Policy Brief • September 2021

WWAMI • ruralhealth researchcenter
UNIVERSITY of WASHINGTON

Geographic Access to Health Care for Rural Medicare Beneficiaries: A National Study

KEY FINDINGS

- Generalist physicians, nurse practitioners (NPs), and physician assistants (PAs) provided the majority of health care visits (51.7%) for rural Medicare beneficiaries ages 65 and older in the U.S. in 2014 (compared to 38.1% among urban beneficiaries).
- Rural beneficiaries received slightly more total visits per capita in 2014 than urban beneficiaries overall and within the same Census Division.
- Median travel distances and travel times to care for beneficiaries from isolated small rural areas were substantially higher (22.5 miles/31.0 minutes) than distances and times for urban beneficiaries (9.2 miles/18.0 minutes). Median travel distances and times for Hispanic and North American Native beneficiaries from isolated small rural areas were 28.0 miles (37.0 minutes) and 30.7 miles (42.0 minutes), respectively.
- For beneficiaries from small rural and isolated small rural areas, over 25% of visits for serious conditions such as ischemic heart disease and cancer required one-way trips of more than 50 miles taking more than one hour.
- Beneficiaries from isolated small rural places were much more likely to travel to another type of rural (or urban) area for their visits than rural beneficiaries from large and small rural areas.

BACKGROUND

Though the Medicare program provides near-universal health care coverage to Americans 65 years of age and older, there is evidence that differences in geographical access to care exist across the rural/urban dimension.[1-4] These differences in geographical access may create differences in utilization, access to medical and surgical specialists, and time and distance barriers that separate rural and urban beneficiaries from providers.[2,5-9] Recent work by the WWAMI Rural Health Research Center (RHRC)[10] used Medicare data to compare utilization, provider mix, and distance traveled for care among rural and urban beneficiaries from five states (AK, ID, NC, SC, WA) in 1998 and 2014.[10-11] The study found that, in 2014, generalist physicians, nurse practitioners (NPs), and physician assistants (PAs) provided a higher proportion of care to rural beneficiaries than in 1998. In addition, rural beneficiaries from smaller, more isolated, rural areas experienced higher one-way travel times to care than other beneficiaries, often exceeding the 30-minute benchmark for "appropriate access to care"[11] for serious conditions such as ischemic heart disease and cancer.[10]

The purposes of this study were to describe, for different types of rural/urban areas in the nine Census Divisions of the U.S., 1) the health workforce caring for rural and urban Medicare beneficiaries 65 years of age and older, 2) the quantity of care received by beneficiaries, 3) the distance/time traveled for care for selected conditions, and 4) where beneficiaries traveled for care.

METHODS

Medicare administrative data for calendar year 2014 (the latest data available at the time of the analysis) were used to examine the number of visits received by rural and urban fee-for-service Medicare beneficiaries aged 65 years and older who resided in the U.S. (Medicare also provides coverage for Americans under age 65 with disabilities and/or end-stage renal disease (ESRD); the present study includes data only from beneficiaries aged 65 and older.) Our data included 1) inpatient claims (where each claim represented a hospital stay (and is considered a "visit" in this study)), 2) outpatient claims submitted by institutional outpatient providers (such as hospital outpatient clinics), and 3) the carrier claims for outpatient services submitted by professional providers (such as physicians, NPs, and PAs) for a 20% random sample of beneficiaries. A single visit was defined by rows of data from the inpatient claims file, the outpatient claims file, and the carrier line file with the same beneficiary ID, visit date and provider National Provider Identifier (NPI) number. We obtained beneficiary information (residence ZIP code, age, race, and gender) from the carrier claims file and visit information (service facility ZIP code, provider NPI number, diagnosis code, procedure code, and cost) from the carrier line file. We obtained provider specialty codes from the Medicare Data on Provider Practice and Specialty (MD-PPAS) file for most providers (96.6%) in the study. For providers not in the MD-PPAS file, we used the Medicare specialty code from the claims files. We considered generalist physicians to include the following specialties: general practice, family practice, internal medicine, pediatrics, and geriatrics. We classified other physicians as medical specialists (e.g., allergy/immunology, cardiology, or dermatology) or surgical specialists (e.g., general surgery, otolaryngology, or neurosurgery). The two remaining provider groups were (1) nurse practitioners (NPs) and physician assistants (PAs), and (2) other (e.g., psychologists, social workers, or physical therapists). More detail on the Medicare data sources and processing can be found in the Technical Appendix.

The service facility ZIP code was used to identify where a visit took place (provider location). As shown in Table 1, we used the primary digit of the 2010 Rural-Urban Commuting Area (RUCA) codes[12] to classify each beneficiary and provider location as urban (RUCAs 1-3), large rural (RUCAs 4-6), small rural (RUCAs 7-9), or isolated small rural (RUCA 10). Version 3.1 of the ZIP code approximation of RUCA codes was used.[12]

Table 1. Primary Rural-Urban Commuting Area Codes (RUCAs), 2010[12]

Code	Description
Urban	
1	Metropolitan area core: primary flow within urbanized area (UA)
2	Metropolitan area high commuting: primary flow 30% or more to UA
3	Metropolitan area low commuting: primary flow 10% to 30% to UA
Large Rural	
4	Micropolitan area core: primary flow within an urban cluster of 10,000 to 49,999 (large UC)
5	Micropolitan area high commuting: primary flow 30% or more to a large UC
6	Micropolitan area low commuting: primary flow 10% to 30% to a large UC
Small Rural	
7	Small town core: primary flow within an urban cluster of 2,500 to 9,999 (small UC)
8	Small town high commuting: primary flow 30% or more to a small UC
9	Small town low commuting: primary flow 10% to 30% to a small UC
Isolated Small Rural	
10	Rural areas: primary flow to ZIP outside a UA or UC

We calculated the distance and time traveled for each visit using the beneficiary and service facility ZIP code and Google Maps. Full details of the provider type classifications, data set construction and analyses, and distance/travel time calculations are in the Technical Appendix. We used Version 9.4 of the SAS System for Windows software for analysis. Using procedures approved by the University of Washington's Internal Review Board, it was determined that human subjects review was not required for this study.

