Final Report

Travel Distance Study for Rural/Competitive Bid Area/Neither Rural nor CBA Census Tracts to Hospitals and Home Medical Equipment Suppliers: Montana, North Dakota, Oregon, Washington, West Virginia, Wisconsin

UNI GeoTREE Center

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Scope of Work

In response to considerable changes in the competitive bidding process regarding the Medicare Durable Medical Equipment, Prosthetics, Orthotics, and Supplies (DMEPOS), the GeoInformatics Training, Research, Education, and Extension (GeoTREE) Center carried out an analysis of travel distance from defined rural, competitive bid area (CBA), and not rural nor in a CBA to Hospitals and Home Medical Equipment (HME) suppliers in Montana, North Dakota, Oregon, Washington, West Virginia, and Wisconsin.

The goal of the study was to quantify and report on the proximity of populations to certain healthcare providers in rural areas and compare that proximity to that available to people in urban areas. To accomplish this, census tracts were categorized, hospital and HME locations were geocoded, travel distances between census tract centroids and the nearest hospitals/HMEs within classifications were calculated. In addition, demographic characteristics of each census tract were compiled and summary statistics were compiled for the three types of classifications. This report details findings of the study and summarizes important statistics from the study.

Data and Methods

Table 1 describes the source of various data used in the study. For the six states, counties were defined as being (1) rural, (2) competitive bid area (CBA), or (3) neither rural nor in a CBA. A county was defined as rural if it did not contain a CBA and did not contain an acute care hospital. Counties that did not contain a CBA, but contained acute care hospitals, were defined as neither rural nor in a CBA. As census tracts are nested within counties, the county classifications were carried down to the more detailed census tract boundaries within the county. The address of HMEs were attained from the medicare.gov supplier dataset (Table 1) and then geocoded by the GeoTREE Center using the Google Maps API geocoding engine. There were 576 HMEs geocoded across the six states (Montana N = 68, North Dakota N = 22, Oregon N = 93, Washington N = 157, West Virginia N = 115, Wisconsin N = 121). Hospital

locations were geocoded from a .csv file downloaded from the medicare.gov Hospital Compare datasets website (Table 1). Before geocoding, hospitals that were not classified as Acute Care, Acute Care Veterans, or Critical Access Hospitals were removed. There were 434 hospitals geocoded across the six states (Montana N = 58, North Dakota N = 45, Oregon N = 61, Washington N = 92, West Virginia N = 51, Wisconsin N = 127). Each hospital and HME was classified as rural, competitive bid area (CBA), and neither rural nor in a CBA based on how the census tract it fell in was classified.

All GIS processing was carried out using ArcGIS 10.2.2 including the Network Analyst extension. All data for each individual state was projected to the UTM zone that covered the majority of that state (Montana = UTM 12N, North Dakota = UTM 14N, Oregon = UTM 10N, Washington = UTM 10N, West Virginia = UTM 17N, Wisconsin = UTM 16N). The national TIGER (Topologically Integrated Geographic Encoding and Referencing) roads data was clipped to each state boundary and a network dataset built for each state. An Origin Destination Cost Matrix was constructed from the centroid of each census tract to each HME and hospital location using the ArcGIS Network Analyst software. For each state, a table was produced with the distance from each census tract centroid to each HME and hospital in that state. In this report, results are summarized for each of the three classifications (rural, competitive bid area (CBA), and not rural or in a CBA) based on the distance from census tract centroids within one class to the nearest HME or hospital facility within that classification. So, for each census tract, the distance to the nearest HME and hospital facility falling in the given classification was calculated and averaged across each classification in that state (Tables 2-7).

Table 1: Data sources and description/notes

Dataset	Source	Description/Notes
TIGER Roads spatial data	https://www.census.gov/geo/maps-data/data/tiger-geodatabases.html	Detailed road network for each state
Census Tracts spatial data	https://www.census.gov/geo/maps-data/data/tiger-geodatabases.html	Census tract polygon boundaries, centroids calculated for travel distance calculation
Hospitals	https://data.medicare.gov/data/hospital-compare	
HMEs	https://data.medicare.gov/data/supplier-directory	Includes home medical equipment suppliers only*
Demographic attributes	factfinder.census.gov	The 2010 decennial census** was used for all attributes except the education, veterans, and disabled percentage estimates which were estimates from the 2013 5 year American Community Survey***

* Only home medical equipment suppliers (by location) that offer home medical equipment suitable to effect a timely hospital or facility discharge to the home are included. These companies are accredited in several of the following product categories: Commodes, Urinals, & Bedpans; Hospital Beds: Electric; Hospital Beds: Total Electric & Pediatric; Hospital Beds: Manual; Hospital Beds: Manual & Pediatric; Negative Pressure Wound Therapy Pumps & Supplies; Support Surfaces: Pressure Reducing Beds, Mattresses, Overlays, & Pads; Support Surfaces (e.g. Air Fluidized bed); Traction Equipment; Transcutaneous Electrical Nerve Stimulators (TENS) Units; Canes & Crutches;

