Final Report

Accessibility in rural and urban areas: Nebraska, Idaho, Kansas, Utah, and South Dakota

UNI GeoTREE Center

August 28, 2015

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 South Dakota, Kansas, Nebraska, Idaho, and Utah.

The goal of the study was to understand, quantify and report on the proximity of people 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 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 five 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 400 HMEs geocoded across the five states (Idaho N = 61, Kansas N = 113, Nebraska N = 86, South Dakota N = 59, Utah = 81). 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 363 hospitals geocoded across the five states (Idaho N = 42, Kansas N = 132,

Nebraska N = 89, South Dakota N = 55, Utah = 45). 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 and the Network Analyst extension. All data for each individual state was projected to the UTM zone that covered the majority of that state (Idaho = UTM Zone 11N, Kansas = UTM Zone 14N, Nebraska = UTM Zone 14N, South Dakota = UTM Zone 14N, Utah = UTM Zone 12N). 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 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 averaged across each classification in that state (Tables 2-6).

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. On average, patients in the rural tracts are traveling 39 miles further to reach an HME than patients in the other two classifications. The greatest difference being in South Dakota with 51 miles difference and the lowest variance being Kansas with 23 miles difference.

Results and Products:

Tables 2-6 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.

Table 2: Idaho

	Rural	Urban (CBA)	Neither
# of HME Suppliers	16	13	32
# of Hospitals	24	7	11
HMEs per Hospital	0.7	1.9	2.9
Demographics			
Area in class (sq. miles)	**58,931**	**11,826**	**12,858**
Population	398,778	616,561	552,243
Median age (years)	40	36	35
% of population over 65	16.2%	11.7%	12.9%
% of population with disabilities	15.2%	12.2%	13.1%
% of population who are veterans	11.8%	10.4%	11.0%
Comparative Metrics			
Avg Distance to HME (miles)	**52**	**7**	**8**
Avg Distance to Hospital (miles)	23	7	9
Sq miles per HME supplier	3,683	910	402
# of people served per HME supplier	24,924	47,428	17,258
# of people served per hospital	16,616	88,080	50,204
# of people over 65 served per HME supplier	3,683	5,175	2,139
# of disabled people served per HME supplier	3,449	5,386	2,173
# of veterans served per HME supplier	2,074	3,534	1,370

*Rural counties= Adams, Bear Lake, Benewah, Blaine, Bonner, Boundary, Butte, Camas, Caribou, Cassia, Clark, Clearwater, Custer, Franklin, Fremont, Gooding, Idaho, Jefferson, Jerome, Latah, Lewis, Lincoln, Minidoka, Oneida, Payette, Power, Shoshone, Teton, Valley, Washington

*Urban area (CBA) counties: Ada, Boise, Canyon, Gem, Owyhee

*Neither urban (CBA) nor rural counties: Bannock, Bingham, Bonneville, Elmore, Kootenai, Madison, Nez Perce, Twin Falls

