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Comparing Factors to the Spread of Coronavirus in New Mexico Counties

Abstract

Coronavirus is a mild to severe respiratory illness that is spread through a multitude of factors, some more direct, while others hidden in the shadows. Comparing the spread of the virus throughout the New Mexico counties has shown that wealth plays a hidden role into the spread of coronavirus, but isn't a leading contributor. The counties with the highest total cases were in the average range of all the income per capitas. After normalizing cases by population, there is still a trend showing an increase to counties with higher population. Population density plays a large factor into the spread of the disease. Counties with high population per square miles are also counties with high cases of coronavirus. This further supports the Centers for Disease Control(CDC) recommendation to social distance at least 6 feet apart. Choosing to aid the major factors will lead to improving our battle against the spread of coronavirus. Using the factors shown to have positive correlations to the spread, we can aid specific groups that are suffering the most. This will make the most efficient use of our current resources to fight the disease as well as build lasting defenses against future diseases.

1. Introduction

Coronavirus is a disease caused from SARS-CoV-2, severe acute respiratory syndrome coronavirus 2. The disease spreads by entering through the nose and throat attaching itself to cells rich in cell-surface receptors. Once the virus has entered a cell, it begins to duplicate more virus cells thus spreading the disease further. The disease weakens the lung tissues causing tears and ruptures in the lungs. This can allow fluid into the lungs leading to pneumonia. Coronavirus blocks alveoli from receiving oxygen to the body (Wadman, Cousin-Frankel, Kaiser, and Matacic, 2020). A vaccine/cure has not yet been discovered, therefore the only treatment available for patients is to treat their restriction of oxygen. This begins with assisted oxygen and can lead into requiring a ventilator to breathe.

On January 20, 2020 the first confirmed case of coronavirus hit the United States in Washington. This confirmed that the United States was at risk for the contagious disease. As time progressed more and more cases began to appear. The virus continued to spread across the country. New Mexico had their first case in Socorro County on March 11, 2020 (Sackett, 2020). This was an elderly couple who recently traveled from Egypt. By April, there were 363 confirmed cases (Sacket, 2020). As of July 20, 2020, John Hopkins University of Medicine reported over 18 thousand confirmed cases in the state of New Mexico. We know that the disease is highly contagious and some factors that contribute. We know that the virus is spread through particles within our respiratory system and can be transmitted through aerosols (Lewis, 2020). As such, the CDC has informed the public to stay at home and if not possible, to stay at least six feet apart. Whenever it comes to rules, age plays a hidden factor. We can see that starting in the

beginning of the pandemic, those with older age and traveling were infected with the virus. Now that the virus has become more prominent and is spreading through the public, those still active are becoming sick. This age group is shown to be younger than the first victims, around the twenty to forty range. The only way to treat the infected is with hospitals. The number of hospitals in each county will play a factor to how well the virus is contained and will be shown in the numbers of deaths.

The goal of this research is to determine what factors play into the spread of coronavirus and how we can improve our defense against any future diseases. Understanding why certain counties are at higher risks and what actions could have been done to prevent them will help protect residents in New Mexico. We can use what we learn from this pandemic to help defend against the next pandemic.

2. Methods

I will be correlating confirmed total cases, new cases, and deaths to population, population density, population age, income per capita, and number of hospitals. I took nationwide data regarding coronavirus through NY Times' data collection. This collection contains information about registered coronavirus cases in every county in every state. I created a python script that downloads data from the NY Times data collection for all the counties in the U.S. After filtering and sorting information only pertaining to New Mexico counties, I was able to produce a county to county comparison in cases and deaths (see Appendix A Figures 1-3). The data was later standardized by date and plotted using Matlab's plotting library. Total cases will demonstrate how contagious the disease spreads and new deaths will portray the how effective the county's healthcare is. Counties with weaker hospitals show higher death rates. The new

cases display how effective our policies are. New Mexico partially reopened in July, and as such new cases spiked during this time. Bernalillo grew rapidly starting the month of July.

