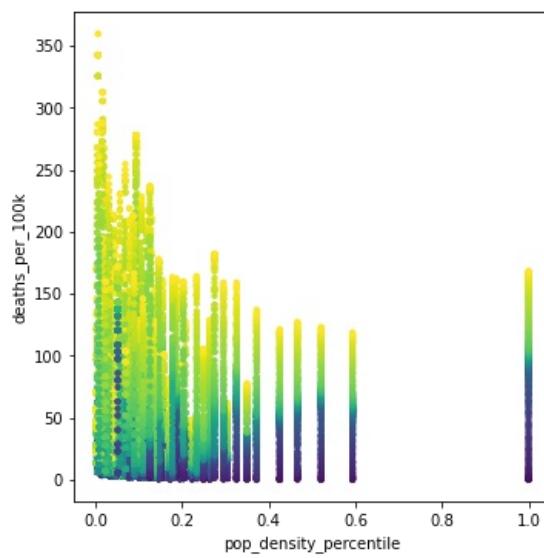
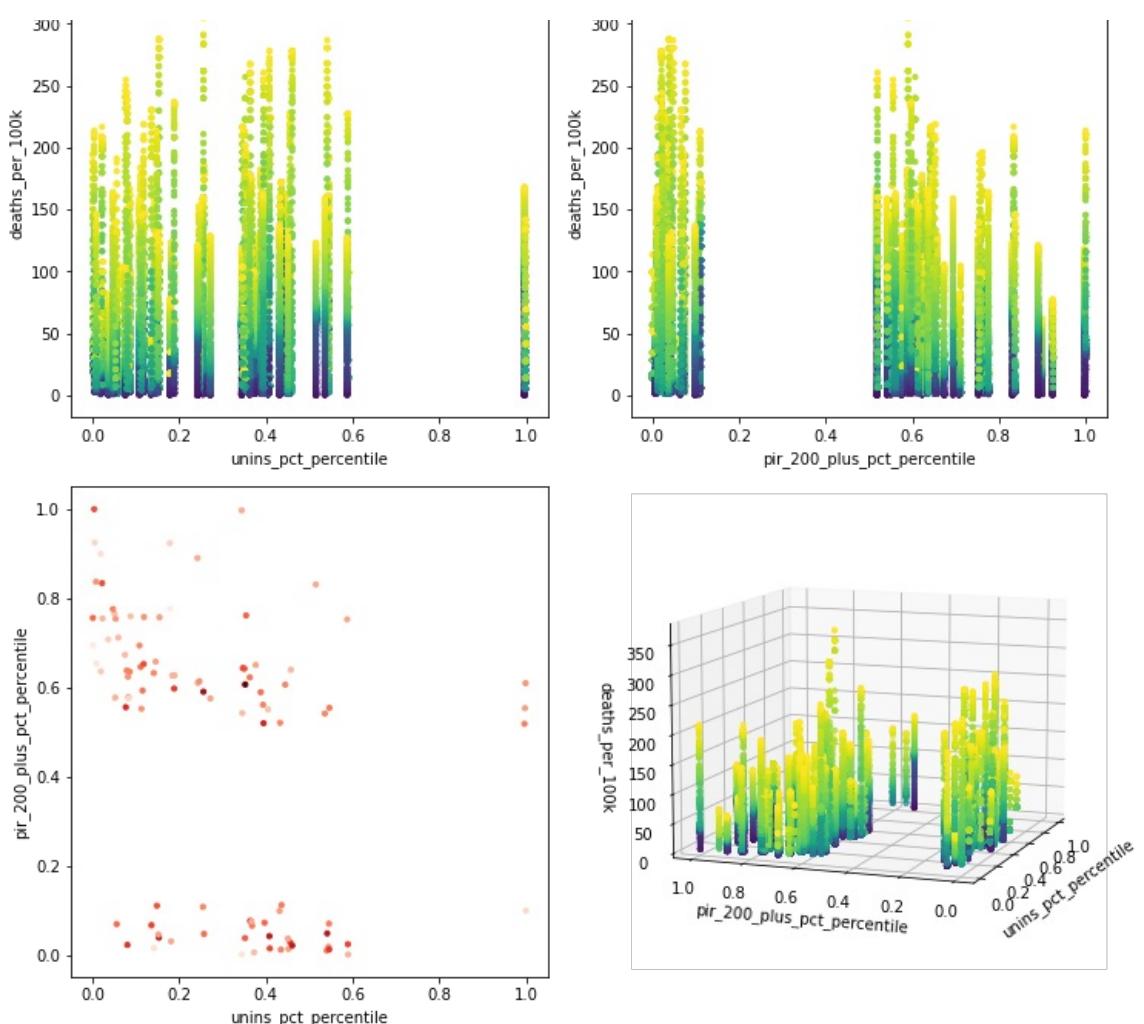


Figure 2.7.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [71]: plotInteractions(data, 'unins_pct_percentile', 'pir_200_plus_pct_percentile', 'deaths_per_100k',[state])
```





#

Section 2.8: Massachusetts

```
In [72]: state = 'MA'
death_min = 300
```

Figure 2.8.1: Cases and Deaths (Total, Per 100k People)

```
In [73]: stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```

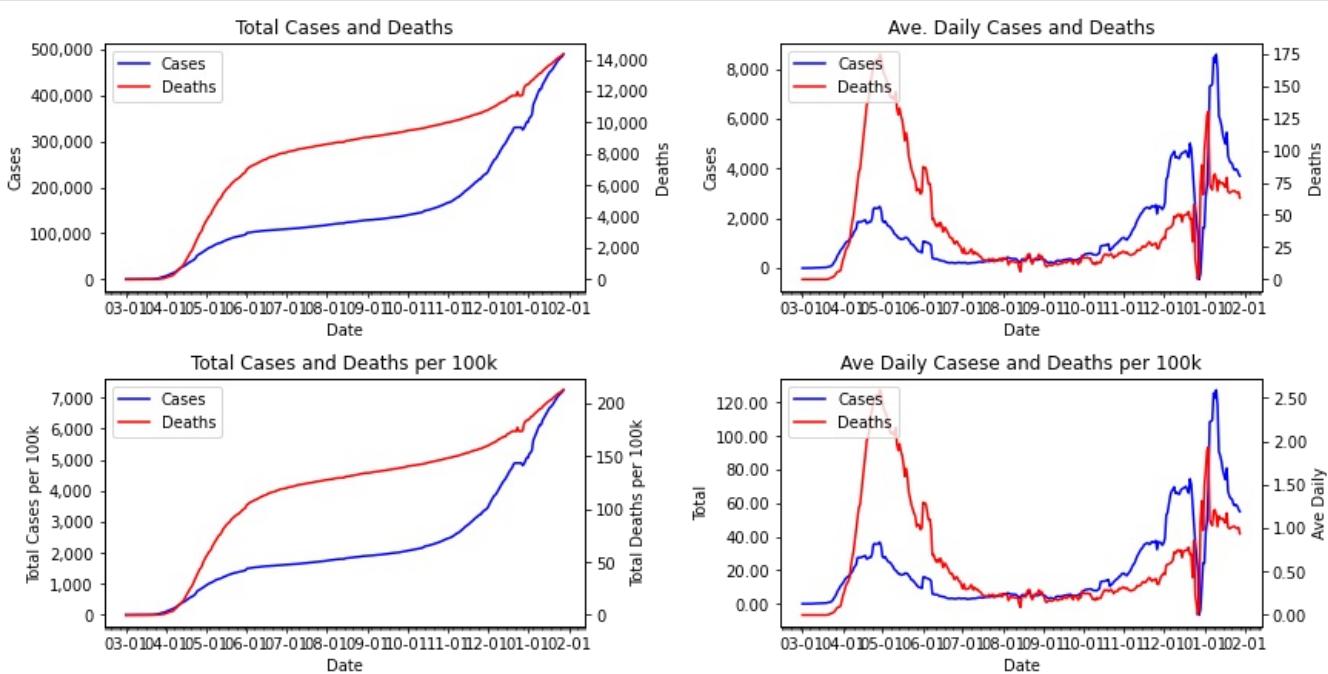
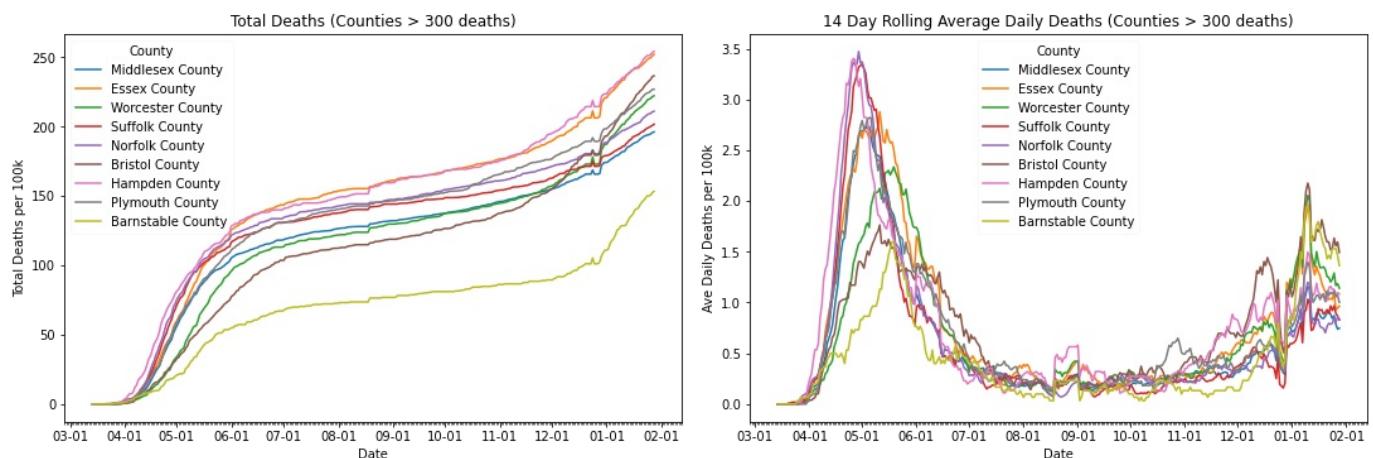


Figure 2.8.2: Deaths per 100k People - 14 Day Average

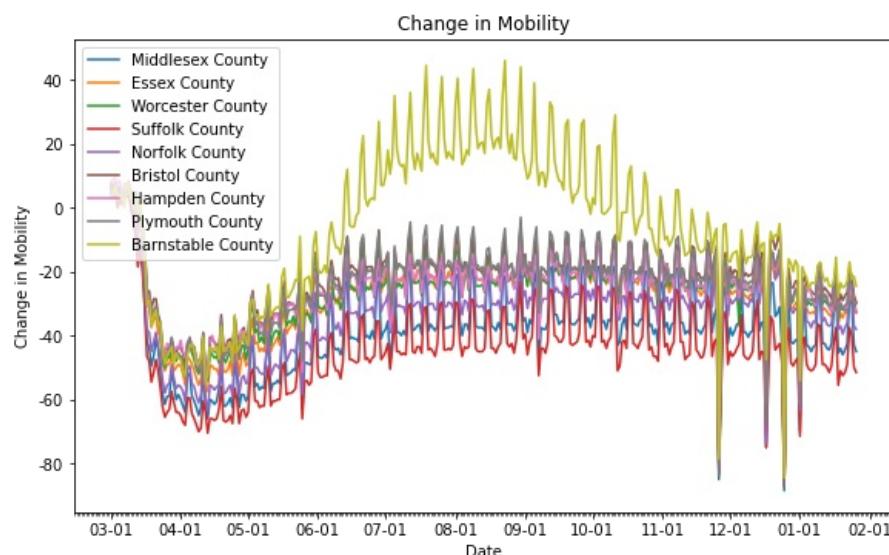
```
In [74]: plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')
```



