

# Health Services Access and Use among Older Adults in North Carolina: Urban vs Rural Residents

## ABSTRACT

**Objectives.** This study compared health service use and satisfaction with health care among older adults living in urban vs rural counties in North Carolina.

**Methods.** A stratified random sample of 4162 residents of one urban and four rural counties of North Carolina was surveyed to determine urban/rural variation in inpatient and outpatient health service use, continuity of care and satisfaction with care, and barriers (transportation, cost) to care.

**Results.** Inpatient and outpatient service use did not vary by residence in controlled analyses. Continuity of care was more frequent in rural counties. Transportation was not perceived as a barrier to health care more frequently in rural than in urban counties, but cost was a greater barrier to care among rural elderly people.

**Conclusions.** In this sample, older persons living in rural counties within reasonable driving distance of urban counties with major medical centers used health services as frequently and were as satisfied with their health care as persons in urban counties. Cost of care, however, was a significant and persistent barrier among rural elderly people, despite Medicare coverage. (*Am J Public Health*. 1995;85:1384-1390)

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### Introduction

Delivery of health services to persons experiencing barriers to access has been central to discussions of health care reform.<sup>1-3</sup> Older persons in rural areas have been hypothesized to be at especially high risk of inadequate health care. Nevertheless, national surveys reveal that use of health services is unrelated to either urban or rural residence. While such surveys comparing urban and rural residents may indicate the national situation accurately, they do not take into account the diversity that exists within each setting.<sup>1</sup> Region-specific comparisons of urban vs rural use of and satisfaction with health services by older adults will help us assess the impact of residence on these individuals, who have virtually universal health insurance coverage but may be especially handicapped in terms of access to services located at some distance from their homes.

The South has the highest number and highest percentage of rural residents of the four major regions of the United States. Older persons in the rural South may be at particular risk for poor access because of the larger number of Blacks and persons of lower socioeconomic status.<sup>2,4,5</sup> Transportation to health care services may be a barrier to service delivery in rural areas. The rural South, however, is more densely populated than other rural regions, so residents are more likely to be within reasonable driving distance of comprehensive health services (30 to 90 minutes), including major medical centers.<sup>2,5,6</sup> This may offset sparse, substandard, and noncomprehensive services.<sup>2</sup> Most older persons are covered by Medicare, and their access to services should therefore be less limited than that

of persons in middle age who are more likely to lack health insurance.

Considerable literature has emerged describing poorer health and lower use of health services in the rural United States. Rural residents are characterized by low mortality but relatively high rates of chronic disease.<sup>3,7,8</sup> Physician use among rural elderly people continues to lag behind use among urban elderly people, even though there is almost universal health coverage.<sup>3</sup> Rural elderly people report more hospital discharges but shorter lengths of stay than do their urban counterparts.<sup>3</sup> Possibly, older persons living in rural areas tend to postpone health care visits until their symptoms are more severe. In addition, health care professionals may be more likely to admit older persons from rural areas to hospitals, given concern about these patients' access to emergency services if they remain at home.

In this study, we compared health service use and barriers to health care of older adults living in urban as compared

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with rural counties of the North Carolina Piedmont. North Carolina has the second largest rural population in the United States.<sup>3</sup> Forty-five percent of the population lived in nonmetropolitan areas in 1987 (as compared with 23% of the US population). In a representative sample of nearly 4200 older adults in the Piedmont area of North Carolina, we examined extent of use of health services, perceived barriers to such use, continuity of health care, and satisfaction with health care. The Andersen model of access to health care was followed as a conceptual framework for these analyses.<sup>2</sup> Predisposing factors (age, sex, race, education), enabling factors (income, insurance coverage, residence), and need factors (self-rated health and general health status) were included in multivariate modeling.

## Methods

Data from the baseline (1986/87) cross-sectional survey of the Duke Established Populations for Epidemiologic Studies of the Elderly cohort were analyzed. The sample, stratified by race and residence, yielded 4162 respondents (80% response rate). The sample was representative of more than 28 000 persons 65 years of age and older who, at the time of the survey, resided in five adjacent counties (Durham, Granville, Vance, Warren, and Franklin) in the northeastern Piedmont of North Carolina.<sup>9,10</sup> Durham County is primarily urban, with a rich array of medical services; the other four counties are rural and medically underserved. The sample was fairly evenly divided between the one urban and the four rural counties and between Blacks and non-Blacks (non-Blacks almost exclusively consisting of White individuals), and all socioeconomic levels were represented. As a result of lack of information on some measures of interest, 161 proxy interviews were excluded, leaving 4001 respondents available for analysis. Relevant characteristics of the urban and rural populations are given in Table 1. All persons residing in these four counties are within a 1.5-hour driving distance of major medical centers.