To counteract the fact that higher populated cities will have higher cases, I normalized the total cases by their respective county population. This population was taken from the United States Census from 2010 and estimated for the 2020 population (see Appendix A Figure 4). This US Census data also contains information regarding the population age, square footage, and their income per county. These factors were all compared to the growing rates of coronavirus. Using population I could compare whether higher population has more cases due to higher population or if higher population had no impact. To compare this, I normalized the total number of cases in a county by its respective population. US Census data only collects every ten years, so the data used was estimated by the US Census by their own factors. This provides us with a ratio or percentage of cases per populus which is reflected in an overall comparison of each county. If Bernalillo has higher cases because they have more people or because there are more factors that play a role into the spread.

Using the population density, I can determine if living in close proximities to each other correlates to higher cases. This has the underlying factor of the line of work involved. Cities are more likely to have closer proximity jobs such as business, retailers, office jobs. Counties with large plots of land, focused around agriculture, will be further spaced apart and separated from other humans. The number of hospitals a county has is their first line of defense against the disease. Counties with more hospitals and better equipment should show that they reduce the spread of coronavirus.

Population age is a factor I'm particularly interested in. Telling a group of elderly to socially distance versus telling a group of children to stay at home will highlight why age plays a role. John Nienstedt makes a remark that the disease has created a small battle between the old and the young (Nienstedt, 2020). Younger generations continue to ignore rules from both state and federal governments. They continue to gather and party. Days later they find they are confirmed positive for coronavirus. An example of this is 20 teens who tested positive for the novel disease after a party in New Jersey (Harmata, 2020).

3. Results

As of July 28, 2020, the top five counties with the highest cases were Bernalillo, McKinley, San Juan, Doña Ana, and Otero. All five of these counties have comparatively high populations (See Appendix B Figure 2). After normalizing each county by its respective population, the top five counties remained the top five counties. In fact, the list barely changes at all. This supports that the percentage of confirmed cases and the population is still higher than the rest of the other counties (See Appendix A Figure 4). This showed that higher populations do not directly correlate to higher cases. This leads to the next factor, population density.

Population density is an extremely strong factor. When I consider those top five counties (Bernalillo, McKinley, San Juan, Doña Ana, and Otero), they also have large population densities (See Appendix B Figure 3). The CDC urges the public to stay at home when possible and to avoid close proximities with others. In cases like Bernalillo, the population density is extremely high, thus leading to higher chances of coming into contact with another person. Looking at the tree map, there is a strong correlation between the population density and higher cases.

Population age is a weaker factor to the spread of coronavirus. Even in densely populated counties, counties with higher average age had much fewer cases than those with a younger average age. Bernalillo (38), McKinley (31), San Juan (35), Doña Ana (33), Otero (36) compared to counties which were also densely populated, but had significantly less cases. Counties like Santa Fe (45), Los Alamos (44), Valencia (39), and Sandoval (39) were all densely populated, but had lower registered cases. Age and maturity play a significant role when it comes to following rules. As mentioned before, a group of seniors are more likely to follow a stay at home order than a group of young teenagers. If fewer people socialized in close proximities and wore masks there would be a significant drop in cases.

Wealth is a factor that impacts many outcomes. I assumed being in a wealthier county provided better healthcare and more opportunities to stay at home which would correlate to lower cases. Individuals with higher wealth have less stressful environments and are often under less socioeconomic stress. The lower your socioeconomic status, the greater the risk of your physical and psychological health problems (Clay, 2001). Studies across sixteen different countries all showed signs that more wealth led to better health. The major point being that those with more wealth have better access to a country's resources (Semyonov, 2013). People with higher paying jobs often can work from home or take more vacation/sick/paid time off. Families living in lower socioeconomic status do not have the same options. Low income families living paycheck to paycheck may not have the opportunity to take time off or are laid off as a result of the outbreak. New York Times reports unemployment has reached over 36 million after the virus outbreak (Cohen, 2020). Although studies have proven that higher wealth has led to better health, that situation changes when the hospitals are over-packed with patients. High and low