Section 2.8.3: County Level Mobility Reduction

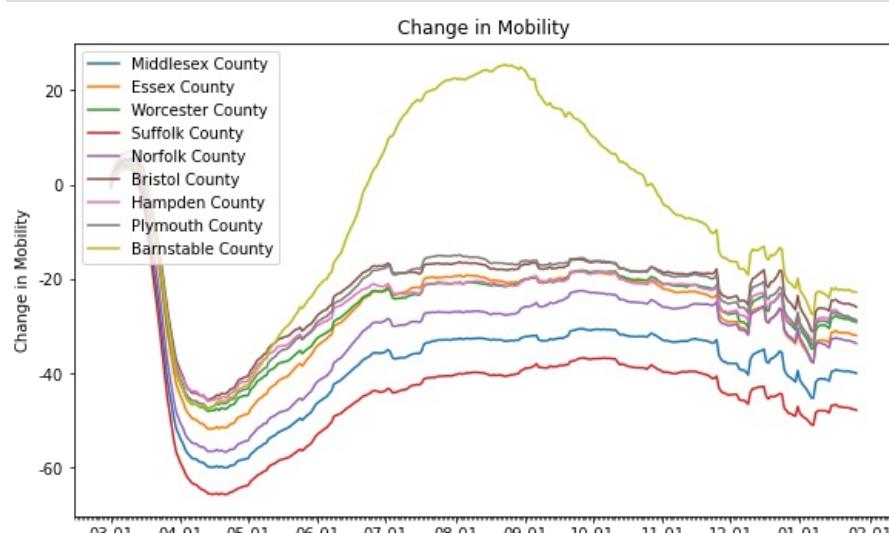
Mobility Reduction by County - Showing daily fluctuations

```
In [75]: graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)
```



Mobility Reduction by County - 14 Day Average

```
In [76]: graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)
```



Section 2.8.4: County Attributes Analysis

Figure 2.8.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [77]: plotInteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k', [state])
```

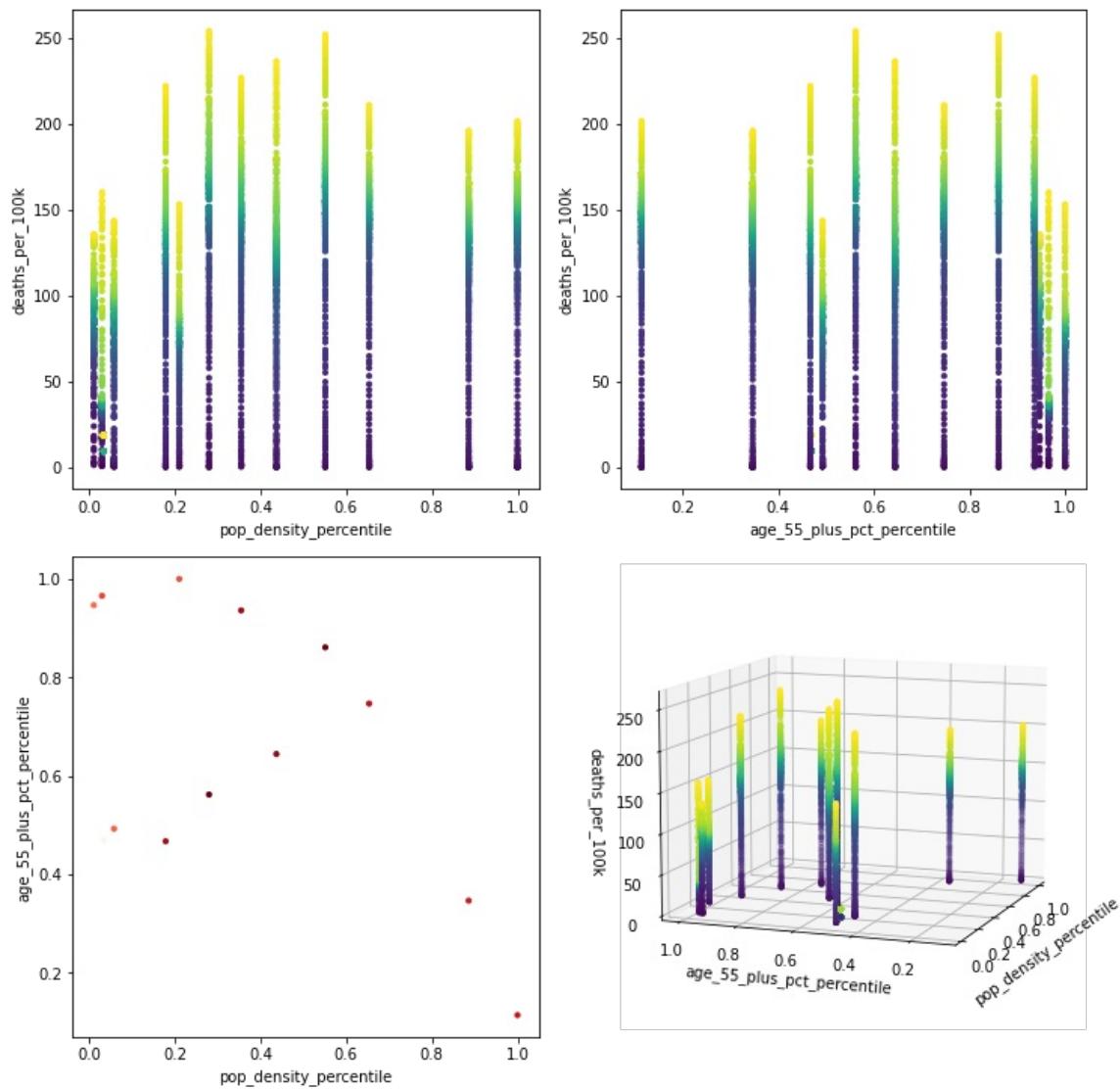
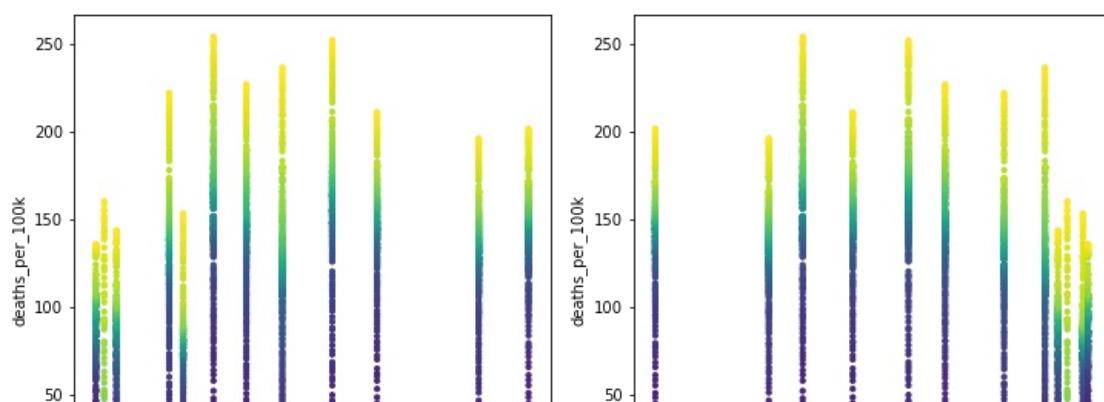


Figure 2.8.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [78]: plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k', [state])
```



