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Geographic Access to Health Care for Rural Medicare Beneficiaries

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by

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ABSTRACT

BACKGROUND

Patients in rural areas may utilize less medical care than those living in urban areas. This could be due to differences in travel distance and time and a utilization of a different mix of generalists and specialists for their care.

PURPOSE

To compare the travel times, distances, and physician specialty mix of all Medicare patients living in Alaska, Idaho, North Carolina, South Carolina, and Washington.

METHODS

Retrospective design, utilizing 1998 Medicare billing data. Travel time was determined by computing the road distance between two population centroids: the patient's and the provider's ZIP codes.

FINDINGS

There were 2,220,841 patients and 39,780 providers in the cohort, including 6,405 (16.1%) generalists, 24,772 (62.3%) specialists, and 8,603 (21.6%) nonphysician providers. There were 20,693,828 patient visits during the study. The median overall one-way travel distance and time was 7.7 miles (interquartile range 1.9-18.7 miles) and 11.7 minutes (interquartile range 3.0-25.7 minutes). Those in rural areas needed to travel two to three times farther to see medical and surgical specialists than those living in urban areas. Rural residents with heart disease, cancer, depression, or needing complex cardiac procedures or cancer treatment traveled the farthest. Increasing rurality was also related to decreased visits to specialists, and an increasing reliance on generalists. The vast majority of visits by those living in large rural areas were in large rural areas or the patients' home ZIP codes.

CONCLUSIONS

Residents of rural areas have increased travel distance and time compared to their urban counterparts. This is particularly true of rural residents with specific diagnoses or those undergoing specific procedures. Our results suggest that most rural residents do not rely on urban areas for much of their care.

INTRODUCTION

Patients in rural areas may utilize less medical care than those living in urban areas.[1,2] This difference in access to health care for the elderly in rural areas may be dependent on a number of variables. These include patient-specific factors such as age, race, ethnicity, and perceptions of quality, as well as extrinsic factors such as insurance coverage, and health care costs.[3-6] Another potential factor related to health care utilization is travel time and distance.[7-13] Research has suggested that utilization is adversely affected by long travel times. Indeed, patients may forgo free care if it is greater than 20 miles away.[9] Several state health departments have proposed a standard in which rural residents should not have to travel more than 30 minutes to see a physician.[8]

Our current framework of the rural-urban hierarchy of care is one in which rural areas are very dependent on urban ones for health care, in particular specialty care. In this "hub and spoke model" rural patients must, and are willing to, travel long distances for their care. However, more recently, a much less dependent model has been put forward, wherein most specialty care is obtained in larger rural towns/cities (e.g., > 25,000 population).[14]

The objective of this project was to describe where Medicare beneficiaries of five states obtain their care, how far they travel for that care, and the mix of physician specialties from whom they obtain their ambulatory care. Our primary interest was whether remote and isolated Medicare beneficiaries received a different mix of physician care than their urban counterparts (i.e., fewer overall visits, visits to generalist physicians, visits to medical and surgical specialists). In addition, we were interested in comparing the time and distance patients travel to see health care providers depending on the patient's rural vs. urban location.

This study is important because we utilized a newer, sensitive taxonomy for determining rural status. In addition, we employed a sophisticated method for

calculating travel time and distance that is more accurate than those used in the past to provide us with a comprehensive look at geographic access. Our findings have implications for policies regarding such topics as graduate medical education, geographic reimbursement differentials, and telehealth networks.

METHODS

We used a cross-sectional design, collecting 1998 Medicare Part B data for the five study states (Alaska, Idaho, North Carolina, South Carolina, and Washington) in a process that has been described previously.[15] These data include encounter information for Medicare inpatients and outpatients who were seen in the fee-for-service environment during 1998. This includes patients who were treated in 1998 but whose billing occurred in 1999.

