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The Quality of Care Received by Diabetic Patients in Washington State: A Rural-Urban Comparison

by

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About the Center

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ABSTRACT

Background: Diabetes is a common serious chronic disease where careful clinical monitoring can improve the quality of care and patient outcomes. This study examines the extent to which Medicare patients in Washington State receive care that adheres to established clinical guidelines and the extent to which the rural or urban location where the patient lives affects the quality of care received.

Methods: All fee-for-service Medicare patients 65 years and older with two physician encounters for a diabetic condition in 1994 were included in this study. Patient residence was determined by using the ZIP code of the patient's dwelling as listed in the Medicare National Claims History File. Adherence to guidelines was measured by determining the extent to which patients received three tests recommended by the major authoritative bodies during the study year: glycated hemoglobin, an eye examination, and a cholesterol measurement. The independent effect of patient residence was determined using logistic and multiple regression, after controlling for patient illness severity, sociodemographic characteristics, and physician utilization patterns.

Results: Based on the study criteria, 30,589 Medicare patients (8.4%) were considered to have diabetes; 29.1 percent lived in rural communities. Urban patients received virtually all their medical care in their local communities, as did over 80 percent of rural patients who lived in rural communities with more than 10,000 people; by contrast, people living in smaller rural towns received almost half their outpatient care in other communities. Most diabetic care in all locations is provided by generalists. Although rural patients were slightly but significantly less likely to receive the recommended services than their urban counterparts—both before and after adjustment for possible confounders—the differences were not homogeneous across rural places. Patients living in large rural towns remote from metropolitan areas received higher quality care on these measures than all other groups, while those living in large communities adjacent to metropolitan areas had the lowest adherence rates. Patients who saw an endocrinologist at least once during the year were more likely to have received the recommended tests, although this factor alone did not explain the entire rural-urban differences.

Conclusions: We still have a long way to go to improve the quality of care for chronic illnesses like diabetes. Even though clear guidelines exist for certain routine monitoring tests—and even though Medicare pays for these tests—most patients do not get all the recommended interventions during the course of the year. Where the patients live makes a difference, but not in a simple way. Large rural towns remote from cities seem to have higher quality of care, which may be a function of the fact that these are vibrant, growing, largely self-sufficient places.

Endocrinologic consultation increased the likelihood that patients would receive the recommended tests, but visits to endocrinologists are rare, even in urban areas. Given that most diabetic care is given by generalists, the challenge is to create a system where patients and their primary care physicians can work together to improve the care of serious chronic conditions. The quality of care is neither intrinsically better nor intrinsically worse in rural areas. The challenge is to improve care for all patients and improve the coordination among generalist and specialist physicians and the patients for whom they care.

INTRODUCTION

Diabetes mellitus is one of the most common, serious, and costly chronic diseases in the United States (Robert Wood Johnson Foundation, 1996). Among the elderly (65 years and older), diabetes is the fourth most common reason for visits to office-based physicians (Harris et al., 1995). Diabetes is a more common reason for office visits than prostate disease among men or cancer among women (Verbrugge & Patrick, 1995).

Diabetes is also a disease where treatment makes a difference (Gaede et al., 1999). Good-quality care—and adherence to generally accepted standards—results in better outcomes and longer life (Diabetes Control and Complications Trial Research Group, 1995; UK Prospective Diabetes Study Group, 1998). Diabetes is a disease where knowledgeable and committed patients and physicians—working together—can mitigate the harmful effects of a potentially lethal condition.

Rural diabetic patients may receive lower quality care for a number of reasons (Dansky & Dirani, 1998). First, rural patients may be less willing to seek medical care for chronic conditions, either because of cultural attitudes or an inability to pay for care or medications. Second, there are fewer physicians in rural areas, and the crush of emergent problems may crowd out elderly patients seeking care for an important but chronic condition (Himes & Rutrough, 1994). Third, the relative lack of specialists in rural areas may make it more difficult for rural doctors and their patients to get some of the specialized services they may need. Fourth, knowledge about advances in diabetic care may diffuse more slowly to rural areas, making it less likely that doctors and patients will be aware of or adhere to published guidelines.

This exploratory study uses Medicare data to examine the patterns of diabetic care received by diabetic Medicare patients in the state of Washington. Previous studies have shown that the rural elderly—particularly those living in the smallest and most remote areas—make fewer office visits to physicians (Himes & Rutrough, 1994). These same patients are more likely to see family physicians—and less likely to visit specialists—than their urban counterparts (Baldwin et al., 1999). Whether or not this is true of patients with diabetes, and the impact of these patterns on adherence to generally accepted guidelines, is unknown.

