

A GIS Analysis for the use of the Texas Hospital Association

As instructed from THA management, I have researched, organized, and have produced a series of GIS-assisted maps for the THA to receive a better view of how current Mental Health Hospitals are currently dispersed throughout the state. The purpose of the maps is to help visualize areas that are currently lacking a mental health facility but are have characteristics indicating they would benefit from the establishment of one. As mental health becomes more and more understood and less stigmatized every year, more people will feel inclined to ask for help; these maps and conclusions are designed to establish hospitals in areas that can answer that call for help to the most people and ease their burden of travel expenses.

Before I begin with the analysis of the maps, I want to layout some constants that are used across each map for the sake of not having to reiterate them for each one later. The first is that red crosses represent each hospital location (or potential location for Map 5), the second is that the circles of various colors surrounding each hospital are all 30 mile radiuses meant to display reasonable travel distances for patients to a facility. The data used for the map is from the 2010 US Census, so it should be recognized that 8 years of demographic shifts have occurred since then. It should also be noted that each of the maps are dot density maps that vary based on what demographic the dots represent. I felt dot density visualizations would be most appropriate since it would show an accurate display of how much of a community a hospital could reach based on where it's placed. Additional choropleth maps were prepared, however the information given from them were redundant and also not relevant to the final recommendations since they (the

recommendations) relied on the total number of people within an area regardless of the rate they exist at.

The first map in this analysis is designed to show the location and reach of current mental health hospitals to the general population of Texas. This map acts as a good foundational frame of reference for map viewers as they can see the areas and populations of Texas that do and do not currently have access to mental health care. It allows us to sort our minds to recognize potential areas to analyze once demographic variables are introduced, to see whether they're respective numbers increase or decrease in the area. 4 potential areas of interest from visuals alone are found in Austin, a strip of land just southeast of DFW, Abilene, and El Paso.

The 2<sup>nd</sup> map in the series is a dot density map meant to show the specific geographic diffusion of those living under the poverty line in the state. The people and communities should be of priority when considering how to best provide mental healthcare access to the state. Poverty is often a catalyst to destructive behaviors that can inhibit decision-making skills and deteriorate mental cognition. Providing access to these areas could be a step towards reducing the scope and depth of the poverty cycle in Texas. Unsurprisingly, the majority of poverty population clusters exist near or within urban cores, however not all urban cores have mental health facilities as shown from the map, most obvious of them being Austin. The same areas are used for the large scale inset maps except College Station is visualized instead of southeast DFW.

The 3<sup>rd</sup> map in the series displays the geographic diffusion of Texas' non-Hispanic black population. The reason behind visualizing this specific demographic is that many black Americans lack access to proper mental health facilities, which can be correlated to

their higher and disproportionate rate of poverty in their communities, which can partly be attributed to historical systemic discrimination. If its any indication, many of the areas in the second map with high concentrations of poverty are also areas found in this map to have high concentrations of black Texans. Providing access to proper mental healthcare access to these communities can be work to ameliorate a problem much larger than just lack of mental healthcare, the service to them could be a stimulant for positive community growth that's built upon individuals who now have stronger mental fortitude. Areas of key consideration found in the inset maps are once again Austin, College Station, Abilene, and El Paso.

The 4<sup>th</sup> map in the series is the last geo-demographic variable I chose to visualize, which was the geographic diffusion of US armed forces veterans. I chose this variable because as it stands in 2018, many veterans lack access to proper mental health services, namely due to the inadequacies of the VA which has been marred with inefficiency, ineffectiveness, and corruption for several years. Apart from the moral and ethical failure of government services and the dilemma that alone poses, what is left unattended and forgotten are the thousands of veterans living with poorly treated or untreated cases of PTSD. Left uncared for, individuals suffering from the disorder are increasingly a potential threat to those around them and more commonly a threat to themselves. Providing access to proper services to people who have sacrificed their safety and wellbeing for the country should be of premiere concern, not only to management, but also for Americans as a nation with dignity. Areas for consideration due to high concentrated populations of veterans are the same as before: Austin, College Station, Abilene, and El Paso.