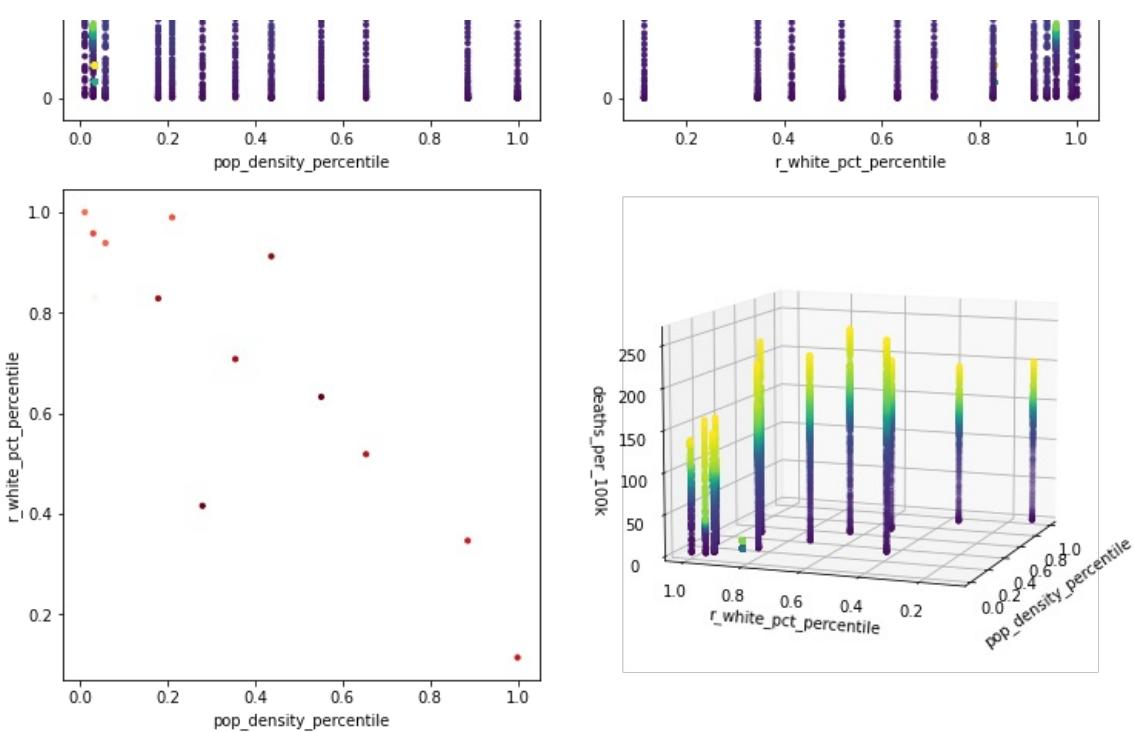


Figure 2.8.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [79]: plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k',[state])
```

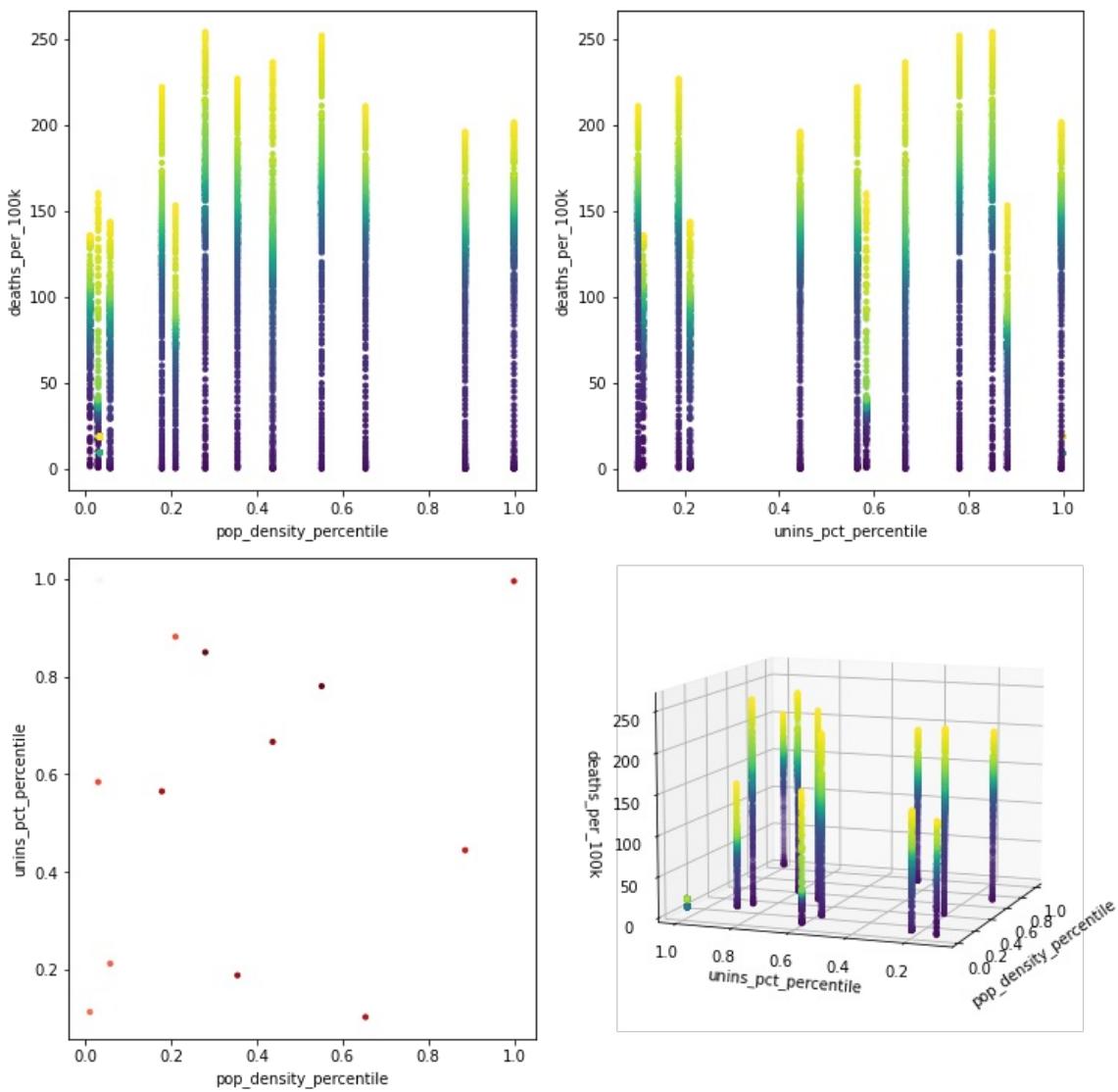
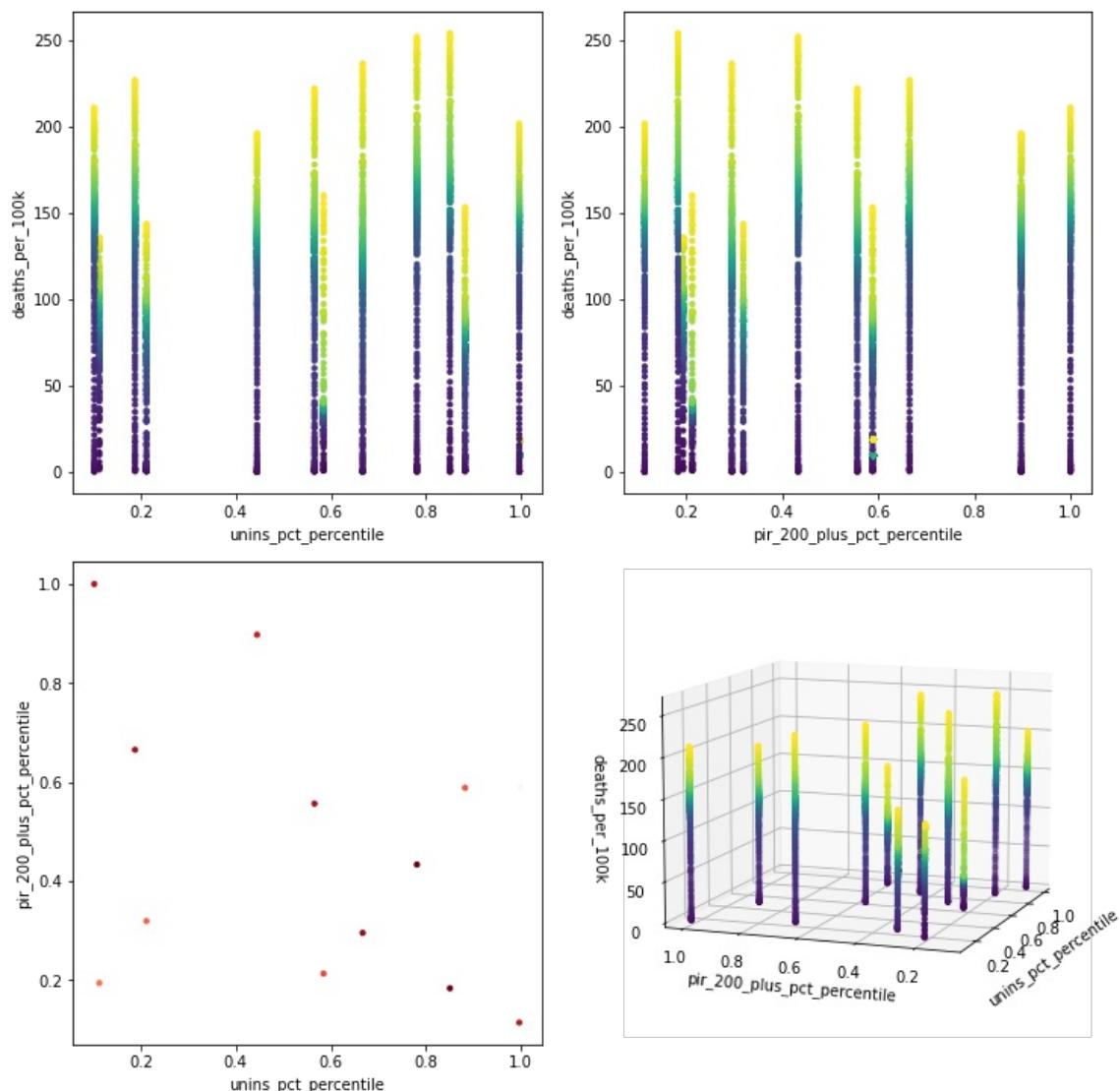


Figure 2.8.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [80]:

```
plotInteractions(data, 'unins_pct_percentile', 'pir_200_plus_pct_percentile', 'deaths_per_100k',[state])
```



```
# # # #
```

Section 2.9: Arizona

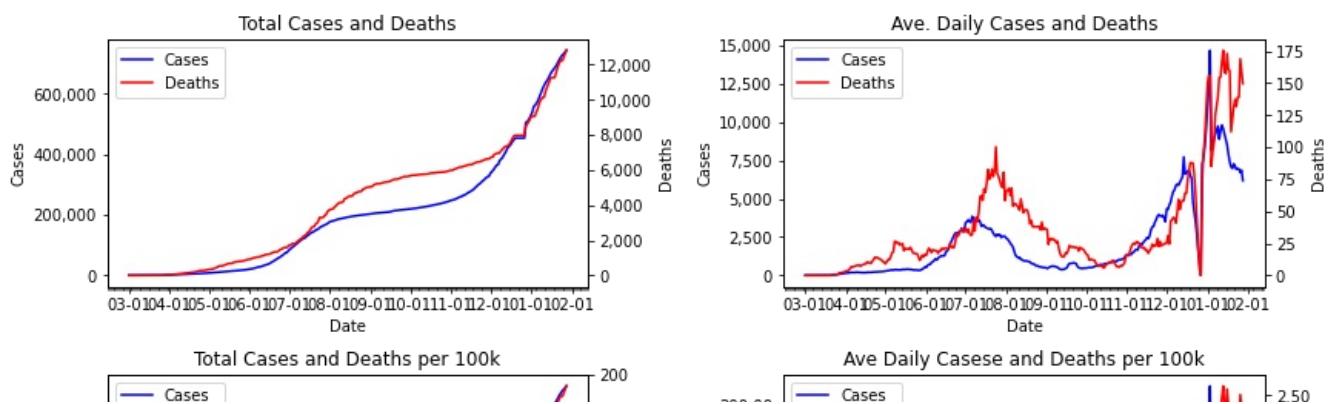
In [81]:

```
state = 'AZ'
death_min = 300
```

Figure 2.9.1: Cases and Deaths (Total, Per 100k People)

In [82]:

```
stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```



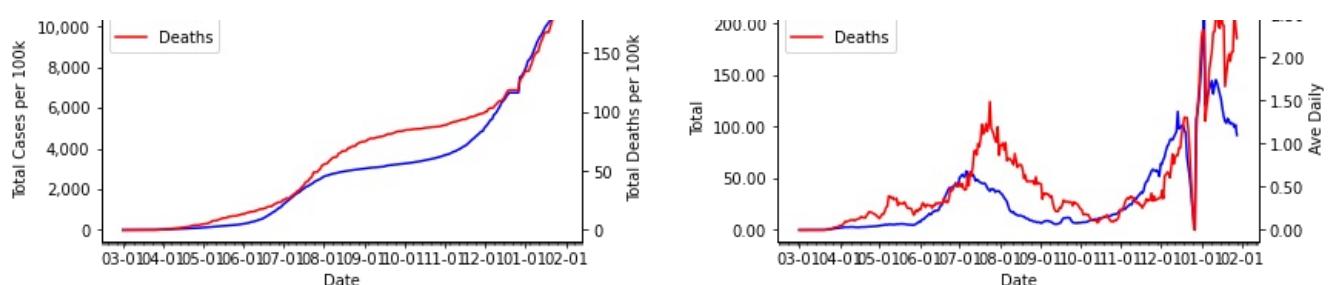
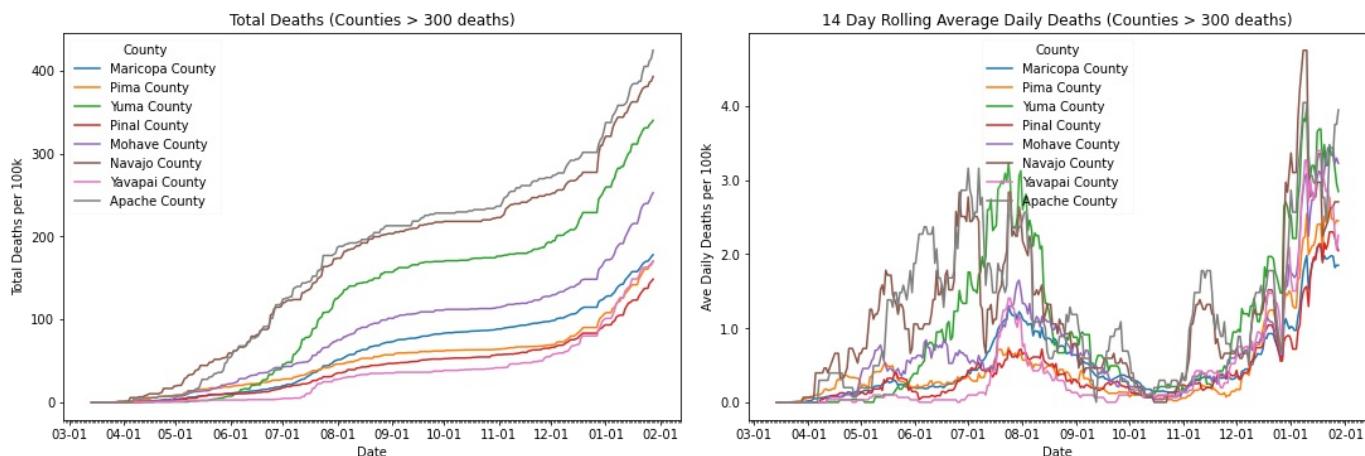


Figure 2.9.2: Deaths per 100k People - 14 Day Average

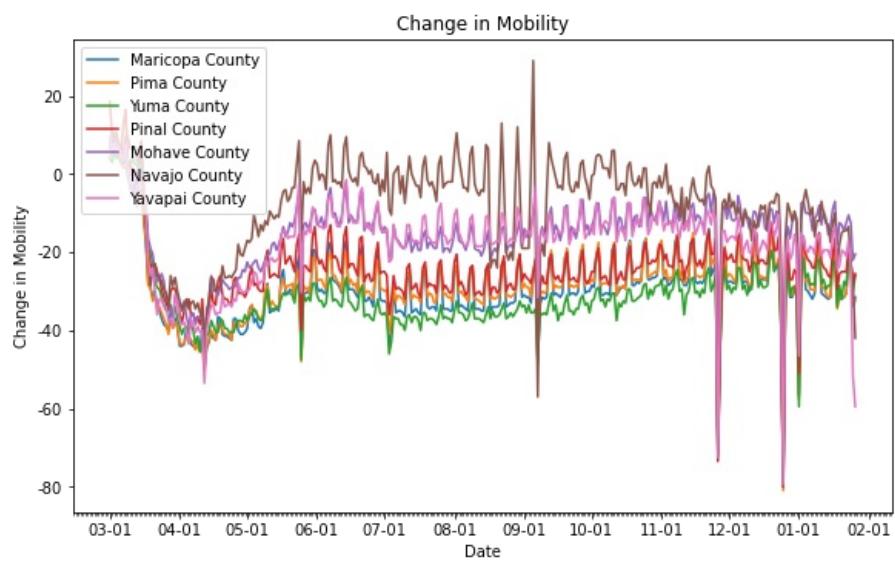
```
In [83]: plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')
```