This study tests the null hypothesis that rural patients with diabetes are just as likely to receive the recommended diagnostic tests as their urban counterparts. If there are clinically meaningful differences in the type of care received by people living in different kinds of rural communities, it is important to identify and understand those differences. It may be possible to improve that care either through

further training of the generalists who provide much of their care or by providing opportunities for formal consultation with relevant specialists within the communities where these patients live.

METHODS

This study derives from the Health Care Financing Administration's (HCFA's) National Claims History File (NCHF) for Washington State for 1994. The analytic file contains all Medicare recipients 65 years of age and older who utilized medical care during the study year who did not belong to a capitated managed health care plan during the year, had continuous Medicare coverage, received all their medical care in Washington State, and were alive at the conclusion of 1994. These criteria were met by 362,145 people.

For the purposes of this study, a diabetic visit is defined as any visit to a physician in an ambulatory setting where the physician entered one of the following ICD-9 codes as a diagnosis: 250.XX (diabetes), 362.01 and 262.02 (diabetic retinopathy), 357.2 (diabetic polyneuropathy), or 366.41 (diabetic cataract). Patients are considered to be diabetic if they have at least two physician encounters for one of these codes in an ambulatory setting on separate days.

Patient residence was determined by the residential ZIP code for the last recorded medical encounter of the study year. In cases where a residential ZIP code was missing, we used the residential ZIP code listed in Medicare's denominator file. The location of the visit was recorded as a separate variable in the Part B file. All ZIP codes in Washington State were assigned to a unique health service area; the methods for this assignment have been described elsewhere (Washington State Department of Health, 1994). Each health service area is further categorized along a spectrum from most urban to most rural, and each patient was assigned to one and only one such location. Adjacent large rural areas are health service areas with hospitals with more than 100 beds, contiguous with an urban area. Adjacent small rural areas are also contiguous with urban areas but have hospitals with 100 or fewer beds. Remote rural areas are not contiguous with urban areas, and a break point of 100 hospital beds is used to distinguish remote large from remote small rural areas.

The identity of the physician providing the service recorded in Part B comes from the UPIN, the Unique Physician Identification Number designated by Medicare. UPINs were present 99.1 percent of the time. We were able to identify the specialty of these physicians using a combination of the roster of the American Board of Medical Specialties (ABMS), the American Medical Association (AMA)

Masterfile, and HCFA's provider specialty codes; 99.0 percent of the providers could be identified using these three sources of data. In cases where the specialty designation differed from one source to another, we selected the specialty that seemed most likely based on the information available. The one percent of physicians whose specialty could not be determined with reasonable certainty were classified as "unknown" in the analyses that follow.

Quality of Care Measurements

Clinical guidelines for the care of diabetic patients have been promulgated by a number of authoritative national organizations (*Diabetes Care*, 1989). Although there is some variation across the recommended clinical protocols, there is a core set of procedures that most authoritative sources agree should be performed regularly, including such items as periodic eye and foot exams and laboratory tests such as glycated hemoglobin. Some of these interventions, such as a glycated hemoglobin measurement, can be reliably tracked using the Medicare Part B claims file, since providers code and charge for these services separately; others, such as a foot exam, are bundled into more generalized categories such as a routine evaluation and management visits and cannot be tracked with precision using billing records.

We created a core quality index, following the lead of previous investigators (United States General Accounting Office, 1997a; United States General Accounting Office, 1997b; Weiner et al., 1995). The core quality index included glycated hemoglobin measurement, an eye examination, and a cholesterol measurement. A service was considered to have been performed if a claim for any one of the above items—or for a multitest procedure of which that item is a part—was submitted by any provider during the 1994 study year.

Analytic Approach

We used logistic regression to test the null hypothesis that quality of diabetic care is unrelated to the rural-urban dimension of patient residence. Control variables were derived from both the claims file and the denominator file and include demographic data, patterns of ambulatory care, and adjustments for patient illness status, as follows:

Demographics: The age and sex of the patient were derived from the denominator files.

Patterns of Ambulatory Care: Using the claims file, we determined the total number of ambulatory visits made by each patient during the study year and the specialties of the providers whom the patients saw during these visits. We

aggregated the provider specialties into the following categories: general and family practitioners; endocrinologists; other medical specialists; surgical specialists; and others. We recorded the number of times that patients saw physicians in each of the above categories of provider.

