Homelessness & COVID-19 in Los Angeles County

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GEOG 176A
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Section 1: Project Summary

For our final project, we wanted to learn more about the homeless population in Los Angeles County in the context of the COVID-19 pandemic. We wanted to investigate the relationship between the homeless population and the accessibility of vaccination centers. We wondered: considering income and homeless shelter locations, do homeless populations in Los Angeles County have a lack of access to vaccination locations? The pandemic has affected many groups such as minorities and immunocompromised people. Over the course of the COVID-19 pandemic, the media has not emphasized the effect of COVID-19 on homeless populations enough. The homeless population in LA County is large so focusing on this population can help mitigate the spread of this disease. Our work is significant is because we can learn about disadvantaged communities and their reasons for not getting vaccinated. Homeless people may choose to not get vaccinated due to their distrust in the government. Our approach to finding a solution for this problem was to focus on the locations of vaccination locations in relation to homeless shelter locations, while looking at median household income. We created one map that focuses on the median household income levels and another that focuses on the density of homeless populations. We found areas in LA County with less vaccination centers, a higher homeless population, and low income level. This shows that homeless populations have a lack of access to vaccination centers in particular areas in LA County and where we can establish more vaccination centers in the future.

Section 2: Technical Details

Homelessness is a significant problem in Los Angeles County, which is the most populated county in California.[1] The estimated LA County population count in 2021 is 9,969,510 people.[2] LA County is a large, urbanized area with many metro lines, among other modes of transportation. The COVID-19 pandemic has greatly impacted the homeless population in LA County. In a NPR article from June 21st of this year, it was stated that LA's homeless count was reported to be 66,433 which is 12.7% higher than the reported homeless count from 2019.[3] This includes people living in the streets, in vehicles, and in homeless shelters.

Data Content	**Data File Name**	**Data File Format**	**Data Type**	**Data Source: Name of Provider**
SUD Recovery Treatment Facilities	SUD_Recovery_Treatment_Facilities	shapefile	Vector Points	California State Geoportal https://gis.data.ca.gov/datasets/63459617d2604decab840bd2ca047ee2_0/explore?location=37.651652%2C-120.635373%2C7.56
LA County Vaccination Locations	LA _County_COVID-19_Vaccination_Locations	URL - Shapefile	Vector Points	ArcGIS Online https://services1.arcgis.com/ZIL9uO234SBBPGL7/ArcGIS/rest/services/Possible_Sites_for_new_COVID_19_Vaccination_Site_WFL1/FeatureServer/1
Homeless Shelter Bed Gap Analysis	Homeless_Shelter_Bed_Gap_Analysis	URL - Shapefile	Vector Points	ArcGIS Online https://services9.arcgis.co

[1] Population of counties in California (2021). (n.d.). Retrieved December 10, 2021, from https://worldpopulationreview.com/us-counties/states/ca.
[2] Los Angeles County, California population 2021. (n.d.). Retrieved December 10, 2021, from https://worldpopulationreview.com/us-counties/ca/los-angeles-county-population.
[3] Scott, A. (2020, June 12). *Homelessness in Los Angeles County rises sharply*. NPR. Retrieved December 10, 2021, from https://www.npr.org/2020/06/12/875888864/homelessness-in-los-angeles-county-rises-sharply.

	_(2019)			m/2ynJbr9BE17vXxR8/arcgis/rest/services/Homeless_Shelter_Bed_Gap_Analysis_(2019)/FeatureServer/0
LA County Boundary	County_Boundaries	URL- Shapefile	Vector Polygon	ArcGIS Online https://services1.arcgis.com/ZIL9uO234SBBPGL7/ArcGIS/rest/services/Possible_Sites_for_new_COVID_19_Vaccination_Site_WFL1/FeatureServer/6
LA Tract Homeless Population Data	LATractHomelessPopData	URL - Shapefile	Vector Polygon	ArcGIS Online https://services1.arcgis.com/ZIL9uO234SBBPGL7/ArcGIS/rest/services/Possible_Sites_for_new_COVID_19_Vaccination_Site_WFL1/FeatureServer/8
ACS Median Household Income - LA County	Tract	URL - Shapefile	Vector Polygon	ArcGIS Online https://services.arcgis.com/RmCCgQtiZLDCtblq/arcgis/rest/services/ACS_Median_Household_Income_LA_County/FeatureServer

