

*** Files needed for Part 1 of this exercise: *Twin_Cities_Tracts_2012_acs.shp*, *Twin_Cities_PWC_Tracts_acs.shp*, *Twin_Cities_FQHCs_30mile.shp*, and *Streets* (network dataset provided by StreetMap USA)

Part 1 Goals: The goal of this exercise is to compare the results proximity based analyses that evaluate geographic access to Federally Qualified Health Care Centers (FQHC) in the Twin Cities Area of MN. First you will calculate a half mile Euclidean distance from each FQHC using the buffer tool, next you will calculate half mile Network based distance service area for each FQHC. With this measures you will estimate geographic access to each US Census Tract level population aggregated to the geometric centroid AND its population weighted centroid.

Part 1 Skills: After completing this exercise, you should have a basic familiarity with both Euclidean and Network based proximity analyses and have an understanding of the implications of population aggregation.

Part 1 Problem: You are interested in finding the percentage of the Twin City's population below the poverty level within a half mile distance to any FQHC. To do this, you will create both a as the crow flies buffer, and a service area polygon representing a half mile drive distance through a network dataset (StreetMap USA) to any FQHC.

Add the data for you area of interest:

- 1. Open a new blank map in ArcMap.
- Add the Twin Cities Tract shapefile: Twin_Cities_Tracts_2012_acs.shp. This shapefile represents the US Census Tract Boundaries for the study area joined to a set of social and demographic variables from the 2012 ACS. It will provide some useful geographical context for your analysis.
- Next add the Twin_Cities_PWC_Tracts_acs.shp. This shapefile represents the population weighted centroids US Census Tract Boundaries joined to a set of social and demographic variables from the 2012 ACS.
- 4. Finally add FQHCs for the Twin Cities: *Twin_Cities_FQHCs_30mile.shp.* These data represent FQHCs within the Twin City Tracts and up to 30 miles beyond. You should note that 56 FQHCs in this shapefile.
- 5. All of the datasets you have added have been projected to the MN state standard projected coordinate system in any proximity based analysis your data must be projected correctly, confirm the projection of your datasets by examining their properties.
- 6. Make sure you points are on top of your polygons and symbolize your data so they are distinguishable.





Perform a Buffer Analysis

- 1. Activate the Buffer tool- you can find this tool using the Search window, or under the Geoprocessing tab, or under the Proximity Analysis Toolset in ArcToolBox
- 2. Parameters for the tool:
 - a. Your input features will be: *Twin_Cities_FQHCs_30mile.shp*
 - b. Save you output feature class as: Twin_Cities_FQHCs_halfmile_buffer.shp
 - c. Your buffer distance value will be a linear unit of 0.5 miles this is an approximation of the distance that can be covered walking for 10 mins at a rate of 3 miles per hour.
 - d. You will choose ALL for the dissolve type- do you know why?
 - e. Stick with the defaults for the rest of the buffer options.



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C: \Users \Cehi_rice \Desktop \Proximity_data \TwinCities_FQHC_halfmile_buffer.shp			remove buffer overlap.
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	0.5 Miles	•	regardless of overlap. This is the default
) Field			ALL—All buffers are dissolved
			together into a single feature,
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		- 271	 LIST—Any buffers sharing
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3. Take a look at your results.



Perform a Service Area analysis to calculate the a 1//2 mile network based distance to each of the FQHCs

1. Activate the Network Analyst Extension by right clicking on Customize>Extensions and checking the Network Analyst box.





2. Activate your Network Analyst toolbar. Go to Customize > Toolbars > Network Analyst. Note that you need to make sure that you have activated the extension prior to adding the toolbar - the software will allow you to add the toolbar to a project even if the Network Analyst extension is not activated (it will not work though).

The toolbar looks like this:

-		
Network Analyst		▼ X
Network Analyst 🕶 📭 🦂 🛵 🎬	🔁 Network Dataset:	- ₩ ₩

4. Add your Streetmap USA network dataset *streets*. It is located in the streets folder. Choose **Yes** to add all feature classes that participate in the network dataset. **Note:** This is a nationwide dataset included with Esri ArcGIS software disks. Be forewarned, it is large. The .sdc format is un-editable, but it means you will not need to create your own network dataset.