FINDINGS

Table 2 shows the demographic characteristics of fee-for-service Medicare beneficiaries 65 years of age and older who had at least one health care visit in 2014 by the level of rurality of their residence. Overall, the average age of these patients was 75.8 years. Most beneficiaries who had a visit were White (86.8%), 7.9% were Black, and less than 2% were Asian, North American Native, or another unspecified race, or of Hispanic ethnicity (though Hispanics can be any race, the data provide only one race/ethnicity category for each beneficiary). More than half (59.1%) were women. The majority of beneficiaries (82.2%) lived in an urban location, while 8.7% lived in large rural, 5.0% in small rural, and 4.1% in isolated small rural places. Table 2 also shows the wide variation in the distribution of the rural beneficiaries at the Census Division level. For example, 29.1% of beneficiaries from isolated small rural areas in the U.S. reside in the West North Central Division, which is home to only 8.7% of U.S. beneficiaries overall. This is in contrast to the Pacific Division, which is home to 11.3% of the study population but only 6.4% of the beneficiaries that live in isolated small rural areas.

Table 2. Characteristics of Medicare Beneficiaries by Beneficiary Residence, 2014

	Urban n=18,127,754 (82.2%)		Large Rural n=1,908,439 (8.7%)		Small Rural n=1,112,060 (5.0%)		Isolated Small Rural n=913,225 (4.1%)		All n=22,061,478 (100.0%)	
Average Age	75.8		75.6		75.7		75.6		75.8	
	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %	Count	Col. %
Age										
65-69	5,031,195	27.8	533,012	27.9	304,897	27.4	248,027	27.2	6,117,131	27.7
70-74	4,158,720	22.9	448,498	23.5	262,064	23.6	218,748	24.0	5,088,030	23.1
75-79	3,288,120	18.1	356,102	18.7	210,303	18.9	173,610	19.0	4,028,135	18.3
80-84	2,551,533	14.1	268,382	14.1	157,155	14.1	129,345	14.2	3,106,415	14.1
85+	3,098,186	17.1	302,445	15.9	177,641	16.0	143,495	15.7	3,721,767	16.9
Gender*										
Male	7,365,113	40.6	792,981	41.6	466,014	41.9	398,498	43.6	9,022,606	40.9
Female	10,762,639	59.4	1,115,458	58.5	646,046	58.1	514,727	56.4	13,038,870	59.1
Race/Ethnicity*										
White	15,321,819	85.5	1,749,153	92.4	1,023,599	92.8	857,882	94.7	18,952,453	86.8
Black	1,559,441	8.7	90,063	4.8	50,921	4.6	22,538	2.5	1,722,963	7.9
Asian	324,535	1.8	6,047	0.3	2,095	0.2	1,066	0.1	333,743	1.5
Hispanic	347,118	1.9	14,283	0.8	5,483	0.5	2,780	0.3	369,664	1.7
North American Native	319,681	1.8	18,177	1.0	14,579	1.3	16,109	1.8	368,546	1.7
Other Unspecified Race	56,981	0.3	15,125	0.8	6,784	0.6	5,130	0.6	84,020	0.4
Census Division†										
New England	1,160,607	6.4	67,490	3.5	50,123	4.5	79,683	8.7	1,357,903	6.2
Middle Atlantic	2,533,656	14.0	104,557	5.5	49,939	4.5	45,503	5.0	2,733,655	12.4
East North Central	3,087,080	17.0	361,728	19.0	188,135	16.9	140,803	15.4	3,777,746	17.1
West North Central	1,161,779	6.4	283,252	14.8	209,069	18.8	265,552	29.1	1,919,652	8.7
South Atlantic	4,118,302	22.7	240,599	12.6	125,803	11.3	86,677	9.5	4,571,381	20.7
East South Central	1,043,975	5.8	276,180	14.5	151,664	13.6	80,446	8.8	1,552,265	7.0
West South Central	1,873,596	10.3	224,250	11.8	150,082	13.5	78,981	8.7	2,326,909	10.6
Mountain	943,940	5.2	178,528	9.4	119,783	10.8	77,144	8.5	1,319,395	6.0
Pacific	2,204,819	12.2	171,855	9.0	67,462	6.1	58,436	6.4	2,502,572	11.3

*Data on race/ethnicity was missing for 230,089 beneficiaries and gender data was missing for two beneficiaries.
†New England =CT, ME, MA, NH, RI, VT; Middle Atlantic=NJ, NY, PA; East North Central=IL, IN, MI, OH, WI; West North Central=IA, KS, MN, MO, NE, ND, SD; South Atlantic=DE, DC, FL, GA, MD, NC, SC, VA, WV; East South Central=AL, KY, MS, TN; West South Central=AR, LA, OK, TX; Mountain=AZ, CO, ID, MT, NV, NM, UT, WY; Pacific=AK, CA, HI, OR, WA.

The average numbers of visits for urban and rural beneficiaries are shown in Table 3. Urban beneficiaries averaged 8.9 visits in 2014. Rural beneficiaries living in large rural places averaged 9.3 annual visits, and those from small and isolated small rural places had 9.7 and 9.8 visits, respectively. Overall, beneficiaries from all three types of rural areas combined received an average of 9.5 visits during the year (not tabled). There was greater variation across Census Divisions. Beneficiaries in the New England Division received the highest average number of annual visits in urban areas (10.4 visits) and in all three types of rural areas (between 11.6 and 12.3 visits). In contrast, the lowest number of mean annual visits was observed among rural beneficiaries from the Mountain Division (between 8.4 and 8.6). The lowest number for mean annual visits for urban beneficiaries was seen in the East South Central Division (8.1). Beneficiaries from all three types of rural areas and from all racial/ethnic groups except Asians received slightly

Table 3. Mean Number of Medicare Beneficiary Visits by Census Division* and Beneficiary Residence, 2014

Mean number of visits (SD)†	Urban	Large Rural	Small Rural	Isolated Small Rural	All
New England	10.4 (13.0)	11.6 (12.5)	12.3 (12.7)	11.9 (12.3)	10.6 (12.9)
Middle Atlantic	9.5 (13.6)	10.5 (12.8)	10.9 (12.6)	10.4 (12.2)	9.6 (13.5)
East North Central	9.1 (11.8)	10.1 (11.9)	10.2 (11.8)	9.9 (11.5)	9.4 (11.8)
West North Central	8.3 (11.2)	9.8 (11.6)	10.7 (11.7)	10.7 (11.6)	9.3 (11.5)
South Atlantic	8.8 (12.3)	8.7 (11.3)	9.0 (10.9)	8.8 (10.8)	8.8 (12.1)
East South Central	8.1 (11.1)	8.5 (11.0)	9.0 (11.1)	9.2 (10.9)	8.4 (11.1)
West South Central	8.3 (11.4)	8.6 (11.1)	9.1 (11.0)	9.0 (10.8)	8.5 (11.3)
Mountain	8.3 (11.9)	8.4 (10.8)	8.6 (10.2)	8.5 (9.8)	8.4 (11.4)
Pacific	8.6 (12.1)	9.4 (11.4)	9.4 (10.8)	8.6 (10.4)	8.7 (12.0)
U.S.	8.9 (12.2)	9.3 (11.5)	9.7 (11.4)	9.8 (11.3)	9.1 (12.0)