Patient Illness Status: We used the Ambulatory Care Group (ACG) case-mix classification system to control for patient comorbidities. This method has been described in detail elsewhere (Starfield et al., 1991; Weiner et al., 1991).

Statistical Tests: Confidence intervals were calculated for independent and control variables in the logistic regression. Chi-square tests were used to compare results across different geographic areas. Because of multiple comparisons, only differences significant at the 0.01 level are reported.

RESULTS

Of the 362,145 elderly Medicare patients who received physician services during 1994 in Washington State, 30,589 (8.4%) were included in our cohort of diabetic patients, based on the study definition. Of the diabetic cohort, 43.6 percent were male and 56.4 percent were female. Patients in this cohort made 392,831 outpatient visits to physicians during 1994, for an average of 12.8 visits per person. Of the ambulatory visits, 167,710 (42.7%) included a diagnosis of diabetes.

Table 1 shows the characteristics of our diabetic cohort, grouped according to the rural-urban location of the patient's residence. As one can see, there are important demographic differences based on the size and location of the communities where the patients in our study lived. Patients living in rural areas are significantly more likely to be male than their urban counterparts. Within the sample of rural patients, those living in large rural communities near urban areas stand out. They are much more likely to be female and are quite a bit older than patients in other locations, even older and with a higher proportion of women than elderly Medicare recipients living in urban places.

Urban patients made more ambulatory visits overall than their rural counterparts, although there was no significant difference in the number of visits coded for diabetes. Patients living in small remote rural communities made significantly fewer ambulatory visits than patients living in any other place, although their number of visits for diabetic reasons was not appreciably lower. The overall illness severity—measured using ACGs—mirrored the number of ambulatory visits: 55.1 percent of urban patients and those living in large remote

areas had four or more major chronic conditions, while only 51.3 percent of the group living in the small remote rural areas had the same burden of disease.

Geographic location has a profound effect on the patterns of care received by Medicare patients. Urban patients receive virtually all of their outpatient care in their local urban areas; of the 282,458 outpatient visits made by urban diabetic patients, 97.9 percent occurred within their local health service area. As seen in Figure 1, patients living in large rural communities—both those adjacent to and those remote from urban areas—also rarely travel to another place for their outpatient care. When patients in these communities do travel to a different type of place, they go predominantly to an urban community.

The small rural communities are much less self-sufficient in their provision of outpatient care. Patients from small communities adjacent to urban settings are likely to get their care in an urban community when they travel. Patients from the remote small communities are more likely to get out-of-community care in other rural communities, though a substantial number also go to urban areas for care. Interestingly, patients are more likely to receive their care in their home community when the diagnosis involves diabetes than when it does not include diabetes (not shown). Diabetic patients living in small rural communities made the majority of their outpatient visits for nondiabetic reasons to providers in other communities, with most of that care taking place in urban and large rural places.

Overall, diabetic patients are most frequently treated for their diabetes by generalist physicians. Family physicians and general internists accounted for 45.0 percent of all visits, with 62.4 percent of the visits for diabetic problems made to physicians from these two specialties. The smaller and more remote the area, the greater the proportion of visits for diabetes that were handled by family physicians, as seen in Table 2. Endocrinologists, who account for over 11 percent of the outpatient diabetic visits of the urban elderly, are responsible for only 3 percent of the diabetic visits of rural patients in our sample living in the smallest remote places. Other medical and surgical specialists—with the exception of ophthalmologists—were involved only rarely in the care of diabetic problems.

Urban patients were much more likely to consult an endocrinologist than their rural counterparts; 16.3 percent of urban patients visited an endocrinologist at least once during the year, compared to 6.9 percent of rural patients. As would be expected, virtually all (99.3%) urban patients who consulted endocrinologists did so within their local service area. The pattern is dramatically different for rural patients, as seen in Figure 2. Although the majority of residents in the large rural communities saw endocrinologists locally, substantial numbers traveled to urban areas for this aspect of their care. Virtually no visits to endocrinologists occurred in the small rural communities. When patients living in these communities did see

endocrinologists, they traveled to a larger town for the visit, and usually to an urban area.

Quality of Care

The majority of patients had their cholesterol and glycated hemoglobin measured and their eyes examined at least once during the study year, as seen in Table 3, although only 27.5 percent of patients had all three determinations performed during the study year. Urban patients were significantly more likely to have their glycated hemoglobin and cholesterol measured than rural patients, although the differences are not large. Most patients who had a glycated hemoglobin measured had either one or two such tests during the study year, with 31.3 percent of patients receiving two glycated hemoglobin determinations during the year (not tabled).