Patient Lifts; Power Operated Vehicles (Scooters); Seat Lift Mechanisms; Walkers; Wheelchairs & Accessories: Standard Manual; Wheelchairs & Accessories: Standard Manual (e.g. Pediatrics); Wheelchairs & Accessories: Standard Power; Wheelchairs & Accessories: Standard Power (e.g. Pediatrics and custom cushions); Wheelchairs & Accessories: Complex Rehabilitative Manual; Wheelchairs & Accessories: Complex Rehabilitative Power; Wheelchairs & Accessories: Complex Rehabilitative Power (e.g. Group 3, Group 4, Group 5); Wheelchair Seating/Cushions; Wheelchair Seating/Cushions (e.g. skin protecting seat cushions); Ostomy Supplies; Urological Supplies; Enteral Nutrients, Equipment, & Supplies; Parenteral Nutrients, Equipment & Supplies; CPAP, RADs, & Related Supplies & Accessories; CPAP and RADs Supplies (e.g. combination masks); Invasive Mechanical Ventilation; Nebulizer Equipment & Supplies; Oxygen Equipment & Supplies; Ventilators, Accessories & Supplies; Diabetic Shoes & Inserts: Prefabricated; Diabetic Shoes & Inserts: Custom Fabricated
**The 2010 decennial census source was the DP-1 "Profile of General Population and Housing Characteristics"] data product
***The 2013 5 year ACS Estimates source was the DP02 "Selected Social Characteristics" data product. It must be kept in mind that these are estimates. Also the veteran percentage is calculated for populations 25 and older.

Summary of Findings

There is a significant difference between distances to HMEs and hospitals for rural census tracts as compared to the other two classifications. For most of the states, the distances from rural census tract centroids to nearest HME within that classification are approximately 3-15 times farther than distances in the other two classifications (range from 2.75 to14.6 times farther).

Results and Products:

Tables 2-7 present summary statistics concerning travel distances from census tract centroids to HME and hospital facilities as well as summary statistics for facilities and census tracts. Figures 1-6 demonstrate the travel distance per census tract (from centroid) to the nearest HME within the classification for each of the six states.
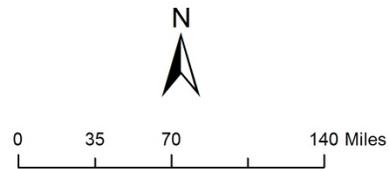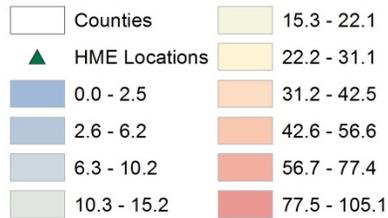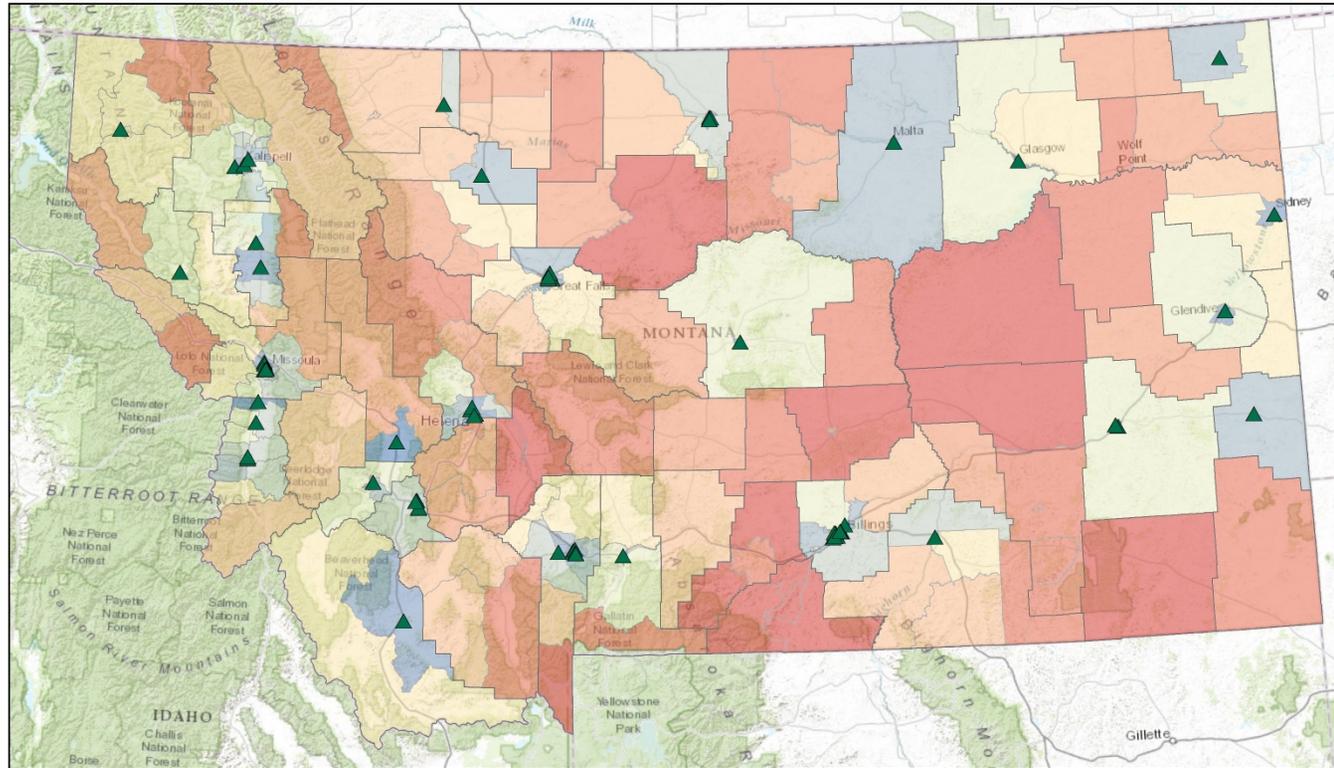
Table 2: Montana