The final display of the series is a map showing my final recommended locations for new mental health services based off of the aggregated analyses and insights gained from the previous 4 maps. The 3 locations I have recommended are Austin, College Station, and El Paso. The primary driving force behind this reasoning is that these locations not only have high general populations that are currently beyond the reasonable distances of other mental healthcare facilities, but they also have higher populations of the variables I chose. Despite some areas having higher rates of variable demographic levels, the overall market size for the area was still much smaller. It makes much more sense, at least in a utilitarian view, to place these new hospitals in areas that can serve the largest number of at-risk individuals. The dots on this map are actually the same as the first map, which showed total population. Incorporated into the map to give more context is a table displaying the estimated populations for each of the 3 new location's 30-mile buffers. These numbers can be used for a number of analyses, perhaps most critical down the road being the market capture rate of the hospital, which is simply the number of patients they attend to divided by the total market size of the area they serve. It should also be noted that the location could be located anywhere within that buffer, the point chosen is simply the official XY coordinates for each city respectively. I believe Austin and College Station locations would be particularly successful financially since they would both be in proximity to large universities with a growing college-educated labor market, which the hospital can hire from and fit into the overall agglomeration economies. Although I'm unsure of the financial aspects of an El Paso location, the high counts of both poverty and veterans are high enough to indicate to me that this area is in dire need of these services especially due to the fact that the nearest hospital currently is 100+ miles away. If these plans are rolled out

effectively, I believe great improvements in overall quality of living will improve across each of the cities.

### Methodology

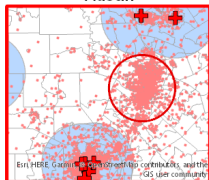
A handful of methods were used to visualize this data within ArcGIS. I began by having to sort the data to show only mental health hospital locations, which I accomplished by querying for hospitals that excluded the text “mental” and then inverting the search results so that I would be left with just mental health hospitals. After that I created 30-mile buffers with the buffer tool for each location to display reasonable travel distances for patients. Next I visualized the data to show appropriate dot densities after reading through the accompanying codebook from Brown University to make sure I was using the correct columns. These techniques were used for each of the maps, however additional techniques were used to find population estimates for the new location buffers on Map 5. To accomplish that I had to use area-weighted interpolation using the “Add Geometry”, “Intersect”, and “Dissolve” tools to give me the numbers to produce the table on Map 5. In regards to cartography, I chose to use the a dark base for each basemap because I felt it best accentuates the area of focus, in this case the state of Texas. For established hospitals, I chose to use a red cross, which is a universal sign for healthcare, the last map however has white crosses because I wanted to differentiate between “established” and “established” locations. I chose to use red and white together as well since that also pairs well with the theme of the maps. The colors of the different dots and buffer circles were chosen based on what colors appeared best in comparison to the buffers. Included in each inset map are red circles to focus viewer’s eyes on the location I’m referring to. Lastly, included in each map are north arrows and scale bars to help orient new viewers if they were struggling at all.