There are greater differences among the different rural locations than are seen in the rural-urban comparison; patients living in large remote rural communities were significantly more likely to have received all three core diabetes quality measures than patients in any of the other areas. By contrast, patients living in large rural communities adjacent to metropolitan areas were much less likely to have a glycated hemoglobin or an eye exam. Small rural towns had essentially identical screening rates, independent of their proximity to an urban area.

The specialty of the physicians seen by patients had relatively little impact on the extent to which the tests comprising the quality indices were performed, with one exception. Patients who saw an endocrinologist at least once during the year were much more likely to have received a glycated hemoglobin determination. Of patients who saw an endocrinologist, 77.9 percent had received this test, versus 51.0 percent of the diabetic patients who had not seen an endocrinologist. Rural patients who were referred to an endocrinologist were more likely than urban patients to have received this test, with no differences across the four different demographic types of rural areas. The proportion of eye exams and cholesterol measurements were also higher for patients who consulted an endocrinologist, although the disparities are not as large as for glycated hemoglobin.

We used logistic and multiple linear regression to test the independent effect of patient residence on the likelihood of receiving the recommended tests. As seen in Table 4, patient residence is associated with significant differences in the likelihood that a patient would receive a glycated hemoglobin, even after controlling for sociodemographic factors, illness severity, and physician specialty. Patients living in large rural communities adjacent to metropolitan areas were significantly less likely to have received the test than patients living in all other locations. By

contrast, patients living in large remote areas were much more likely to have received the test. Patients living in small remote rural areas received the test at a rate similar to that of patients living in urban areas, all other factors being equal. The single variable with the greatest independent effect was whether or not the patient saw an endocrinologist during the year.

A similar pattern prevails for the three items in the core diabetes quality index, as seen in the multiple linear regression in Table 5. In the aggregate, the control, case-mix, and independent variables explain 18.18 percent of the variance in the index value, the sum of three recommended measures. All four of the rural residence independent variables are statistically significant, with the same directions seen in the unadjusted tables and in the logistic regression. Patients living in remote large rural areas have a greater likelihood of receiving the recommended tests after controlling for potential confounders, while patients living in other types of rural areas are less likely to receive the tests. It should be noted that impact of residence is about as great as the impact of being on Medicaid, but not as large as whether or not the patient saw an endocrinologist during the year. After entering all the control variables, adding patient residence had a modest impact on the explanatory power of this statistical model.

DISCUSSION

The quality of outpatient care for elderly diabetics leaves much to be desired, a finding noted by other observers (United States General Accounting Office, 1997a; United States General Accounting Office, 1997b; Weiner et al., 1995). On a national level, only 21 percent of patients received a glycated hemoglobin determination in 1994, perhaps the best single summary of diabetic control available to physicians (United States General Accounting Office, 1997a; United States General Accounting Office, 1997b). In this study of Washington State for the same year, a much higher proportion of patients received this test, suggesting the existence of major regional differences. Yet even in our study, almost half of patients with a diagnosis of diabetes did not receive a glycated hemoglobin determination even though Medicare reimburses separately for this test. Only 27.5 percent received all three of the tests recommended by authoritative national organizations during the study year.

We hypothesized that living in a rural area did not have any impact on the quality of diabetic care, after controlling for case mix and sociodemographic factors. Our findings force us to reject that hypothesis. The type of community where people live does affect the quality of care they receive. Patients living in large rural communities remote from cities were significantly more likely to receive the

recommended services than their urban counterparts; patients living in other rural locations were less likely to receive these services.

What might explain these findings? One contributing factor is the relative unavailability of endocrinologists in small rural communities. Rural patients who saw an endocrinologist at least once during the year were almost twice as likely to have had a glycated hemoglobin measurement, probably because ordering such a test is part of the routine when endocrinologists see a new diabetic patient (Chin et al., 2000). Only 24.6 percent of the visits to an endocrinologist actually occurred within the rural area where the patient lived, since most endocrinologists practice in urban areas. It is likely that this access barrier explains the much lower rate at which rural patients see endocrinologists and contributes to the lower rate of appropriate testing.

But this is clearly not the only factor. There are very few endocrinologists in Washington State (69), and most diabetic care is provided by primary care physicians in all locations (Rosenblatt et al., 1998). The highest rate of guideline adherence occurs in large remote rural communities, communities that have endocrinologists but where the rate at which patients visit these specialists is still less than half of that in urban communities. It may be that large rural towns represent the best of both worlds: places with an adequate supply of both generalist and specialist physicians but without some of the disadvantages of the big city. The smallest and most remote rural communities share with the large adjacent rural communities the distinction of having the lowest rates of adherence to recommended guidelines, an observation that is perplexing because of the great demographic divide that separates these two kind of communities.