Add Data				-			23
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You should see a detailed road network begin to fill in. You can turn these off by un-checking them in the TOC to speed things up a bit.

- 5. If your network analyst window is not visible, make it visible by left clicking on 💷 in the toolbar.
- 6. In the Network Analyst toolbar, click **Network Analyst > New Service Area**.



7. To adjust your service area properties and analysis settings, click on the Service Area Properties icon in

the Network Analyst window (on the upper right-hand side).

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Service Area	
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Added Cost (0) Line Barriers (0) Restriction (0) Scaled Cost (0) Polygon Barriers (0) 	
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🔊 ArcToolbox 🖽 Table Of (ontents

8. Under the **General** tab, name this service area layer: *1/2 mile Twin City FQHC service area Click* **Apply** rather than OK.



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- 9. Under the **Accumulation** tab, check **Length**. This will length of moving through the network for your analysis. Click **Apply** rather than OK.
- 10. Under the Analysis Settings tab you should see that your impedance or cost will be measured in length (miles). Set your default break as .5 miles. Set your direction as Towards Facility. In this analysis you will Not Use Hierarchy so make sure it is unchecked and go with defaults for the remaining options on this tab. Click Apply rather than OK. (NOTE: Hierarchical analysis is a heuristic method for solving drive time by favoring travel on larger roads (e.g. highways) over small roads (e.g. local streets). Network Analyst can compute service areas more quickly when using a hierarchical analysis, but it is less exhaustive than a non-hierarchical analysis. The About network analysis with hierarchy help page has more information.)



Line Generation	Accur	nulation	Attribu	te Parameters	Network Locations
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Under the Polygon Generation tab, keep all the defaults with the exception of Polygon Type – select
 Detailed and Multiple Facilities Options. Select Merge by break value and click Apply rather than OK.



12. Under the **Network Locations** tab, set the tolerance for locating the FQHCs onto the network dataset. Set the **Search Tolerance** for finding the FQHCs on the network to **50 meters** (i.e. locations up to 50 meters from a road *will be located* on the network).



General	Layers	Source	Analysis	Settings	Polygon Generation
Line Generation	Ac	cumulation	Attribute Pa	rameters	Network Locations
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ocation Type:	Faciliti	es	•]	
Property	Defau	lt Value	Candidate Fields		Load
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SideOfEdge	Left S	50	SideOfEdge;SOE		
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Note: You may need to adjust this since how well the locations load depends on the condition of the network dataset and the quality of your geocoded data. Stick with the defaults for the rest of the settings. Click Apply, then OK.

13. Right click on Facilities in the Network Analyst window and select Load Locations.

The CVS pharmacies are the Facilities that you will be creating service areas for.



14. Make sure that your shapefile *Twin_Cities_FQHCs_30mile.shp* is the data to be loaded and select **ID** as your **Sort Field**. You can sort by any of the attributes in the table, but it is a good idea to use a unique



identifier. For the Name Property select NAME field; this will identify each facility by its name. The Search

Tolerance you input in the Network Locations tab should be reflected here.

Only load select	Twin_Cities_FQH]Only show point lay ed rows	Cs_30mile ers		-
rt Field:)		•	
ocation Analysis	Properties			
Property	Field		Default Value	
Name	Name			
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ocation Position				
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15. Click **OK**. You should see 56 facilities located in your Network Analyst window. All of your FQHCs have been loaded and located on the network dataset indicated by a green colored circle (yours will likely be a different color).



If any of your locations were not located or have errors you will see a red circle, or a circle with a question mark in your TOC.





Solving the Service Area Problem

1. You have set up your analysis and loaded the facilities - now you can solve. Remember, you want to create a network-based area that represents a ½ mile drive time to any FQHC for your area of interest.

Click on the Solve icon to run the analysis. This may take a bit of time (remember that this is a very large network dataset).

2. While you wait, take a look around. Take a look at the lower left-hand side of your screen. If you see this:



3. When the solving is complete you should see something that looks like this:



4. In your table of contents you will see the results of your analysis. Export the polygon for your analysis to a new shapefile by right clicking on the layer in your TOC and choosing Export Data. Use the same coordinate system as the data frame. Name the file TC_FQHC_halfmileSA.shp.