Medicare's Part B files consist of a series of line items, with each line representing a separate service for which a payment claim was made to Medicare for a patient. Each billing line has information regarding the physician providing the care, the ZIP codes of the physician and the patient, the primary diagnosis of the patient, and the type of services performed. The line items were aggregated into "service clusters" using a process described previously.[16] In brief, we considered all line items that had the same date, provider and patient to be a single patient encounter. For encounters with more than one line item, the patient diagnosis (ICD-9 CM) was taken from the line with the "Evaluation and Management" code. If no such code was available, we used the diagnosis from the line with the highest charges. These ICD-9 CM codes were then aggregated into "diagnostic clusters" in a process described previously.[17]

We determined physician specialty by using data from Medicare and from the 2000 American Medical Association (AMA) Masterfile, which has information on residency experience and board certification. For physicians, Medicare's Unique Physician Identification Number (UPIN) was used to match data from the AMA Masterfile.[18] For the purposes of this study, generalists were considered those whose primary AMA specialty was general internal medicine, general practice, family practice, or general pediatrics. Other physician providers were categorized into two groups: medical and surgical specialists (see Table 2 for more details). For other providers, including podiatrists, optometrists, chiropractors, and oral surgeons, we used their self-reported Medicare specialty.

We used the Zone Improvement Plan (ZIP) code of the physician to define where a provider/patient encounter took place. This information is contained on each billing line and represents the ZIP code of the provider's practice setting at the time he/she saw the patient. If the provider worked at more than one site, then the ZIP codes reflected this. This information is maintained and updated by Medicare's Carriers. A different billing ZIP code (location of where reimbursement checks are sent) is also available but was not used as this is often not the location where the patient was seen.

Rural status was determined by linking the patient ZIP code to its Rural-Urban Commuting Area Code (RUCA).[19,20] This rural-urban taxonomy was selected as RUCAs are now the basis of a wide range of federal programs and research studies. The ZIP code version of RUCAs (Version 1.11) provide a much finer geographic unit than county-based systems such as the Office of Management and Budget's Metro, Non-Metro taxonomy and include a measure of functional relationships. RUCAs use Census Bureau information to differentiate areas based on their city/town size and work commuting patterns to larger cities and towns. The 30 RUCA designations were aggregated into four categories: Urban (RUCA = 1.0, 1.1, 2.0, 2.1, 2.2, 3.0, 4.1, 5.1, 7.1, 8.1, 10.1), Large Rural City (in or associated with a large rural city of 10,000 to 50,000, RUCA = 4.0, 5.0, 6.0), Small Rural Town (in or associated with a rural town of 2,500 to 10,000, RUCA = 7.0, 7.2, 7.3, 7.4, 8.0, 8.2, 8.3, 8.4, 9.0, 9.1, 9.2), and Isolated Rural Town (in or associated with a rural town of fewer than 2,500, RUCA = 10.0, 10.2, 10.3, 10.4, 10.5). Non-city/town areas were aggregated with the city/town where they had a strong commuting relationship.

Travel distance was calculated by determining the road distance along the fastest route between the population centroid of the physician's ZIP code and the patient's ZIP code.[21] In brief, we calculated travel time and subsequent distance of each origin and destination ZIP code pair within a 250-mile buffer around the study states. Because of the limited connectivity of Alaska's roads, most Alaska ZIP code pairs have straight-line distances (SLDs) calculated. Some ZIP code pairs had the same origin and destination, therefore, travel times and distances were set to zero (thus, travel times and distances may be underestimated). Some ZIP code pairs shared the same centroid location despite differing ZIP codes and their travel time and distances were also set to zero. Those pairs that could not be processed because of the 250 mile buffer were considered missing. Missing pairs represented < 0.5 percent (2,702) of the total (563,136).

The travel times and distances presented represent one-way values and were derived by adding the ArcView Network Analyst (Environmental Systems Research Institute, Redlands, Calif.) calculated route time and distance to the ArcView derived centroid to

road times and distances. For each predetermined pair, Network Analyst computes the shortest travel time and the subsequent distance of that route.[21]

Descriptive analyses of the data were performed using graphical displays and summaries of the data, such as means and standard deviations. We chose not to display statistical differences as we captured the entire population under study and were not estimating travel times and distances from a sample.