income per capita counties have lower confirmed cases than those of the middle ranged incomes (See Appendix B Figure 1). The top five counties with the most cases in New Mexico, Bernalillo, McKinley, San Juan, Doña Ana, and Otero, each of these counties exhibit moderate or average income per capita, yet they have the highest number of cases. The lowest income counties Guadalupe, Luna, and Mora have significantly less confirmed cases than those with much higher income per capita. This contradicts the notion that more wealth leads to better health. Regardless if you have an above average income, the limiting factor is the hospitals. Hospitals require more equipment and more staff. When the virus continues to spread exponentially, the hospitals are already capped at their maximum capacities. Having more wealth in a situation like this does not benefit your health. Having a wealthier district may lead to better hospitals as a community, but the overspread patients are being treated anywhere and everywhere. This means that although you may be from a wealthy part of the county, you could end up in a hospital miles away due to low vacancy in hospitals.

4. Conclusions

In conclusion, the underlying factors of population density and population age impact the spread of coronavirus in New Mexico counties. Wealth and population play minor roles. Wealth was shown to not benefit wealthier counties and population was irrelevant as a whole. Having a large population, but with a larger county area showed less confirmed cases than counties with a high population alone.

Looking to our neighboring states, Arizona and Colorado had higher confirmed cases than New Mexico (See Appendix A Figure 5). Using what I discovered from the New Mexico counties, I compared their population density and their average age to see if this relation is true

in other states. Arizona, Colorado, and New Mexico have a population density of 61 , 53, 17, in people per square mile respectively. The average age of Arizona, Colorado, and New Mexico is 38, 37, and 37 respectively. There isn't a significantly large difference in the average age, but the large difference in population density explains why Arizona has significantly more cases than Colorado and New Mexico combined.

Major considerations should be done to understand that the number of test cases can affect the overall outcome of confirmed cases. A county will have at least the confirmed cases, but if not enough testing kits are available then the confirmed cases are at least what is discovered from the testing kits. There could be more cases in the county, but are not registered due to lack of testing kits.

Overall, we should make improvements and take action toward plans that will improve social distancing, enforce social distancing, and the public is made aware of what is expected. Hospitals need to get the support they need for equipment and staff, Businesses need to undergo remote work when possible and to keep social distance when possible. Society as a whole needs to look out for each other, both young and old. Keeping each other check, will help prevent further outbreaks. To prevent the spread of coronavirus, individuals need to reduce the amount of exposure they have with those infected. Lowering these percentages can be done by wearing a mask, socially distancing, staying home, and sanitizing common areas. In order for individuals to follow these rules, they need to have the option to stay at home, have the resources to take care of their families, and sanitize their surroundings.

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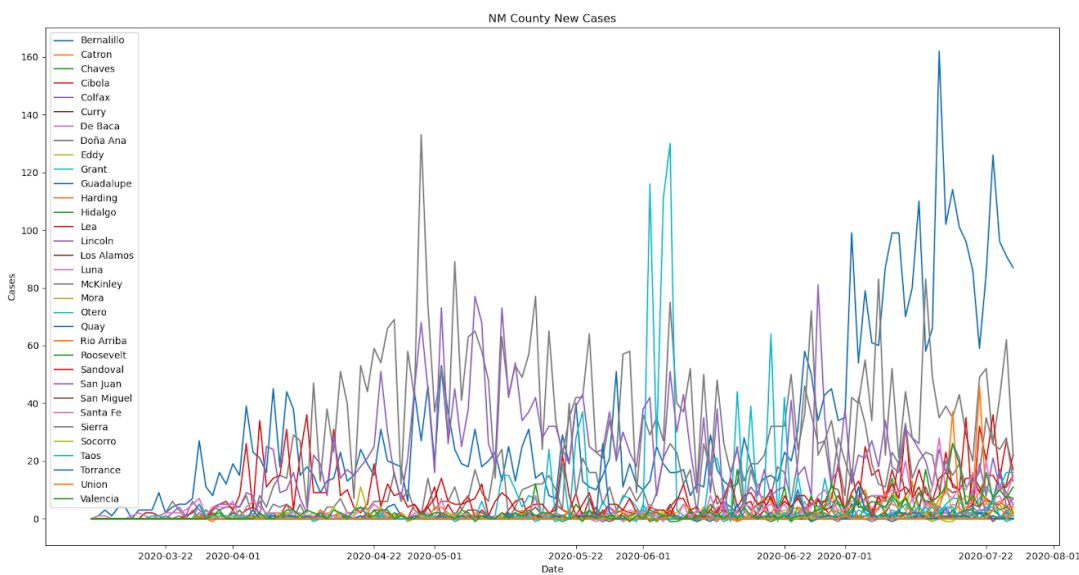
Appendix A