Urban/rural residence was coded by county and, alternatively, by the census definition of rural residence (place of residence with fewer than 2500 inhabitants). The two methods of analysis produced similar results for most variables, except as noted later. Therefore, results are presented by county of residence because this is the more meaningful

**TABLE 1—Demographic and Health Care Characteristics of the Study's Urban (Durham) and Rural Counties, North Carolina**

	County				
	Durham	Vance	Granville	Franklin	Warren
Population <sup>a</sup>	161 625	38 320	36 663	32 777	16 399
Rural population, % <sup>b</sup>	19.8	63.2	65.2	89.2	100.0
Average per capita income, \$ <sup>a</sup>	12 471	9 157	8 592	8 604	8 347
White, % <sup>a</sup>	59.6	54.9	54.6	58.3	34.9
Population per active physician <sup>a</sup>	149	1 198	705	2 049	1 640
Population per active primary care physician <sup>a</sup>	471	2 555	1 358	2 521	2 733
Population per active registered nurse <sup>a</sup>	50	435	133	585	683
General hospital beds, no.	1 569	76	132	100	37

<sup>a</sup>Derived from *North Carolina Health Manpower Databook*.<sup>16</sup>

<sup>b</sup>A rural area, according to the US Bureau of the Census definition, is a location with fewer than 2500 inhabitants. The figures indicate the proportion of a county's residents living in a rural area.

planning unit. Sex, race, education, income, marital status, employment status, and current insurance coverage were assessed by self-report. Subjects were also asked to rate their health as excellent, good, fair, or poor (on a scale of one to four, with one indicating excellent health). In addition, reports of chronic illness and other related information were used to construct a scale indicating status of health, with lower scale scores indicating better health status.<sup>11</sup> Family income was represented by two dummy variables comparing residents at middle (\$4500 to \$8500) and high (more than \$8500) income levels with those reporting less than \$4500 per year.

As a means of identifying barriers to health care, subjects were first asked, "Do you put off or neglect going to the doctor when you feel you really should go?" Those who put off care were asked whether they did so because they were "concerned about cost," because of "distance or transportation," or because they were "unsure where to go for help." Dummy variables were coded for each of these categories. A four-level respondent rating of satisfaction with "medical care that you receive" was also used (one representing "very dissatisfied" and four representing "very satisfied").

Continuity of care was determined by whether the subject reported usually seeing the same provider. Providers were distinguished as either hospital based or not hospital based. Health care use was determined by an outpatient medical visit

or a night in the hospital during the year preceding the survey. Using squared terms, we tested whether our continuous measures (age, education, health status, and self-rated health) were linear in their association with each outcome. Nonlinear associations were present between health status and any medical visit and any hospitalization and between self-rated health and site of care, number of medical visits, and number of nights in a hospital. To model these nonlinearities, we used dummy variables (coded 1 for poor health status or poor self-rated health in relevant equations).

Ordinary least squares and logistic regression analyses were used to model the effects of predictors on continuous and dichotomous outcomes, respectively. In multivariate regression models, demographic, socioeconomic, and then other potential covariates were added hierarchically to an initial model containing only county of residence. An examination of relevant diagnostics (tolerances) for county of residence, in addition to all covariates taken together, indicated that multicollinearity was not a problem with these regression models. Because the Duke Established Populations for Epidemiologic Studies of the Elderly data were based on a complex stratified sampling design, we retested the significance of all results using specialized software developed by Holt<sup>12</sup> (for ordinary least squares) and Shah et al.<sup>13</sup> (for logistic regression). This specialized software was used to estimate F values and confidence intervals

TABLE 2—Demographic, Health, and Health Care Characteristics of Sample, by County