The effects of rural residence are not only a function of decreased supply of endocrinologists in rural areas, but are most likely influenced by differences in the way patients and physicians use medical resources. It is important to note that the rural areas are not homogeneous within themselves. The differences between large rural communities that are remote from or adjacent to metropolitan areas are much greater than the differences between rural areas taken in the aggregate and the urban areas with which they are compared. It is noteworthy that the highest adherence to established guidelines—both before and after adjustment—occurs in the large remote rural areas. Since many of these larger rural towns become small-scale referral centers in their own right, these data suggest that the quality of care in these settings may excel.

Study Limitations

It is important to acknowledge the limitations that arise in using secondary data sets to examine the quality of clinical care. Major limitations include:

Lack of Generalizability: These data are based on the elderly Medicare population in Washington State who are not members of managed care organizations. Managed care penetration in 1994 was relatively low at 12 percent of the entire population but was higher in urban than in rural areas. With the increased attention that managed care pays to adherence to guidelines such as these, it is possible that the true rate of urban compliance is higher than reported here. The rates in rural areas would be little affected by this limitation.

The Medicare population is unusual in having generally excellent insurance coverage for all of the service items comprising the quality indexes developed for this study. Substantial portions of patients under 65 are uninsured and are likely to experience financial barriers to receiving recommended care. Patterns of care may also be different for younger people, irrespective of insurance coverage.

Reliance on Claims Data: Medicare's data systems are primarily mechanisms to ensure accurate billing and payment; they were not designed as research tools. It is possible that coding of diagnostic and therapeutic interventions is incomplete or inaccurate and that the diagnosis assigned to some patients is inaccurate. Previous work by Weiner et al. (1995) shows that the data in the states they studied were of generally good quality, but some underascertainment of selected tests and procedures is likely.

Geographic Information: We relied on ZIP codes for both patient residence and the place of visit to assign patient residence and to determine where the visit occurred. In some cases, patients' ZIP codes changed during the study year, reflecting residential moves, different locations at which care was received, or errors in the coding. Fortunately, these inconsistencies are quite uncommon, and we are reasonably confident that we have accurately assigned patients to the towns in which their primary residence is located.

The actual location of physician visits is somewhat more problematic. We know that occasionally medical specialists provide itinerant services in rural communities, but bills are sent from the larger rural or urban communities where the group practices are based. This would have the effect of making it appear as if patients were traveling out of town for selected specialty services when in fact these visits were occurring locally.

Inability to Measure Outcomes of Care: This study relies entirely on process of care as a surrogate for medical care quality. Although there is general consensus that the process measures studied here are desirable in the care of patients with diabetes, we do not know whether patients who received these tests had better outcomes.

Policy Implications and Suggestions for Further Research

There has been exponential growth in the use of practice guidelines and performance standards as tools to assess and improve the quality of medical care. The underlying premise is that adherence to proven standards improves the quality of life for patients with the selected disease. Diabetes mellitus is an excellent example of such a condition: diabetes is a common but serious disease, where good medical care can reduce morbidity and mortality and prolong high-quality life.

The results of this study demonstrate that the quality of care received by Medicare patients in Washington State in 1994 was better in some important respects than that received in other parts of the country. With over half of Washington State Medicare patients receiving the majority of recommended surveillance tests for diabetes, it is not too distant a stretch to predict that their clinical outcome and health status are likely to also be better. Although there is still significant room for improvement, the fact that regional variation is marked suggests that focused interventions at both the patient and physician level will lead to meaningful improvements in the quality of care. For example, both provider and patient education are important in improving adherence to the recommended guidelines. It would be useful to identify communities where quality of care indicators were suboptimal and design educational efforts for patients and providers alike.

The effect of rural residence on the quality of care is complex, and not what we would have predicted. These findings emphasize the heterogeneity of rural life: adherence to quality standards was not uniform across rural communities. It is troubling that rural communities in counties adjacent to metropolitan areas had significantly lower quality of care measures than people living in nearby urban areas. Perhaps there are unmeasured socioeconomic or medical practice factors among these populations that explain this lower level of adherence to established standards, even after correcting for the confounding variables that we were able to measure. Certainly it would be worth embarking on a systematic exploration of the clinical, social, and organizational factors that led to this relatively substandard experience.