Figure A: Table displaying information about datasets used

For our analyses, we used six datasets which are shown in Figure A. Figure A displays the data file name, the data file format, data type, and data source links for each of the six datasets used for this project. Half of these datasets are point data and the rest of the datasets are polygon data. The first dataset is for the SUD Recovery Treatment Facilities, which are the California Department of Health Care Services Licensed Residential Facilities and Certified Alcohol and Drug Program locations. This dataset includes information about the specific treatment facilities, such as the ZIP code, address, phone number, service type, and target population. In order to display the recovery treatment facilities on our maps, we used the

“Address” attribute. The second dataset is for the precise locations of LA County COVID-19 vaccination sites which includes information about the type of agency and hours. For LA county vaccination locations, we used the attribute called “fulladdr” in order to display them on our maps. We displayed the vaccination locations on our maps using a red cross symbol. The third dataset is is Homeless Shelter Bed Gap Analysis which tells us the number of beds available per tract and the total homeless individuals. For this dataset, we used the “Count of Points” attribute and used graduated symbols. The fourth dataset is the LA County Boundary and we did not need to select specific attributes since it is vector polygon data. The fifth dataset is the LA Tract Homeless Population Data which includes information about the amount of homeless people, both unsheltered and sheltered, as well as percentages of people who are of a particular race. From this dataset, we used the attribute called “Total Homeless People” in order to do a vector overlay operation and create a map. The sixth and final dataset is the ACS Median Household Income for LA County which includes the median household income from the past twelve months. From this dataset, we used the “Median Household Income in the past 12 months (inflation-adjusted dollars to last year of 5-year range)” attribute in order to create the Income and COVID-19 map using vector overlay.

We applied several spatial analyses and used geoprocessing tools. We used the “Clip” feature to clip the data down to LA County. The “Clip” feature was specifically applied to the recovery treatment facilities data since it included data for all of California. We used “Vector Overlay” to intersect two data layers: the LA County Boundary and the LA Tract Homeless Population Data. We called the output feature class “LATractHomelessPopData_CountyBoundaries,” which became our new layer. We did this in order to better manage our data layers and practice the skills we learned in this class. We did a

geospatial query in SQL using the Tract dataset because this dataset included more data beyond LA County. After opening up the attribute table for Tract, we clicked on “Select by Attributes.” Then, we created a new expression in SQL and typed: County = ‘Los Angeles County’. Then, we created a new layer by clicking on “Make layer from selected features.” Also when we originally added our homeless shelter bed gap data to our map, it plotted shelters with zero available beds. In order to fix this and only show shelters with a positive number of available beds, we had to do a geospatial query that allowed us to select all of the rows in our data. We created a new expression that said: “Count of Points is greater than 0.” For the homeless shelter bed gap analysis, we chose the method called quantile with five classes. For the median household income by tract, we used the method called “manual interval” with four classes and we set the upper values for the intervals ourselves. We chose these methods and number of classes simply because these were the only methods that allowed us to depict the data nicely on the maps. When we tried using other methods and number of classes, our data was not distributed evenly on the maps and the maps did not seem interpretable. We also did spatial cluster detection, specifically Average Nearest Neighbor (ANN), for the vaccination locations and homeless shelter bed gap analysis; this spatial cluster detection was done in order to determine whether or not the data is clustered and if there is any randomness. We created scatterplots so that we can determine any patterns within the data and determine the level of correlation between variables.