	Durham County	All Rural Counties <sup>a</sup>	Rural Counties				Total
			Vance	Granville	Franklin	Warren	
Rural, %	16.3	73.5	53.1	67.4	86.5	100.0	43.3
Female, %	62.8	61.8	59.5	62.4	61.9	64.6	62.3
Black, %	31.3	39.8	37.6	39.9	31.7	56.4	35.3
Married, %	51.8	50.6	49.5	51.2	49.1	54.0	51.2
Currently employed, %	12.4	11.6	9.0	11.7	14.2	11.7	12.0
Without Medicare, % <sup>b</sup>	3.5	5.4	3.9	7.9	3.9	6.1	4.4
On Medicaid, % <sup>c</sup>	4.6	7.5	7.4	4.7	10.3	8.0	5.9
Private insurance, % <sup>d</sup>	70.2	52.9	51.3	57.0	58.1	40.3	59.5
Age, y, mean	73.5	73.3	73.0	72.9	73.8	73.5	73.4
Education, y, mean	9.8	8.5	8.5	8.7	8.0	8.8	9.2
Income, \$, mean	14 899	9981	10 758	9904	9820	8985	12 582
Poor health (self-rated), mean	2.3	2.5	2.6	2.5	2.5	2.6	2.4
Poor health (index), mean	0.9	0.9	0.9	1.0	1.1	0.9	0.9
Total no.	2 010	2152	655	543	540	414	4 162
% of sample	52.9	47.1	13.8	13.3	12.3	7.7	100

Note. Percentages and means were weighted.

<sup>a</sup>Average percentage or mean for the four rural counties combined.

<sup>b</sup>This dummy variable compared those without Medicare coverage with all others.

<sup>c</sup>This dummy variable compared those on Medicaid with all others.

<sup>d</sup>This dummy variable compared those with private insurance with all others. Note that this and the other two insurance dummies are not exclusive and thus do not sum to 100%.

reported in the tables. Measures of rural residence involved no missing data; however, several covariates had missing values. For items with fewer than 1% missing, we imputed the mean prior to analyzing the data. For items involving 1% or more missing data (income had almost 18% missing), we used stochastic regression imputation techniques.<sup>14,15</sup> With these techniques, the imputed value consists of the regression estimate plus random error. Error is added in order to estimate the variance as well as the mean of the imputed variable and, thus, to minimize bias in significance testing. To check for potential bias associated with imputation, we reestimated our regression models using only complete cases. The results were essentially the same as those reported in Tables 4 and 5.

## Results

County of residence was related to several demographic and social characteristics (see Table 2). Durham is primarily an urban county, with 16% of older residents living in census-defined rural areas; the other four counties are primarily rural. Elderly residents of the rural counties were more likely to be Black and to lack Medicare coverage (but they were more likely to have Medicaid), and they were less likely to have private health insurance. Education and income tended

to be lower in these counties, and self-rated health status tended to be poorer.

Table 3 presents bivariate associations between county of residence and the outcome measures. In comparison with those in Durham County, rural residents were less likely to obtain outpatient care at a hospital-based setting and more likely to obtain care at a nonhospital setting. They were more likely, in the previous year, to have had at least one ambulatory visit (and to have had more such visits) and to have spent at least one night in a hospital. Rural residents were also more likely to have put off care as a result of cost or transportation difficulties. There were differences among the counties (but not reflecting the urban or rural nature of the county) with respect to having a usual provider and satisfaction with care received. Those residents who reported having a usual provider tended to indicate that that provider resided in the same county in which they did (among non-Blacks and Blacks, the respective percentages were 96% and 93% in Durham, 78% and 76% in Franklin, 74% and 78% in Granville, 89% and 80% in Vance, and 41% and 46% in Warren). We do not know whether that provider was office based or hospital based; however, Warren is the only county without a major health care center.

Table 4 presents regression effects of county of residence on seven measures of

health care use after adjustment for relevant control variables. Exponentiated logistic betas indicating the change in the relative odds of an event associated with a predictor are given for five outcomes.

Residents of rural counties were less likely to obtain health care at a hospital. Reports of having a usual provider (a measure of continuity of care) appeared to vary by county rather than by specific urban vs rural residence. However, rural residents were more likely to report seeing the same provider. Contrary to our expectation, rural residents had, on average, a higher rather than a lower number of ambulatory care visits. In addition, persons in Warren County (the most rural county) were more likely to have spent a night in the hospital.

The effects of the covariates are also provided in Table 4. Need for care (as measured by self-rated health and the health index) had substantial and significant effects on virtually all of the service use variables. Predisposing factors (age, gender, education, marital status) had weaker and less consistent effects. Older respondents, women, and married respondents were all more likely to have a usual provider and less likely to receive outpatient treatment at a hospital setting. Blacks, on the other hand, were more likely to receive outpatient services at a hospital. Women were more likely to report an outpatient visit but less likely to