	Rural	Urban (CBA)	Neither
# of HME Suppliers	25	None	43
# of Hospitals	42	None	16
HMEs per Hospital	0.6	None	2.7
Demographics			
Area in class (sq. miles)	**121,141**	None	**26,032**
Population	343,253	None	646,129
Median age (years)	44	None	39
% of population over 65	17.9%	None	13.4%
% of population with disabilities	14.7%	None	12.5%
% of population who are veterans	13.1%	None	12.0%
Comparative Metrics		None	
Avg Distance to HME (miles)	**39**	None	**9**
Avg Distance to Hospital (miles)	23	None	10
Sq miles per HME supplier	4,846	None	605
# of people served per HME supplier	13,730	None	15,026
# of people served per hospital	8,173	None	40,383
# of people over 65 served per HME supplier	2,453	None	1,986
# of disabled people served per HME supplier	2,030	None	1,825
# of veterans served per HME supplier	1,421	None	1,369

*Rural counties= Beaverhead, Big Horn, Blaine, Broadwater, Carbon, Carter, Chouteau, Custer, Daniels, Dawson, Deer Lodge, Fallon, Fergus, Garfield, Golden Valley, Granite, Jefferson, Judith Basin, Lake, Liberty, Lincoln, Madison, McCone, Meagher, Mineral, Musselshell, Park, Petroleum, Phillips, Pondera, Powder River, Powell, Prairie, Ravalli, Richland, Roosevelt, Rosebud, Sanders, Sheridan, Stillwater, Sweet Grass, Teton, Toole, Treasure, Valley, Wheatland, Wibaux

*Neither urban (CBA) nor rural counties: Cascade, Flathead, Gallatin, Glacier, Hill, Lewis and Clark, Missoula, Silver Bow, Yellowstone

Figure 1: Travel distance from census tracts to nearest HME for Montana within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract
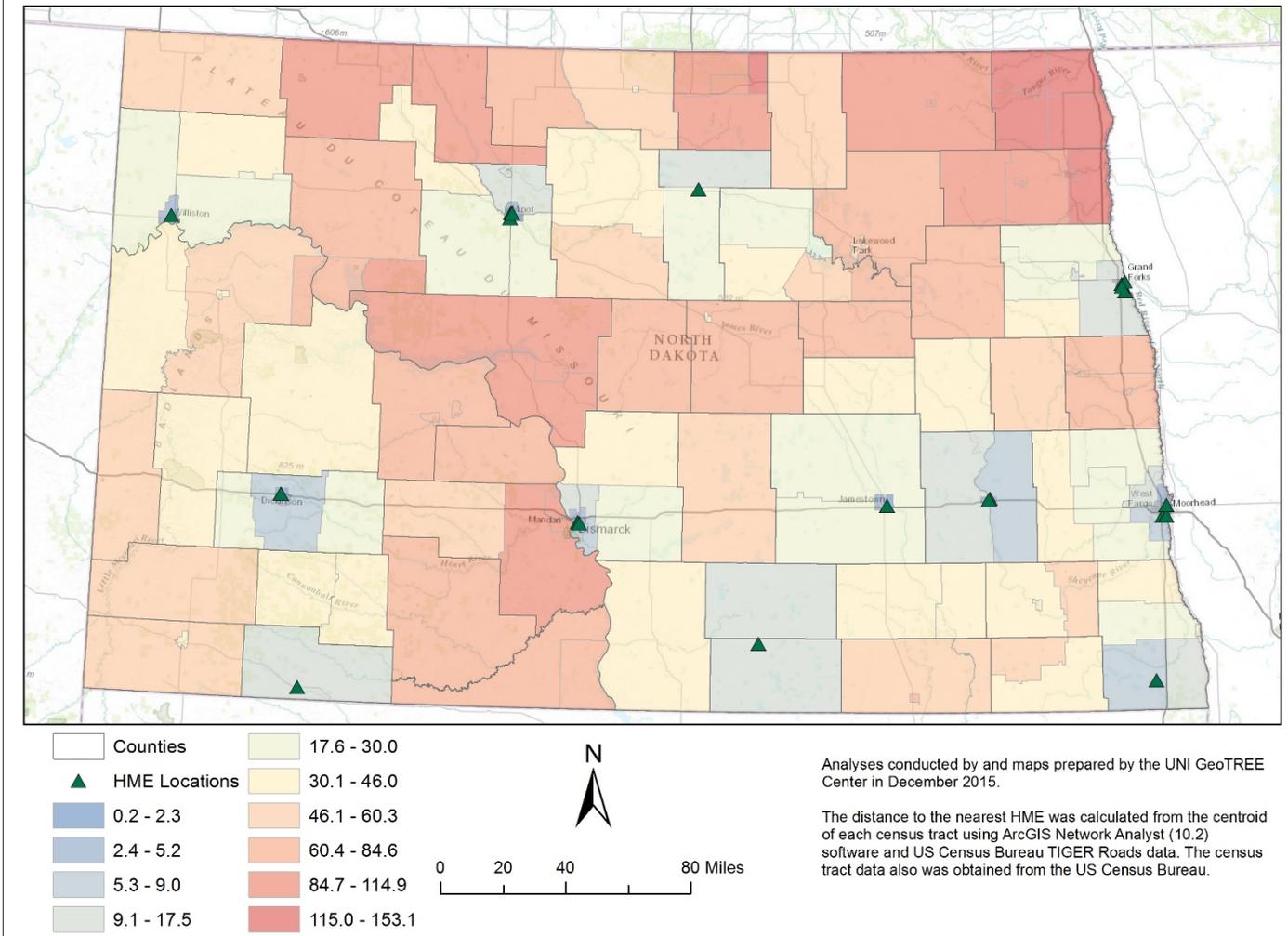
Table 3: North Dakota