Section 2.9.3: County Level Mobility Reduction

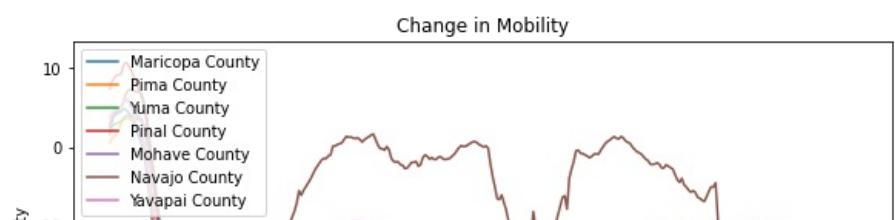
Mobility Reduction by County - Showing daily fluctuations

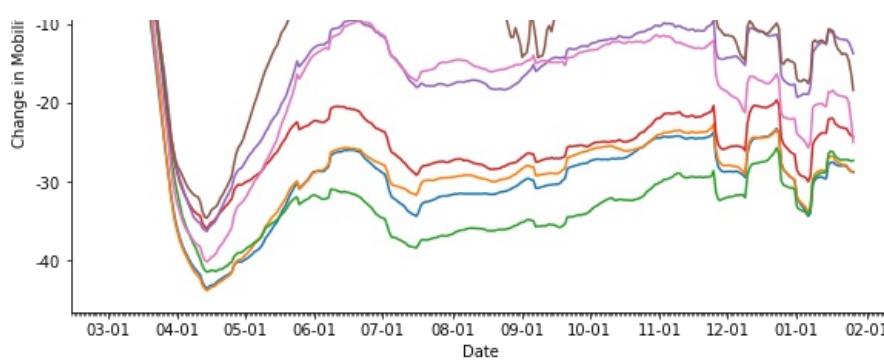
```
In [84]: graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)
```



Mobility Reduction by County - 14 Day Average

```
In [85]: graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)
```





Section 2.9.4: County Attributes Analysis

Figure 2.1.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [86]:

```
plotInteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k', [state])
```

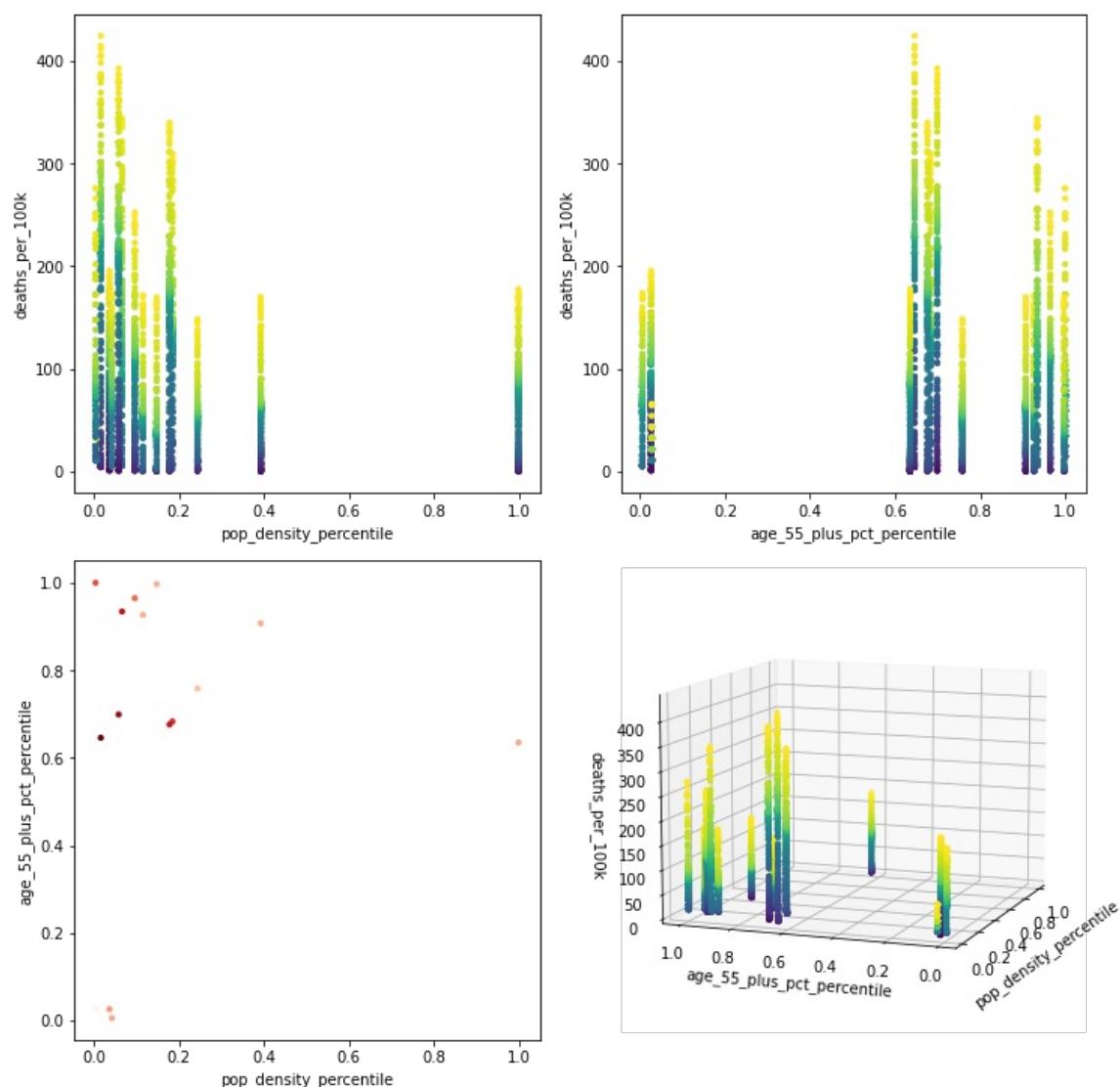


Figure 2.9.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [87]:

```
plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k', [state])
```



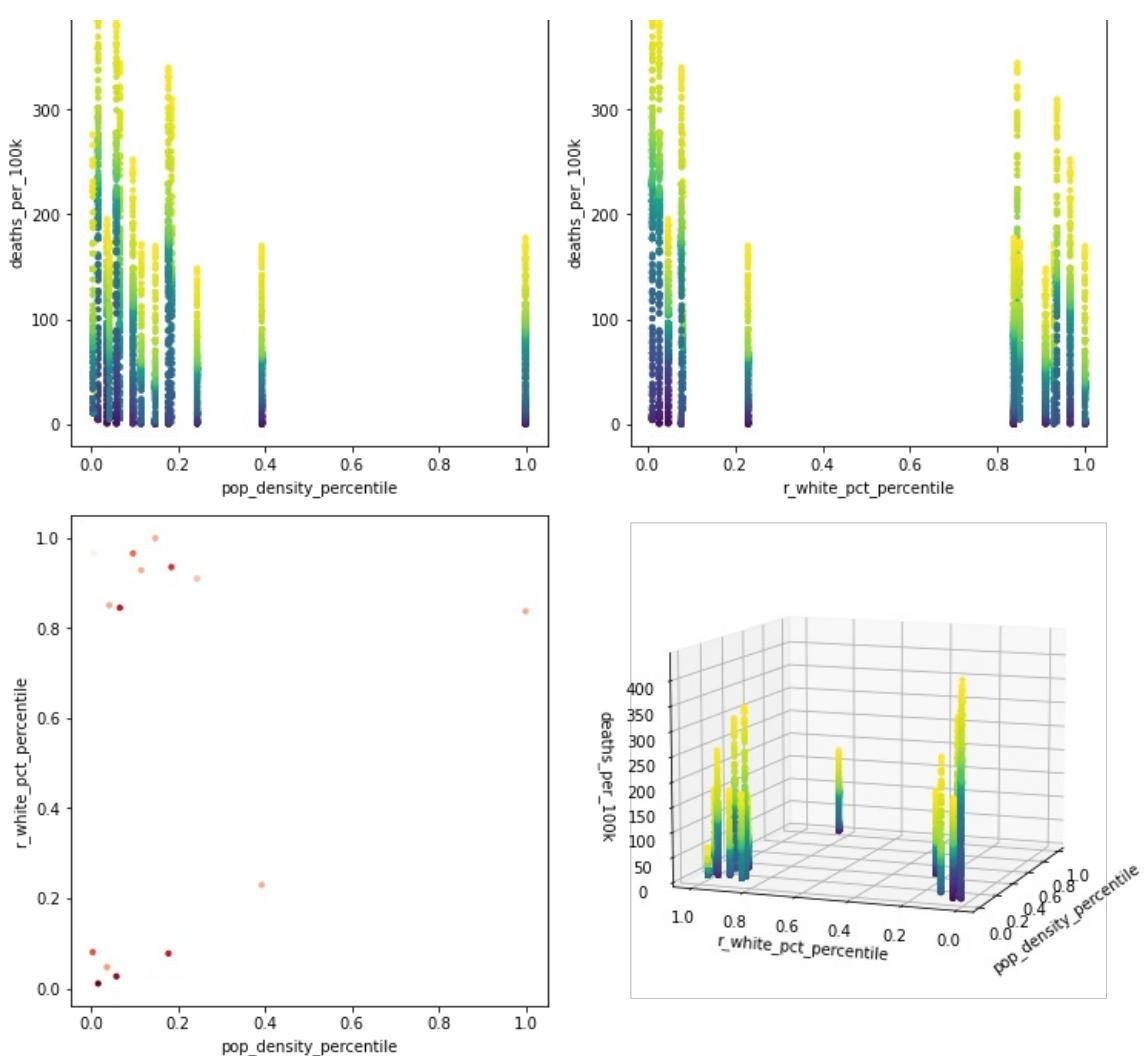
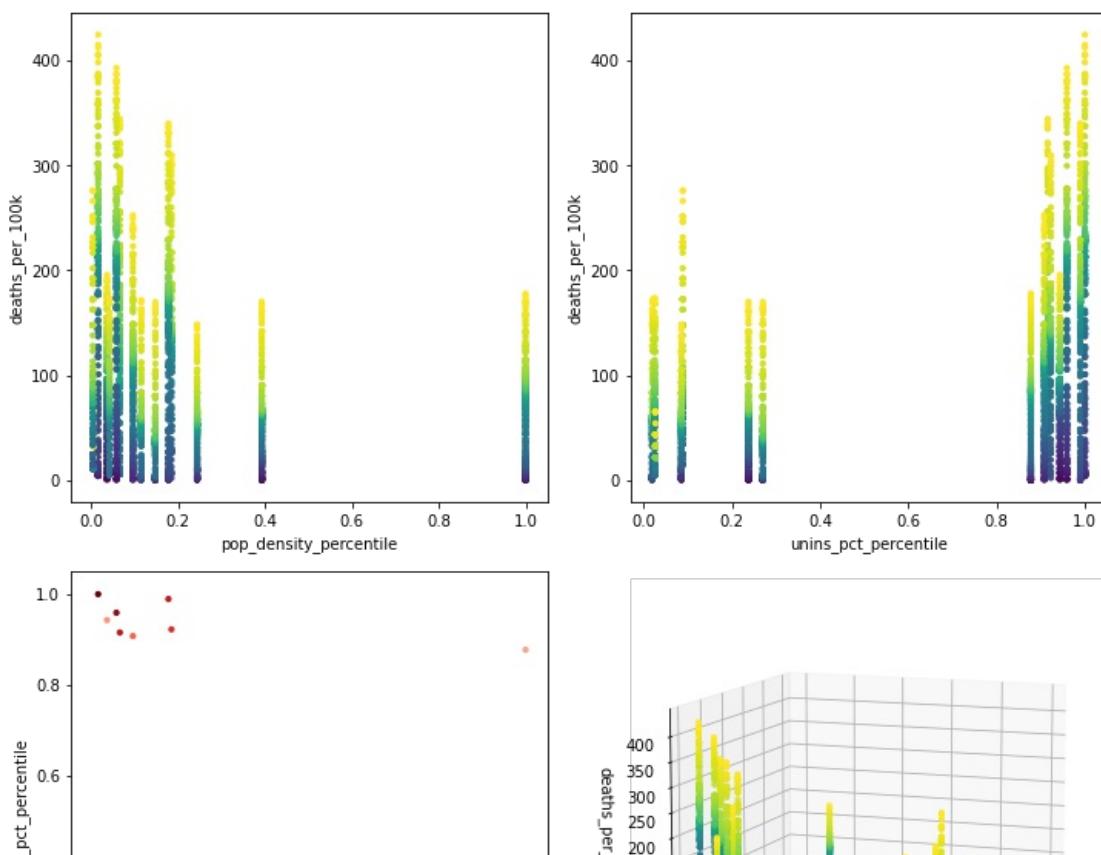