TABLE 3—Elderly Residents' Health Care Use, by County

	Durham County	All Rural Counties <sup>a</sup>	Rural Counties				Total
			Vance	Granville	Franklin	Warren	
Has usual provider, %	95.0	96.4	98.3	96.0	95.2	95.2	95.7
Usually sees same provider, %	82.2	87.6	90.1	86.8	85.9	87.1	84.8
Hospital-based site, %	22.3	7.4	6.3	9.6	6.1	7.9	15.2
Non-hospital-based site, %	72.8	88.9	92.0	86.4	89.1	87.3	80.4
Any health care visit, %	79.6	82.6	83.5	80.7	81.3	87.0	81.1
Any night in hospital, %	16.0	18.7	15.8	18.5	20.0	22.0	17.3
Put off care due to cost, %	14.3	24.9	27.6	24.2	22.3	25.5	19.4
Put off care due to transportation difficulties, %	5.8	9.8	8.5	10.5	10.4	10.3	7.7
Put off care due to not knowing where to go, %	4.5	4.8	3.4	5.6	4.7	6.0	4.6
No. health care visits, <sup>b</sup> mean	4.8	5.8	5.0	5.5	7.0	5.7	5.3
No. nights in hospital, <sup>c</sup> mean	1.4	1.4	1.5	1.5	1.4	1.3	1.4
Satisfaction with health care, mean	3.3	3.2	3.1	3.3	3.5	3.0	3.3

Note. Percentages and means were weighted.

<sup>a</sup>Average percentage or mean for the four rural counties combined.

<sup>b</sup>Among respondents with at least one visit.

<sup>c</sup>Among respondents with at least one overnight stay.

report an overnight stay at a hospital. Employed respondents were less likely to report an outpatient visit. Absence of Medicare coverage reduced the odds of a visit for medical care but increased the odds of receiving outpatient care in a hospital setting. Medicaid coverage increased the odds of spending at least one night in the hospital. Private insurance reduced the odds of receiving outpatient care at a hospital rather than at a private or clinic setting. More than 95% of respondents reported Medicare coverage, and this presumably accounted for the absence of income effects on use. Being female and White, better educated, and in poorer health and having private health insurance were associated with seeing the same provider.

Table 5 presents the effects of rural residence on perception of problems in accessing care, satisfaction with care, and self-rated health. In comparison with persons in Durham County, rural residents were about 1.5 times more likely to put off care because of cost; with covariates controlled, however, transportation was not an issue.

Regardless of where people lived, they knew where to go for medical care. Satisfaction with care was associated with specific county of residence but not necessarily with the urban or rural nature of the county. Rural residents reported poorer self-rated health after adjustment for socioeconomic and demographic controls, while the health index was unrelated to county of residence.

Those reporting poor self-rated health were more likely to put off care and were less satisfied with the care they received. Older respondents were less likely to put off care because of cost and less likely to report poor self-rated health. Women were more likely to put off care and were in poorer health according to the health index. Blacks were less likely to put off care because of cost. The more educated were less likely to put off care, more satisfied with the care received, and in better health (by self-rated measures). High-income respondents were less likely to put off care because of cost and were in better health. Married respondents were less likely to put off care because of transportation problems, as were employed respondents. The latter were more likely to put off care because they did not know where to go, and they were in better health. Medicaid coverage reduced the odds of putting off care because of costs, while private insurance was associated with higher self-rated health. We tested for interactions of county residence with race, income, and health. The results of these interaction tests were all negative.

Because our 13 dependent variables required us to perform multiple tests for each predictor, some significant effects in Tables 4 and 5 may be due to an inflated type I error rate. The following significant ( $P = .05$ ) county-of-residence effects became nonsignificant when a Bonferroni-adjusted significance level ( $.05/13 = .0038$ ) was used: satisfaction with care (Vance County), poor self-rated health (Vance

County and residence in a rural county), usually sees same provider (Granville County), put off care because of cost (Granville and Warren counties), poor health (Franklin County), any health care visit (Warren County), and any night in the hospital (Warren County). Treating these effects as nonsignificant would not substantially alter the basic conclusions presented below.