*New England=CT, ME, MA, NH, RI, VT; Middle Atlantic=NJ, NY, PA; East North Central=IL, IN, MI, OH, WI; West North Central=IA, KS, MN, MO, NE, ND, SD; South Atlantic=DE, DC, FL, GA, MD, NC, SC, VA, WV; East South Central=AL, KY, MS, TN; West South Central=AR, LA, OK, TX; Mountain=AZ, CO, ID, MT, NV, NM, UT, WY; Pacific=AK, CA, HI, OR, WA.
†SD-Standard Deviation

higher mean numbers of visits than their urban counterparts (Table 4). Whites and North American Natives received the highest mean number of visits overall (9.2 and 9.9 respectively). Blacks, Asians, Hispanics, and those of other unspecified races received fewer visits than their White and North American Native counterparts in each geographic category. Among the five racial/ethnic groups analyzed, Asian beneficiaries received the lowest mean number of visits overall (7.9) and in each geographic category.

Table 4. Mean Number of Medicare Beneficiary Visits by Race/Ethnicity* and Beneficiary Residence, 2014

Mean number of visits (SD)†	Urban	Large Rural	Small Rural	Isolated Small Rural	All
White	9.0 (12.4)	9.4 (11.6)	9.8 (11.5)	9.9 (11.3)	9.2 (12.2)
Black	8.6 (11.5)	8.6 (10.9)	9.1 (10.9)	8.9 (10.6)	8.6 (11.4)
Asian	8.0 (11.4)	7.4 (9.3)	7.8 (9.7)	8.0 (9.2)	7.9 (11.3)
Hispanic	8.1 (10.8)	9.0 (10.5)	8.9 (9.8)	8.3 (9.5)	8.2 (10.7)
North American Native	9.4 (11.2)	10.0 (10.4)	10.1 (10.4)	10.2 (10.9)	9.9 (10.8)
Other Unspecified Race	7.6 (11.1)	8.0 (10.6)	8.3 (10.1)	8.6 (10.6)	7.7 (11.0)

*Data on race/ethnicity was missing for 230,089 beneficiaries.
†SD-Standard Deviation

Table 5 describes the types of providers who performed the 200,209,620 visits examined in the study by the rural/urban category of their residence. At the national level, generalist physicians and medical specialist physicians each provided slightly more than one third of all beneficiary visits (35.7% and 36.0% respectively). Surgical specialist physicians provided 14.6% of all visits. NPs and PAs combined provided 6.1% of visits, and other clinicians provided 7.7% of visits. Of visits provided by 'other providers,' the most frequent included physical therapists (28.5%), podiatrists (23.4%), chiropractors (22.3%), and optometrists (10.5%), not tabled. Generalist physicians provided a larger share of the care for beneficiaries from large rural, small rural and isolated small rural areas than for urban beneficiaries (39.9%, 44.3% and 42.4% respectively, versus 33.4%). Generalist physicians and NPs/PAs provided more than half (51.7%, not tabled) of the visits received by all rural beneficiaries (48.3% in large rural areas, 54.1% in small rural areas, and 56.1% in isolated small rural areas), compared with 38.1% of the visits received by urban residents. Medical specialist physicians provided a larger percentage of visits for urban beneficiaries (38.6%) than for rural beneficiaries from large rural, small rural, and isolated small rural areas (31.1%, 27.4% and 25.6% respectively). The provider mix caring for rural Medicare beneficiaries also varied across Census Division. Generalist physicians provided a larger proportion of rural visits in the West North Central, East North Central, and West South Central Divisions, especially for beneficiaries residing in small rural and isolated small rural areas. NP/PAs provided larger contributions to rural care in the New England, West North Central, and Mountain Divisions.

Table 5. Medicare Beneficiary Visits by Provider Type, Census Division* and Beneficiary Residence, 2014