## Population of Texas in Relation to Mental Health Service Facilities

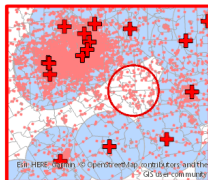
### Legend

- + Mental Health Facility
- 1000 People

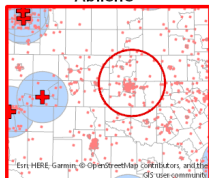
Austin



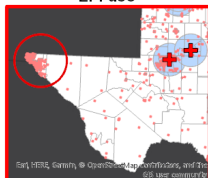
Southeast of DFW



Abilene



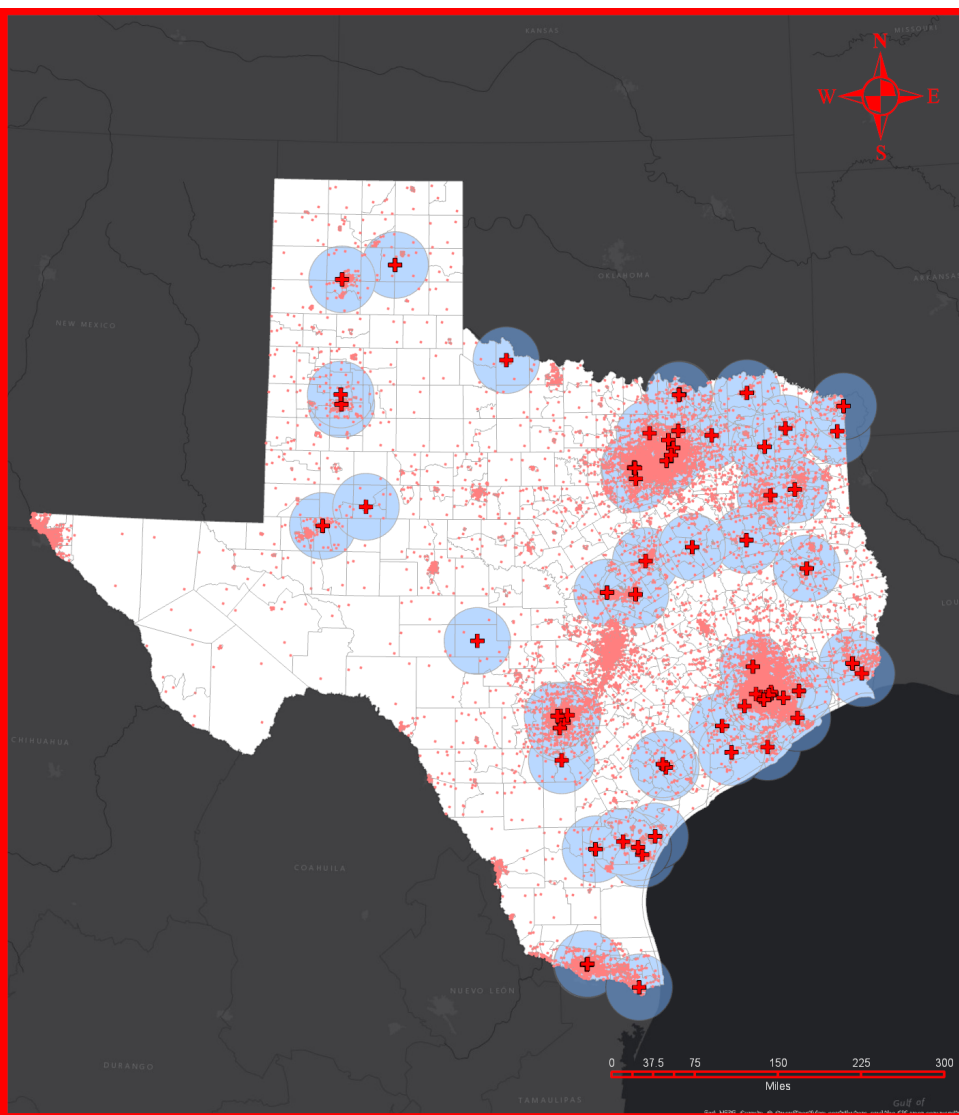
El Paso



This map displays the total population of Texas geographically and their proximity to current Mental Health Service Facilities. This is intended to be the foundational map for this analysis, a broad vision to see what areas and populations do or do not have access to this type of healthcare. Above are 4 large-scale views of locations that stand out geographically and may be considered for future analysis and strategy. In this case, "standing out" means large clusters of people living out of range of any facility's 30 mile radius marked by the blue transparent circles. A red circle is used within these maps to help identify the area. (The same buffer distances and identifier circles are used across each of the 4 maps)

Geo-demographic data for this display was obtained from the LTDB Census Data for 1970-2010 prepared by Brown University