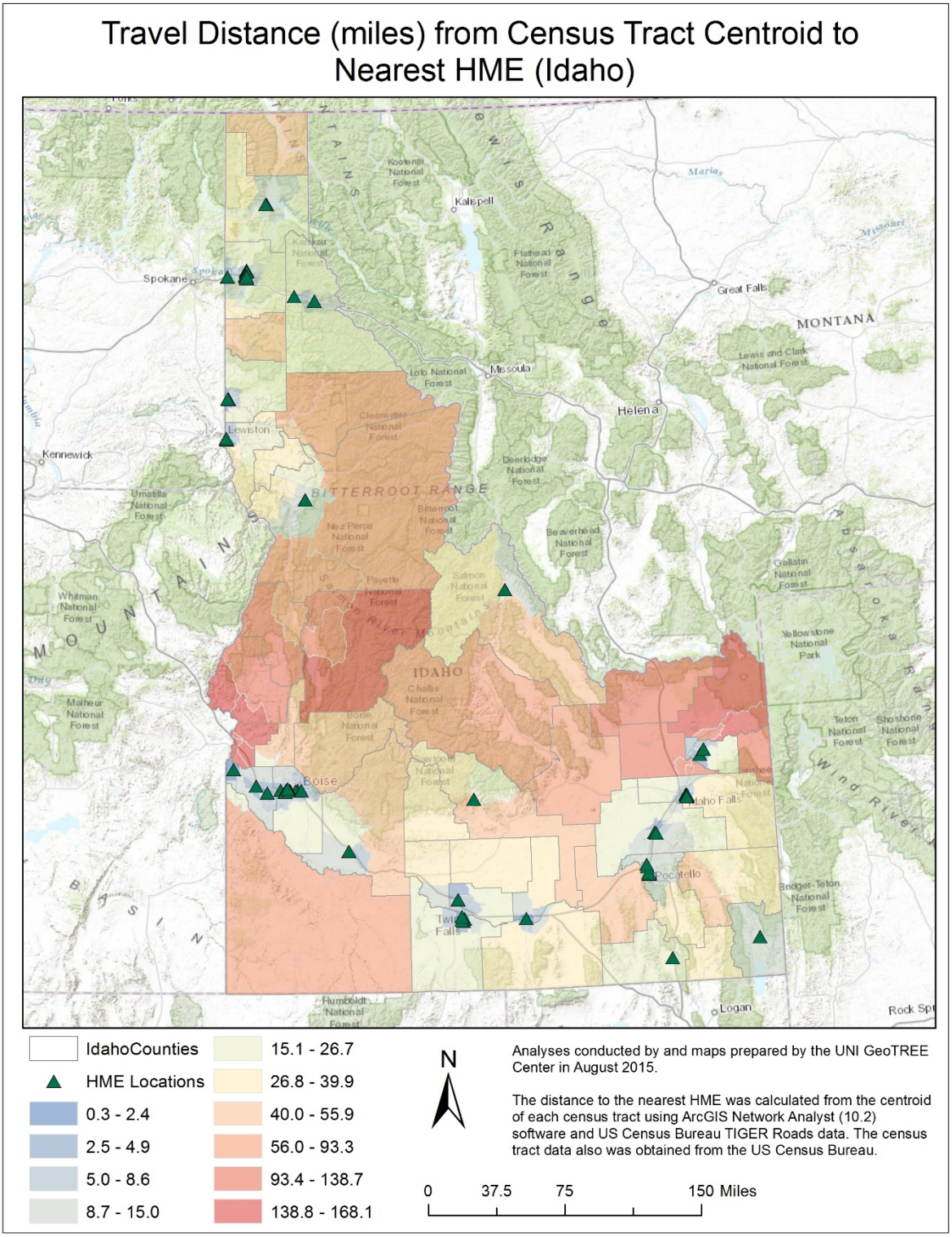

Figure 1: Travel distance from census tracts to nearest HME for Idaho within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract

Table 3: Kansas

	Rural	Urban (CBA)	Neither
# of HME Suppliers	23	28	62
# of Hospitals	68	28	36
HMEs per Hospital	0.3	1	1.7
Demographics			
Area in class (sq. miles)	**57,264**	**7,412**	**17,612**
Population	455,163	1,472,311	925,544
Median age (years)	44	36	36
% of population over 65	19.6%	11.9%	13.3%
% of population with disabilities	15.0%	11.8%	13.6%
% of population who are veterans	11.3%	9.9%	10.0%
Comparative Metrics			
Avg Distance to HME (miles)	**31**	**7**	**6**
Avg Distance to Hospital (miles)	22	10	11
Sq miles per HME supplier	2,490	265	284
# of people served per HME supplier	19,790	52,583	14,928
# of people served per hospital	6,694	52,583	25,710
# of people over 65 served per HME supplier	3,716	6,077	1,943
# of disabled people served per HME supplier	2,861	5,751	1,847
# of veterans served per HME supplier	1,686	3,748	1,087