## Discussion

Among elderly people in urban and rural counties in North Carolina, inpatient and ambulatory health service use did not vary by urban vs rural residence in controlled analyses, except for one rural county; this finding was contrary to the expectation that outpatient service use would be lower among rural-dwelling elderly individuals. The site from which medical service was received did differ: rural residents were distinctly less likely to obtain care in a hospital setting unless they were Black. We were unable to determine the specific site of care (whether, for instance, a rural elderly resident received ambulatory care in an urban area). Poor health, whether subjectively or objectively determined, was a significant predictor of service use, as was female gender. Regarding barriers to care, cost remained a reason for delaying care in the rural counties, although Medicare was widespread. Problems with transportation were not significantly greater in rural counties, although the

TABLE 4—Regression Effects of County of Residence and Other Predictors on Source of Care and Amount of Care Received among 4001 Nonproxy Respondents

	Coefficient (95% Confidence Interval)						
	Has Usual Provider	Usually Sees Same Provider	Site: Hospital	Any Visit	No. Visits <sup>a</sup>	Any Night in Hospital	No. Nights <sup>a</sup>
All rural counties vs Durham <sup>b</sup>	1.50 (0.97, 2.31)	1.87 <sup>c</sup> (1.43, 2.42)	0.22 <sup>c</sup> (0.16, 0.30)	1.21 (0.96, 1.53)	0.64 <sup>c</sup> (0.20, 1.08)	1.12 (0.87, 1.43)	-0.08 (-0.22, 0.06)
Each rural county vs Durham <sup>b</sup>							
Vance	3.50 <sup>c</sup> (1.65, 7.41)	2.39 <sup>c</sup> (1.74, 3.30)	0.18 <sup>c</sup> (0.11, 0.29)	1.32 (0.89, 1.95)	0.10 (-0.47, 0.66)	0.91 (0.65, 1.27)	-0.07 (-0.35, 0.20)
Granville	1.39 (0.63, 3.05)	1.75 <sup>c</sup> (1.13, 2.72)	0.30 <sup>c</sup> (0.18, 0.51)	1.06 (0.76, 1.48)	0.50 (-0.19, 1.19)	1.13 (0.82, 1.56)	-0.00 (-0.21, 0.21)
Franklin	1.06 (0.59, 1.91)	1.47 (0.98, 2.21)	0.20 <sup>c</sup> (0.12, 0.33)	1.09 (0.80, 1.50)	1.58 <sup>c</sup> (0.88, 2.26)	1.16 (0.77, 1.75)	-0.10 (-0.31, 0.11)
Warren	1.11 (0.63, 1.95)	2.02 <sup>c</sup> (1.33, 3.05)	0.19 <sup>c</sup> (0.18, 0.51)	1.66 <sup>c</sup> (1.10, 2.48)	0.46 (-0.16, 1.09)	1.48 (1.02, 2.15)	-0.18 (-0.38, 0.02)
P-value set <sup>e</sup>	.027	.000	.000	.145	.000	.225	.539
Age	1.04 <sup>c</sup> (1.01, 1.07)	1.03 <sup>c</sup> (1.01, 1.05)	0.98 <sup>c</sup> (0.96, 0.99)	1.02 (0.99, 1.04)	0.00 (-0.03, 0.04)	1.01 (0.99, 1.03)	0.00 (-0.01, 0.01)
Female vs male	1.67 <sup>c</sup> (1.04, 2.65)	1.96 <sup>c</sup> (1.46, 2.62)	0.47 <sup>c</sup> (0.36, 0.62)	1.41 <sup>c</sup> (1.09, 1.81)	0.29 (-0.15, 0.72)	0.57 <sup>c</sup> (0.43, 0.76)	-0.13 (-0.28, 0.03)
Black vs non-Black	1.06 (0.60, 1.87)	0.55 <sup>c</sup> (0.41, 0.74)	2.32 <sup>c</sup> (1.76, 3.06)	1.24 (0.96, 1.59)	-0.00 (-0.47, 0.46)	0.89 (0.69, 1.16)	-0.06 (-0.22, 0.11)
Education	1.12 <sup>c</sup> (1.04, 1.19)	1.06 <sup>c</sup> (1.02, 1.09)	1.03 (0.99, 1.06)	1.03 (0.99, 1.07)	0.02 (-0.05, 0.08)	1.02 (0.98, 1.06)	0.00 (-0.02, 0.02)
Income \$4500-\$8500 vs income less than \$4500	1.34 (0.69, 2.60)	0.92 (0.66, 1.27)	1.22 (0.89, 1.67)	1.07 (0.78, 1.46)	0.07 (-0.52, 0.66)	0.94 (0.70, 1.25)	-0.13 (-0.34, 0.08)
Income \$8500 or more vs income less than \$4500	1.32 (0.54, 3.23)	1.00 (0.64, 1.55)	1.53 (0.99, 2.37)	1.50 (0.98, 2.30)	0.17 (-0.51, 0.86)	1.02 (0.70, 1.49)	-0.20 (-0.45, 0.06)
Married vs nonmarried	1.90 <sup>c</sup> (1.19, 3.04)	1.57 <sup>c</sup> (1.18, 2.07)	0.74 <sup>c</sup> (0.56, 0.999)	1.17 (0.89, 1.53)	-0.09 (-0.56, 0.37)	0.72 <sup>c</sup> (0.54, 0.96)	0.06 (-0.09, 0.22)
Employed vs not employed	0.90 (0.52, 1.43)	0.98 (0.70, 1.37)	0.90 (0.64, 1.26)	1.02 (0.77, 1.35)	-0.66 <sup>c</sup> (-1.25, -0.08)	0.71 (0.45, 1.14)	-0.00 (-0.29, 0.29)
Poor health: self-rated <sup>f</sup>	1.81 <sup>c</sup> (1.35, 2.42)	1.14 (0.98, 1.32)	2.10 <sup>c</sup> (1.50, 2.92)	1.62 <sup>c</sup> (1.41, 1.84)	2.71 <sup>c</sup> (1.98, 3.44)	1.62 <sup>c</sup> (1.41, 1.86)	0.24 <sup>c</sup> (0.04, 0.44)
Poor health <sup>g</sup>	1.97 <sup>c</sup> (1.46, 2.64)	1.27 <sup>c</sup> (1.10, 1.48)	1.05 (0.92, 1.20)	1.91 <sup>c</sup> (1.48, 2.45)	0.86 <sup>c</sup> (0.62, 1.10)	2.02 <sup>c</sup> (1.59, 2.56)	0.13 <sup>c</sup> (0.05, 0.21)
No Medicare vs Medicare	0.56 (0.26, 1.21)	0.73 (0.45, 1.88)	1.78 <sup>c</sup> (1.12, 2.81)	0.58 <sup>c</sup> (0.37, 0.92)	0.44 (-0.53, 1.41)	0.92 (0.59, 1.43)	0.16 (-0.27, 0.59)
Medicaid vs no Medicaid	2.15 (0.62, 7.48)	1.27 (0.77, 2.08)	1.04 (0.63, 1.70)	1.51 (0.90, 2.53)	1.13 (0.16, 2.09)	1.51 <sup>c</sup> (1.05, 2.18)	-0.05 (-0.33, 0.23)
Private insurance vs no private insurance	1.39 (0.84, 2.30)	1.50 <sup>c</sup> (1.14, 1.96)	0.61 <sup>c</sup> (0.45, 0.81)	1.04 (0.79, 1.35)	-0.07 (-0.60, 0.47)	1.27 (0.99, 1.64)	-0.01 (-0.20, 0.19)