The fact that the highest quality care occurs in large remote rural communities may contain some lessons for the optimal organization of health

services. These are communities that have moderate-sized hospitals, a balanced mix of generalists and specialists, and population sizes between 10,000 and 50,000 people. There may be advantages to living in areas such as these where patients are not exposed to the potentially deleterious effect of too few physicians or fragmentation of services amidst a surplus of specialists. Again, this is speculative, but it would be worth knowing if these findings generalize to the care of other patients and other conditions.

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Table 1: Demographic Characteristics of Elderly Medicare Patients with Diabetes in Washington State, 1994, by Patient Residence

Location	Age (mean)	% Female	# of Outpatient Visits (mean)	# of Outpatient Diabetic Visits (mean)	% of Patients with 4 or More Major Diagnoses (ACGs)	Total N
Rural	73.9	55.1 **	12.4 ***	5.5	52.9 ***	8,910
Urban	74.1	57.0	13.0	5.4	55.1	21,679
Total	74.0	56.4	12.8	5.5	54.5	30,589
Adjacent large	74.5	59.1 ***	12.4	5.4	53.1	1,527
Remote large	73.8 *** ***	52.7 ** ***	12.9	5.4	55.1	2,287
Adjacent small	73.8	54.8	12.5 *** **	5.5 **	52.2	3,410
Remote small	73.7	55.2	11.5 ***	5.2	51.3	1,686

** $p \leq 0.01$
*** $p \leq 0.001$

Table 2: Percentage of Outpatient Visits for Diabetes Made to Selected Specialties, Washington State Medicare Patients, 1994

Specialty	Patient Residence					
	Urban	Adjacent Large	Remote Large	Adjacent Small	Remote Small	Total
Family practice	27.9	31.5	43.1	48.8	47.6	32.6
Internal medicine	31.7	37.3	24.1	21.3	23.1	29.8
Endocrinology	11.2	3.2	4.5	4.6	3.0	9.1
Ophthalmology	7.2	5.1	7.0	7.3	6.2	7.0
Medical specialty	6.3	7.2	5.2	3.2	4.8	5.8
Surgical specialty	1.4	1.1	2.2	1.6	3.0	1.5
Nonphysician	9.4	10.4	9.0	7.9	7.9	9.2
Other and unknown	5.0	4.2	4.9	5.2	4.4	5.0
						100%

Table 3: Proportion of Patients Receiving Recommended Diabetes Monitoring Services by Patient Residence, Washington State Medicare Patients, 1994

Residence	Glycated Hemoglobin #	Glycated Hemoglobin %		Ophthalmologic Exam #	Ophthalmologic Exam %		Cholesterol #	Cholesterol %		Mean Core Quality Index Score (max = 3)	
Total urban	12,064	55.6	***	12,830	59.2	NS	14,440	66.6	***	1.81	***
Total rural	4,652	52.2		5,326	59.8		5,627	63.2		1.75	
Rural Categories (all pair-wise comparisons are significant at the 0.00 level **except** *those indicated):*											
Adjacent large	659	43.2		856	56.1		1,001	65.6		1.65	
Remote large	1,385	60.6		1,426	62.4		1,700	74.3		1.97	NS
Adjacent small	1,733	50.8	NS	2,070	60.7	NS	1,988	58.3	NS	1.7	NS
Remote small	875	51.9		974	57.8		938	55.6		1.65	NS
Total	16,716	54.6		18,156	59.4		20,067	65.6		1.8	

** $p \leq 0.01$
*** $p \leq 0.001$
NS = nonsignificant

Table 4: Impact of Patient Residence on Likelihood of Having a Glycated Hemoglobin, Washington State, Medicare Patients with Diabetes, 1994 — Logistic Regression

	Odds Ratios (95% confidence intervals)	
Variables of Interest:		
Adjacent large residence	0.68	(0.61-0.76)
Remote large residence	1.34	(1.23-1.47)
Adjacent small residence	0.90	(0.84-0.97)
Remote small residence	0.96	(0.87-1.06)
Control Variables:		
Total outpatient visits	1.00	(1.00-1.01)
Medicaid coverage	0.89	(0.83-0.96)
Hospitalized during study year	0.77	(0.73-0.82)
Visit with an endocrinologist	3.29	(3.04-3.57)
Sex	0.99	(0.95-1.04)
Age	0.99	(0.98-0.99)
ADGs	*	

* 32 individual ADGs are entered as individual control variables, as specified by the ACG case-mix adjustment system. The reference category to which the odds ratios are compared is urban residence. For more information, see Starfield et al., 1991.