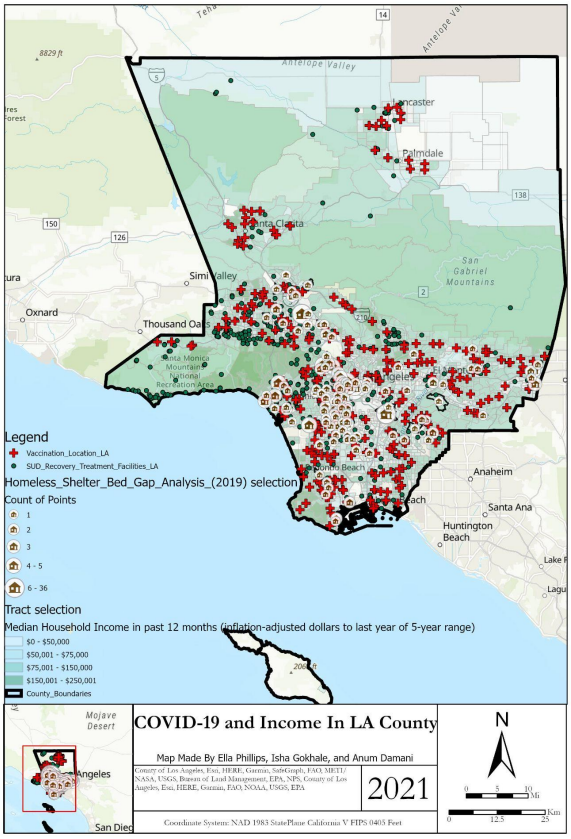

Figure B: Map Displaying COVID-19 Vaccination Centers, Homeless Shelter Bed Gaps, and Median Household Income in LA County

The first map we created is Figure B, which is a thematic map displaying the COVID-19 vaccination centers, homeless shelter bed gaps, median household income by tract, and county boundary. We used the NAD 1983 State Plane Coordinate System which is the best coordinate system for the zones in LA County. The median household income by tract is a vector polygon layer and we increased the transparency so that the vaccination locations, treatment facilities, and city names are easier to see on the map. We used graduated symbols to represent the homeless shelter bed gaps. The green dots represent the recovery treatment facilities and the red crosses are the vaccination locations.

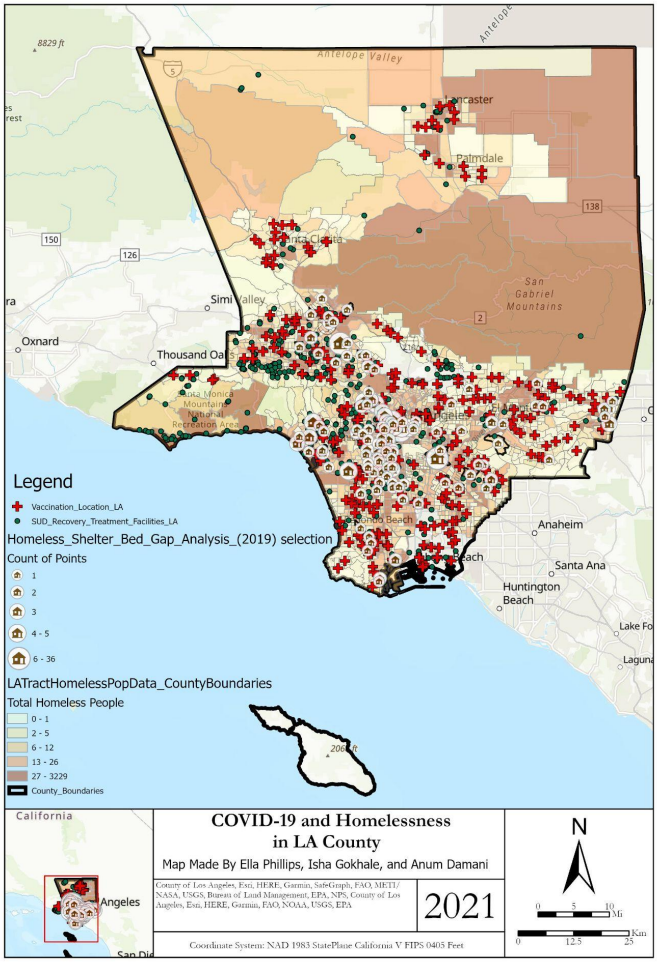

Figure C: Map Displaying COVID-19 Vaccination Centers, Homeless Shelter Bed Gaps, and Total Homeless People in LA County

The second map we created is Figure C, which is a thematic map displaying the COVID-19 vaccination centers, homeless shelter bed gaps, total homeless people by tract, and county boundary. We used the NAD 1983 State Plane Coordinate System which is the best coordinate system for the zones in LA County. The total homeless people by tract is a vector polygon layer. Similar to the process of creating Figure B, we had to increase the transparency so that the vaccination locations, treatment facilities, and city names are easier to see on the map. In this map, we also included graduated symbols to depict the homeless shelter bed gaps. The green dots are the recovery treatment facilities and the red crosses are the vaccination sites.