Figure 1
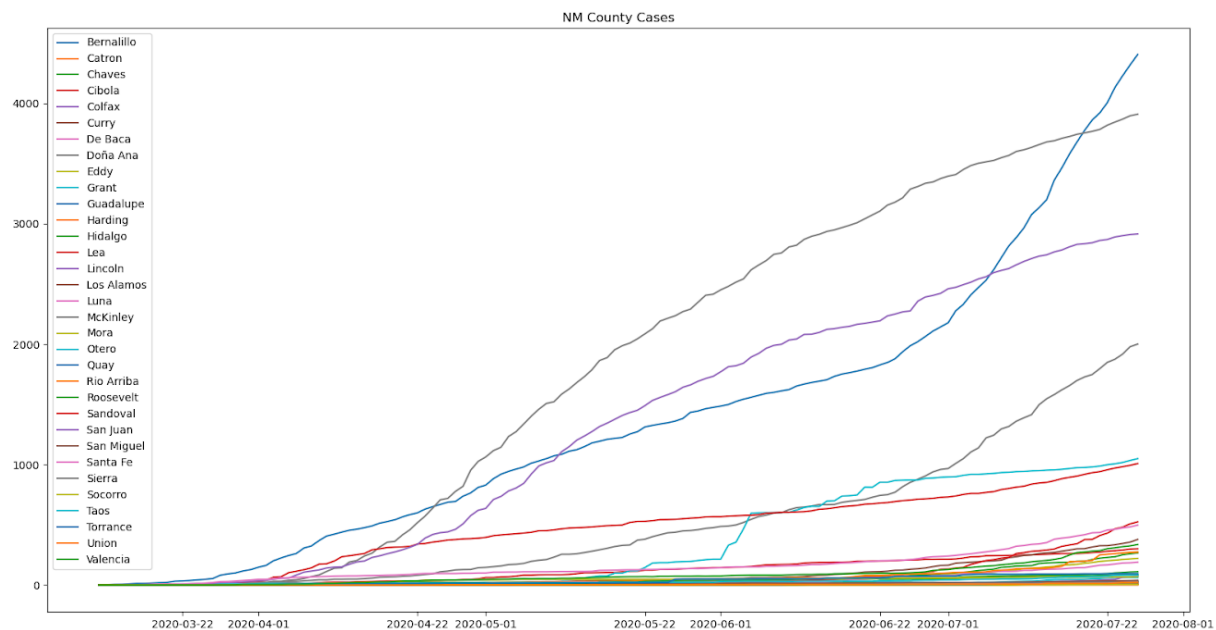
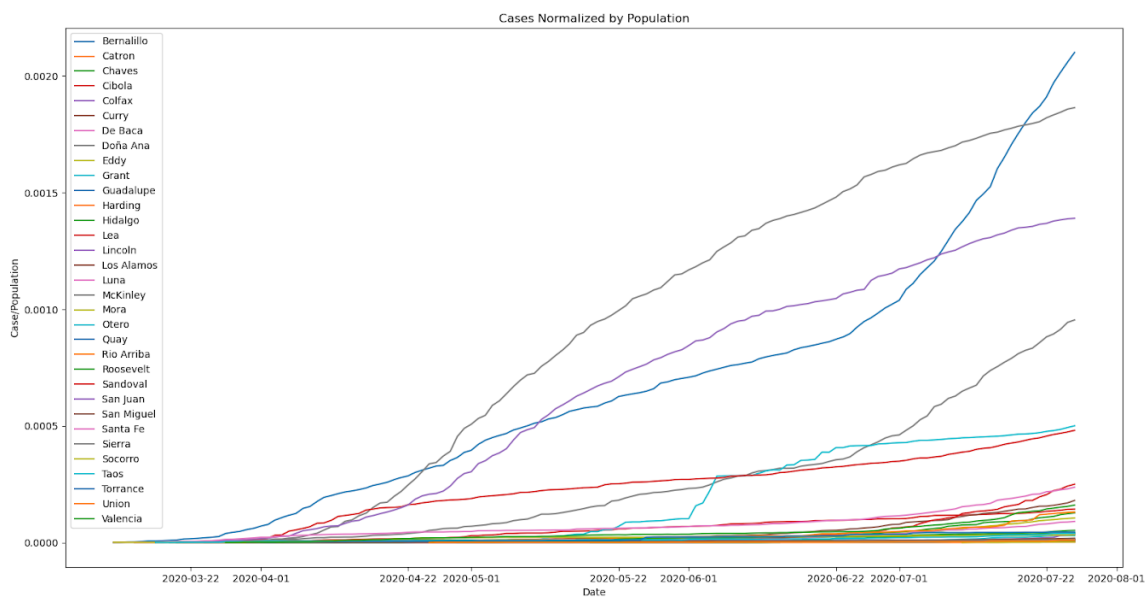Total confirmed cases by county.