Export Dat	3
Export:	All features 👻
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Output fe	ature dass:

Add *TC_FQHC_halfmileSA.shp* to your data frame when prompted and aadjust the transparency of the service area so you can see all of the data beneath. Now that you have calculated both a Euclidean and Network based measure of Geographic accessibility to the FQHCs take a closer look at areas created by each method.



Determine the target population within both your buffer and service area polygons.

- 1. First evaluate population with ½ geographic accessibility using your Euclidean buffers:
- Click Selection > Select by Location. Spatially select all Twin_Cities_PWC_Tracts_2012_acs.shp (target layer) that intersect Twin_Cities_FQHCs_halfmile_buffer.shp (source layer). You will assume that all of the population weighted centroids within the ½ mile buffer have populations that are within the ½ distance to a FQHC. Click Apply, then OK.





3. Open the table for Twin_Cities_PWC_Tracts_2012_acs.shp; you should see that 74 of the 228 tracts have been selected. Right click on the TotBelow (Total population below poverty) attribute field and select Statistics for these selected block groups. Take a look at the sum of the block group values for your selection. The 2012 ACS estimates 68,484 people below the poverty level in the study within a ½ mile Euclidean distance to any FQHC.

TotBelow	Frequency Distribution
Statistics:	20 4
Count: 74 Minimum: 55 Maximum: 3006 Sum: 68484 Mean: 925 459459	
Standard Deviation: 583.374368 Vulls: 0	
	55 634 1213 1792 2371 2950

4. Now **Clear Selection** and take a look at the sum of the tract TotBelow values for all of the study area. The total estimate for this population is 157,145



rield	
TotBelow 👻	Frequency Distribution
Statistics:	
Count: 228 Minimum: 13 Maximum: 3462 Sum: 157145 Mean: 689.232456 Standard Deviation: 581.38722 Nulls: 0	
	13 556 1099 1642 2185 2728 3271

Solution

It looks like ~43% of population below poverty level for our study area are within a ½ mile Euclidean distance from any FQHC.

- 1. Now evaluate population with ½ mile geographic accessibility using the Network based service area
- 2. Click Selection > Select by Location. Spatially select all Twin_Cities_PWC_Tracts_2012_acs.shp (target layer) that intersect TC_FQHC_halfmileSA.shp (source layer). You will assume that all of the population weighted centroids within the ½ mile service area have populations that are within the ½ distance to a FQHC. Click Apply, then OK.

Select By Location
Select features from one or more target layers based on their location in relation to the features in the source layer.
Selection method:
select features from
Target layer(s):
TC_FQHC_halfmileSA
Only show selectable layers in this list
Source layer:
Use selected features (0 features selected)
Spatial selection method for target layer feature(s):
intersect the source layer feature 🔹
Apply a search distance
3000.000000 Meters •
About select by location OK Apply Close





 Open the table for Twin_Cities_PWC_Tracts_2012_acs.shp; you should see that 46 of the 228 tracts have been selected. Right click on the TotBelow (Total population below poverty) attribute field and select Statistics for these selected block groups. Take a look at the sum of the block group values for your selection. The 2012 ACS estimates 40,472 people below the poverty level in the study within a ½ mile network distance to any FQHC.

Field			
TotBelow -	Frequency Distribution		
Statistics:			
Court: 46 Maximum: 55 Maximum: 3006 Sum: <u>10972</u> Mean: 879.826087 Sandard Deviation: 606.381617 Nulls: 0			

Solution

It looks like ~26% of population below poverty level for our study area are within a ½ mile Euclidean distance from any FQHC.

Discussion

- 1. What are some of important choices you made in this analysis?
- 2. There does seem to be a difference in the results of the two analyses do you think this is important?
- 3. We aggregated population to a population weighted centroid in this analysis- how different would the results have been if we had aggregated population to the geometric centroid? The answers are below but if you would like to try this out the geometric centroids are also in the exercise data folder.

	geometri	geometric centroid		ed centroid
	count	%	count	%
Euclidean Distance Buffer	63,470	40.4%	68,484	43.6%
Network Distance Service Area	36,233	23.1%	40,472	25.8%

4. What are some likely assumptions/caveats to this type of analysis?