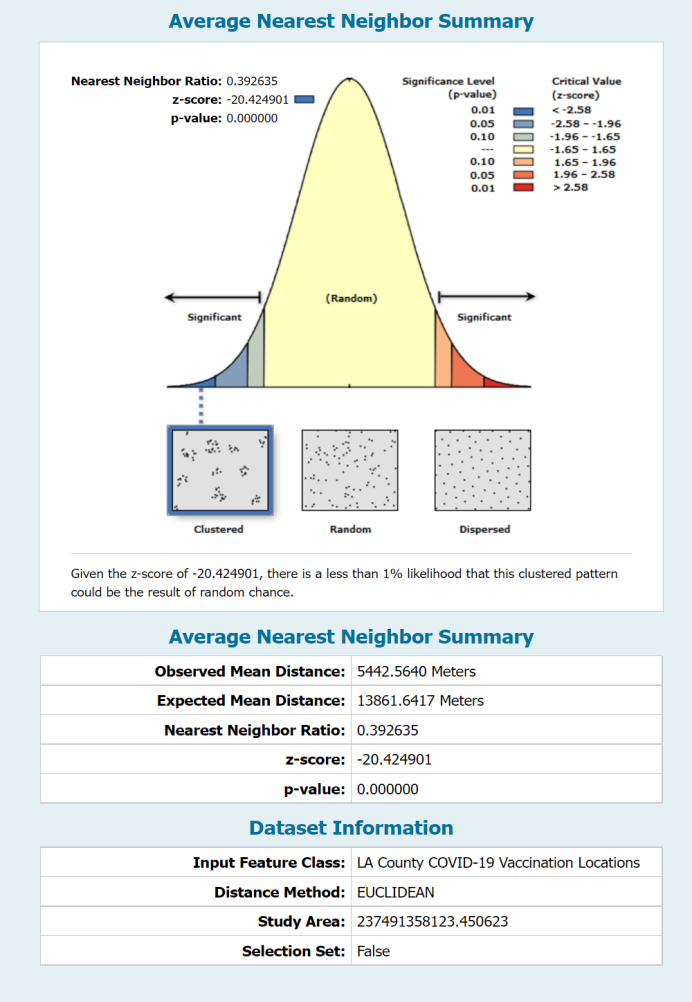

Figure D: ANN Result for LA County COVID-19 Vaccination Centers

Figure D is the ANN result for LA County COVID-19 vaccination centers. We wanted to perform the Average Nearest Neighbor Analysis to see whether vaccination locations are purposefully placed where they are or if there is any randomness involved. Since the p-value is zero, there is no randomness. Also, these vaccination centers are clustered and this is shown by the Nearest Neighbor Ratio. The Nearest Neighbor ratio is 0.392635, which is a value that is smaller than one. Since there is no randomness involved in the placement of these vaccination locations and they are clustered together, a possible solution to increase accessibility for homeless people is to spread these locations out more.