Note. Numbers of respondents for specific outcomes varied as a result of missing data. Coefficients are exponentiated logistic betas unless otherwise indicated. Excluding imputed values, the maximum number of cases was 3085 (any night in hospital); the minimum was 2974 (any outpatient visit). Seven hundred eighty-six respondents who had missing data on income accounted for most of the missing data.

<sup>a</sup>Ordinary least squares metric b values.

<sup>b</sup>The effect of rural residence on each outcome was estimated with an equation containing a single dummy variable (for residence in any county other than Durham) plus the covariates below.

<sup>c</sup>Significant at  $P \leq .05$ .

<sup>d</sup>For each outcome, the effect was estimated with an equation containing four dummy variables (one for each rural county) and the covariates. The effects of covariates reported below are based on the equation(s) with the four dummies for county of residence.

<sup>e</sup>P-value based on F test of overall differences in outcome associated with county of residence.

<sup>f</sup>For three outcomes (site: hospital, number of visits, and number of nights), the effect of self-rated health was nonlinear and was measured with a dummy variable coded 1 for the poorest health category. For other outcomes, a linear (four-level) measure was used for self-rated health.

<sup>g</sup>For two outcomes (any visit and any night at hospital), the effect of poor health was nonlinear and was measured with a dummy variable coded 1 for the poorest health category. For other outcomes, a linear (three-level) measure was used for poor health.