*Rural counties= Allen, Anderson, Atchison, Barber, Brown, Chase, Chautauqua, Cheyanne, Clark, Clay, Cloud, Comanche, Decatur, Dickinson, Doniphan, Edwards, Elk, Ellsworth, Gove, Graham, Gray, Greeley, Greenwood, Hamilton, Harper, Haskell, Hodgeman, Jackson, Jefferson, Jewell, Kearney, Kingman, Kiowa, Lane, Lincoln, Linn, Logan, Marshall, Meade, Mitchell, Morris, Nemaha, Neosho, Ness, Norton, Osage, Osborne, Ottawa, Pawnee, Philips, Pottawatomie, Rawlins, Republic, Rice, Rooks, Rush, Russell, Scott, Sheridan, Sherman, Smith, Stafford, Stanton, Stevens, Thomas, Trego, Wabaunsee, Wallace, Washington, Wichita, Wilson, Woodson

*Urban area (CBA) counties: Butler, Franklin, Harvey, Johnson, Leavenworth, Marion, Miami, Sedgwick, Sumner, Wyandotte

*Neither urban (CBA) nor rural counties: Barton, Bourbon, Cherokee, Coffey, Cowley, Crawford, Douglas, Ellis, Finney, Ford, Geary, Grant, Labette, Lyon, McPherson, Montgomery, Morton, Pratt, Reno, Riley, Saline, Seward, Shawnee