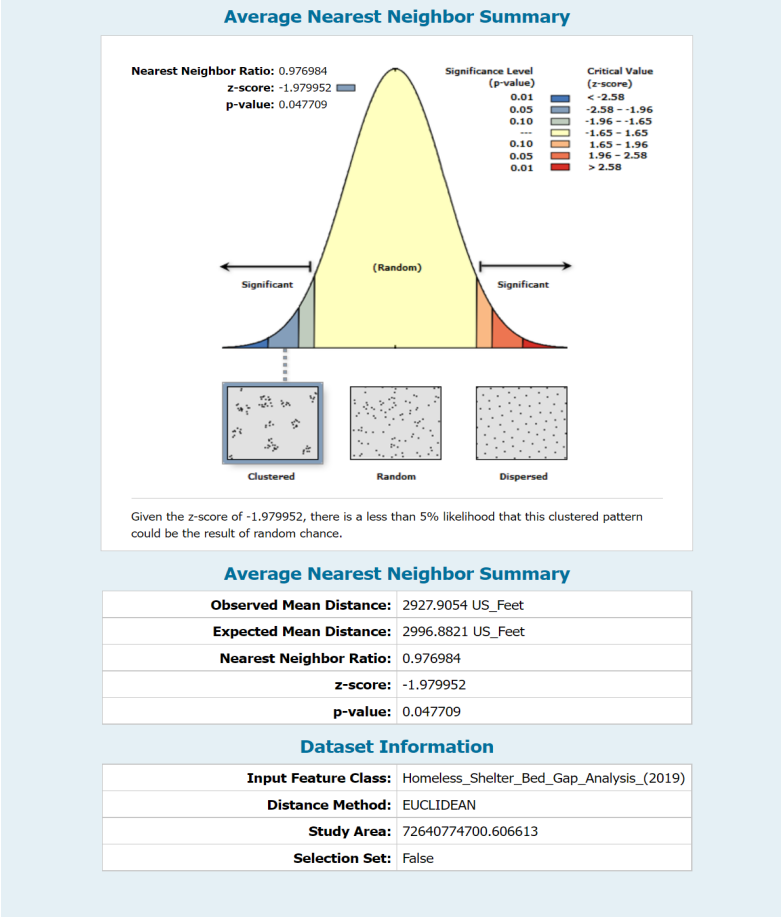

Figure E: ANN Result for LA County Homeless Shelter Bed Gap Analysis

Figure E is the ANN Result for the LA County Homeless Shelter Bed Gap Analysis. The p-value is 0.047709 which is approximately 0.05; this indicates that there is some randomness involved. This makes sense because every homeless shelter may not have the same capacity and some shelters have more available beds than others. This ANN result also reveals that the homeless shelter bed gaps are clustered.