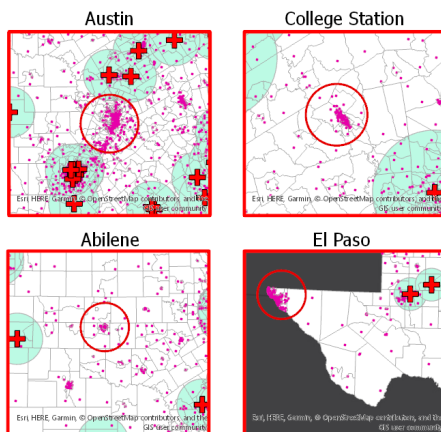
Cartographer: Michael W Biehl  
Date Created: 12/1/2018



## Populations of Texans in Poverty in Relation to Mental Health Service Facilities

### Legend

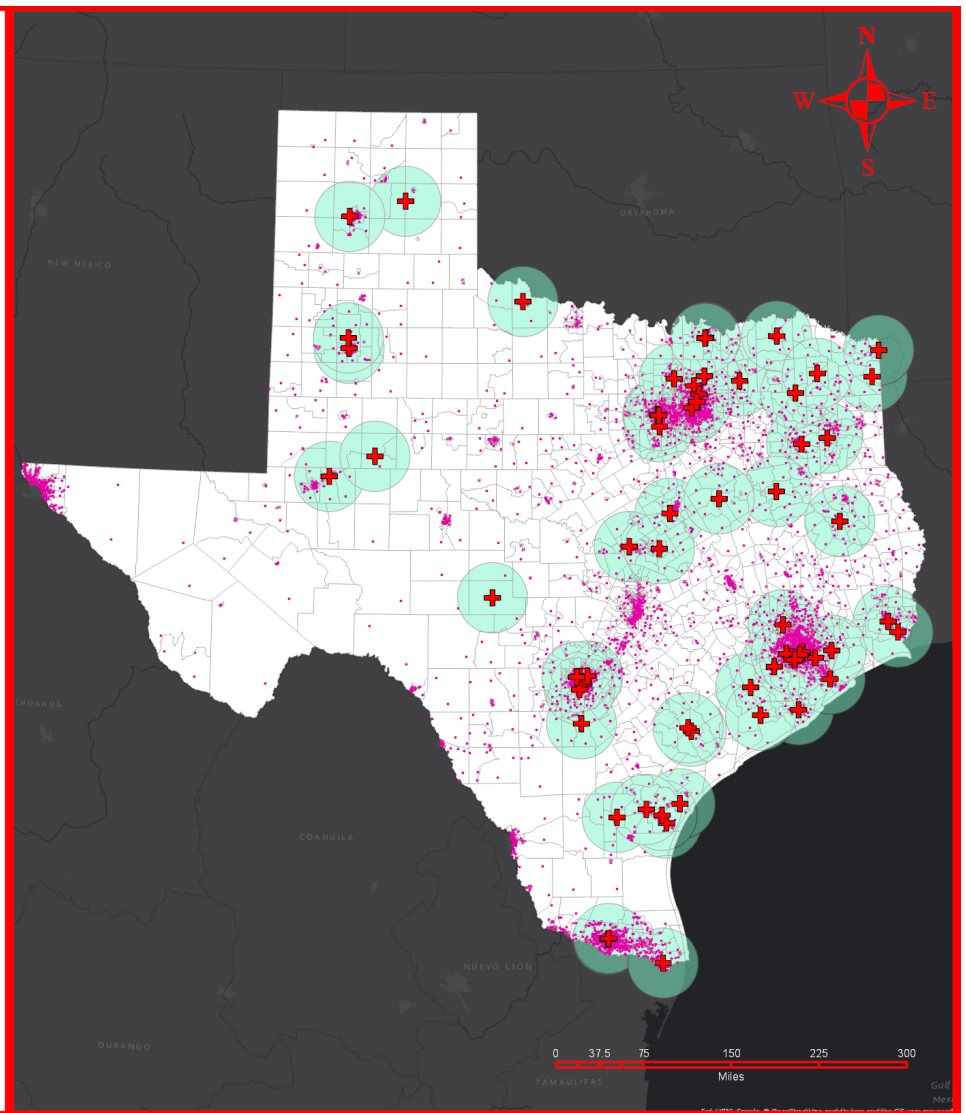
- ✚ Mental Health Facility
- 500 People in Poverty



This map displays the geographic spread of Texans living under the poverty line in proximity to Mental Health Service Facilities. These people and communities should be of priority when strategizing how to best improve mental healthcare across the state. Poverty is often the catalyst for destructive behaviors that can inhibit decision-making skills and deteriorate mental cognition. Above are 4 large-scale views of areas with large concentrations of Texans in poverty without reasonably close access to mental services.