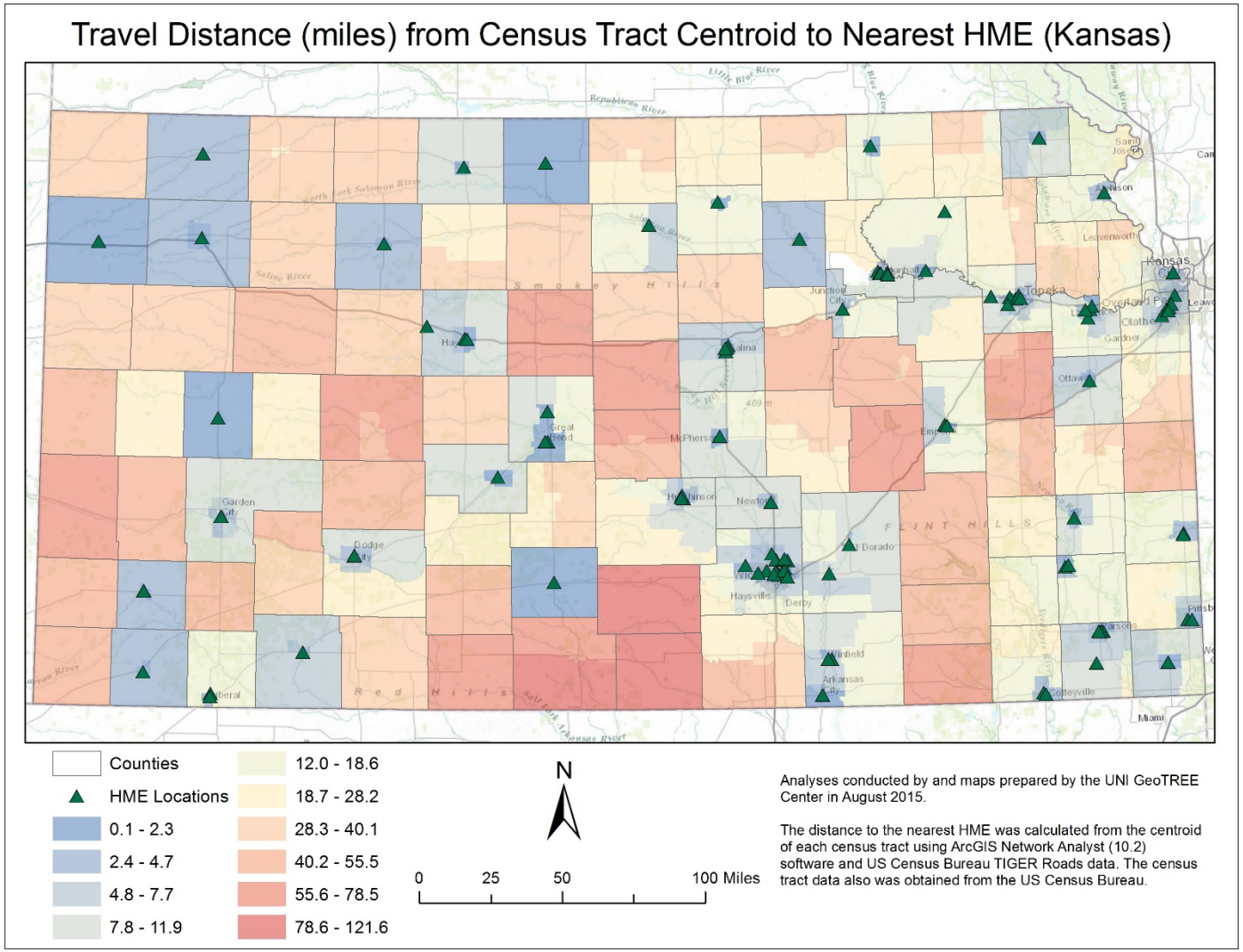

Figure 2: Travel distance from census tracts to nearest HME for Kansas within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract

Table 4: Nebraska

	Rural	Urban (CBA)	Neither
# of HME Suppliers	22	28	36
# of Hospitals	60	15	14
HMEs per Hospital	0.4	1.9	2.6
Demographics			
Area in class (sq. miles)	**65,735**	**2,850**	**8,774**
Population	456,343	778,896	591,102
Median age (years)	44	35	36
% of population over 65	19.6%	11.1%	12.9%
% of population with disabilities	13.4%	10.2%	10.9%
% of population who are veterans	11.2%	10.9%	9.5%
Comparative Metrics			
Avg Distance to HME (miles)	**41**	**4**	**5**
Avg Distance to Hospital (miles)	15	4	6
Sq miles per HME supplier	2,988	102	244
# of people served per HME supplier	20,743	27,818	16,420
# of people served per hospital	7,606	51,926	42,222
# of people over 65 served per HME supplier	3,889	3,029	2,120
# of disabled people served per HME supplier	2,620	2,735	1,724
# of veterans served per HME supplier	1,707	2,215	1,184

*Rural counties = Antelope, Arthur, Banner, Blaine, Boone, Box Butte, Boyd, Brown, Burt, Butler, Cedar, Chase, Cherry, Cheyenne, Clay, Colfax, Cuming, Custer, Dakota, Dawes, Dawson, Deuel, Dixon, Dundy, Fillmore, Franklin, Frontier, Furnas, Garden, Garfield, Gosper, Grant, Greeley, Hamilton, Harlan, Hayes, Hitchcock, Holt, Hooker, Howard, Jefferson, Johnson, Kearney, Keith, Keya Paha, Kimball, Know, Logan, Loup, McPherson, Merrick, Morrill, Nance, Nemaha, Nuckolls, Otoe, Pawnee, Perkins, Phelps, Pierce, Polk, Red Willow, Richardson, Rock, Saline, Seward, Sheridan, Sherman, Sioux, Stanton, Thayer, Thomas, Valley, Wayne, Webster, Wheeler, York

*Urban area (CBA) counties = Cass, Dodge, Douglas, Sarpy, Saunders, Washington

*Neither urban (CBA) nor rural counties = Adams, Buffalo, Gage, Hall, Lancaster, Lincoln, Madison, Platte, Scotts Bluff, Thurston