Figure 2.9.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [88]: plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k',[state])
```



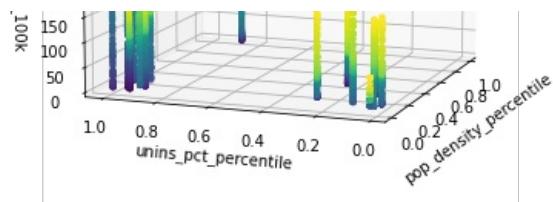
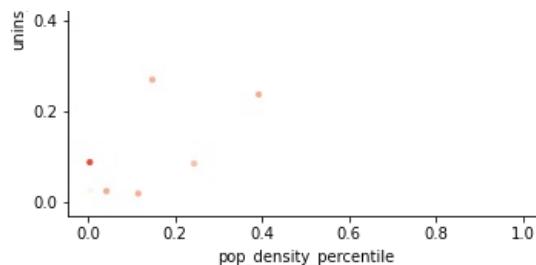
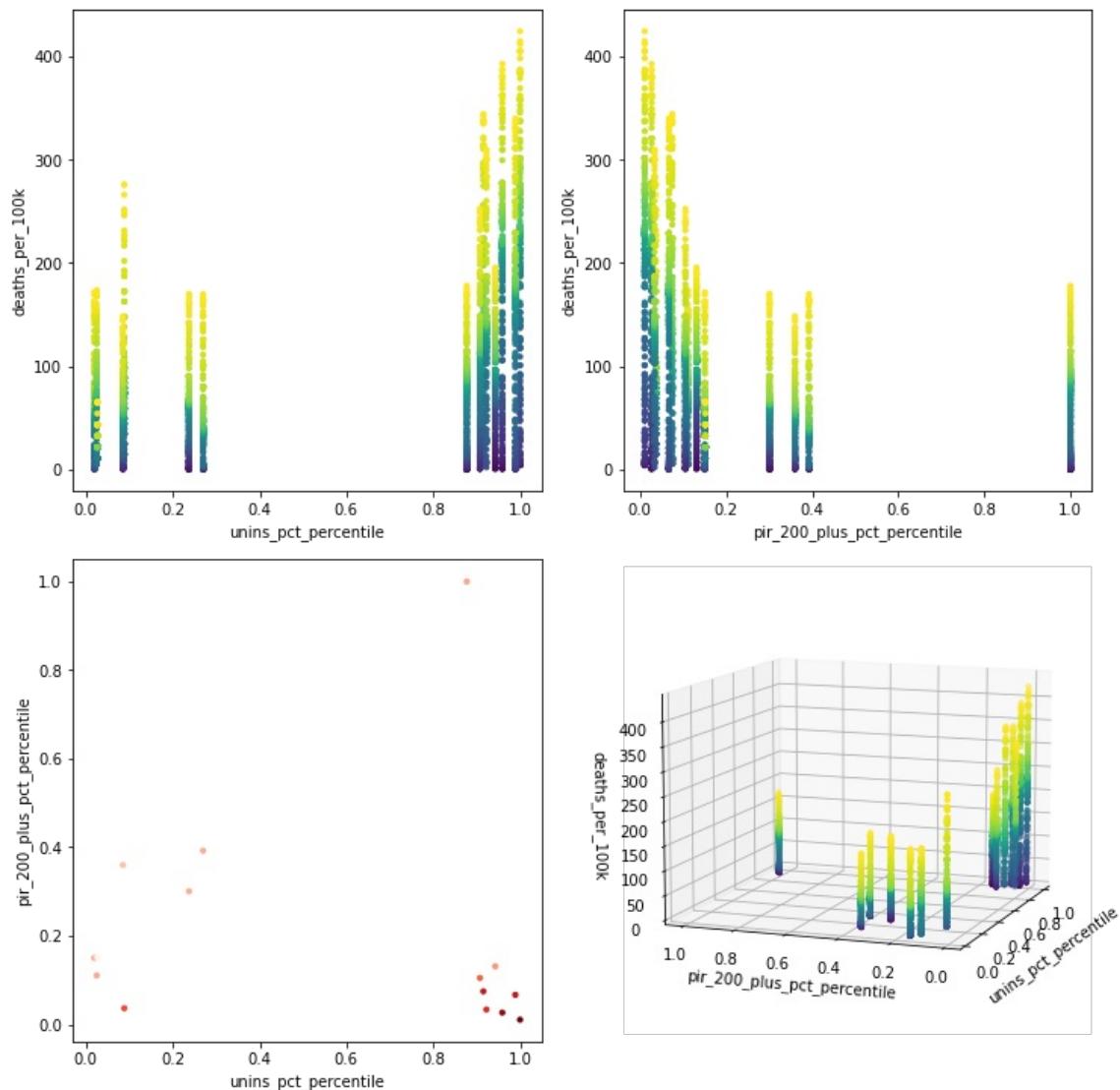


Figure 2.9.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [89]: plotInteractions(data, 'unins_pct_percentile', 'pir_200_plus_pct_percentile', 'deaths_per_100k', [state])
```



```
# # # #
```

Section 2.10: Michigan

```
In [90]: state = 'MI'
death_min = 300
```

Figure 2.10.1: Cases and Deaths (Total, Per 100k People)

```
In [91]: stateGraphs(data, [state], 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 7)
```



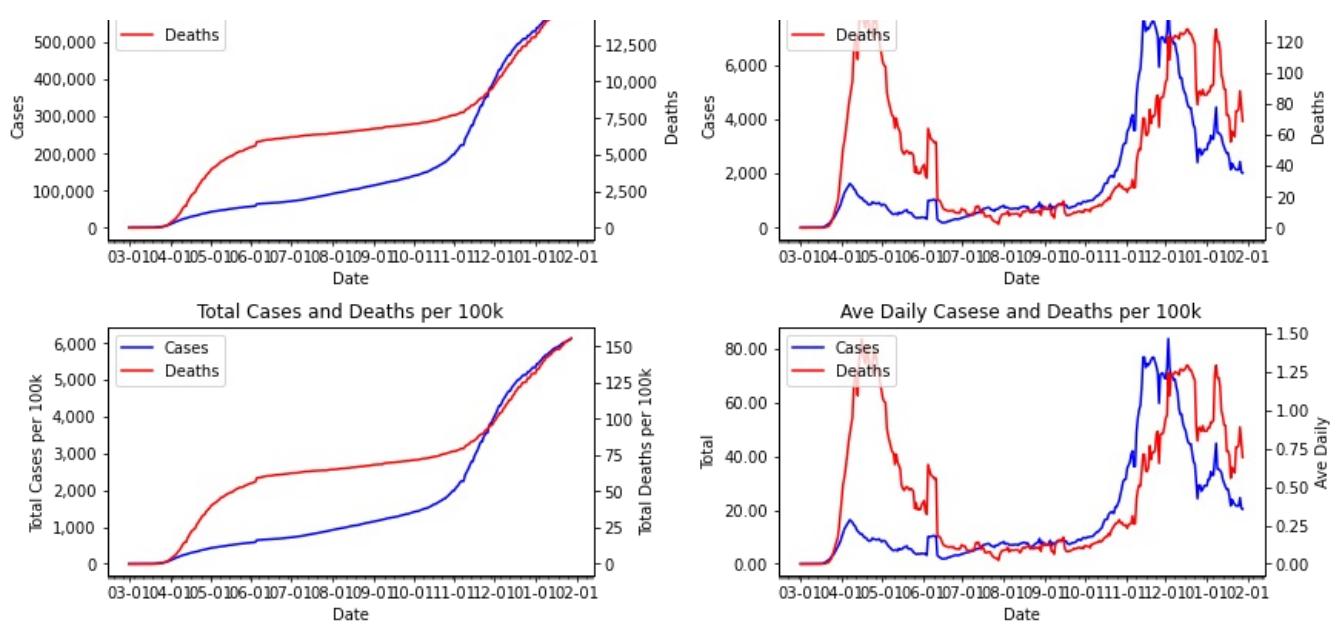
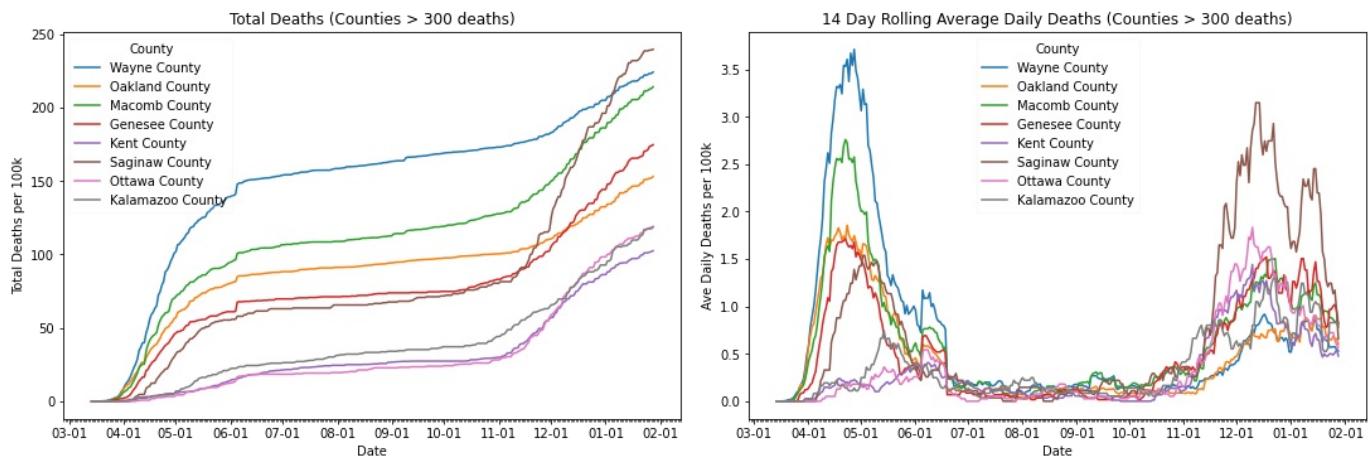