	Rural	Urban (CBA)	Neither
# of HME Suppliers	10	None	12
# of Hospitals	33	None	12
HMEs per Hospital	0.3	None	1
Demographics			
Area in class (sq. miles)	**61,709**	None	**8,996**
Population	294,879	None	377,712
Median age (years)	44	None	35
% of population over 65	19.4%	None	11.7%
% of population with disabilities	12.4%	None	10.0%
% of population who are veterans	10.6%	None	10.3%
Comparative Metrics		None	
Avg Distance to HME (miles)	**53**	**None**	**13**
Avg Distance to Hospital (miles)	19	**None**	7
Sq miles per HME supplier	6,171	**None**	750
# of people served per HME supplier	29,488	**None**	31,476
# of people served per hospital	8,936	**None**	31,476
# of people over 65 served per HME supplier	5,539	**None**	3,507
# of disabled people served per HME supplier	3,601	**None**	3,012
# of veterans served per HME supplier	2,434	**None**	2,401

*Rural counties= Adams, Barnes, Benson, Billings, Bottineau, Bowman, Burke, Cavalier, Dickey, Divide, Dunn, Eddy, Emmons, Foster, Golden Valley, Grant, Griggs, Hettinger, Kidder, LaMoure, Logan, McHenry, McIntosh, McKenzie, McLean, Mercer, Morton, Mountrail, Nelson, Oliver, Pembina, Pierce, Ramsey, Ransom, Renville, Richland, Sargent, Sheridan, Slope, Stark, Steele, Stutsman, Towner, Traill, Walsh, Wells, Williams

*Neither urban (CBA) nor rural counties: Burleigh, Cass, Grand Forks, Rolette, Sioux, Ward

Figure 2: Travel distance from census tracts to nearest HME for North Dakota within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract
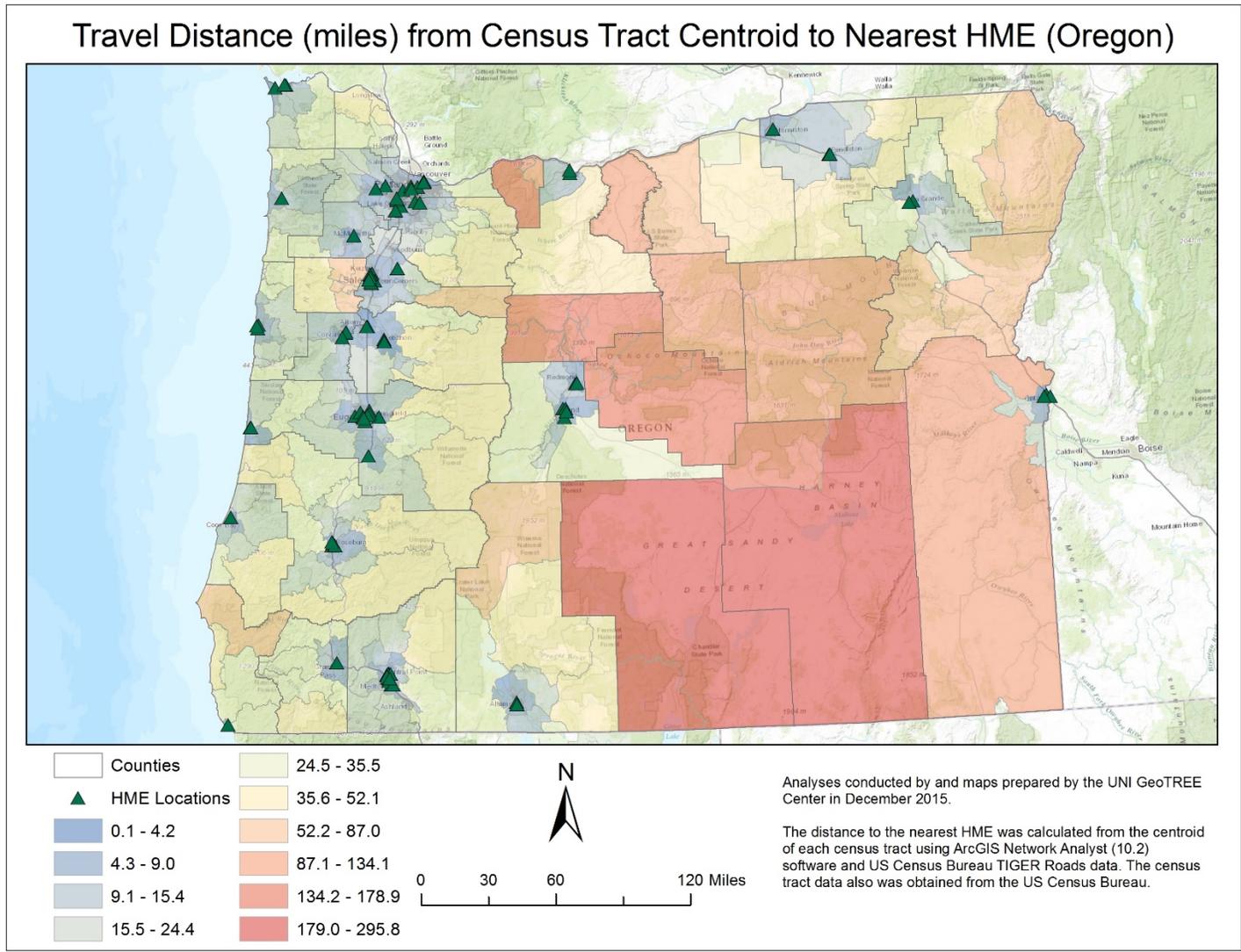
Table 4: Oregon