**TABLE 5—Regression Effects of County of Residence and Other Predictors on Putting Off Care, Satisfaction with Care, and Self-Rated Health among 4001 Nonproxy Respondents**

	Coefficient (95% Confidence Interval)					
	Put Off Care Due to Cost	Put Off Care Due to Transportation Difficulties	Put Off Care Due to Not Knowing Where to Go	Satisfaction with Care <sup>a</sup>	Poor Self-Rated Health <sup>a</sup>	Poor Health <sup>a</sup>
All rural counties vs Durham <sup>b</sup>	1.53 <sup>c</sup> (1.22, 1.92)	1.37 (0.98, 1.93)	0.92 (0.60, 1.41)	-0.03 (-0.10, 0.04)	0.10 <sup>c</sup> (0.02, 0.18)	0.03 (-0.04, 0.10)
Each rural county vs Durham <sup>b</sup>						
Vance	1.78 <sup>c</sup> (1.31, 2.41)	1.12 (0.72, 1.75)	0.67 (0.32, 1.39)	-0.14 <sup>c</sup> (-0.26, -0.03)	0.11 <sup>c</sup> (0.001, 0.22)	-0.03 (-0.14, 0.07)
Granville	1.51 <sup>c</sup> (1.04, 2.10)	1.59 (0.95, 2.67)	1.10 (0.55, 2.20)	-0.01 (-0.09, 0.07)	0.09 (-0.03, 0.20)	0.03 (-0.09, 0.15)
Franklin	1.28 (0.92, 1.79)	1.46 (0.96, 2.24)	0.83 (0.50, 1.39)	0.22 <sup>c</sup> (0.10, 0.35)	0.08 (-0.03, 0.20)	0.13 <sup>c</sup> (0.03, 0.24)
Warren	1.54 <sup>c</sup> (1.04, 2.21)	1.34 (0.66, 2.70)	1.18 (0.65, 2.16)	-0.25 <sup>c</sup> (-0.41, -0.09)	0.15 (-0.00, 0.29)	-0.02 (-0.14, 0.10)
P-value set <sup>e</sup>	.002	.279	.599	.000	.113	.089
Age	0.97 <sup>c</sup> (0.95, 0.98)	1.00 (0.98, 1.02)	1.00 (0.96, 1.04)	0.00 (-0.00, 0.01)	-0.01 <sup>c</sup> (-0.00, -0.01)	-0.00 (-0.01, 0.01)
Female vs male	1.35 <sup>c</sup> (1.05, 1.74)	2.47 <sup>c</sup> (1.63, 3.73)	1.39 (0.87, 2.23)	0.02 (-0.05, 0.09)	-0.00 (-0.08, 0.08)	-0.16 <sup>c</sup> (-0.25, -0.07)
Black vs non-Black	0.59 <sup>b</sup> (0.48, 0.75)	0.94 (0.67, 1.31)	0.92 (0.59, 1.44)	-0.02 (-0.09, 0.05)	-0.08 (-0.16, 0.00)	-0.02 (-0.09, 0.06)
Education	0.93 <sup>c</sup> (0.90, 0.97)	0.91 <sup>c</sup> (0.86, 0.97)	0.96 (0.89, 1.03)	0.01 <sup>c</sup> (0.004, 0.02)	-0.04 <sup>c</sup> (-0.05, -0.03)	-0.01 (-0.02, 0.00)
Income \$4500-8500 vs income less than \$4500	0.99 (0.75, 1.29)	1.08 (0.77, 1.51)	1.14 (0.66, 1.98)	-0.02 (-0.10, 0.05)	-0.17 <sup>c</sup> (-0.27, -0.06)	-0.10 <sup>c</sup> (-0.19, -0.00)
Income \$8500 or more vs income less than \$4500	0.47 <sup>c</sup> (0.30, 0.71)	0.71 (0.38, 1.34)	0.82 (0.39, 1.70)	0.09 (-0.02, 0.20)	-0.36 <sup>c</sup> (-0.50, -0.22)	-0.17 <sup>c</sup> (-0.30, -0.04)
Married vs nonmarried	1.22 (0.94, 1.58)	0.62 <sup>c</sup> (0.41, 0.94)	1.12 (0.63, 2.02)	-0.03 (-0.10, 0.04)	0.06 (-0.02, 0.15)	-0.03 (-0.12, 0.05)
Employed vs not employed	1.12 (0.80, 1.59)	0.39 <sup>c</sup> (0.19, 0.82)	1.98 <sup>c</sup> (1.12, 3.53)	0.02 (-0.09, 0.12)	-0.26 <sup>c</sup> (-0.36, -0.16)	-0.25 <sup>c</sup> (-0.35, -0.15)
Poor health: self-rated <sup>f</sup>	1.76 <sup>c</sup> (1.55, 2.00)	1.83 <sup>c</sup> (1.53, 2.19)	1.60 <sup>c</sup> (1.27, 2.00)	-0.09 <sup>c</sup> (-0.13, -0.06)	.....	.....
Poor health	0.95 (0.84, 1.07)	0.96 (0.81, 1.14)	1.07 (0.83, 1.40)	0.02 (-0.01, 0.06)	.....	.....
No Medicare vs Medicare	1.00 (0.59, 1.67)	1.50 (0.88, 2.57)	2.14 (0.97, 4.73)	-0.01 (-0.14, 0.12)	0.10 (-0.08, 0.28)	-0.09 (-0.26, 0.07)
Medicaid vs no Medicaid	0.54 <sup>c</sup> (0.34, 0.86)	0.92 (0.56, 1.52)	1.43 (0.69, 2.98)	0.02 (-0.10, 0.13)	0.01 (-0.15, 0.17)	0.01 (-0.14, 0.16)
Private insurance vs no private insurance	0.78 (0.61, 1.00)	0.73 (0.49, 1.11)	1.41 (0.89, 2.22)	-0.02 (-0.09, 0.06)	-0.14 <sup>c</sup> (-0.22, -0.05)	0.01 (-0.07, 0.09)