Geo-demographic data for this display was obtained from the LTDB Census Data for 1970-2010 prepared by Brown University.

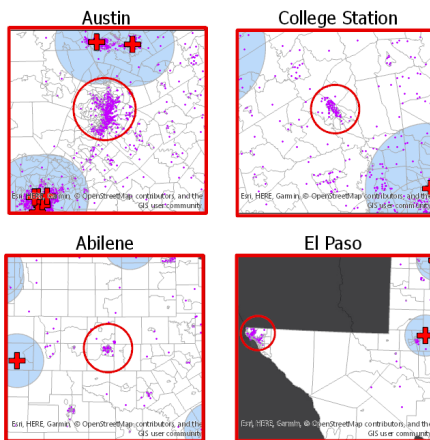
Cartographer: Michael W Biehl  
Date Created: 12/1/2018



## Black Population of Texas in Relation to Mental Health Service Facilities

### Legend

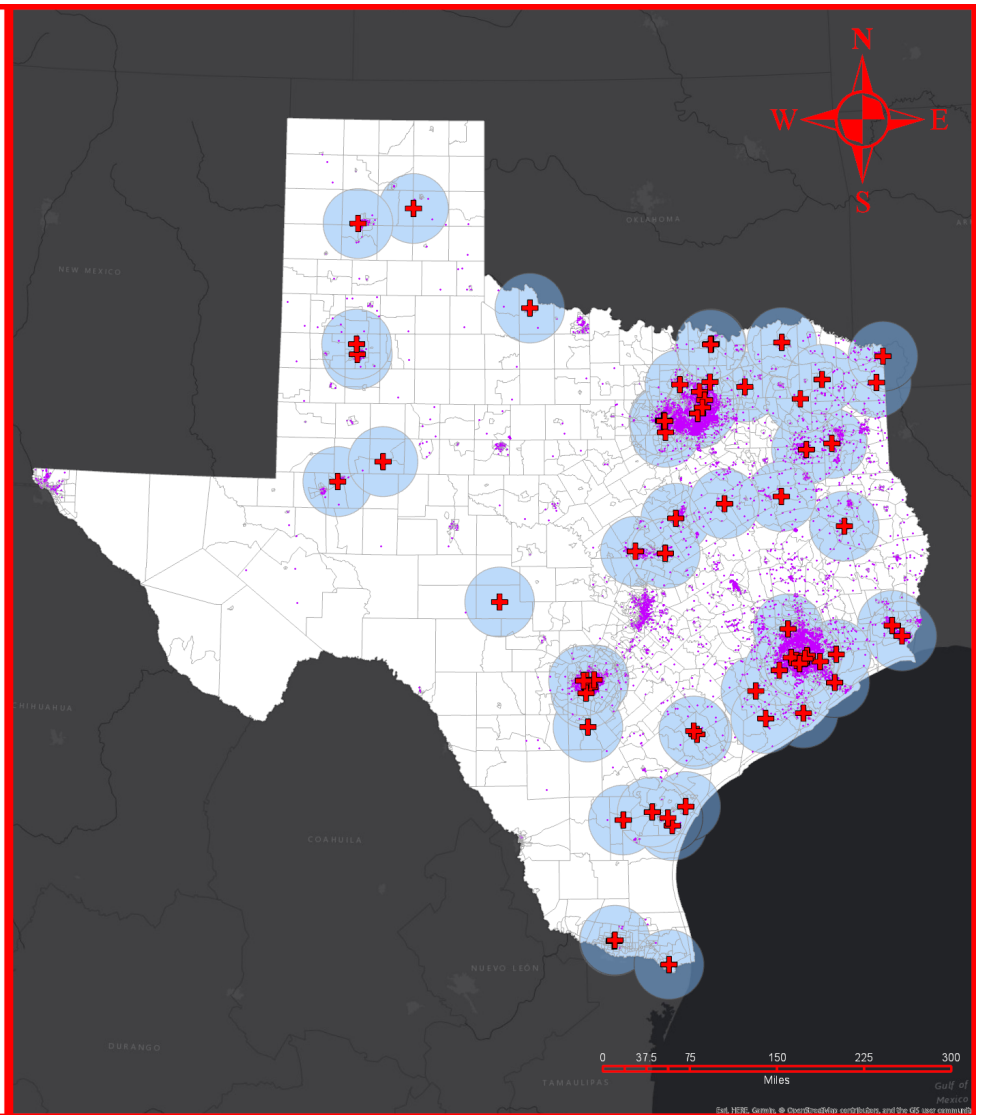
- ✚ Mental Health Facility
- 200 Black Americans