	Rural	Urban (CBA)	Neither
# of HME Suppliers	13	19	61
# of Hospitals	19	16	26
HMEs per Hospital	0.7	1.2	2.3
Demographics			
Area in class (sq. miles)	**51,171**	**4,478**	**41,475**
Population	434,925	1,789,572	1,606,569
Median age (years)	44	37	41
% of population over 65	18.6%	11.3%	16.2%
% of population with disabilities	17.7%	11.6%	15.9%
% of population who are veterans	13.7%	8.7%	12.5%
Comparative Metrics			
Avg Distance to HME (miles)	**55**	**6**	**9**
Avg Distance to Hospital (miles)	17	5	10
Sq miles per HME supplier	3,936	236	680
# of people served per HME supplier	33,456	94,188	26,337
# of people served per hospital	22,891	111,848	100,411
# of people over 65 served per HME supplier	5,824	10,627	4,195
# of disabled people served per HME supplier	5,467	10,855	4,091
# of veterans served per HME supplier	3,465	6,385	2,571

*Rural counties = Baker, Clatsop, Crook, Curry, Gilliam, Grant, Harney, Hood River, Jefferson, Lake, Lincoln, Morrow, Polk, Sherman, Tillamook, Umatilla, Union, Wallowa, Wheeler

*Urban area (CBA) counties = Clackamas, Columbia, Multnomah, Washington, Yamhill

*Neither urban (CBA) nor rural counties = Benton, Coos, Deschutes, Douglas, Jackson, Josephine, Klamath, Lane, Linn, Malheur, Marion, Wasco

Figure 3: Travel distance from census tracts to nearest HME for Oregon within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract.
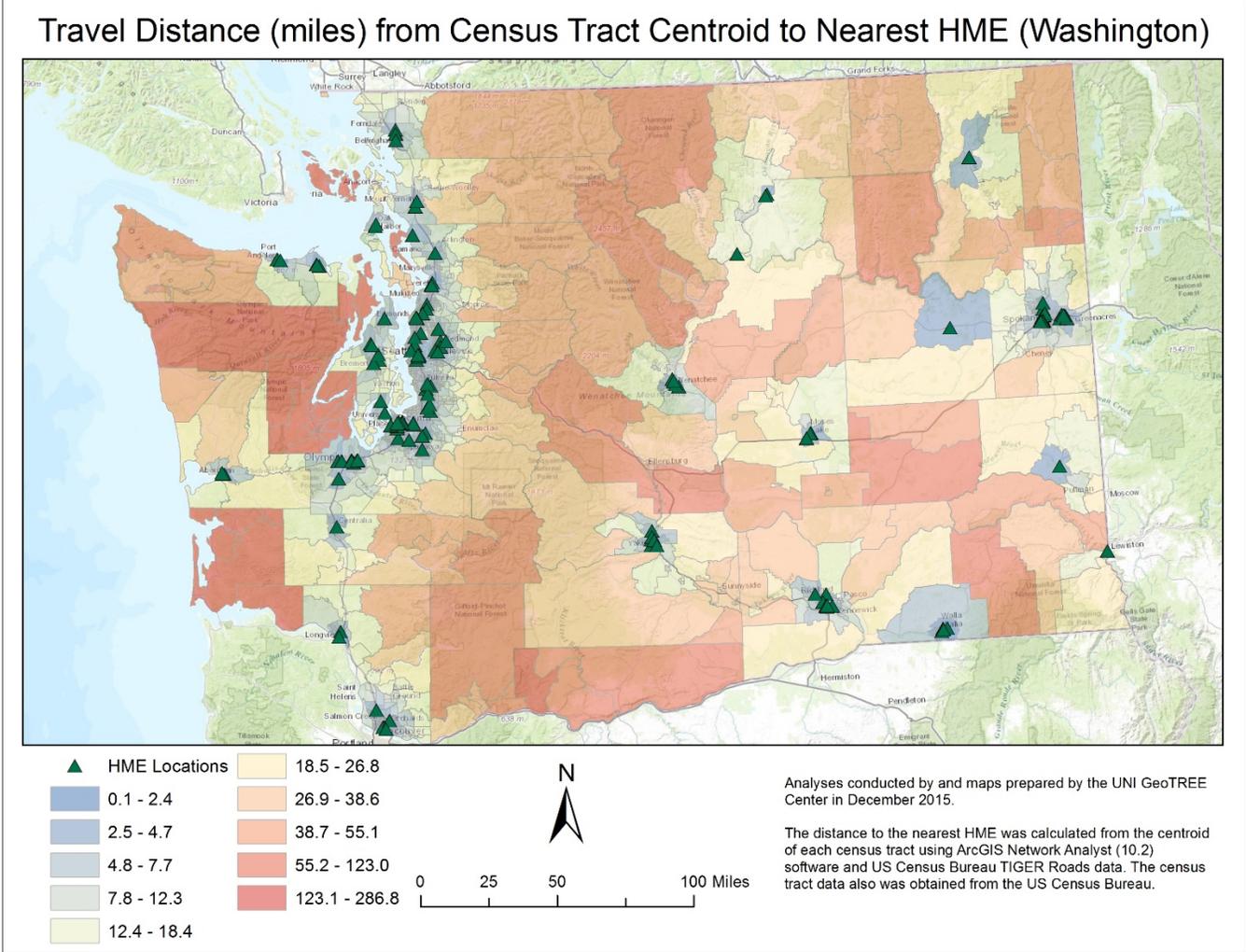
Table 5: Washington