Note. Numbers of respondents for specific outcomes varied as a result of missing data. Coefficients are exponentiated logistic betas unless otherwise indicated. Excluding imputed values, the maximum number of complete cases was 3102 (poor health index); the minimum was 3068 (put off care because of not knowing where to go). Seven hundred eighty-six respondents who had missing data on income accounted for most of the missing data.

<sup>a</sup>Ordinary least squares metric. <sup>b</sup>Values. <sup>c</sup>The effect of rural residence on each outcome was estimated with an equation containing a single dummy-variable (for residence in any county other than Durham) plus the covariates below. <sup>d</sup>For each outcome, the effect was estimated with an equation containing four dummy variables (one for each rural county) and the covariates. The effects of covariates reported below are based on the equation(s) with the four dummies for county of residence. <sup>e</sup>P value based on F test of overall differences in outcome associated with county of residence.

overall pattern was in the expected direction. Satisfaction with health care did vary by county, but there was no clear difference between the urban and the rural counties. Contrary to expectations, residents of rural areas did not differ from those in the urban county in knowing where to go for care; continuity of care among rural elderly people appeared to have been better, since they were more likely to report seeing the same provider on each visit.

Black elderly people were less likely than non-Blacks to delay seeking health care, and they did not obtain their care from the same source. These Black elderly individuals were more likely to receive their ambulatory care at a hospital, a provider that, in this area, does not discriminate against the poor. Nevertheless, universal coverage may reduce urban/rural differences in source of care when distance to care is not excessive, because ambulatory visits to primary care physicians' offices would be covered under such a health insurance plan.

A major contributor to differences in access to health services by urban as compared with rural residents may be the cost of obtaining health care. While cost as a barrier to health care diminishes in later life as a result of the almost universal coverage of older persons by a combination of Medicare and Medicaid, substantial out-of-pocket expenses nevertheless mean that health care is not equally accessible to all. In the South, this burden appears to fall more heavily on those in rural areas, possibly because they may need to rely more heavily on family members to help them reach medical care and these family members may experience financial burdens, such as loss of work, in providing access to such care. The availability of Medicare or Medicaid, therefore, does not appear to eliminate all costs as a barrier to care, especially in the rural South. If Medicare, in its current form, becomes a model of universal health insurance, cost may persist as a barrier to care.

These results should not be generalized to rural areas throughout the United States. Although the Duke Established-Populations for Epidemiologic Studies of

the Elderly is representative of the rural South, it is not representative of one of the major barriers to health care in rural areas in other regions: excessive distance from health care services. Most rural residents in the South (especially the Southeast) are within a 1.5-hour drive of a major medical center along well-maintained roads. These findings also demonstrate that proximity to major medical centers does not increase continuity of care. They do not demonstrate, however, that increased availability of primary care is associated with increased continuity of care.

The reader must also take caution in generalizing these findings to younger age groups, especially children. Most of the subjects in this study reported that transportation was not a major factor limiting their access to timely care, presumably because they could drive themselves or because friends or family members could drive them. Working parents in rural areas may not have the flexibility of time, as do older persons, to seek health care some distance from their homes, and they may not have insurance coverage.

Yet it is the cost of health care, above all, that remains an issue for elderly people in these southern rural counties. Even with Medicare and Medicaid coverage, and after demographic status and health condition have been controlled, cost is a significant and constant barrier for rural elderly people in comparison with their urban counterparts. The availability of easily accessible primary care services may not overcome this barrier if cost is not reduced. With current threats to Medicare, which may require more out-of-pocket contributions to health care, rural elderly people in the South may be especially at risk for decreased health care. □

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