Figure 2.10.2: Deaths per 100k People - 14 Day Average

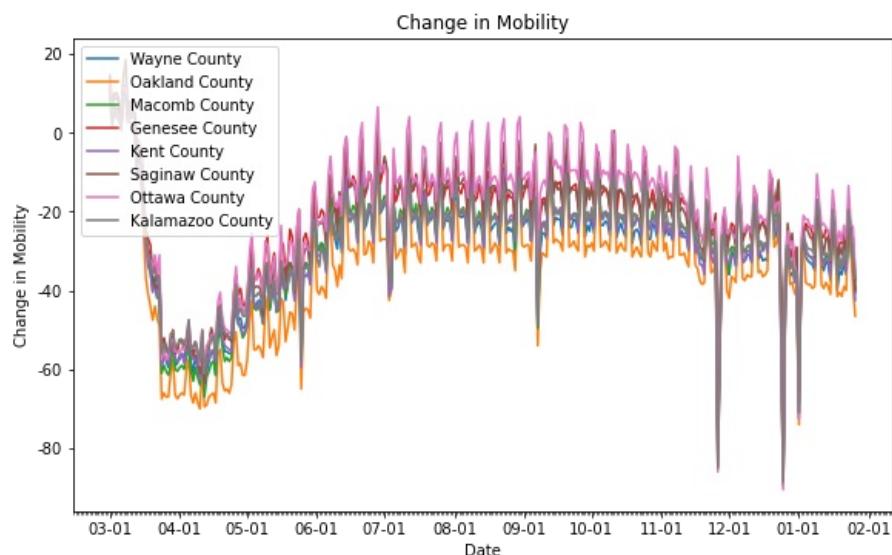
```
In [92]: plotCountyDeathCurves(data, state, death_min = death_min, rolling_ave = 14, start_date='2020-03-14')
```



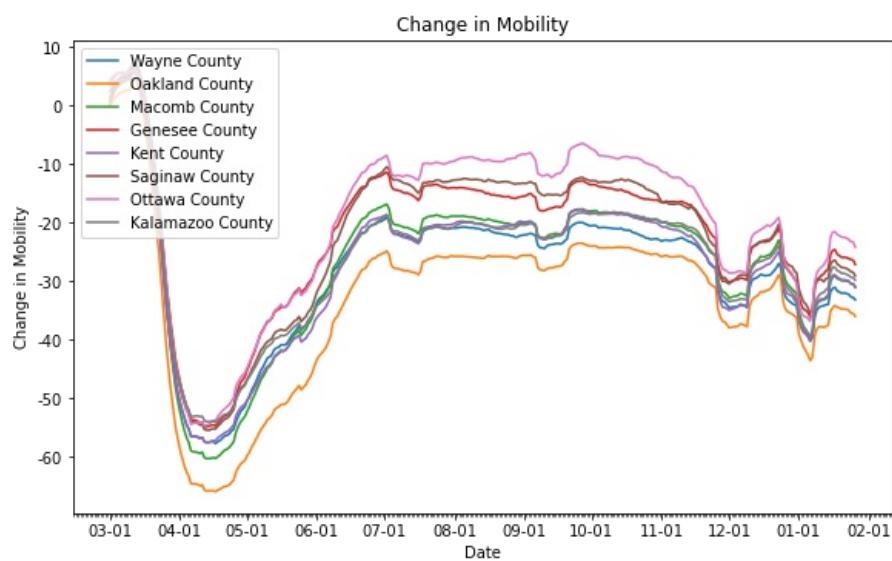
Section 2.10.3: County Level Mobility Reduction

Mobility Reduction by County - Showing daily fluctuations

```
In [93]: graphMobilityCounty(data, state, '2020-03-01', 1, death_min = death_min)
```



```
In [94]: graphMobilityCounty(data, state, '2020-03-01', 14, death_min = death_min)
```



Section 2.10.4: County Attributes Analysis

Figure 2.1.4.1: Population Density and Over Age 55 Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

```
In [95]:
```

```
plotInteractions(data, 'pop_density_percentile', 'age_55_plus_pct_percentile', 'deaths_per_100k', [state])
```

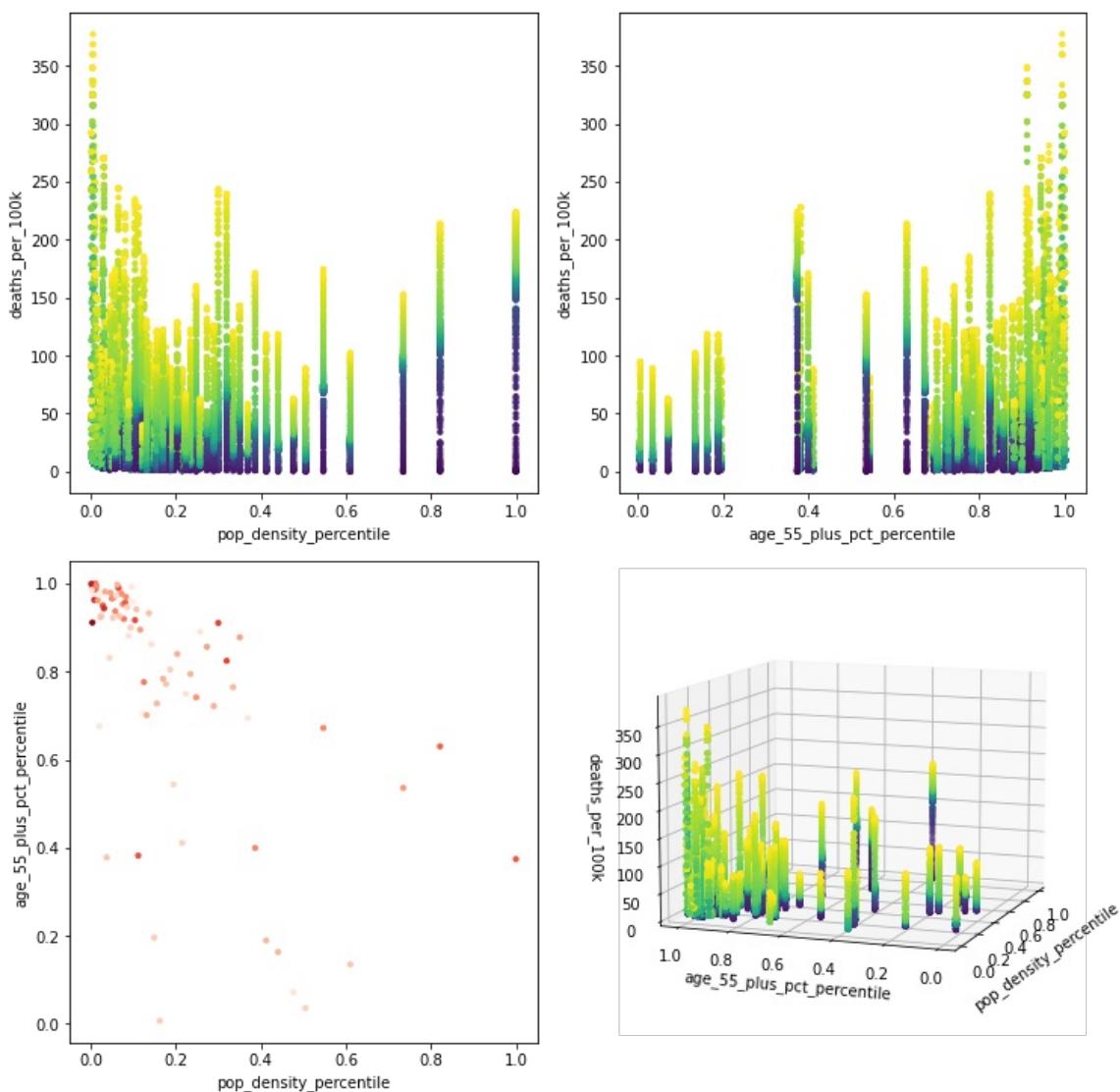


Figure 2.10.4.2: Population Density and (Non) White Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [96]:

```
plotInteractions(data, 'pop_density_percentile', 'r_white_pct_percentile', 'deaths_per_100k',[state])
```

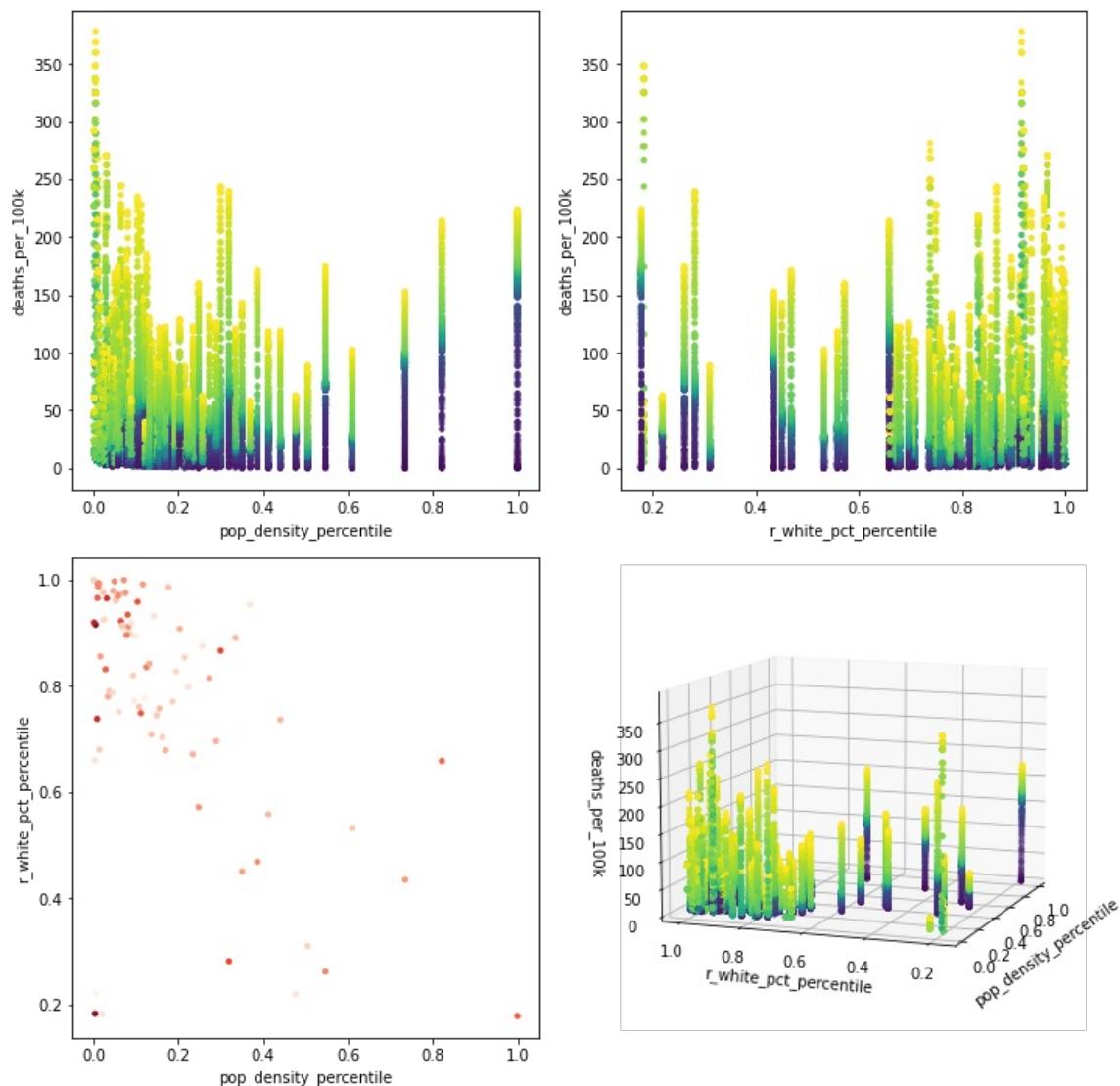
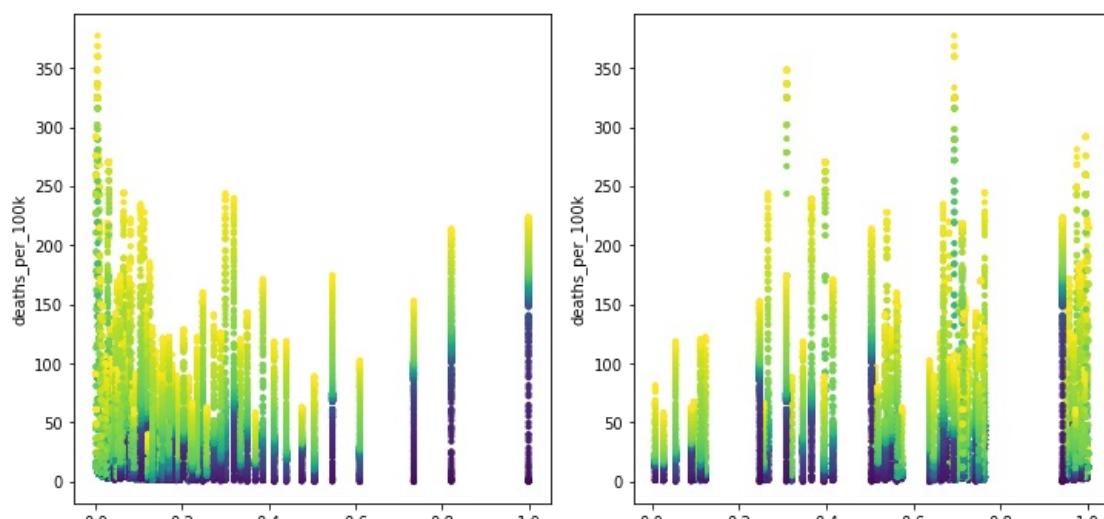