Figure 2
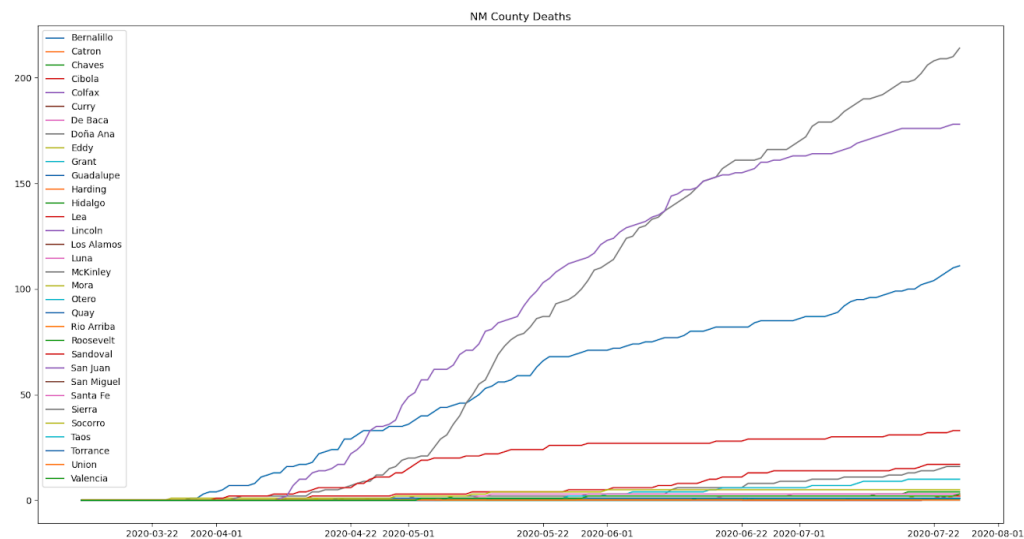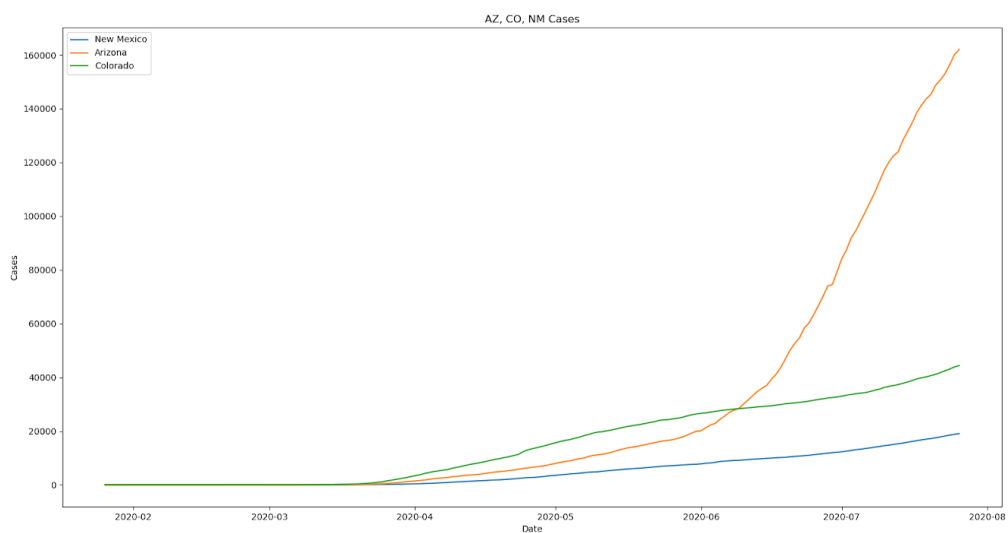