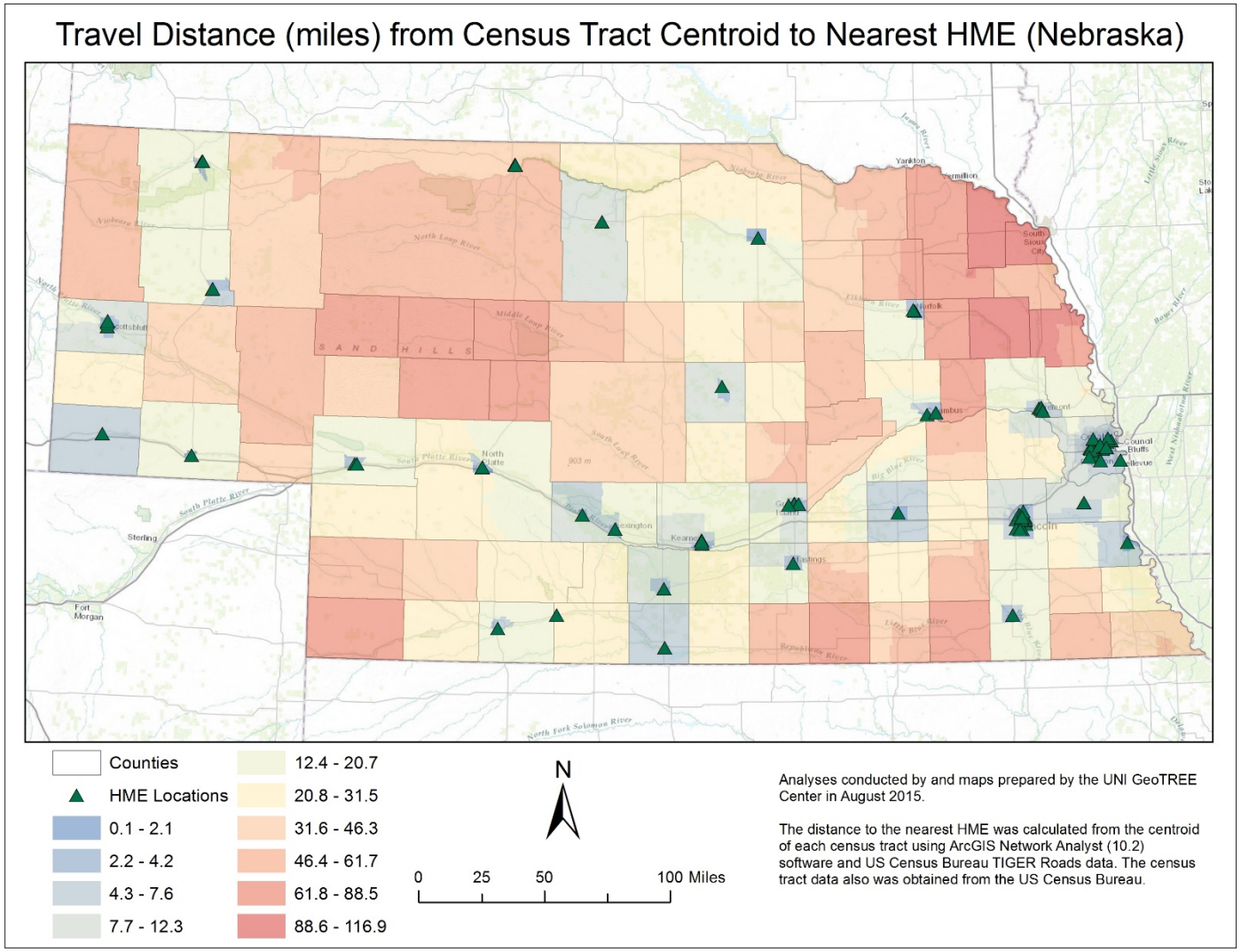

Figure 3: Travel distance from census tracts to nearest HME for Nebraska within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract.