	Generalists		Medical Specialists		Surgical Specialists		Nurses Practitioners and Physician Assistants		Other Providers		All
	Visits	Row (%)	Visits	Row (%)	Visits	Row (%)	Visits	Row (%)	Visits	Row (%)	Visits
U.S.	**71,409,749**	**35.7**	**71,991,858**	**36.0**	**29,206,860**	**14.6**	**12,234,300**	**6.1**	**15,366,853**	**7.7**	**200,209,620**
Urban	48,988,114	33.4	56,487,899	38.6	22,100,505	15.1	6,873,210	4.7	12,024,493	8.2	146,474,221
Large Rural	10,478,013	39.9	8,177,732	31.1	3,674,307	14.0	2,219,822	8.5	1,717,421	6.5	26,267,295
Small Rural	7,078,028	44.3	4,381,465	27.4	2,021,094	12.7	1,562,723	9.8	937,262	5.9	15,980,572
Isolated Small Rural	4,865,594	42.4	2,944,762	25.6	1,410,954	12.3	1,578,545	13.7	687,677	6.0	11,487,532
New England	**5,256,122**	**36.2**	**5,045,071**	**34.7**	**2,112,886**	**14.5**	**1,107,630**	**7.6**	**1,006,293**	**6.9**	**14,528,002**
Urban	3,978,348	34.8	4,258,390	37.2	1,689,602	14.8	692,820	6.1	826,172	7.2	11,445,332
Large Rural	472,878	40.2	334,485	28.4	167,686	14.3	132,889	11.3	68,423	5.8	1,176,361
Small Rural	333,755	42.4	182,789	23.2	104,953	13.3	119,903	15.2	45,144	5.7	786,544
Isolated Small Rural	471,141	42.1	269,407	24.1	150,645	13.5	162,018	14.5	66,554	5.9	1,119,765
Middle Atlantic	**8,460,805**	**32.1**	**9,907,341**	**37.6**	**4,093,372**	**15.5**	**1,158,845**	**4.4**	**2,742,956**	**10.4**	**26,363,319**
Urban	7,017,838	30.7	8,900,354	38.9	3,605,461	15.8	842,101	3.7	2,517,399	11.0	22,883,153
Large Rural	798,257	41.2	580,568	30.0	275,301	14.2	155,643	8.0	126,951	6.6	1,936,720
Small Rural	343,682	42.8	221,590	27.6	110,589	13.8	77,277	9.6	50,619	6.3	803,757
Isolated Small Rural	301,028	40.7	204,829	27.7	102,021	13.8	83,824	11.3	47,987	6.5	739,689
East North Central	**13,745,194**	**38.7**	**12,535,357**	**35.3**	**4,964,564**	**14.0**	**1,861,468**	**5.2**	**2,430,083**	**6.8**	**35,536,666**
Urban	9,394,489	37.0	9,542,482	37.5	3,665,672	14.4	1,000,093	3.9	1,815,331	7.1	25,418,067
Large Rural	2,154,105	41.7	1,597,655	30.9	694,127	13.4	399,373	7.7	318,150	6.2	5,163,410
Small Rural	1,450,755	45.3	903,431	28.2	390,368	12.2	268,948	8.4	188,210	5.9	3,201,712
Isolated Small Rural	745,845	42.5	491,789	28.0	214,397	12.2	193,054	11.0	108,392	6.2	1,753,477
West North Central	**7,289,492**	**40.6**	**5,169,919**	**28.8**	**2,236,718**	**12.4**	**1,872,592**	**10.4**	**1,402,737**	**7.8**	**17,971,458**
Urban	2,957,035	36.0	2,878,902	35.0	1,088,898	13.2	594,884	7.2	699,522	8.5	8,219,241
Large Rural	1,440,683	42.7	890,458	26.4	437,218	13.0	324,173	9.6	279,170	8.3	3,371,702
Small Rural	1,429,235	47.7	678,586	22.6	342,970	11.4	343,021	11.4	205,420	6.8	2,999,232
Isolated Small Rural	1,462,539	43.3	721,973	21.4	367,632	10.9	610,514	18.1	218,625	6.5	3,381,283
South Atlantic	**13,452,717**	**33.5**	**15,376,679**	**38.3**	**6,303,795**	**15.7**	**2,054,314**	**5.1**	**2,992,024**	**7.4**	**40,179,529**
Urban	10,753,245	32.4	13,071,386	39.4	5,267,334	15.9	1,498,716	4.5	2,598,183	7.8	33,188,864
Large Rural	1,437,631	36.9	1,351,194	34.7	592,975	15.2	280,674	7.2	232,736	6.0	3,895,210
Small Rural	823,117	41.5	612,587	30.9	280,221	14.1	166,749	8.4	101,215	5.1	1,983,889
Isolated Small Rural	438,724	39.5	341,512	30.7	163,265	14.7	108,175	9.7	59,890	5.4	1,111,566

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Table 5. Medicare Beneficiary Visits by Provider Type, Census Division* and Beneficiary Residence, 2014 *Continued*

	Generalists		Medical Specialists		Surgical Specialists		Nurses Practitioners and Physician Assistants		Other Providers		All
	Visits	Row (%)	Visits	Row (%)	Visits	Row (%)	Visits	Row (%)	Visits	Row (%)	Visits
East South Central	**4,716,005**	**36.3**	**4,571,036**	**35.2**	**1,892,181**	**14.6**	**1,043,603**	**8.0**	**768,044**	**5.9**	**12,990,869**
Urban	2,387,466	33.8	2,701,719	38.2	1,082,720	15.3	431,032	6.1	467,586	6.6	7,070,523
Large Rural	1,160,916	37.1	1,041,321	33.3	456,366	14.6	298,388	9.5	171,434	5.5	3,128,425
Small Rural	786,680	41.2	578,207	30.3	247,601	13.0	205,472	10.8	91,456	4.8	1,909,416
Isolated Small Rural	380,943	43.2	249,789	28.3	105,494	12.0	108,711	12.3	37,568	4.3	882,505
West South Central	**7,247,142**	**36.7**	**7,378,719**	**37.3**	**2,955,890**	**15.0**	**949,776**	**4.8**	**1,224,190**	**6.2**	**19,755,717**
Urban	4,500,106	33.8	5,329,674	40.0	2,082,370	15.6	550,133	4.1	868,949	6.5	13,331,232
Large Rural	1,293,386	40.5	1,059,224	33.2	469,447	14.7	176,521	5.5	192,617	6.0	3,191,195
Small rural	1,010,437	45.1	694,957	31.0	281,204	12.6	138,545	6.2	115,034	5.1	2,240,177
Isolated Small Rural	443,213	44.6	294,864	29.7	122,869	12.4	84,577	8.5	47,590	4.8	993,113
Mountain	**3,749,695**	**34.0**	**3,778,356**	**34.2**	**1,519,732**	**13.8**	**984,678**	**8.9**	**1,007,706**	**9.1**	**11,040,167**
Urban	2,259,078	31.0	2,765,122	37.9	1,030,668	14.1	517,945	7.1	723,068	9.9	7,295,881
Large Rural	648,194	37.1	531,914	30.5	237,603	13.6	182,488	10.5	144,761	8.3	1,744,960
Small Rural	515,273	42.9	296,970	24.7	154,951	12.9	147,039	12.2	86,355	7.2	1,200,588
Isolated Small Rural	327,150	41.0	184,350	23.1	96,510	12.1	137,206	17.2	53,522	6.7	798,738
Pacific	**7,492,577**	**34.3**	**8,229,380**	**37.7**	**3,127,722**	**14.3**	**1,201,394**	**5.5**	**1,792,820**	**8.2**	**21,843,893**
Urban	5,740,509	32.6	7,039,870	39.9	2,587,780	14.7	745,486	4.2	1,508,283	8.6	17,621,928
Large Rural	1,071,963	40.3	790,913	29.7	343,584	12.9	269,673	10.1	183,179	6.9	2,659,312
Small Rural	385,094	45.0	212,348	24.8	108,237	12.7	95,769	11.2	53,809	6.3	855,257
Isolated Small Rural	295,011	41.7	186,249	26.3	88,121	12.5	90,466	12.8	47,549	6.7	707,396

*New England=CT, ME, MA, NH, RI, VT; Middle Atlantic=NJ, NY, PA; East North Central=IL, IN, MI, OH, WI; West North Central=IA, KS, MN, MO, NE, ND, SD; South Atlantic=DE, DC, FL, GA, MD, NC, SC, VA, WV; East South Central=AL, KY, MS, TN; West South Central=AR, LA, OK, TX; Mountain=AZ, CO, ID, MT, NV, NM, UT,WY; Pacific=AK, CA, HI, OR, WA.