Total deaths by county.

Figure 3

New Cases by Day for each county.

Figure 4

Total confirmed cases normalized by population for each county.
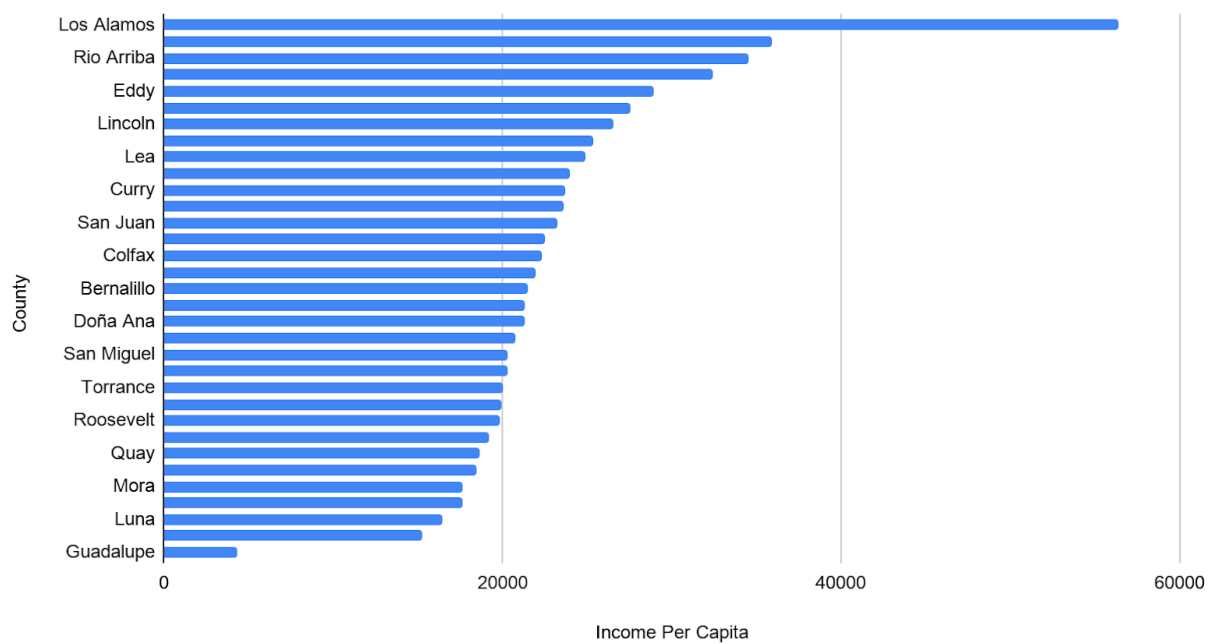
Figure 5