This map displays the geographic spread of Black Texans in proximity to Mental Health Service Facilities. The reason behind visualizing this specific demographic's geographic location is that many black Americans lack access to proper mental health access, which can also be correlated to these people's disproportional poverty rates caused by historical discrimination. Providing access to proper mental health services to these communities can help ameliorate current substandard conditions in Texas and perhaps be an example for the rest of the US to follow if executed properly and effectively.

Geo-demographic data for this display was obtained from the LTDB Census Data for 1970-2010 prepared by Brown University.

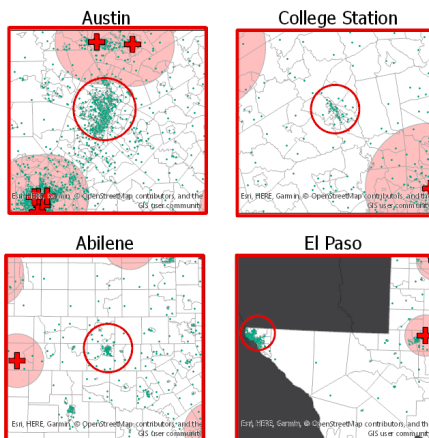
Cartographer: Michael W Biehl  
Date Created: 12/2/2018



## Texas Veteran Population in Relation to Mental Health Service Facilities

### Legend

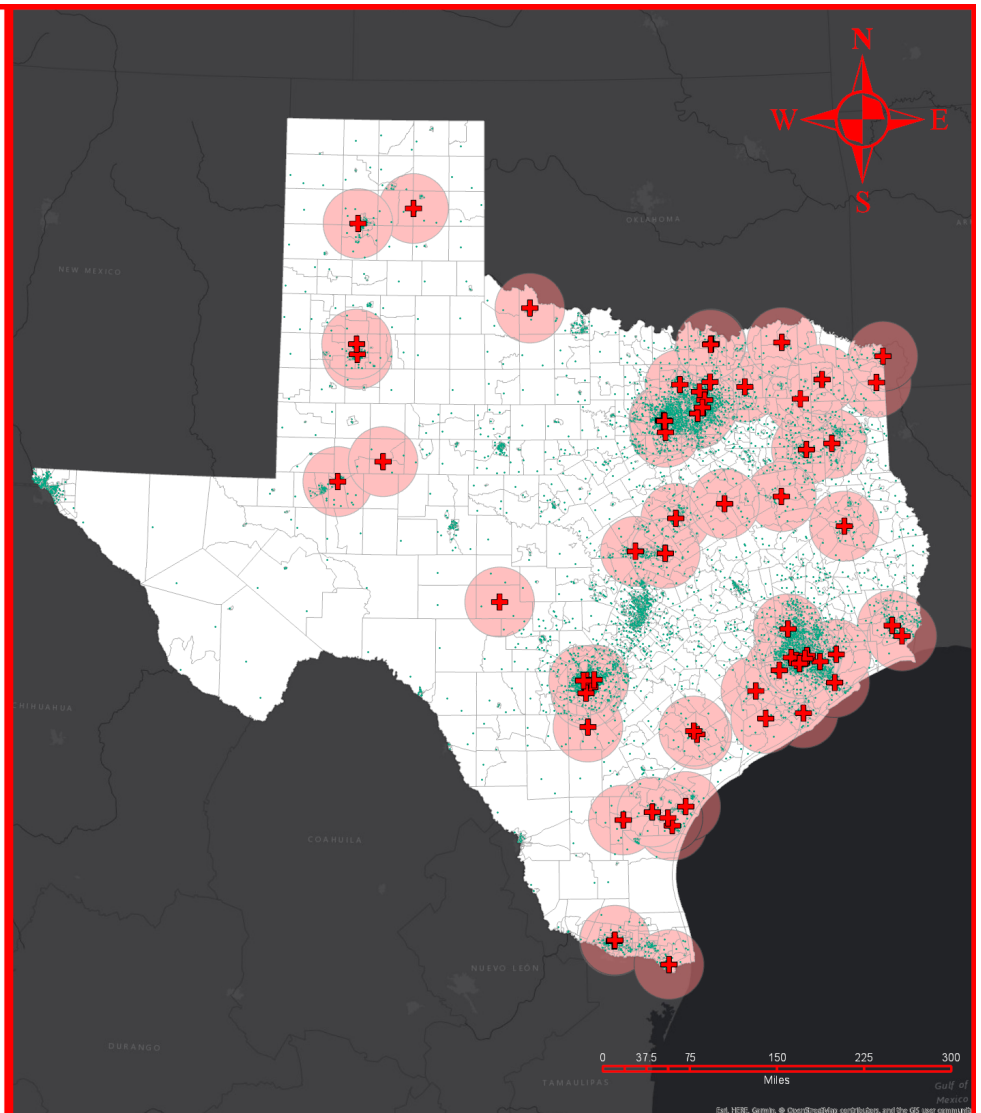
- ✚ Mental Health Facility
- 200 Veterans



This map displays the geographic spread of Texas Veterans in proximity to Mental Health Service Facilities. The reason behind visualizing this specific demographic's geographic location is that many veterans lack access to mental health services, namely due to the inadequacies of the VA which has been marred with inefficiency and ineffectiveness for years. Apart from the moral dilemma this poses, it also