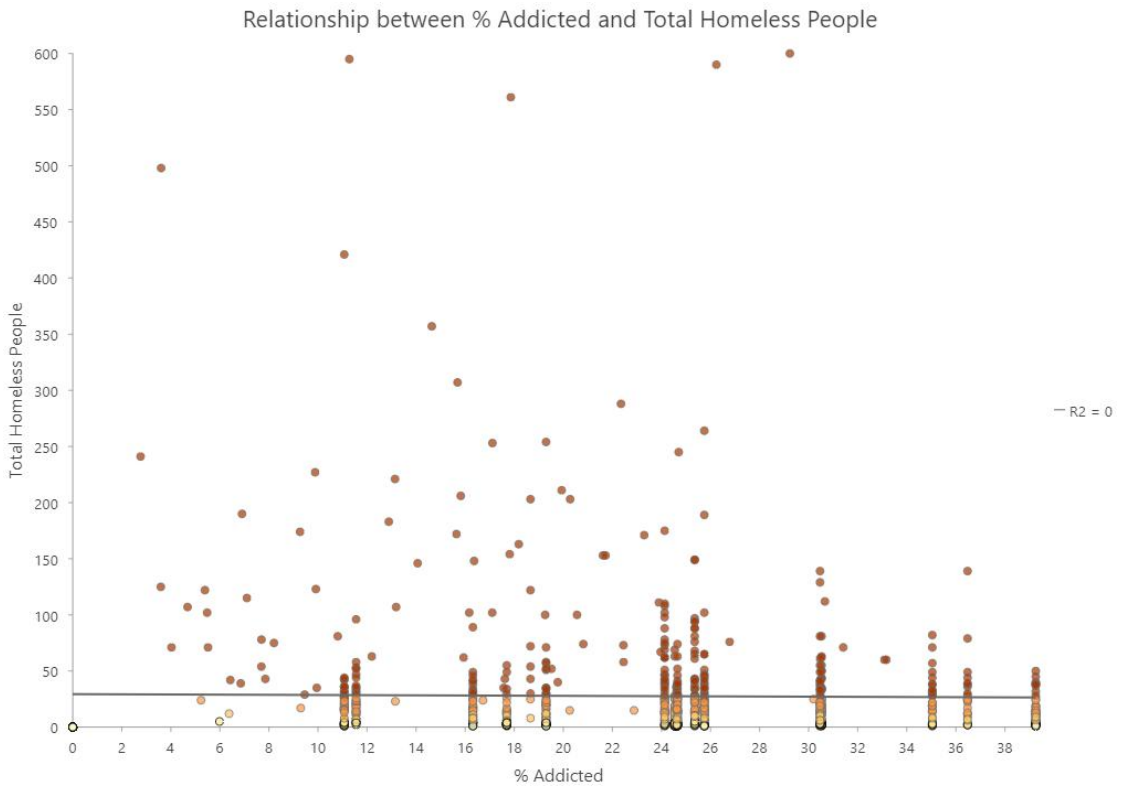

Figure F: Scatterplot of % Addicted and Total Homeless People

Figure F is a scatterplot created with the LA Tract Homeless Population data. When I initially created scatterplots with this dataset, there was an outlier that was skewing my results. I had to do a geospatial query to delete this outlier from the dataset and rerun my analysis. The "% Addicted" variable refers to the percent of people in LA County that suffer from addiction. The slope of the trend line is -0.07367, which indicates an inversely proportional relationship between the two variables. The y-intercept is 29.38474. The R^2 value is 0.0001812613608, which is essentially zero. This means that there is no correlation between the two variables.

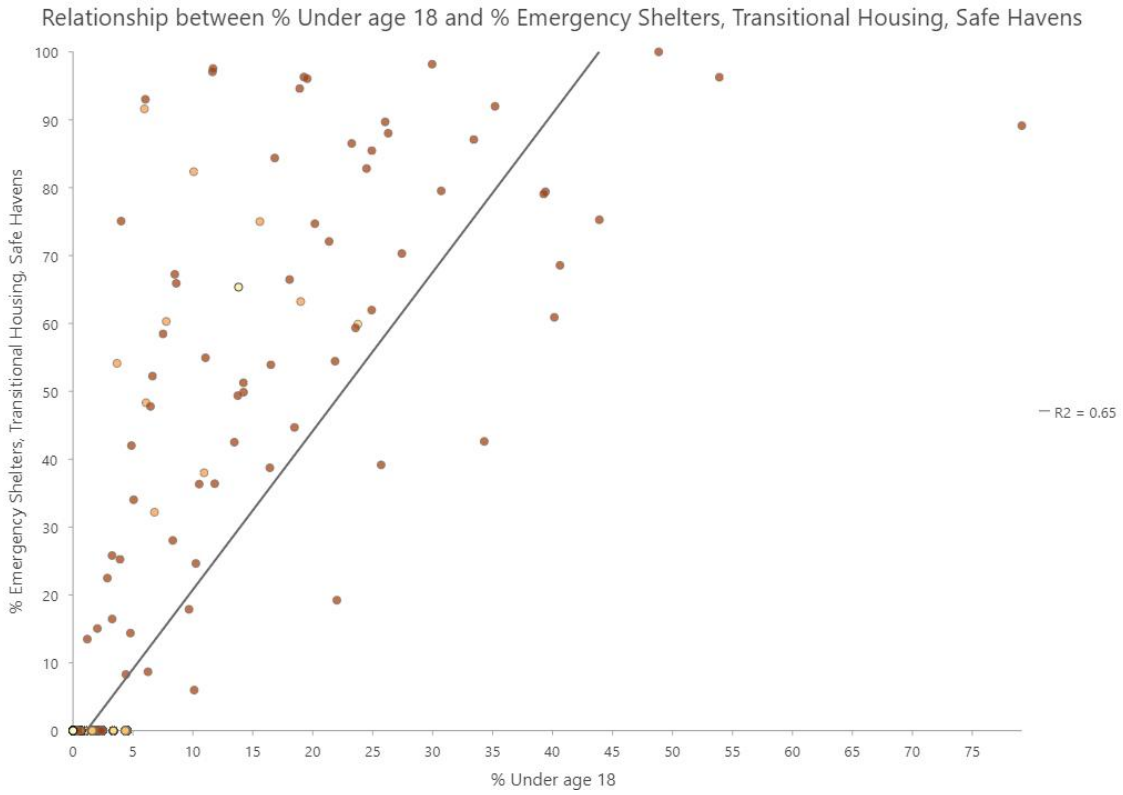

Figure G: Scatterplot of % Under 18 and % Emergency Shelters, Transitional Housing, and Safe Havens

Figure G is a scatterplot created with the LA Tract Homeless Population data. The slope of the trend line is 2.33878, which indicates that there is a proportional relationship. The y-intercept is -2.62487. The R^2 value is 0.6493149845. Census tracts with a higher percentage of people under 18 years old are strongly, positively correlated with census tracts that have a higher percentage of emergency shelters, transitional housing, and safe havens.