	Rural	Urban (CBA)	Neither
# of HME Suppliers	13	61	83
# of Hospitals	26	29	37
HMEs per Hospital	0.5	2.1	2.2
Demographics			
Area in class (sq. miles)	32,128	8,352	27,390
Population	587,034	3,876,238	2,261,263
Median age (years)	42	38	39
% of population over 65	17.1%	11.1%	14.1%
% of population with disabilities	16.4%	11.1%	14.6%
% of population who are veterans	14.1%	10.3%	12.9%
Comparative Metrics			
Avg Distance to HME (miles)	**73**	5	**9**
Avg Distance to Hospital (miles)	17	6	8
Sq miles per HME supplier	2,471	137	330
# of people served per HME supplier	45,156	63,545	27,244
# of people served per hospital	22,578	133,663	61,115
# of people over 65 served per HME supplier	6,975	6,923	3,742
# of disabled people served per HME supplier	6,584	6,857	3,768
# of veterans served per HME supplier	4,496	4,960	2,629

*Rural counties= Adams, Asotin, Columbia, Douglas, Ferry, Franklin, Garfield, Island, Jefferson, Kittitas, Klickitat, Lincoln, Mason, Okanogan, Pacific, Pend Oreille, San Juan, Stevens, Wahkiakum, Whitman

*Urban area (CBA) counties: Clark, King, Pierce, Skamania, Snohomish

*Neither urban (CBA) nor rural counties: Benton, Chelan, Clallam, Cowlitz, Grant, Grays Harbor, Kitsap, Lewis, Skagit, Spokane, Thurston, Walla Walla, Whatcom, Yakima