Table 5: South Dakota

	Rural	Urban (CBA)	Neither
# of HME Suppliers	11	None	48
# of Hospitals	25	None	30
HMEs per Hospital	0.4	None	1.6
Demographics			
Area in class (sq. miles)	55,484	None	21,646
Population	244,726	None	569,454
Median age (years)	42	None	36
% of population over 65	18.8%	None	12.6%
% of population with disabilities	13.8%	None	11.4%
% of population who are veterans	11.1%	None	10.9%
Comparative Metrics		None	
Avg Distance to HME (miles)	**61**	None	**10**
Avg Distance to Hospital (miles)	30	None	7
Sq miles per HME supplier	5,044	None	451
# of people served per HME supplier	22,248	None	11,864
# of people served per hospital	9,789	None	18,982
# of people over 65 served per HME supplier	4,104	None	1,488
# of disabled people served per HME supplier	2,967	None	1,324
# of veterans served per HME supplier	1,875	None	985

*Rural counties= Aurora, Beadle, Bennett, Bon Homme, Brule, Buffalo, Butte, Campbell, Charles Mix, Clark, Clay, Corson, Custer, Day, Deuel, Douglas, Edmunds, Faulk, Grant, Gregory, Haakon, Hamlin, Hand, Hanson, Harding, Hutchinson, Hyde, Jackson, Jerauld, Jones, Kingsbury, Lake, Lyman, McCook, McPherson, Marshall, Mellette, Miner, Moody, Perkins, Potter, Roberts, Sanborn, Spink, Stanley, Sully, Tripp, Turner, Walworth, Ziebach

*Urban area (CBA) counties: None

*Neither urban (CBA) nor rural counties: Brookings, Brown, Codington, Davison, Dewey, Fall River, Hughes, Lawrence, Lincoln, Meade, Minnehaha, Pennington, Shannon, Todd, Union, Yankton