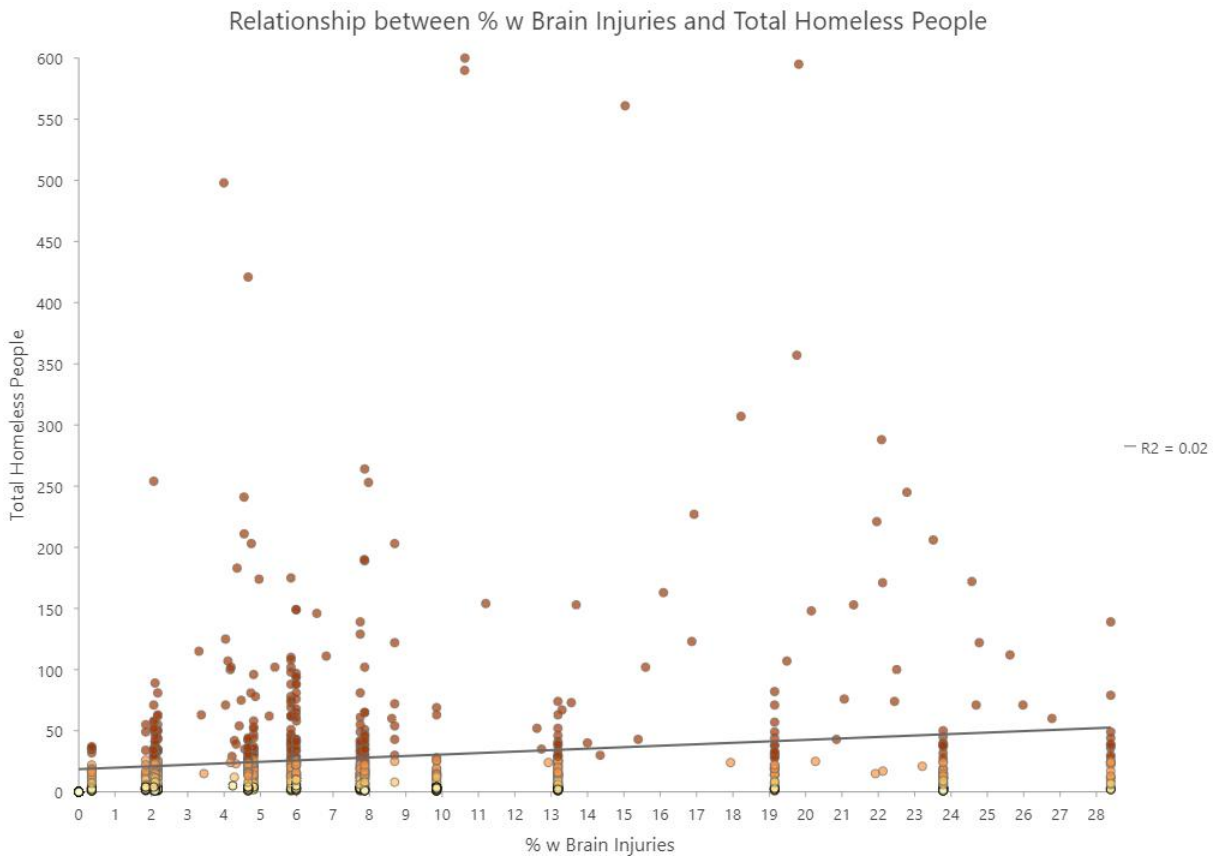

Figure H: Scatterplot of % with Brain Injuries and Total Homeless People

Figure H is a scatterplot created with the LA Tract Homeless Population data. The slope of the trend line is 1.19819, which indicates that there is a proportional relationship. The y-intercept is 18.60047. The R^2 value is 0.02485201116. This means that there is no strong correlation between census tracts with a higher percentage of people who have brain injuries and total homeless people.