RESULTS

There were 2,073,488 patients and 39,780 providers in the cohort. The mean age of the patients was 71.8 years (standard deviation (sd) 12.2 years), and 60.2 percent were female. Of the patients, 83 percent were white. Of the providers, 6,405 (16.1%) were generalists, 24,772 (62.3%) were medical and surgical specialists, and 8,603 (21.6%) nonphysician providers.

Table 1 displays the mean number of visits by the location of the patient for each of the study states. We found that increasing rurality was associated with a decrease in the total number of visits per patient such that those in urban areas had a mean of 10.1 (standard deviation [sd] 9.8) visits and those in isolated rural areas had a mean of 9.1 (sd 8.9) visits. This represented 9.9 percent fewer visits. This relationship existed in all five states but was most noticeable in the West (Alaska, Idaho, and Washington). It should be noted that the median number of visits (7) was the same in all rural and urban areas, suggesting that urban areas had a larger proportion of patients who visit providers frequently.

Table 2 provides a breakdown of the number and percentage of patient visits to generalists, medical specialists, surgical specialists, and other providers. Results are stratified by rural/urban location. We found that increasing rurality (comparing urban to isolated small rural) was associated with an 8 percent increase in the percentage of overall visits made to generalists and a 10 percent decrease in the percentage of visits to medial specialists. The percentage of visits to surgical specialists and other providers remained relatively stable.

Table 3 (a and b) displays the overall median one-way distance and travel time for all patient visits. In addition, it presents these variables for a representative sample of common diagnostic and procedural categories. Not surprisingly, increasing rurality was associated with longer travel distance and time, although those in the large rural communities seemed to have the shortest travel distances and the briefest travel times (median distance 4.6 miles (interquartile range (IQR) 0.0-19.9 miles), median time 6.4 minutes, IQR 0-25.9 minutes). In some cases, we found that rural patients traveled significantly farther for their care. For instance, during those visits where the principal diagnosis was malignant neoplasms, the median travel time for urban dwellers was 12.6 minutes (IQR 7.2-23.4 minutes, median distance 7.9 miles (IQR 4.5-16.5 miles). Those living in isolated rural areas had a median time of 42.0 minutes (IQR 24.5-67.8 minutes, median distance 32.9 miles (IQR 18.7-56.2 miles). Isolated rural patients also traveled quite far for certain procedures including: complex spinal surgeries, radiation oncology, cardiac surgery,

Table 1: Mean Number of Visits (sd) by State

	Urban	Large Rural	Small Rural	Isolated Rural
Alaska	7.4 (8.1)	8.0 (8.0)	6.5 (6.7)	5.1 (5.1)
Idaho	8.3 (7.8)	8.5 (7.9)	7.8 (7.4)	7.4 (7.1)
North Carolina	10.0 (9.8)	10.3 (9.7)	9.9 (9.3)	9.5 (9.1)
South Carolina	10.5 (10.0)	10.1 (9.5)	9.8 (9.4)	9.6 (9.4)
Washington	10.2 (9.7)	9.5 (9.1)	9.3 (9.1)	7.9 (7.9)
All states	10.1 (9.8)	9.9 (9.4)	9.6 (9.2)	9.1 (8.9)

Table 2: Provider Type by Location

	Generalists		Medical Specialists		Surgical Specialists		Non-MDs		
	Visits	Row %	Visits	Row %	Visits	Row %	Visits	Row %	All Visits
Urban	2,278,868	18.3	6,674,922	53.6	2,448,702	19.7	1,054,816	8.5	12,457,308
Large rural	762,344	21.6	1,699,350	48.2	736,713	20.9	327,438	9.3	3,525,845
Small rural	694,200	25.7	1,223,595	45.2	545,882	20.2	241,833	8.9	2,705,510
Isolated rural	497,651	25.9	842,374	43.9	396,221	20.6	182,846	9.5	1,919,092
All	4,233,063	20.5	10,440,241	50.7	4,127,518	20.0	1,806,933	8.8	20,607,755