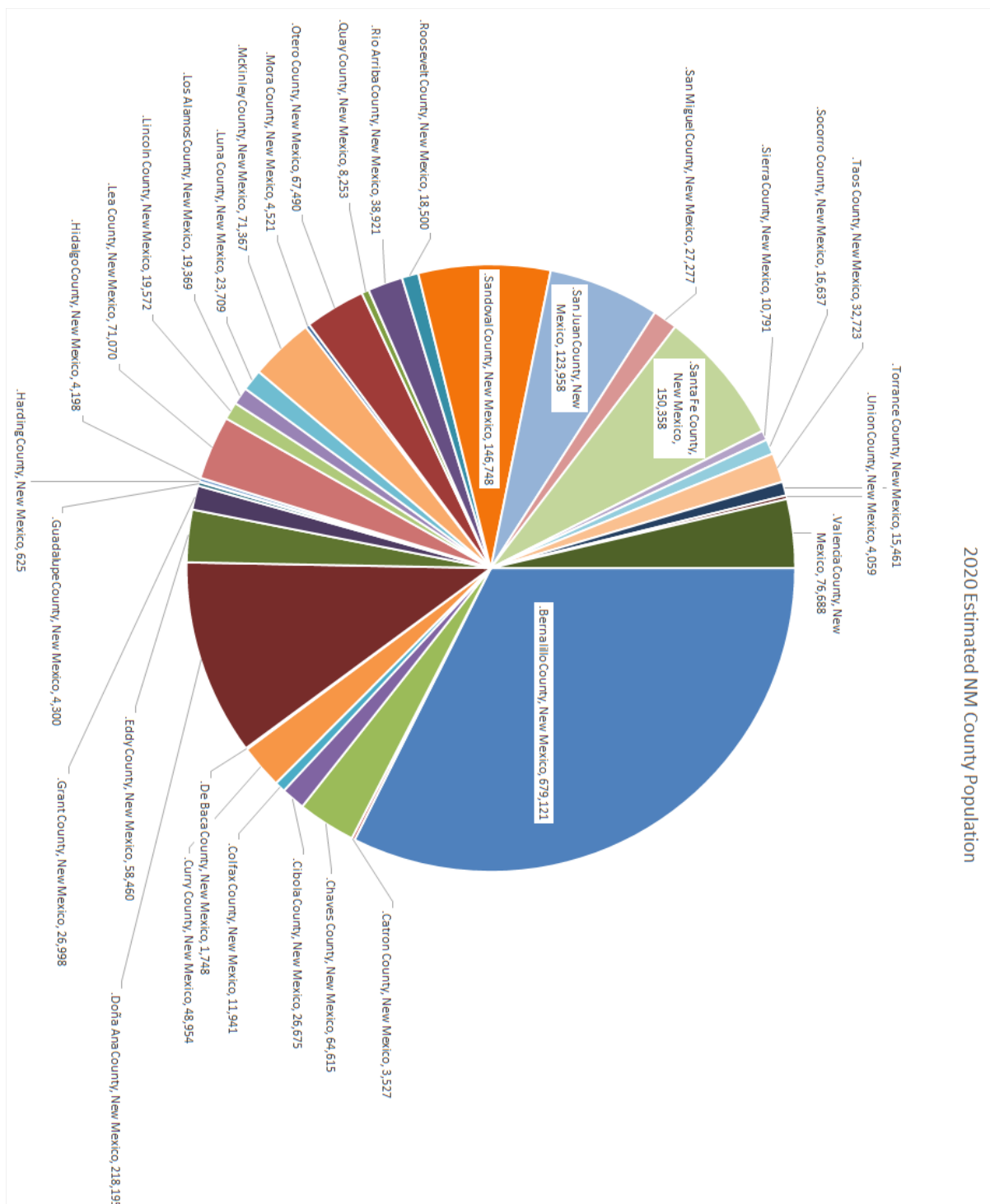Arizona, Colorado, New Mexico total case comparison.
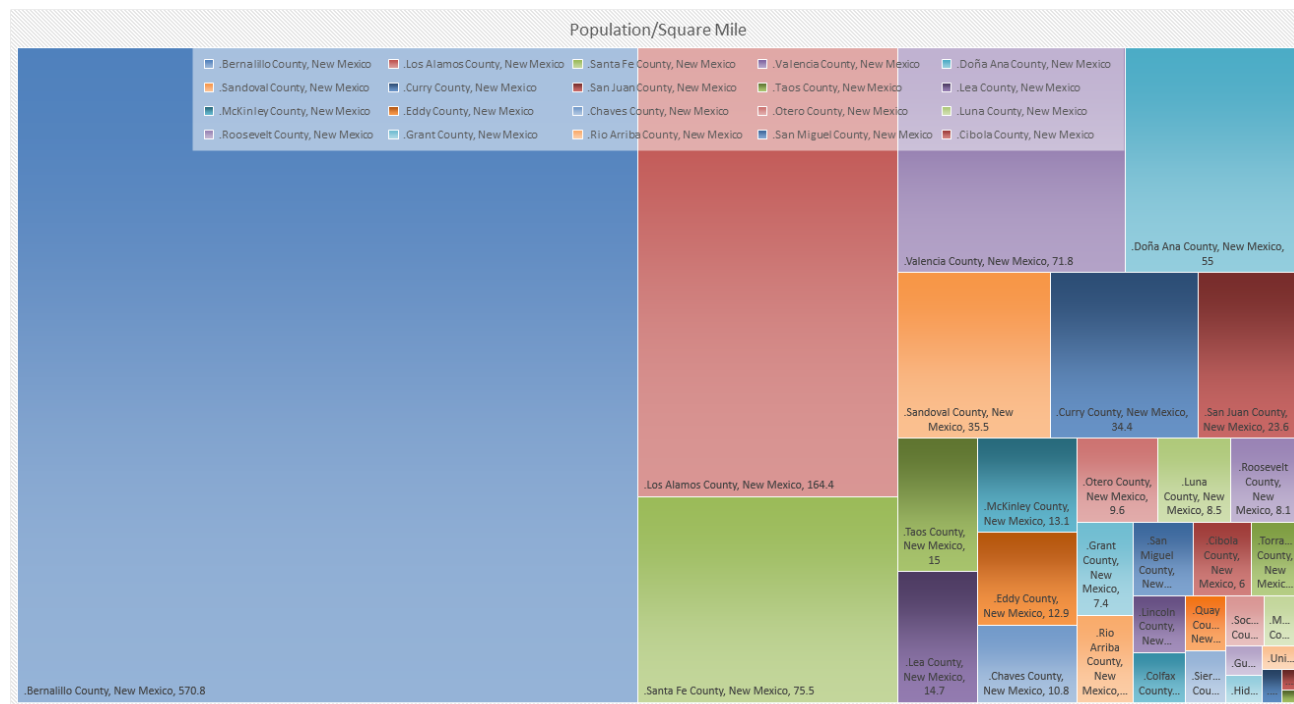
Appendix B

Figure 1

Income per capacity of each New Mexico County.

Figure 2

Pie chart comparing the population between New Mexico counties.

Figure 3

Tree map of population densities in New Mexico counties. The larger the area, the more people per square mile.