My role in this project was to gather the datasets, help create the maps in ArcGIS Pro by completing spatial analysis on the data, and complete the statistical analysis. I worked on creating the two maps using the geoprocessing tools, making the scatterplots, and generating the ANN results in ArcGIS Pro. This is the link to my Google Drive with all of my project materials: https://drive.google.com/drive/folders/132rOLQKytUgtzSys3i526qHR6FxIdCCE?usp=sharing

Section 3: Conclusion

Overall, I think that my group was successful because we were able to determine homeless populations in LA County that may lack access to vaccination centers. By comparing the specific areas in LA County in the two maps we created, we can determine the median household income levels and total homeless people. We are also able to identify the areas in which vaccination locations are located and determine whether they are in poor or wealthy areas. We came to the conclusion that for some homeless populations in LA County, there may be a lack of accessibility to homeless shelters. Through our ANN analysis, we learned that the vaccination locations are not randomly placed in those areas. So, in order to create more accessibility for homeless populations, it is necessary to spread out these vaccination centers or establish new vaccination centers in areas that lack them. It is important to note that we do not have correct estimates of homeless populations in LA County but these are proxies. It is highly possible that many homeless people and tents/encampments/trailers have not been accounted for in the datasets that we used. This means that we need to be careful with making overgeneralizations or assumptions based on our results.

To improve our project in the future, we could make a bivariate chloropleth map. At the beginning of our project, we were struggling to display median household income and homeless populations on a single map without making the map look too crowded. This is why we decided to create two maps. A bivariate chloropleth map would solve this issue because we would be able to show median household income and homeless populations on a single map. Instead of a legend, we can have a square with multiple classes. The large square would be comprised of sixteen small squares with different colors. The upper left corner of the large square would be green, which indicates low median household income and less homeless people. The upper right

corner of the large square would be purple, which indicates high median household income and less homeless people. The lower left corner of the large square would be yellow, which indicates low median household income and a lot of homeless people. The lower right corner of the large square would be red, which indicates high median household income and a lot of homeless people. We could also do more research on the specific actions that homeless shelters are taking to help get homeless people vaccinated. In many areas of LA County with low median household income and high numbers of homeless people, there are homeless shelters that are very far away from vaccination centers. We can try to determine whether or not these homeless shelters provide transportation that would help homeless people reach vaccination sites. Then, we can add this data to our datasets so we can do more analysis. We could have done more analysis with the recovery treatment facilities since we mainly focused on the COVID-19 vaccination centers.

Over the course of completing this project, I learned that research is a long process and redirection can lead to insightful discoveries. Initially, we had collected over sixteen datasets which was very overwhelming. At the start of the project, we wanted to compare the homeless population in LA County in 2019 to the homeless population in LA County in 2021 to see the effects of COVID-19 on this group. We had to make critical decisions and narrowed down to six datasets. I think that this redirection allowed us to do more purposeful research since our topic became more clear. Through this process, I encountered many challenges. We learned many tools and spatial processes in this class so it was difficult to quickly determine which tool or process was most suitable to use in certain situations. However, through teamwork, my group members and I were able to apply the knowledge we gained in this course in order to achieve our goals for this project. If I had to redo this project, I would start off with a more specific idea and gather a few datasets. I believe that we made a mistake by starting off with a broad idea and gathering

over sixteen datasets because we had to make many changes along the way. Having a more focused goal and creating a specific problem statement before we started the project would have been more beneficial in the long run.

Section 4: Career-Readiness Component

If I had to describe this course to my friend, I would say: "GEOG 176A allows students to learn the principles of GIS, display spatial data clearly on maps, and investigate real-world, spatial problems."

If I had to describe how what I learned in this course could contribute to the society or community in which I am involved, I would say: "I can better identify spatial problems within my community and use GIS tools and spatial operations to find effective solutions."

If I had to summarize how what I learned in this project could apply to my future career in research or GIS industry, I would say: "This project better prepared me for a geospatial data science career because I was able to gain skills in map making and perform statistical analyses."

If I were to interview for a GIS position and needed to describe how I would articulate my readiness and qualifications for that position, I would say: "Through this course, I became familiar with ArcGIS Pro and applied its geoprocessing tools, such as the clip and intersect tools, in order to do spatial analyses. Now, I have a good understanding of how to create properly-labeled, thematic maps that effectively convey information to diverse audiences. I can perform geospatial queries in ArcGIS Pro using SQL. I know how to perform pattern analysis in ArcGIS Pro such as spatial cluster detection using Average Nearest Neighbor. I can do statistical analysis in ArcGIS Pro by using the scatterplot function and determining the strength of the correlation between variables."