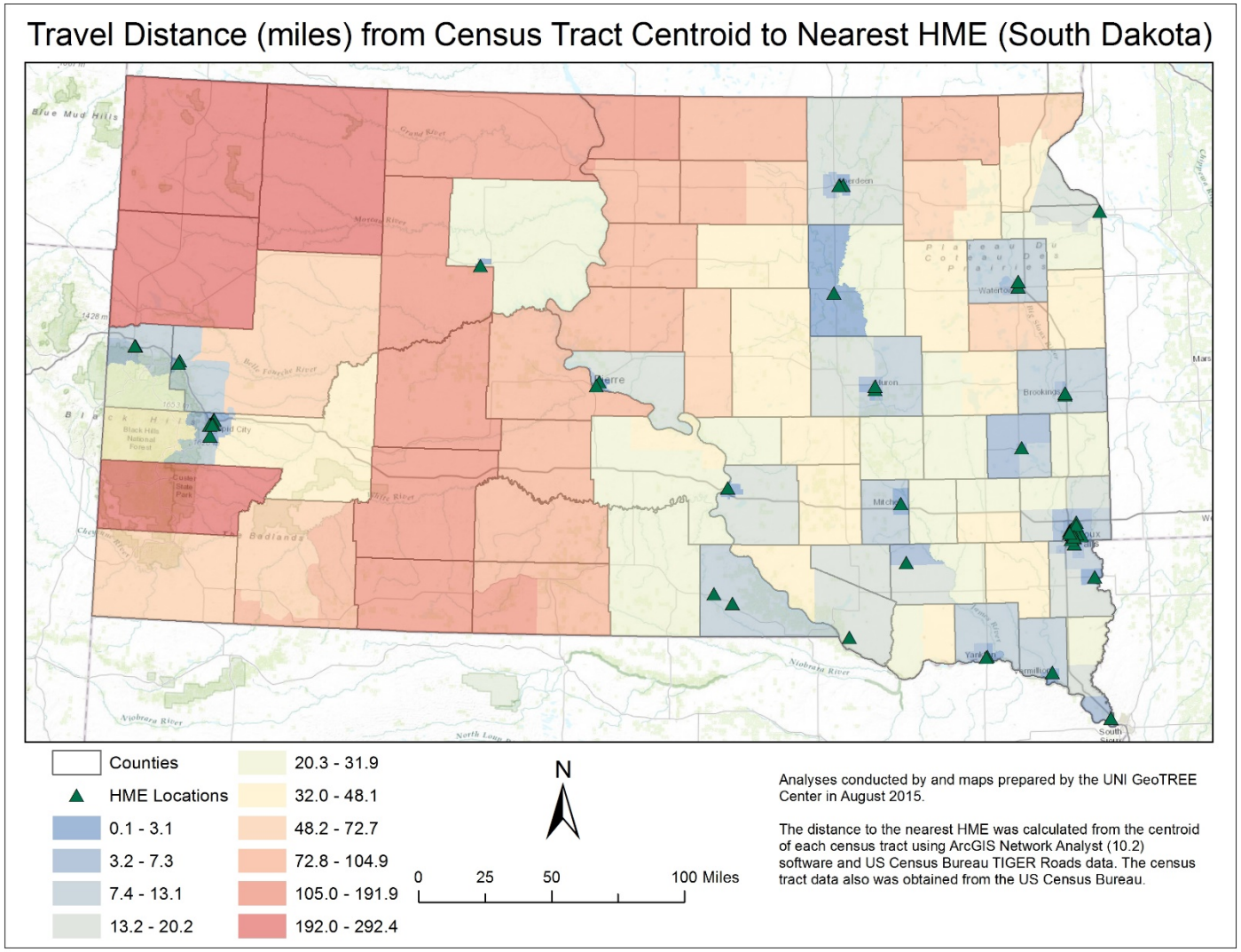

Figure 4: Travel distance from census tracts to nearest HME for South Dakota within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract.

Table 6: Utah

	Rural	Urban (CBA)	Neither
# of HME Suppliers	8	28	45
# of Hospitals	10	13	22
HMEs per Hospital	0.8	2.2	2.0
Demographics			
Area in class (sq. miles)	38,875	9,974	36,019
Population	133,299	1,124,197	1,506,389
Median age (years)	34	32	29
% of population over 65	12.7%	9.2%	9.1%
% of population with disabilities	12.1%	9.2%	9.2%
% of population who are veterans	8.8%	6.9%	7.7%
Comparative Metrics			
Avg Distance to HME (miles)	**43**	**5**	**8**
Avg Distance to Hospital (miles)	42	5	7
Sq miles per HME supplier	4,859	356	800
# of people served per HME supplier	16,662	40,150	33,475
# of people served per hospital	13,330	86,477	68,472
# of people over 65 served per HME supplier	1,992	3,447	3,045
# of disabled people served per HME supplier	1,871	3,558	3,028
# of veterans served per HME supplier	967	1,974	1,795

*Rural counties = Daggett, Emery, Grand, Juab, Kane, Millard, Morgan, Piute, Rich, San Juan, Sanpete, Wasatch, Wayne

*Urban area (CBA) counties = Salt Lake, Summit, Tooele

*Neither urban (CBA) nor rural counties = Beaver, Box Elder, Cache, Carbon, Davis, Duchesne, Garfield, Iron, Sevier, Uintah, Utah, Washington, Weber