The median one-way distances (miles) and times (minutes) that beneficiaries traveled for care for all visits and for a select group of diagnoses is shown in Table 6. Urban beneficiaries traveled a median of 9.2 miles for each visit. Rural beneficiaries traveled farther, ranging from a median of 9.6 miles for beneficiaries from large rural places, to 13.0 miles for those from small rural areas, to 22.5 miles for those from isolated small rural places. Analysis of the distribution of the distances traveled by rural beneficiaries indicates that a large minority of rural residents face far longer journeys for care. This can be seen by examining the interquartile ranges (IQR) for distance traveled by rural beneficiaries, also shown in Table 6. For example, the IQR for isolated small rural beneficiaries was between 10.2 and 41.9 miles; this indicates that 25% of visits by residents of isolated small rural areas involved travel distances greater than 41.9 miles. In contrast, the IQR for visits received by urban beneficiaries was much narrower, between 3.5 and 17.8 miles. Analogous differences were observed in travel times; median travel times for residents of large rural and small

rural areas were similar to urban travel times, but the IQRs for beneficiaries in large rural and small rural places (0-35.0 minutes and 0-44.0 minutes, respectively) were much broader than the urban IQR (10.0-28.0 minutes). (Lower IQR thresholds of zero were sometimes observed because distances between residence and care site were calculated using the distance between the geographic center of the ZIP code of residence and the geographic center of the ZIP code of the care site. If residence and care site were in the same ZIP code, the distance was, for purposes of the analysis, zero miles. See Technical Appendix for details.) The estimate of median travel time for all visits received by residents of isolated small rural areas was 31.0 minutes (IQR 16.0-54.0).

Examination of median distance and travel times for seven selected diagnoses revealed similar patterns of longer rural distances and travel times with much broader IQRs. For example, the median distance rural beneficiaries traveled for treatment for ischemic heart disease ranged from 14.1 miles (IQR 0-37.8) for visits by residents of large rural areas, to 29.0 miles (IQR 14.7-57.5) for visits by residents of isolated small rural areas. The median distance traveled for visits by urban residents was 10.4 miles (IQR 4.5-19.7). Similar patterns were seen in distance and travel time to care for malignant neoplasm. Visits by beneficiaries from isolated small rural areas for malignant neoplasm (cancer) involved a median travel distance of 36.9 miles (IQR 20.1-67.2 miles) and median travel time of 47.0 minutes (IQR 28.0-79.0 minutes). The IQR for distance traveled for cancer care by beneficiaries from isolated small rural areas indicates that 25% of those visits required traveling more than 67.2 miles.

Table 6. Median Medicare Beneficiary Travel Distance and Time by Selected Diagnosis and Beneficiary Residence, 2014

Selected Diagnoses		Median Distance in Miles (IQR*), Median Time in Minutes (IQR*)				
		Urban	Large Rural	Small Rural	Isolated Small Rural	All Areas
All Visits (200,209,620)	Median Distance in Miles (IQR)	9.2 (3.5-17.8)	9.6 (0*-24.5)	13.0 (0*-34.2)	22.5 (10.2-41.9)	9.6 (2.6-19.6)
	Median Time in Min (IQR)	18.0 (10.0-28.0)	16.0 (0*-35.0)	19.0 (0*-44.0)	31.0 (16.0-54.0)	18.0 (8.0-30.0)
Depression and Anxiety (1,180,519)	Median Distance in Miles (IQR)	8.4 (2.8-16.8)	9.2 (0*-24.1)	0† (0*-25.9)	17.8 (0*-33.0)	8.6 (1.1-18.2)
	Median Time in Min (IQR)	17.0 (9.0-27.0)	16.0 (0*-34.0)	0† (0*-36.0)	26.0 (0*-45.0)	17.0 (2.0-28.0)
Fractures and Dislocations (2,290,890)	Median Distance in Miles (IQR)	8.4 (3.1-16.4)	9.2 (0*-24.4)	15.4 (0*-39.3)	24.8 (12.2-46.6)	8.8 (2.1-18.5)
	Median Time in Min (IQR)	17.0 (9.0-26.0)	16.0 (0*-35.0)	23.0 (0*-49.0)	34.0 (18.0-59.0)	17.0 (7.0-28.0)
Cerebrovascular Disease (2,294,968)	Median Distance in Miles (IQR)	9.4 (3.7-18.3)	11.6 (0*-31.6)	17.1 (0*-44.4)	26.2 (12.9-52.7)	10.0 (3.0-20.8)
	Median Time in Min (IQR)	18.0 (10.0-28.0)	19.0 (0*-42.0)	25.0 (0*-55.0)	36.0 (19.0-65.0)	18.0 (9.0-31.0)
Congestive Heart Failure (2,059,023)	Median Distance in Miles (IQR)	9.0 (3.4-17.6)	9.0 (0*-23.0)	6.1 (0*-29.4)	20.5 (0*-37.2)	9.3 (1.7-19.4)
	Median Time in Min (IQR)	17.0 (10.0-27.0)	15.0 (0*-33.0)	11.0 (0*-39.0)	28.0 (0*-48.00)	17.0 (6.0-29.0)
Degenerative Joint Disease (3,594,194)	Median Distance in Miles (IQR)	9.0 (3.4-17.9)	11.3 (0*-30.3)	17.1 (0*-42.3)	25.7 (12.4-49.6)	9.6 (2.8-20.2)
	Median Time in Min (IQR)	18.0 (10.0-28.0)	18.0 (0*-40.0)	25.0 (0*-53.0)	35.0 (18.0-62.0)	18.0 (9.0-30.0)
Ischemic Heart Disease (3,828,222)	Median Distance in Miles (IQR)	10.4 (4.5-19.7)	14.1 (0*-37.8)	23.1 (0*-53.1)	29.0 (14.7-57.5)	11.3 (4.2-22.9)
	Median Time in Min (IQR)	19.0 (11.0-30.0)	22.0 (0*-47.0)	32.0 (0*-64.0)	39.0 (21.0-69.0)	20.0 (11.0-33.0)
Malignant Neoplasm (9,630,656)	Median Distance in Miles (IQR)	12.0 (5.7-23.1)	16.1 (0*-41.8)	30.3 (0*-59.4)	36.9 (20.1-67.2)	13.1 (5.7-26.6)
	Median Time in Min (IQR)	22.0 (13.0-34.0)	24.0 (0*-52.0)	39.0 (0*-70.0)	47.0 (28.0-79.0)	22.0 (13.0-38.0.0)

*IQR-Interquartile Range. Lower IQR thresholds of zero were sometimes observed because distances between residence and care site were calculated using the distance between the geographic center of the ZIP code of residence and the geographic center of the ZIP code of the care site. If residence and care site were in the same ZIP code, the distance was, for purposes of the analysis, zero miles and the time was zero minutes. If 25% or more of the observed distances/times were zero, the lower threshold of the IQR was zero. See Technical Appendix for details.
†A median distance and travel time of zero indicates that at least 50% of the visits occurred in the same ZIP code as the beneficiaries' residence. See Technical Appendix for details.