Figure 4: Travel distance from census tracts to nearest HME for Washington within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract.
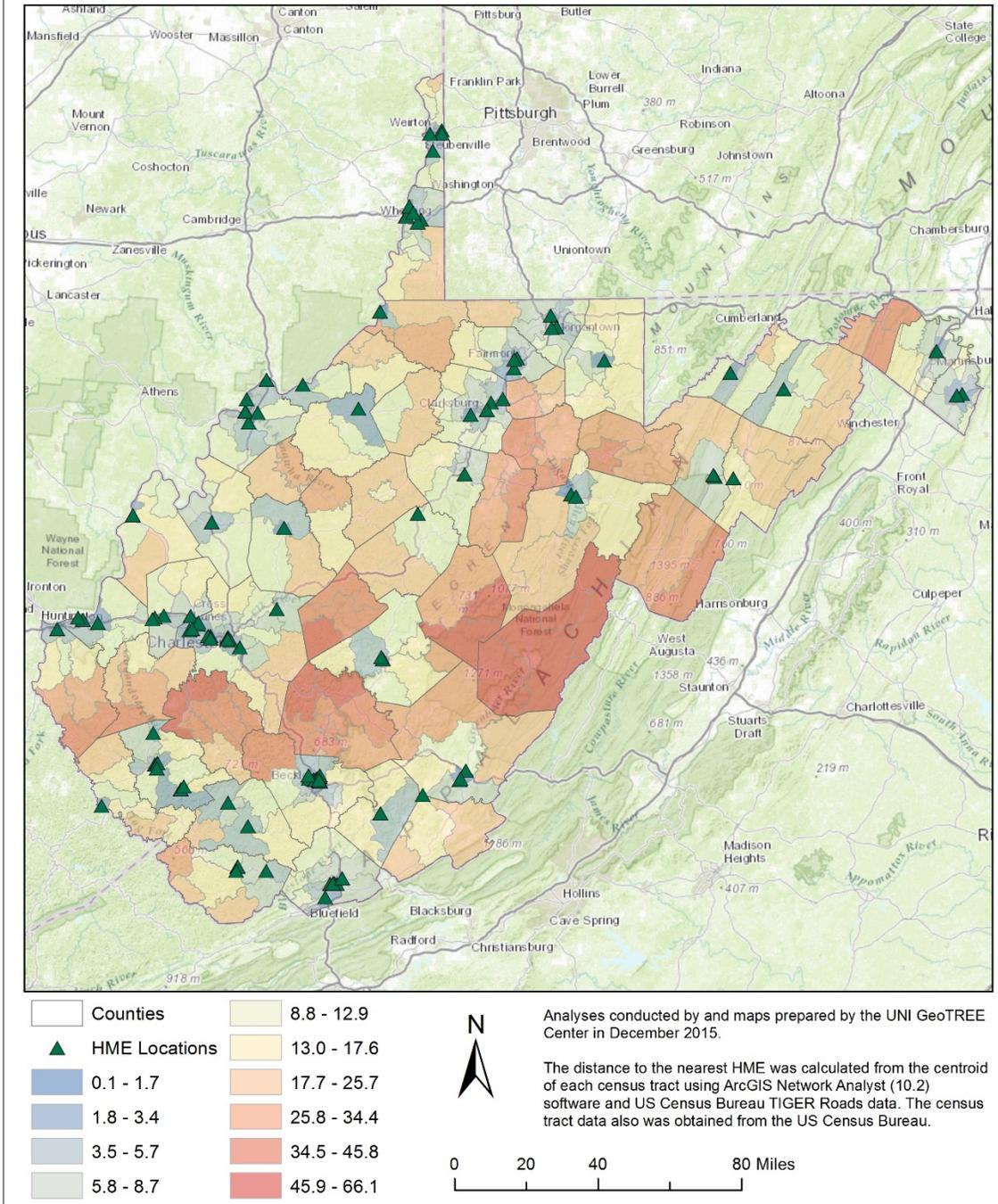
Table 6: West Virginia

	Rural	Urban (CBA)	Neither
# of HME Suppliers	18	9	88
# of Hospitals	19	3	29
HMEs per Hospital	1.1	3	3.0
Demographics			
Area in class (sq. miles)	13,056	1,589	9,570
Population	560,211	216,006	1,076,777
Median age (years)	43	40	42
% of population over 65	16.7%	15.6%	16.3%
% of population with disabilities	20.7%	19.4%	19.7%
% of population who are veterans	10.9%	10.7%	10.9%
Comparative Metrics			
Avg Distance to HME (miles)	**22**	**8**	**7**
Avg Distance to Hospital (miles)	19	14	8
Sq miles per HME supplier	725	177	109
# of people served per HME supplier	31,123	24,001	12,236
# of people served per hospital	29,485	72,002	37,130
# of people over 65 served per HME supplier	5,089	3,738	1,944
# of disabled people served per HME supplier	6,089	4,433	2,251
# of veterans served per HME supplier	2,607	1,997	1,067

*Rural counties = Barbour, Boone, Braxton, Calhoun, Clay, Doddridge, Fayette, Gilmer, Grant, Hampshire, Hancock, Hardy, Jackson, Jefferson, Mineral, Monroe, Morgan, Pendleton, Pleasants, Pocahontas, Preston, Ritchie, Roane, Summers, Taylor, Tucker, Tyler, Upshur, Webster, Wirt, Wyoming
*Urban area (CBA) counties = Cabell, Lincoln, Putnam, Wayne

*Neither urban (CBA) nor rural counties = Berkeley, Brooke, Greenbrier, Harrison, Kanawha, Lewis, Logan, Marion, Marshall, Mason, McDowell, Mercer, Mingo, Monongalia, Nicholas, Ohio, Raleigh, Randolph, Wetzel, Wood