signifies that many veterans are living with untreated PTSD, which can be a threat to themselves as well as others. Providing access to proper mental health services to people who have sacrificed everything should be of premiere concern to not only management, but for Americans as a nation with dignity.

Geo-demographic data for this display was obtained from the LTDB Census Data for 1970-2010 prepared by Brown University.

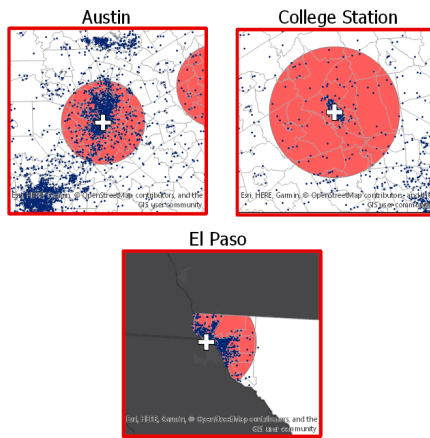
Cartographer: Michael W Biehl  
Date Created: 12/2/2018



## Final Recommended Locations for New Mental Health Facilities

### Legend

- ⊕ Recommended Site Location
- 1000 People



This map depicts the final recommended locations for the 3 new mental health facilities planned to be established in Texas by the THA. These recommendations were chosen based off of the respective population clusters of the 3 demographic variables from the previous 3 maps: the impoverished, black americans, and US veterans. Above are large scale views of the 3 locations: Austin, College Station, and El Paso. The buffers in this case are different however in that they represent the potential area a new facility can be placed, not necessarily the travel distance to it.

Geo-demographic data for this display was obtained from the LTDB Census Data for 1970-2010 prepared by Brown University.

Cartographer: Michael W Biehl  
Date Created: 12/2/2018