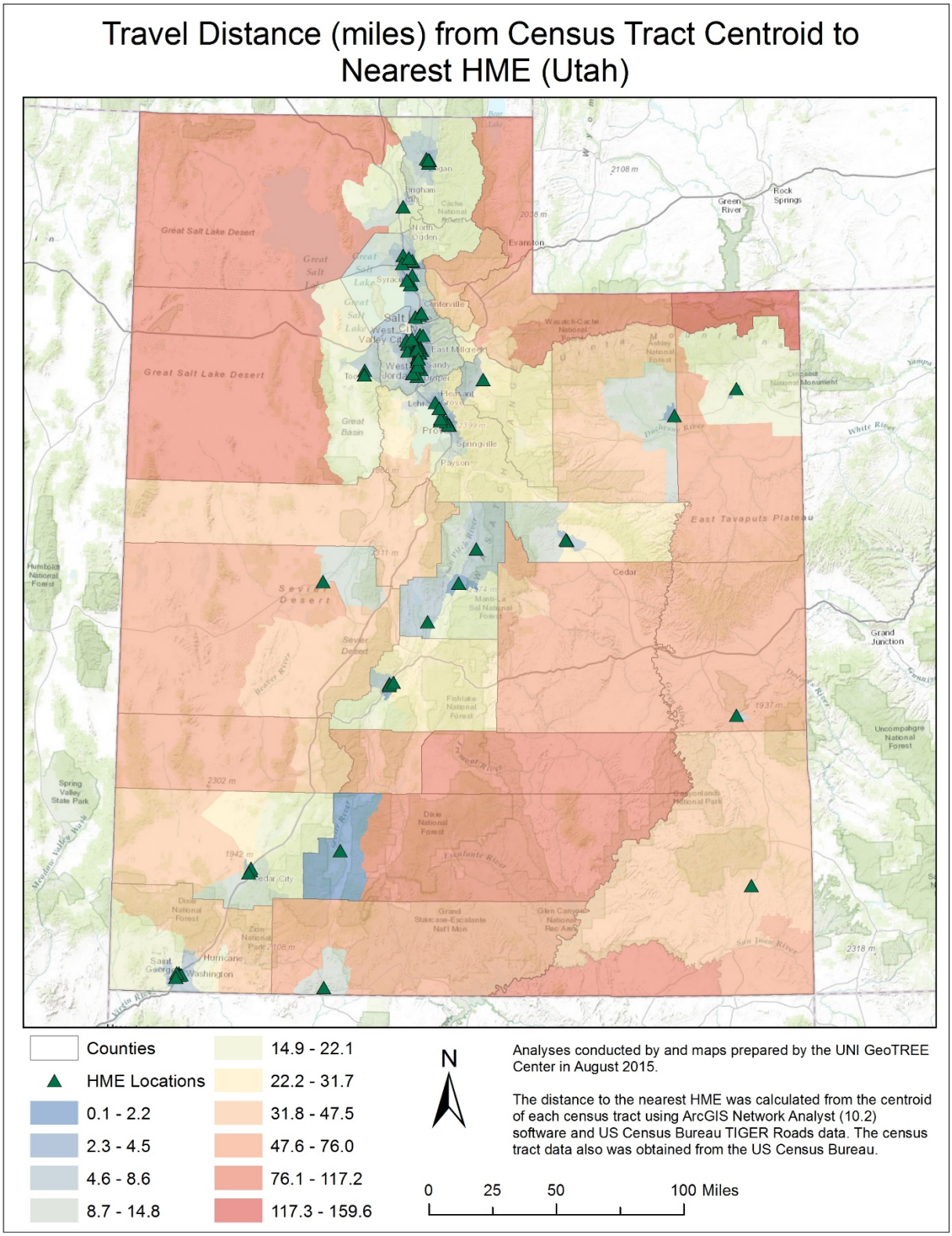

Figure 5: Travel distance from census tracts to nearest HME for Utah within a given classification. For example the distance to the nearest rural HME was calculated from each rural census tract.

Disclosures

The Avg Distance To Facility (miles) 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 or Rural 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 1-5).

The GeoInformatics Training, Research, Education, and Extension (GeoTREE) Center

August 28, 2015

The GeoTREE Center, located within the Geography Department at the University of Northern Iowa specializes in the application of geospatial technologies across a wide variety of disciplines. Geospatial technologies include Geographic Information Systems (GIS), Remote Sensing (RS), Global Positioning Systems (GPS), web mapping, and other related technology. The Center's mission includes supporting the use of these technologies across the campus at UNI and also throughout the state of Iowa. This is done through collaborative projects, contracts, and grants. The GeoTREE Center has provided training, extension, and outreach services to a variety of organizations across a range of governmental, non-profit, and private companies.

John DeGroote, Director of the GeoTREE Center and Instructor in the Geography Department, has 15 years' experience applying geospatial technologies to a variety of real world issues. He oversaw or carried out all data acquisition, managent, processing, and analysis for this project. UNI Geography Masters students Dylan Nielsen and Garrett Jepsen as well as undergraduate student Clemir Abbeg Coproski assisted in downloading, formatting, and processing various datasets.

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