The median one-way distances (and times) traveled for all visits were also examined across beneficiary race/ethnicity. The results are shown in Table 7. The median distances traveled, especially by non-White beneficiaries, were quite variable and were sometimes calculated to be zero miles (for the reasons explained above and in the Technical Appendix). The upper thresholds of the IQRs are more revealing, however, indicating that rural Hispanic and North American Native beneficiaries traveled farther than beneficiaries of other races. As an example, Hispanic beneficiaries from isolated small rural areas traveled a median distance of 28.0 miles for their visits, but the IQR of 3.3-49.8 miles indicates that 25% of the visits by those beneficiaries involved one way travel distances exceeding 49.8 miles. In contrast, White beneficiaries from isolated small rural areas traveled a median distance of 22.5 miles, and the distance IQR was 10.2-41.7 miles.

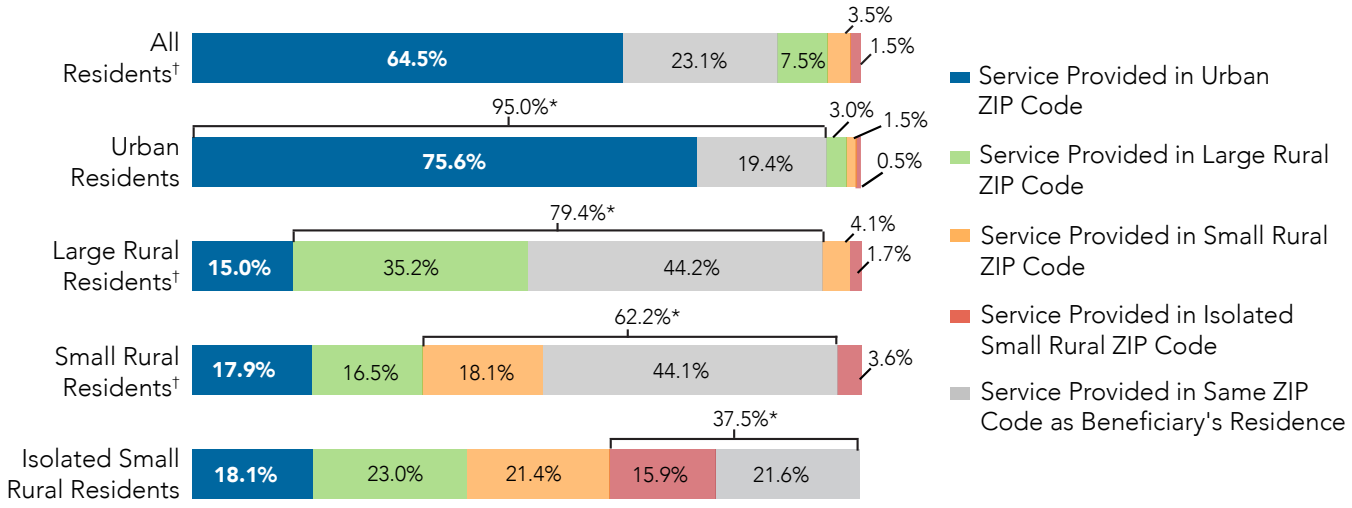
Table 7. Median Medicare Beneficiary Travel Distance and Time by Race/Ethnicity, all visits, 2014

Race/Ethnicity (no. of visits††)		Median Distance in Miles (IQR*), Median Time in Minutes (IQR*)				
		Urban	Large Rural	Small Rural	Isolated Small Rural	All Areas
White (174,190,782)	Median Distance in Miles (IQR)	9.5 (3.7-18.2)	9.6 (0*-24.4)	12.9 (0*-34.0)	22.5 (10.2-41.7)	10.0 (2.5-20.2)
	Median Time in Min (IQR)	18.0 (10.0-28.0)	16.0 (0*-35.0)	19.0 (0*-44.0)	31.0 (16.0-53.0)	18.0 (8.0-30.0)
Black (14,914,476)	Median Distance in Miles (IQR)	7.8 (3.2-14.6)	11.1 (0*-26.5)	14.4 (0*-35.6)	22.3 (11.5-39.9)	7.9 (2.9-15.6)
	Median Time in Min (IQR)	17.0 (10.0-25.0)	18.0 (0*-35.0)	21.0 (0*-44.0)	30.0 (18.0-49.0)	17.0 (9.0-26.0)
Asian (2,797,875)	Median Distance in Miles (IQR)	6.9 (3.1-13.1)	0†(0*-19.5)	0† (0*-31.6)	22.3 (0-40.2)	6.9 (3.0-13.3)
	Median Time in Min (IQR)	16.0 (10.0-24.0)	0† (0*-30.0)	0† (0*-43.0)	33.0 (0-55.0)	16.0 (10.0-24.0)
Hispanic (2,782,237)	Median Distance in Miles (IQR)	6.7 (2.5-14.0)	0†(0*-27.4)	12.5 (0*-40.2)	28.0 (3.3-49.8)	6.7 (2.1-14.6)
	Median Time in Min (IQR)	16.0 (9.0-25.0)	0† (0*-38.0)	18.0 (0*-53.0)	37.0 (8.0-63.0)	16.0 (8.0-25.0)
North American Native (1,041,305)	Median Distance in Miles (IQR)	14.4 (1.7-32.8)	0† (0*-35.6)	0† (0*-51.0)	30.7 (0*-57.6)	15.1 (0*-40.0)
	Median Time in Min (IQR)	23.0 (6.0-44.0)	0† (0*-47.0)	0† (0*-64.0)	42.0 (0-72.0)	23.0 (0*-52.0)
Other Unspecified Race (2,756,815)	Median Distance in Miles (IQR)	8.0 (3.5-15.2)	0† (0*-22.7)	12.7 (0*-35.6)	23.0 (9.9-44.1)	8.0 (3.2-15.9)
	Median Time in Min (IQR)	17.0 (11.0-26.0)	0† (0*-35.0)	19.0 (0*-48.0)	32.0 (15.0-58.0)	17.0 (10.0-27.0)