Figure 2.10.4.3: Population Density and Uninsured Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people

In [97]:

```
plotInteractions(data, 'pop_density_percentile', 'unins_pct_percentile', 'deaths_per_100k',[state])
```



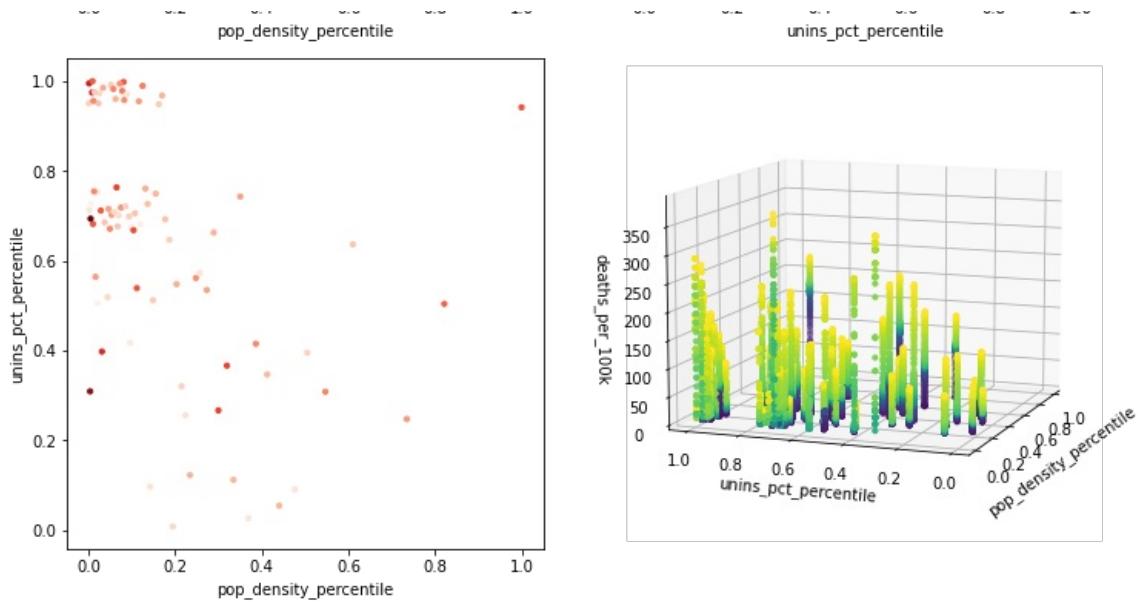
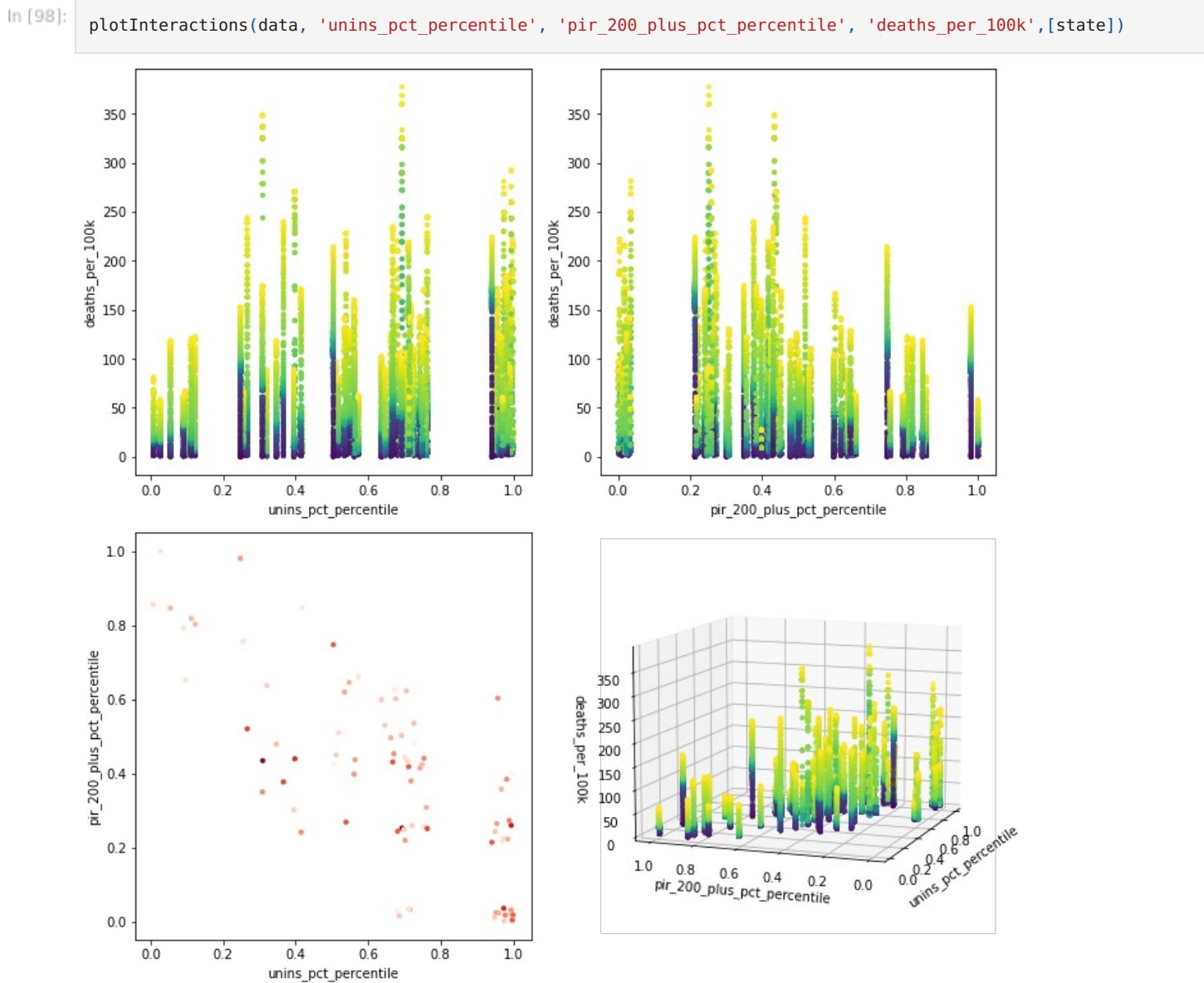


Figure 2.10.4.4: Population Density and Poverty Income Ratio > 200% Percentile

- The purple to yellow color gradient is the date, with yellow being the most recent
- The red color gradient is deaths per 100k people



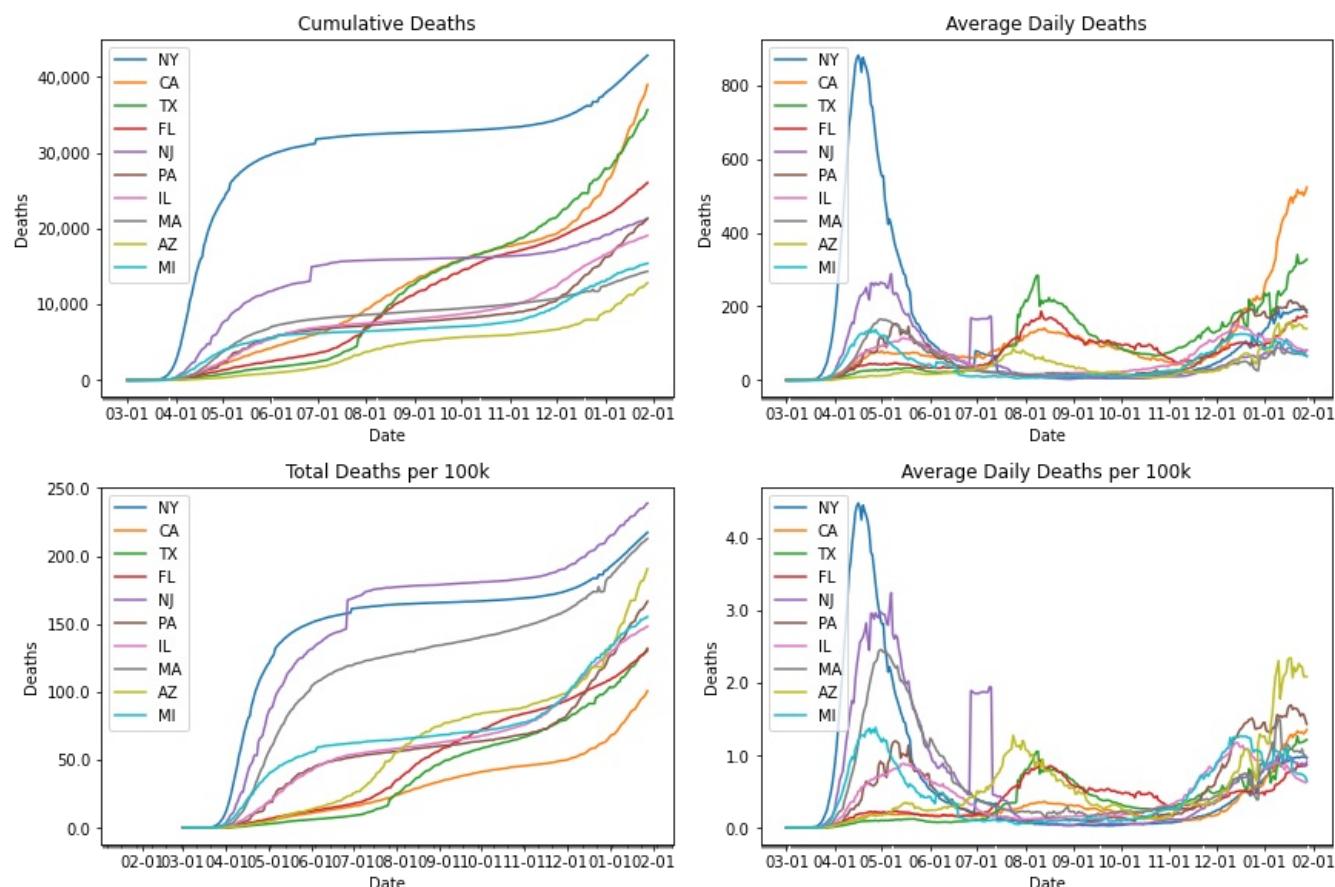
```
# # # #
```

Section 3: State Comparisons

```
In [99]: states = ['NY', 'CA', 'TX', 'FL', 'NJ', 'PA', 'IL', 'MA', 'AZ', 'MI']
```

Figure 3.1: Deaths - 14 Day Average

```
In [100]: statesCompare(data, states, 'confirmed_cdc', 'deaths_cdc', '2020-03-01', 14)
```



```
# # # #
```

Section 4: Univariate Analysis of County Death Rates

- Available fields: pir_grp, unins_grp, pop_density_grp, e_grp, r_b_grp, r_w_grp, age_55_plus_grp

```
In [101]: states = list(data.state_code.unique())
```

Figure 4.1: Population Density

```
In [102]: plotGroupedDeathCurves(data, states=states, rolling_ave=30, bycol='pop_density_grp', start_date='2020-03-01')
```