Medical specialists were those with a primary AMA specialty of allergy & immunology, aerospace medicine, anesthesia, cardiology, vascular medicine, psychiatry, dermatology, radiology, emergency medicine, sports medicine, gastroenterology, public health/prevention, hyperbaric medicine, adolescent medicine, critical care medicine, endocrinology, geriatrics, hematology/oncology, infectious disease, nephrology, pulmonary critical care, rheumatology, genetics, neurology, occupational medicine, pain medicine, physical medicine and rehabilitation, pathology, and radiation oncology. Surgical specialists were those with a primary AMA specialty of general surgery, obstetrics and gynecology, colorectal surgery, cardiothorasic surgery, hand surgery, orthopedics, otolaryngology, transplant surgery, vascular surgery, neurosurgery, ophthalmology, plastic surgery, and urology.

Table 3a: Median Patient Travel Distance and Time by Selected Diagnosis

Diagnosis (number of visits)	Median Distance in Miles (IQR), Median Time in Minutes (IQR)				
	Urban	Large Rural	Small Rural	Isolated Rural	All Areas
All visits (20,637,828)	7.0 (3.5-13.9), 10.9 (5.7-20.1)	4.6 (0.0-19.9), 6.4 (0.0-25.9)	14.8 (0.0-33.3), 18.1 (0.0-42.3)	10.9 (0.0-20.4), 26.9 (14.8-49.4)	7.7 (1.9-18.7), 11.7 (3.0-25.7)
Dementia (106,962)	7.9 (3.8-17.1), 12.5 (6.2-24.2)	5.4 (0.0-24.4), 8.5 (0.0-31.4)	12.5 (0.0-33.9), 16.3 (0.0-42.2)	21.3 (10.6-38.2), 28.2 (14.6-49.1)	8.6 (2.6-21.6), 13.0 (4.1-29.0)
Obstructive lung disease (120,720)	7.0 (3.5-14.0), 11.1 (5.6-19.6)	2.3 (0.0-13.4), 3.2 (0.0-17.6)	9.0 (0.0-26.0), 11.7 (0.0-33.1)	17.3 (8.4-31.2), 22.3 (11.4-39.1)	7.3 (0.0-16.6), 11.2 (0.0-23.1)
Depression and anxiety (154,454)	7.3 (3.6-15.7), 11.7 (6.1-22.4)	6.8 (0.0-28.3), 10.2 (0.0-36.4)	19.1 (0.0-36.2), 24.0 (0.0-45.6)	23.3 (11.4-47.7), 30.3 (15.5-59.1)	8.5 (3.1-21.1), 12.8 (5.1-28.5)
Fractures and dislocations (350,194)	6.3 (2.8-12.5), 9.9 (4.6-18.5)	3.1 (0.0-15.1), 4.5 (0.0-19.2)	8.5 (0.0-27.5), 11.4 (0.0-35.3)	20.5 (10.7-39.8), 26.9 (14.6-50.7)	6.5 (0.0-15.6), 10.2 (0.0-22.0)
Cerebrovascular disease (385,114)	7.5 (3.8-15.0), 11.7 (6.3-21.5)	5.2 (0.0-24.6), 8.2 (0.0-31.6)	16.9 (0.0-35.8), 21.8 (0.0-45.1)	22.6 (12.2-43.6), 29.7 (16.4-55.2)	8.6 (2.7-20.6), 12.9 (4.5-28.2)
Congestive heart failure (415,596)	6.9 (3.4-13.8), 10.7 (5.5-19.8)	3.8 (0.0-18.1), 5.5 (0.0-24.1)	10.1 (0.0-28.1), 13.1 (0.0-36.1)	19.0 (9.8-34.0), 24.5 (13.6-42.8)	7.3 (0.0-17.7), 11.2 (0.0-24.3)
Degenerative joint disease (463,173)	6.8 (3.4-13.6), 10.5 (5.5-19.6)	4.0 (0.0-17.9), 6.0 (0.0-23.9)	13.3 (0.0-31.1), 17.1 (0.0-39.4)	20.0 (10.3-36.7), 26.0 (14.1-46.2)	7.3 (0.9-18.3), 11.3 (1.3-25.2)
Ischemic heart disease (774,628)	7.7 (4.0-15.7), 12.0 (6.5-22.4)	7.1 (0.0-30.3), 10.3 (0.0-38.8)	22.7 (0.0-41.9), 28.4 (0.0-51.1)	24.5 (12.8-47.7), 32.6 (17.3-60.5)	9.5 (3.6-23.6), 14.1 (5.8-31.6)
Malignant neoplasms (861,340)	7.9 (4.5-16.5), 12.4 (7.2-23.4)	9.9 (0.0-31.5), 13.9 (0.0-39.5)	29.5 (11.9-46.9), 38.6 (15.6-57.8)	32.9 (18.7-56.2), 42.0 (24.5-67.8)	10.7 (4.6-26.5), 15.8 (7.5-35.4)