Figure 5: Travel distance from census tracts to nearest HME for West Virginia within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract.
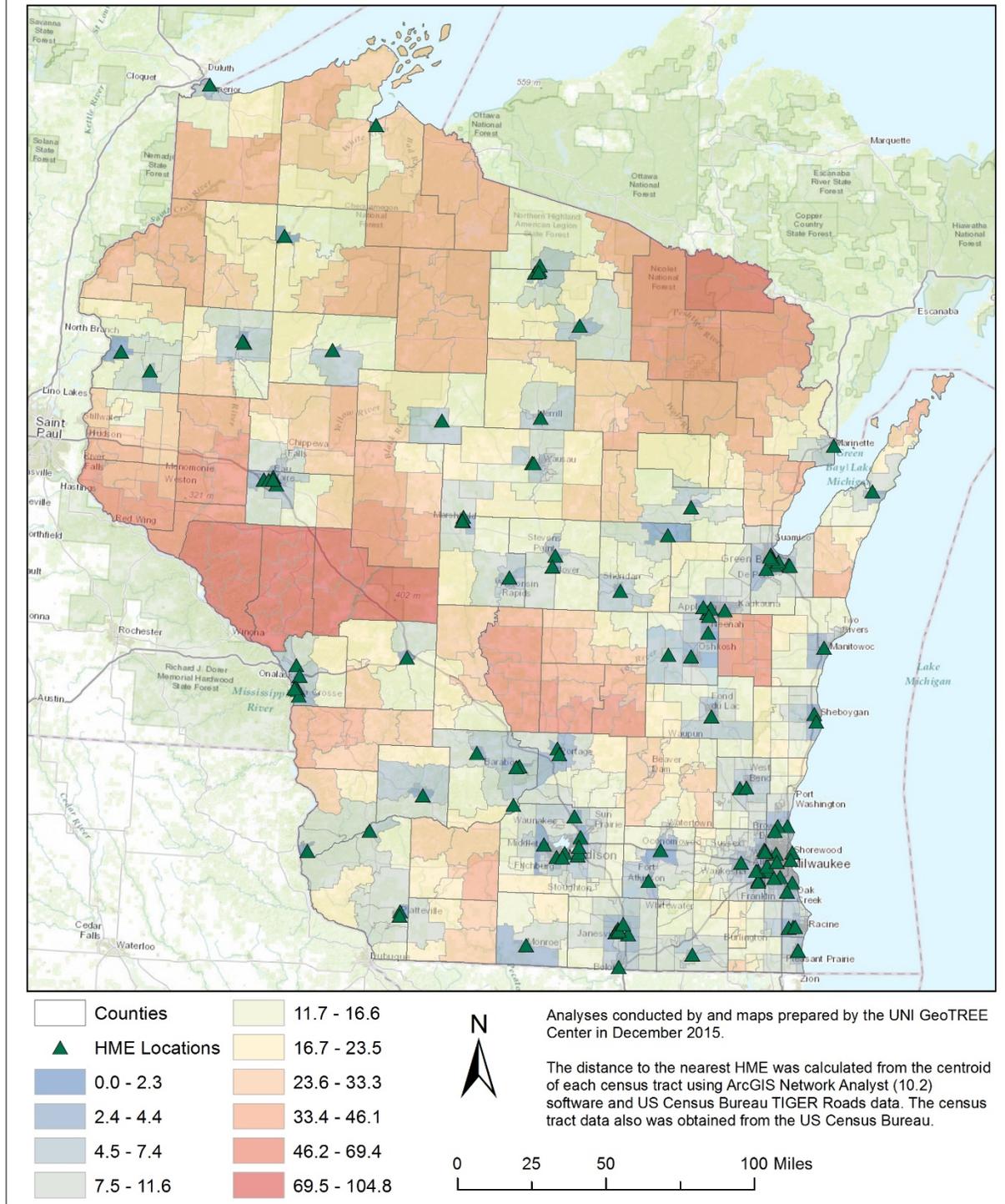
Table 7: Wisconsin

	Rural	Urban (CBA)	Neither
# of HME Suppliers	18	25	78
# of Hospitals	45	21	61
HMEs per Hospital	0.4	1.2	1.3
Demographics			
Area in class (sq. miles)	33,529	1,770	20,888
Population	1,050,664	1,722,334	2,913,988
Median age (years)	43	36	39
% of population over 65	17.5%	11.9%	13.7%
% of population with disabilities	12.6%	12.1%	11.2%
% of population who are veterans	11.3%	7.7%	9.6%
Comparative Metrics			
Avg Distance to HME (miles)	**30**	**4**	**7**
Avg Distance to Hospital (miles)	14	4	7
Sq miles per HME supplier	1,863	71	268
# of people served per HME supplier	58,370	68,893	37,359
# of people served per hospital	23,348	82,016	47,770
# of people over 65 served per HME supplier	9,652	8,580	4,988
# of disabled people served per HME supplier	6,871	7,869	4,004
# of veterans served per HME supplier	4,912	4,233	2,752

*Rural counties = Adams, Ashland, Bayfield, Buffalo, Burnett, Calumet, Clark, Crawford, Door, Douglas, Dunn, Florence, Forest, Grant, Green Lake, Iowa, Iron, Jackson, Kewaunee, Lafayette, Langlade, Lincoln, Marquette, Menominee, Oconto, Pepin, Pierce, Polk, Price, Richland, Rusk, Sawyer, Shawano, St. Croix, Taylor, Trempealeau, Vernon, Vilas, Washburn, Waupaca, Waushara

*Urban area (CBA) counties = Kenosha, Milwaukee, Ozaukee, Washington, Waukesha

*Neither urban (CBA) nor rural counties = Barron, Brown, Chippewa, Columbia, Dane, Dodge, Eau Claire, Fond du Lac, Green, Jefferson, Juneau, La Crosse, Manitowoc, Marathon, Marinette, Monroe, Oneida, Outagamie, Portage, Racine, Rock, Sauk, Sheboygan, Walworth, Winnebago, Wood

Figure 6: Travel distance from census tracts to nearest HME for Wisconsin within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract.

Disclosures

The reported distances in Tables 2-7 represents the average distance to the nearest HME or hospital for census tracts that fall in the given classification (Rural, CBA, Not CBA or Rural) to facilities that also are within that classification. The Median Age (years) represents the average median age for rural, CBA, and Not CBA census tracts in each state while % of population over 65 represents the average percentage of the population over 65 years of age for each type of census tract. Clearly there is a significant difference between distances to HME and hospitals for rural census tracts as compared to the other two classifications. It also should be noted that there can be a wide range of values for rural census tracts distance to nearest HME (see Figures 1-6).