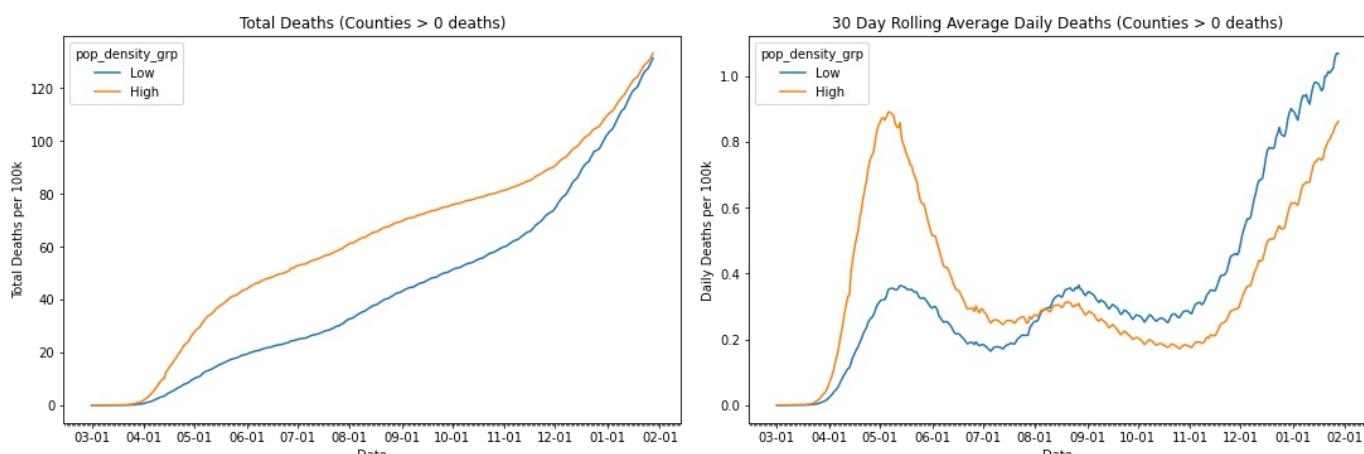


Figure 4.2: Race

The race definition used here is 'white' as reported in census data. Low would be 'non-white' and high would be 'white'.

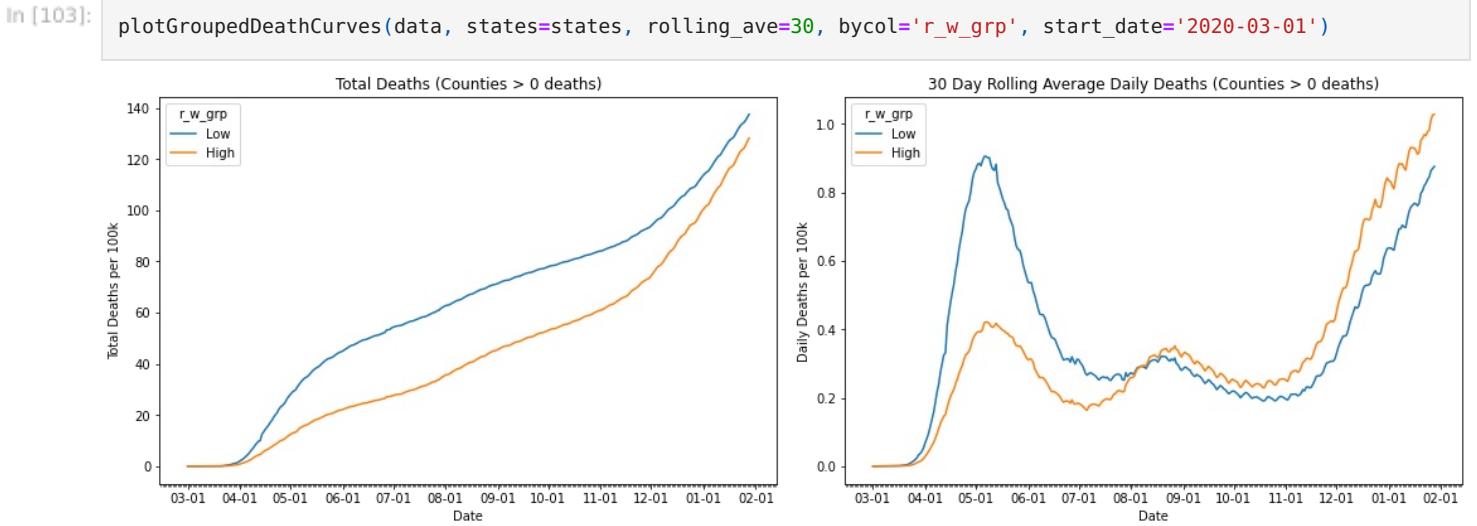


Figure 4.2: Uninsured

'Low' are the counties with the lowest percentages of uninsured individuals.

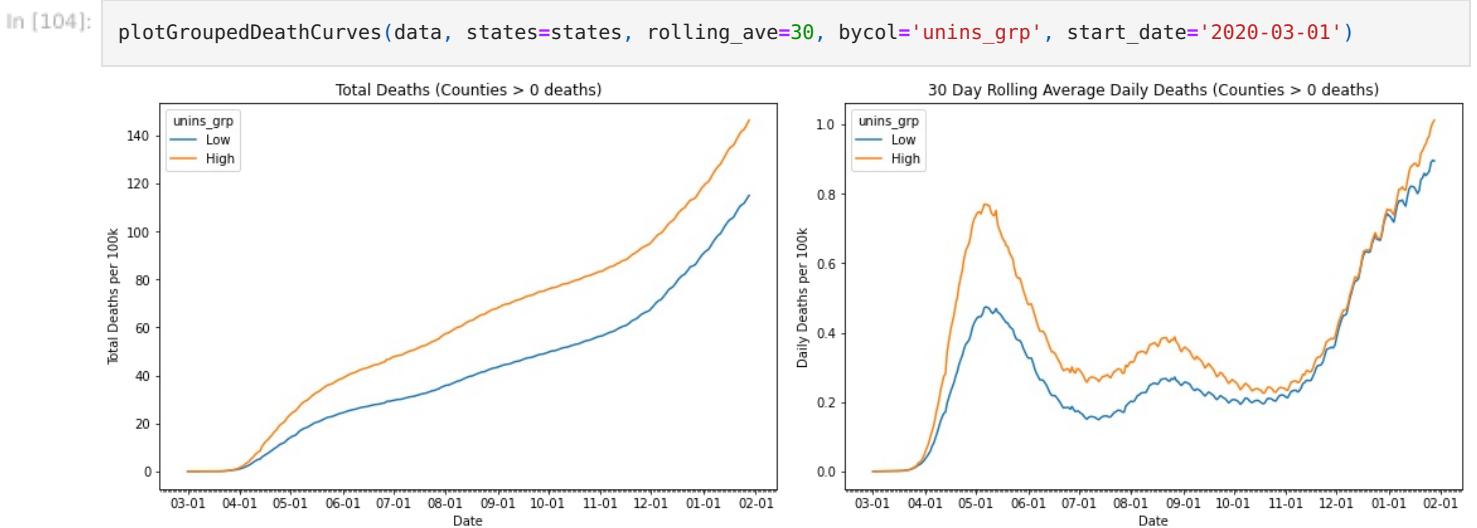
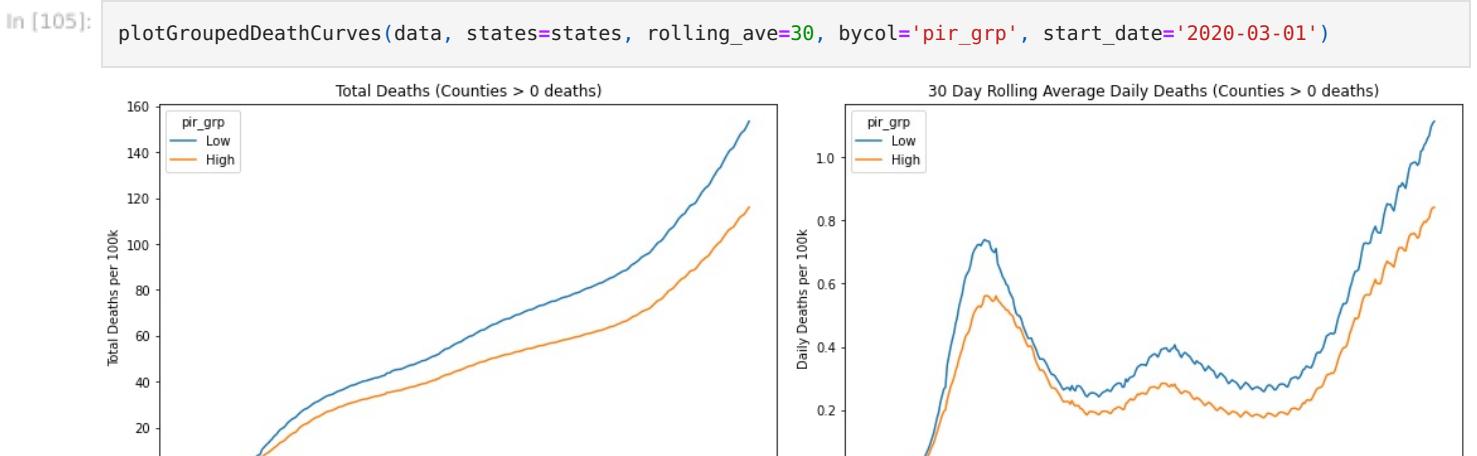


Figure 4.3: Poverty Income Ratio

'High' are the counties with the highest percentage of PIR > 200%



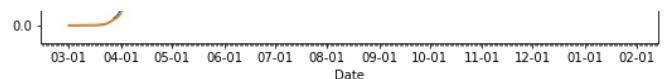
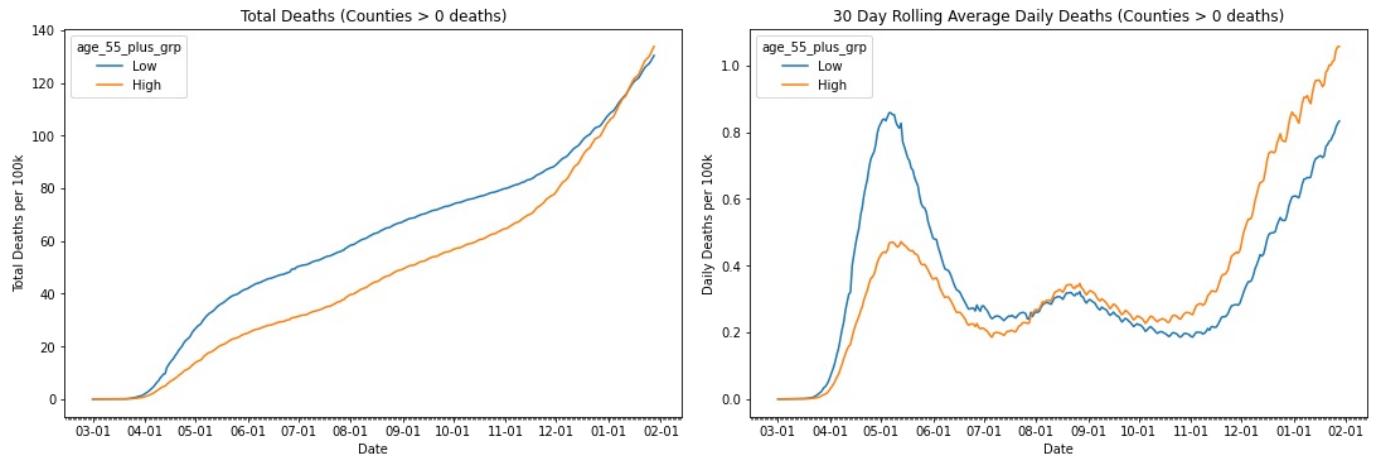


Figure 4.4: Age

In [106]:

```
plotGroupedDeathCurves(data, states=states, rolling_ave=30, bycol='age_55_plus_grp', start_date='2020-03-01')
```



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