Table 3b: Median Patient Travel Distance and Time by Selected Procedure

Procedure (number of visits)	Median Distance in Miles (IQR), Median Time in Minutes (IQR)				
	Urban	Large Rural	Small Rural	Isolated Rural	All Areas
CPR (2,333)	7.2 (3.6-14.4), 11.3 (6.3-20.9)	5.2 (0.0-17.4), 8.5 (0.0-24.5)	8.5 (0.0-25.3), 11.4 (0.0-32.9)	16.0 (11.3-30.0), 21.1 (14.8-41.0)	8.2 (2.5-17.7), 11.7 (3.8-24.6)
Intubation for emergency (4,814)	7.7 (4.0-16.3), 12.0 (6.5-23.1)	14.0 (0.0-42.7), 18.4 (0.0-54.7)	32.3 (16.3-52.4), 40.7 (19.8-65.8)	40.0 (20.4-62.6), 52.7 (26.0-75.8)	11.1 (4.2-28.6), 16.3 (6.7-38.7)
Complex spinal surgeries (4,967)	9.8 (4.8-20.5), 15.0 (8.0-28.4)	32.1 (9.2-57.8), 39.7 (11.7-67.7)	38.6 (26.4-62.6), 47.7 (33.1-77.1)	55.6 (32.6-92.0), 66.2 (41.8-107.0)	16.9 (6.3-38.6), 23.5 (9.8-49.2)
Cardiac surgery (17,378)	11.7 (6.4-24.3), 17.3 (9.9-32.8)	46.3 (32.0-83.7), 56.9 (39.5-97.4)	43.7 (31.1-69.9), 51.3 (39.0-81.7)	53.3 (37.0-83.0), 65.9 (47.2-99.8)	24.4 (9.0-48.8), 32.6 (13.9-62.4)
Pulmonary function tests (26,571)	8.4 (4.4-17.1), 13.0 (7.2-24.3)	9.7 (0.0-38.4), 13.9 (0.0-50.9)	33.4 (14.1-54.9), 42.5 (17.8-67.4)	30.8 (17.3-60.6), 38.7 (21.2-74.2)	11.3 (4.6-29.1), 16.6 (7.5-38.9)
Digestive system surgery (35,868)	7.5 (4.1-15.7), 11.9 (6.6-22.1)	6.1 (0.0-29.4), 9.7 (0.0-37.3)	25.5 (7.7-42.2), 32.3 (10.2-52.7)	27.9 (15.5-50.9), 36.5 (21.0-62.4)	9.6 (4.0-24.2), 14.2 (6.4-32.2)
Critical care services (41,506)	7.5 (3.8-15.7), 11.8 (6.3-22.4)	5.9 (0.0-22.9), 8.7 (0.0-30.2)	15.0 (0.0-34.7), 18.1 (0.0-43.9)	21.9 (12.4-40.8), 28.2 (16.6-51.8)	9.0 (2.8-20.7), 13.3 (4.6-28.3)
Radiation oncology (71,921)	9.5 (4.9-19.2), 14.1 (8.2-26.6)	23.3 (3.9-42.6), 29.0 (5.3-48.7)	32.9 (23.3-49.2), 41.5 (28.4-59.5)	41.9 (24.8-66.7), 51.8 (33.7-78.3)	15.5 (5.9-33.9), 21.0 (9.4-43.0)