Table 5: Impact of Patient Residence on Diabetes Guideline Adherence Score, Washington State Medicare Patients with Diabetes, 1994

Variable	Beta	Significance
Total outpatient visits	0.004	0.00
Medicaid coverage	-0.08	0.00
Hospitalized during study year	-0.15	0.00
Visit with an endocrinologist	0.30	0.00
Adjacent large residence	-0.11	0.00
Adjacent small residence	-0.06	0.00
Remote large residence	0.21	0.00
Remote small residence	-0.08	0.00
Sex	0.03	0.01
Age	-0.005	0.00

Adjusted R^2 = 18.2%

F = 159.1

Significance = 0.0000

Figure 1: Travel Patterns of Rural Diabetic Medicare Patients, Washington State, 1994; Proportion Receiving Care in Local Community, Urban Setting, or Other Rural Area

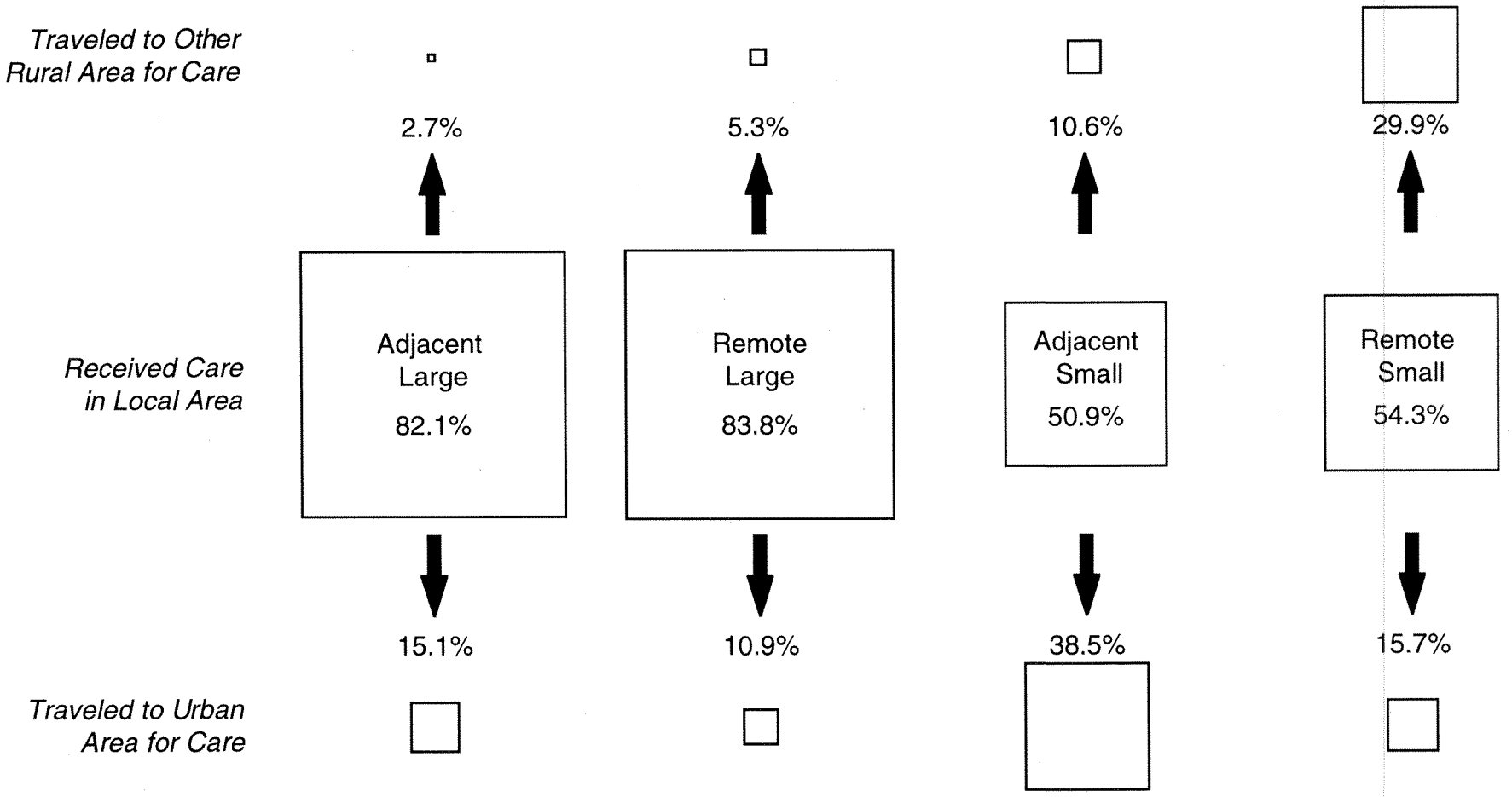
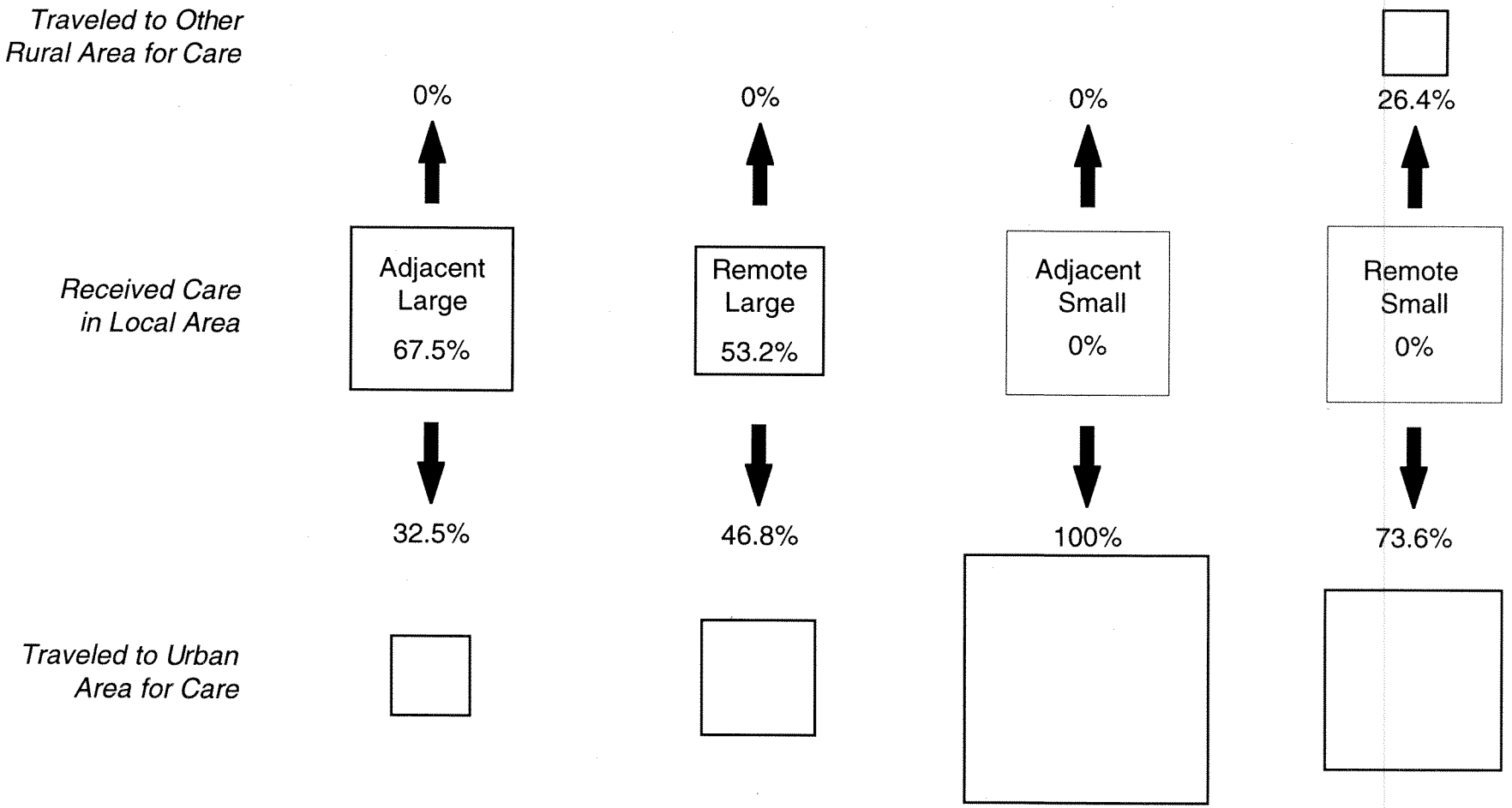


Figure 2: Travel Patterns of Rural Diabetic Medicare Patients to Endocrinologists, Washington State, 1994



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