*IQR-Interquartile Range. Lower IQR thresholds of zero were sometimes observed because distances between residence and care site were calculated using the distance between the geographic center of the ZIP code of residence and the geographic center of the ZIP code of the care site. If residence and care site were in the same ZIP code, the distance was, for purposes of the analysis, zero miles and the time was zero minutes. If 25% or more of the observed distances/times were zero, the lower threshold of the IQR was zero. See Technical Appendix for details.
†A median distance and travel time of zero indicates that at least 50% of the visits occurred in the same ZIP code as the beneficiaries' residence. See Technical Appendix for details.
††Race/ethnicity of beneficiary was unknown for 1,726,130 visits.

Figure 1 depicts the travel patterns of beneficiaries by showing the types of geographic areas residents of urban, large rural, small rural, and isolated small rural places went for their care. Overall, 23.1% of visits took place in beneficiaries' home ZIP codes. The figure also shows that 95.0% of the visits received by urban residents took place in urban areas. Residents of large rural areas received the majority of their visits (79.4%) in large rural places, and 44.2% of those visits were received in the beneficiaries' home ZIP codes. A majority (62.2%) of the visits received by residents of small rural areas took place in small rural areas. In contrast, a minority of visits (37.5%) received by residents of isolated small rural areas took place in isolated small rural areas. Beneficiaries from small and isolated small rural areas received 17.9% and 18.1% (respectively) of their visits in urban places.

Figure 1. Medicare Visit Origins and Care Destinations, 2014



*Brackets indicate the total proportion of visits that occurred in the same type of area as that of the beneficiary's residence. The gray portion under the bracket indicates the proportion that occurred in the beneficiary's home ZIP code; the colored portion under the bracket indicates the proportion that occurred in the same type of area (urban, large rural, small rural, isolated small rural), but not in the home ZIP code.
†Percentages do not add to 100.0% due to rounding.

DISCUSSION

Summary. The rural/urban differences in the constellation of providers caring for Medicare beneficiaries are not surprising. Rural beneficiaries received more care from generalist physicians, NPs and PAs, and less care from specialists and other providers than urban beneficiaries. This was particularly true among beneficiaries from small rural and isolated small rural areas, who received the majority of their visits from generalist physicians and NP/PAs. Rural beneficiaries also received a slightly higher number of mean annual visits than urban ones in all nine Census Divisions (9.5 visits versus 8.9). In addition, rural beneficiaries traveled farther for visits, especially for serious conditions such as ischemic heart disease, malignant neoplasms, degenerative joint diseases and fractures and dislocations. Visits by residents of isolated small rural areas involved median one-way travel times in excess of 30 minutes overall, and for four of seven diagnoses examined.

Limitations. An important limitation of this study is that the claims data used only includes fee-for-service beneficiaries. Medicare Advantage beneficiaries, about 30% of all enrollees,[13] were not included in the study. Since the study uses claims data, it is not possible to know how many beneficiaries had no claims during the year. It was also not possible to determine the practice specialties of NPs and PAs caring for the beneficiaries in the study. Finally, using the claims data did not allow us to adjust for differences in utilization associated with non-geographical factors such as beneficiary health status or socio-economic status. The lack of such measures inhibits our ability to interpret what the slightly higher rates of utilization found among rural beneficiaries represent with respect to the needs of rural beneficiaries.

Calculation of time and distance traveled by rural beneficiaries posed some challenges. Since many rural ZIP codes are larger than urban ZIP codes, rural beneficiaries were more likely than urban beneficiaries to see a provider in the same ZIP code as

their residence. For those visits, it was not possible to calculate the distance and time traveled. We chose to impute zeros for time/distance rather than to exclude those cases from our analysis. While appropriately conservative, the approach probably results in systematic underestimation of aggregate beneficiary travel time and distance. The effect can be observed in the data as interquartile ranges with lower time/distance limits (25th percentiles) of zero, and as a median travel distance of zero miles for travel to visits for care of depression and anxiety for residents of small rural areas (see Table 6). Since a larger proportion of visits in rural places occurred in the beneficiaries' home ZIP code, distances and travel times are more likely to be underestimated for rural than for urban visits. We also conducted the distance and time calculations without imputing zeros and, as expected, saw larger rural/urban differences.

Conclusions. Rural populations in the U.S. face many health care challenges that are often reflected in rural-urban disparities in health outcomes and poorer access to various types of care.[14,15] A recent series of reports by the U.S. Centers for Disease Control and Prevention, for example, provides convincing evidence that rural populations experience higher overall age-adjusted mortality, higher rates of cancer mortality (despite lower cancer incidence), and higher rates of suicide than urban populations.[15-17] In that context, our finding that rural Medicare beneficiaries, overall, received a somewhat higher mean number of visits than their urban counterparts might be considered somewhat surprising. However, in 2017, The Medicare Payment Advisory Commission (MedPAC)[18] reported that its research had shown no overall systematic differences in access between rural and urban beneficiaries (p. 105). MedPAC also reported that 73% of rural beneficiaries reported "no problem" in getting a new primary care physician, compared to 61% of urban beneficiaries.[18] In addition, 84% of rural beneficiaries (versus 81% of urban beneficiaries) reported "no problem" in finding a new specialist provider. The majority of rural and urban beneficiaries (67% and 68%, respectively) also reported that they "never" experienced unwanted delay for routine care.[18]

The finding of slightly higher mean numbers of visits might be partially explained by the greater reliance of rural residents on generalist physicians, NPs, and PAs and the broader scope of practice of rural generalist providers compared to urban ones.[19,20] The greater reliance of urban beneficiaries on specialists (see Table 5) compared to rural beneficiaries may also reflect somewhat longer wait times for specialist visits and/or relatively easier local access to their generalist providers by rural beneficiaries. Finally, the fact that rural beneficiaries have more of their visits with NPs and PAs may reflect relatively easier access to those providers. MedPAC data shows that rural beneficiaries reported higher levels of reliance on NPs and PAs for "all or most" of their primary care compared to urban beneficiaries (16% versus 11%, respectively).[18] It is important that future work explore whether rural/urban differences in utilization are related to differences in the content of care, inter-specialty differences in provision of care (given the underlying differences in the urban and rural clinical workforce), or differences in underlying need for care.