General medical exam (75,790)	6.4 (3.1-11.5), 10.0 (5.3-17.3)	2.3 (0.0-14.1), 3.2 (0.0-17.6)	9.0 (0.0-28.1), 11.5 (0.0-35.2)	17.7 (9.3-34.2), 22.8 (13.3-43.3)	6.5 (0.0-14.8), 10.2 (0.0-20.8)
Cardiac catheterization (78,099)	9.9 (4.9-20.5), 14.6 (8.0-28.0)	35.6 (9.7-62.5), 43.4 (11.8-72.2)	40.1 (27.5-61.5), 49.6 (34.3-76.4)	47.7 (27.8-74.5), 60.5 (37.8-93.0)	17.2 (6.3-40.2), 24.0 (9.7-50.5)
Neurosurgery (84,127)	9.0 (4.8-18.4), 13.6 (7.8-26.1)	12.4 (0.0-38.8), 16.6 (0.0-45.7)	32.4 (15.6-50.1), 41.5 (18.3-62.5)	37.9 (21.1-61.5), 48.1 (28.4-74.5)	12.3 (5.1-29.6), 17.7 (8.2-39.1)
Echocardiography (154,692)	8.2 (4.3-16.9), 12.6 (6.8-24.0)	9.2 (0.0-30.8), 11.3 (0.0-40.7)	26.4 (10.1-44.7), 32.9 (13.3-54.8)	30.5 (16.6-58.4), 38.7 (22.0-72.2)	11.7 (4.5-28.0), 16.7 (7.1-37.2)
Outpatient consultations (561,602)	8.0 (4.5-16.4), 12.7 (7.2-23.4)	9.8 (0.0-34.3), 13.9 (0.0-42.3)	30.3 (14.2-48.7), 38.7 (17.8-58.7)	35.3 (19.1-60.6), 44.8 (25.6-74.2)	11.3 (4.6-27.8), 16.6 (7.7-36.7)
Hospital care (1,637,453)	7.9 (4.3-16.6), 12.5 (7.1-23.5)	9.0 (0.0-33.1), 10.9 (0.0-42.8)	23.6 (0.0-43.3), 30.4 (0.0-53.7)	26.2 (13.9-47.9), 34.0 (17.8-59.5)	10.0 (4.0-24.4), 14.8 (6.5-32.8)
Dialysis (699,542)	7.6 (3.9-16.1), 12.0 (6.4-22.6)	15.1 (0.0-34.0), 19.4 (0.0-43.3)	28.8 (18.1-42.0), 37.1 (22.7-52.8)	32.2 (18.8-51.7), 41.2 (24.5-63.9)	10.1 (4.2-24.7), 14.9 (6.7-33.0)
Emergency dept. services (931,032)	6.8 (3.4-14.2), 10.5 (5.4-20.4)	1.8 (0.0-12.7), 2.8 (0.0-17.2)	7.7 (0.0-20.9), 9.6 (0.0-28.1)	17.3 (10.3-29.8), 22.6 (14.0-38.6)	7.0 (0.0-16.8), 10.5 (0.0-23.1)
Chemotherapy (652)	4.3 (2.1-7.7), 6.8 (3.6-12.2)	37.7 (0.0-50.8), 45.0 (0.0-53.1)	26.4 (21.2-39.3), 34.3 (27.5-47.2)	25.4 (15.3-61.6), 31.2 (21.0-65.2)	5.8 (3.0-16.3), 8.8 (5.1-23.4)

cardiac catheterization, neurosurgery, dialysis, and CPR.

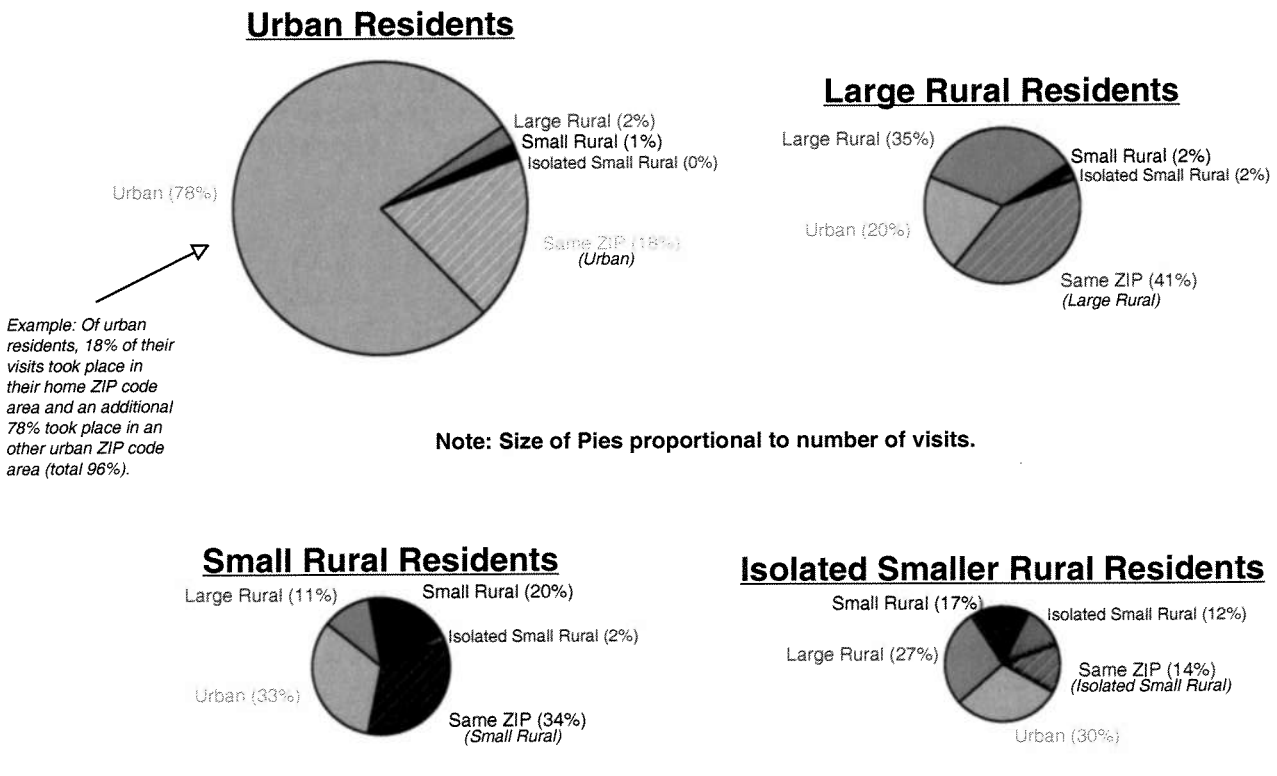
Figure 1 illustrates where patients received their care in relation to where they live. We found that 96 percent of visits by those living in urban communities were either in the patient's home ZIP code or in an urban area. In contrast, only 21 percent of visits by those living in large rural areas were in urban areas. The vast majority (75%) of these visits were in large rural areas or in the patient's home ZIP code. Only about 30 percent of visits by those living in small and isolated rural area were in urban areas. The majority of these visits took place in other rural areas. Thus, rural residents received the vast majority of their visits within rural areas.

DISCUSSION

We found that rural residents have fewer overall visits and see fewer medical specialists and more generalists for their care than their urban counterparts. In addition, we found that residents of small and isolated rural areas have greater travel distance and time compared to those living in urban areas. Median one-way travel time was less than 30 minutes including those living in isolated small rural areas. However, some patients with specific diagnoses or undergoing specific procedures needed to travel much farther. Less than 30 percent of those living in all rural areas traveled to urban areas for their care. The vast majority were seen in their own area or traveled to a larger rural location.