While rural Medicare beneficiaries received as many, or slightly more, mean visits than urban beneficiaries, travel time to care for several serious conditions is outside the 30-minute benchmark noted by Chan et al. as the edge of the range for "appropriate access to care."[11] This echoes findings from a related WWAMI RHRC study of Medicare utilization in five states.[10] It should be noted that the rural median travel times reported above, while longer than urban travel times, also come from a distribution of travel times far wider than urban ones. This is particularly true for rural Hispanic and North American Native beneficiaries. Our findings show that a substantial fraction of visits by rural residents for conditions such as ischemic heart disease exceed one-way travel times of 60 minutes, especially for residents of small rural and isolated small rural areas.

Study results also reiterate the ongoing importance of generalist physicians and NP/PAs in rural health care. Those two groups of providers performed over half of the visits (51.7%) received by rural beneficiaries (compared to 38.1% of visits for urban beneficiaries). Results suggest a possible lack of geographic access to care for some serious chronic conditions often treated by specialists. Overcoming rural health care access problems and assuring equitable access to care for all rural Medicare

beneficiaries will require commitment to training and sustaining a workforce of rurally committed generalist physicians and advanced practice clinicians who, in addition to providing a wide range of care services locally, can help assure efficient and efficacious access to specialty services when needed.[2]

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TECHNICAL APPENDIX

Data Set and Analytic Approach. This study used 2014 Medicare administrative data on fee-for-service Medicare beneficiaries aged 65 years and older who resided in the U.S. The data set included inpatient claims, outpatient claims from institutional providers and a 20% random sample of the carrier claims submitted by professional providers, the carrier line files, and the Medicare Data on Provider Practice and Specialty (MD-PPAS) file.

The inpatient claims file contained claims submitted by inpatient hospital providers (not skilled nursing facilities) for reimbursement of facility costs. Each inpatient claim represented a covered inpatient stay and was considered a single visit for purposes of this study.

The outpatient claims file contained claims submitted by institutional outpatient providers. Examples included hospital outpatient departments, Rural Health Clinics, renal dialysis facilities, Federally Qualified Health Centers, and outpatient rehabilitation facilities. Each outpatient claim represented an outpatient visit (e.g., colonoscopy, cataract surgery).

The carrier claims file includes the outpatient claims for a 20% sample of Medicare fee-for-service beneficiaries. The file contains outpatient claims submitted by professional providers such as physicians, PAs, NPs, and clinical social workers. Each claim was considered a single visit in this study. The carrier file also contained claims for some organizational providers such as freestanding ambulatory surgical centers, independent clinical laboratories, and freestanding radiology centers. We used both the carrier claims file and the carrier line file. Each row in the carrier claims file represented a claim. Each row in the carrier line file represented an item or service for which a claim of payment was made to Medicare. Beneficiary information (residence ZIP code, age, race, and gender) came from the carrier claims file and visit information (service facility ZIP code, provider National Provider Identifier number, diagnosis code, procedure code, and cost) came from the carrier line file.

The final analytic data set (after the exclusions discussed below) included data on 200,209,620 visits and contained rows of data from the inpatient claims file, outpatient claims file, and carrier line file. We considered each group of rows with the same beneficiary ID, visit date, and provider National Provider Identifier (NPI) number to be a single patient visit. If a visit had more than one row or line item, we selected the row with the highest cost or payment amount.

We obtained provider specialty codes from the MD-PPAS file for 96.6% of the visits in the study. The MD-PPAS file assigns Medicare providers to medical practices based on tax numbers and elaborates on the Centers for Medicare & Medicaid Services (CMS) provider specialty classification. The provider-level data set was built around the NPI and the tax identification number (TIN). For providers not in the MD-PPAS file, we used the Medicare specialty code from the claims files. If a provider was not in the MD-PPAS file and did not have a Medicare specialty code in the claims file, we removed all visits associated

with that provider from the analytic data set. A specialty could not be determined for 158,053 providers, resulting in the exclusion of 4,857,381 visits.

We used the service facility ZIP code to identify where a visit took place. For carrier visits, we used the *Line Place of Service (POS) Physician ZIP Code* variable from the line file for provider location. For inpatient and outpatient visits, we used the *Claim Service Facility ZIP Code* variable for provider location. We used the *ZIP Code of Residence from Claim* variable from the three main claims files for beneficiary location.

Distance and Travel Time Calculations. A SAS macro that accessed Google Maps allowed us to calculate one-way driving distance and travel time between beneficiary location (origin) and provider location (destination). We modified the macro so that we could calculate the distance between ZIP codes rather than addresses, as we did not have access to full addresses for beneficiary or provider locations. We calculated driving distance and travel time for the 3,115,085 unique ZIP code pairs in the study. We excluded 5,384,699 visits with a driving distance of 250 miles or more from the analytic data set.

For a number of reasons, we were not able to calculate driving distance and travel time for 505,569 visits. For example, Google Maps could not calculate driving distance for some locations in and around mountains or bodies of water. We were also not able to calculate driving distance for 33.3% of ZIP code pairs in Alaska. In addition, we were not able to determine driving distance for beneficiaries who traveled to a provider located in the same ZIP code in which the beneficiary lived. We excluded most visits for which we could not calculate driving distance from the data set except for visits where the beneficiary and provider were located in the same ZIP code. Since rural beneficiaries are more likely to have visits in their home ZIP codes than their urban counterparts, we chose to impute a mileage of zero for those visits. This helped facilitate comparisons with the previous study[1] and was also a more conservative approach to assessing rural/urban and intra-rural differences in distance traveled. A shadow analysis conducted without inclusion of imputed values found longer travel distances.

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FUNDING

This study was supported by the Federal Office of Rural Health Policy (FORHP), Health Resources and Services Administration (HRSA), U.S. Department of Health and Human Services (HHS) under cooperative agreement #U1CRH03712. The information, conclusions, and opinions expressed in this policy brief are those of the authors and no endorsement by FORHP, HRSA, or HHS is intended or should be inferred.

ACKNOWLEDGMENTS

The authors gratefully acknowledge Beverly Marshall for her assistance with manuscript production.

SUGGESTED CITATION

Larson EH, Andrilla CHA, Garberson LA, Evans DV. *Geographic Access to Health Care for Rural Medicare Beneficiaries: A National Study*. Policy Brief. WWAMI Rural Health Research Center, University of Washington; September 2021.

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