There is relatively little known about the current travel patterns of Medicare beneficiaries. Even less is understood about the impact travel time and distance

Figure 1: Medicare Elderly Visit Origins and Care Destinations (1998 Medicare Elderly Ambulatory Visits: AK, ID, NC, SC, and WA)



Number of visits by residence: Urban (12,389,696), Large Rural (3,499,306), Small Rural (2,696,055), and Isolated Smaller Rural (1,907,208).

may have on health care utilization.[7,22-24] However, many studies suggest an inverse relationship: as travel time and distance increases, geographic access decreases.[7,14,25,26]

Using a 30-minute standard, the majority of the patients in our cohort had appropriate access to care. However, there were sizable groups of patients in small rural and isolated rural areas who required more time to get to their providers. In addition, many patients with certain diseases or who required complex procedures needed to travel far more than the 30-minute benchmark. For instance, a quarter of those living in small and isolated rural areas who were seen for cancer (malignant neoplasm) traveled nearly one hour. This is problematic, as these patients are likely quite sick and could need close monitoring.

Our finding that those living in rural areas have less overall utilization of providers is consistent with other studies.[27] We found that those in the most remote areas had 10 percent fewer visits than those living in urban areas. This was particularly true in Alaska, Idaho, and Washington, where the reduction in overall visits, comparing urban to isolated rural, ranged from 31 percent to 13 percent. A reduction in access to medical specialists (and a concomitant increase in the use of generalists) accounts for almost all of these differences.

Utilization of surgical specialists and other providers seemed unaffected by patient geography. The impact on health status of the disparity in geographic access to medical specialists is unclear from our data. However, many epidemiological studies suggest that health outcomes are better for certain diseases when treated by specialists.[28,29] In addition, these differences certainly create costs for rural residents, increased money for travel, increased time spent traveling, and the possibility of care delay.

Our results suggest that rural residents do not rely on urban areas for the majority of their care. Only about 30 percent of visits by those living in small and isolated rural areas were in urban areas. Indeed, for those living in large rural areas, this figure was only 20 percent. This has several implications. First of all, it appears that patients are unwilling or unable to travel great distances for their care, or do not need to if they live in large rural areas with an adequate supply of providers. Second, these individuals rely heavily on care by generalists: internists and those in family practice.

Some of the limitations to our study data have been described previously.[15] This was a study of five states and the experience of other areas of the country may be different. In addition, our data are several years old and may not reflect current trends. We relied on the provider business ZIP code in the billing data as an indicator of the site where patients were seen. To our knowledge, no one has performed a validation study of this variable, however, it is considered the most accurate source of practice location when compared with other AMA and UPIN Registry data and has been used in many studies.[18,30] In addition, ZIP codes in rural areas that are larger will encompass more geographic area. Therefore, in rural areas there will be an increased likelihood that the patient and the provider will be in the same ZIP code and their travel time set to zero. Thus, there may be a bias toward underestimating the travel time in large rural areas. This is a significant limitation and highlights the need for further research in this area. The Medicare data available to us did not contain billing data for some health encounters. Certain rural health clinics and community health centers do not bill though Medicare's Part B system and their data are only contained in the "Outpatient File," which was unavailable to us. However, pilot data assessing the difference between the Outpatient and Part B files suggest that there is less than a 5 percent difference between these two data sets. Finally, it is important to mention that access to care is determined by more than just geography. Availability of transportation, and other patient characteristics (health status, socioeconomic status, preferences, etc.) play a large part in access and are unmeasured in this study.

Despite these limitations, our study provides one of the most detailed examinations of patient travel time and specialty mix to date. We employed the latest methodologies to determine a patient's rural status, as well as to determine patients' travel times and distances to see their providers.

Our results suggest that those living in small and isolated rural areas have decreased geographic access to health care providers, in particular medical specialists, and rely heavily on generalists for the majority of their care. In addition, these individuals have fewer visits overall (9.9% fewer for those in isolated rural areas) and must travel longer distances to access certain types of care. Our findings also reveal that most rural residents do not rely on urban areas for much of their care.

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