Are There Geographic Disparities in Out-of-Pocket Spending by Medicare Beneficiaries?

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ABSTRACT

This study compares out-of-pocket spending obligations for Medicare beneficiaries residing in urban, rural-adjacent and rural-nonadjacent counties. We use data from the Medicare Current Beneficiary Survey (MCBS) to assess annual out-of-pocket outlays and their observable correlates. Though we find lower overall out-of-pocket spending for rural-nonadjacent beneficiaries compared to residents in other county types, the proportion of their total expenditure attributed to premiums is five to eight percentage points higher than that of other beneficiaries. We empirically tested five hypotheses related to the observation that rural Medicare beneficiaries spend less out-of-pocket on health care than urban residents. Personal characteristics, access to care, prices, generosity of coverage, and affordability of care are examined as possible reasons for lower out-of-pocket health expenditures in rural settings.

Multiple regression results indicate that lower out-of-pocket spending is related to residence in a rural-nonadjacent county but not residence in rural-adjacent rural counties. None of the five hypothesized explanations separately accounts for the majority of variation in spending across county types. Interaction of rural-nonadjacent residence with other correlates, particularly supplemental insurance with prescription drug coverage, reveals that beneficiaries who reside in remote rural counties may have a higher burden of out-of-pocket costs due to less-generous supplemental insurance coverage. Residents of rural-nonadjacent counties are more likely to have either no supplemental coverage or coverage by a safety net provider than other beneficiaries. Though supplemental coverage varies by county type, expenditures as a proportion of income (a proxy for affordability) is similar across the three categories.

The results indicate that rural Medicare beneficiaries in counties nonadjacent to urban areas spend less out-of-pocket on health care than others. Residents of rural counties adjacent to urban counties have out-of-pocket expenditures that closely resemble that of urban residents. These results persist even after controlling for possible covariates. Future research should examine whether cultural differences in care seeking or barriers in accessing the latest, more costly technologies and procedures account for this disparity in spending.

INTRODUCTION

When Medicare was established in 1965, the benefits package mimicked that of private plans offered in employer settings. First-dollar coverage for hospitalization and a coverage limit were common features of contemporary employer-sponsored insurance arrangements. The benefits for private-sector health insurance plans have since evolved to match the changing array of services and technologies available in the U.S. health sector. However, the Medicare program, due to its size, scope, and function, has not. Recent Congressional debate regarding the implementation of a prescription drug benefit and the structure and incentives allowed for managed care organizations willing to serve Medicare recipients are two examples of the challenges inherent in amending Medicare as the social program providing health insurance to virtually all Americans aged 65 or older.

Given that potential changes to the structure of Medicare benefits are increasingly likely and the evidence that older Americans spend substantial portions of their financial resources on health care, examination of exposure to out-of-pocket financial obligation by Medicare beneficiaries is an important area of research (Crystal, Johnson, Harman, Sambamoorthi and Kumar, 2000). This paper evaluates whether there are systematic geographic disparities in out-of-pocket costs to Medicare beneficiaries. Specifically, we use data from the Medicare Current Beneficiary Survey (MCBS) to determine whether beneficiaries who live in non-metropolitan areas have more or less exposure to financial risk than their counterparts in urban areas. There are several reasons that may lead rural Medicare beneficiaries to be differentially exposed to out-of-pocket costs:

- Rural beneficiaries have, on average, personal characteristics that tend to keep utilization of health care lower. Although rural beneficiaries are less likely to be racial or ethnic minorities, they are also less likely to be high school graduates, and tend to live longer than their urban counterparts (Amick, Levine, Tarlov and Walsh, 1995).
- Adjusted average per capita cost (AAPCC) rates in rural areas reflect lower medical care costs, which directly impact out-of-pocket spending (ARF, 2000; MedPAC, 2000).
- Rural beneficiaries have, on average, values or a culture of not using as much health services than urban beneficiaries are accustomed to, for any given level of health status or "medical need." (Fox, Merwin and Blank, 1995; Strickland and Strickland, 1996).
- Rural areas have fewer providers and less access to the latest, more costly, technologies and procedures (ARF, 2000).
- Lower use could reflect a reduced ability to afford care related to differences in urban and rural incomes (ARF, 2000).
- Finally, it is possible that supplemental coverage available to rural beneficiaries is more generous in ways that do not simultaneously drive up premium costs, such as through higher proportions of Medicaid participation, categorical VA eligibility, or distribution of beneficiaries that tend to live in states that have state-assisted drug programs. There may be important differences in the ways that supplemental coverage (Medigap) interacts with out-of-pocket spending among rural beneficiaries compared to urban beneficiaries.

Each of these hypotheses suggests that rural beneficiaries may have lower out-of-pocket expenditures than their counterparts in metropolitan settings. We control for a variety of factors thought to influence spending, including type of supplemental (Medigap) policy, to determine what factors, if any, differentiate out-of-pocket spending for this population.

BACKGROUND

According to data from the 1992 MCBS, Medicare beneficiaries (both aged and disabled) paid $48.7 billion out-of-pocket toward the $247 billion in health care expenditures attributed to them; that is 19.7% of the total health care expenditures for this group (Laschober and Olin, 1997). Excluding home care and long-term nursing home costs, it was estimated that Medicare beneficiaries spent on average $2,430 out-of-pocket in 1999, which represents 19 percent of their income (Gross and Brangan, 1999).

Between 1993 and 1996, health care spending in the Medicare population grew faster than among the nation as a whole, increasing by 29 percent as compared to national health-related spending increases of 17 percent (Murray and Eppig, 1999). Using 1996 MCBS data, Murray and Eppig (1999) estimate that Medicare pays almost 55% of beneficiaries' health care expenses. They estimated that Medicaid pays approximately 12%, and private insurers pay an additional 10% of expenses, with beneficiaries paying about 18% out-of-pocket (Murray and Eppig, 1999).

Of the estimated out-of-pocket expenditures in 1999, slightly less than half (46 percent) was spent on premium payments toward Medicare Part B, private insurance, and Medicare+ Choice plans, with the remaining amount (54 percent) used for coinsurance, deductibles, and payments for goods and services not covered by Medicare (i.e., prescription drugs, dental care) (Gross and Brangan, 1999). The bulk of these non-premium related out-of-pocket expenses are

associated with the purchase of drugs (Laschober and Olin, 1997; Gross and Brangan, 1999; MedPAC, 2000).

As is true of all health care expenditures, the distribution of out-of-pocket spending is skewed, with a small proportion of Medicare beneficiaries paying large out-of-pocket costs (Gross and Brangan, 1999). Factors predictive of high out-of-pocket expenses include differences in health status, income, and possession of supplemental insurance (Davis, Poisal, Chulis, Zarabozo and Cooper, 1999; Gross and Brangan, 1999). Beneficiaries in poor health (Thomas and Kelman, 1990) and those with chronic conditions have higher expenditures overall (Weinberger, Cowper, Kirkman and Vinicor, 1990; Rogowski, Lillard and Kington, 1997; Steinberg, Gutierrez, Momani, Boscarino, Neuman and Deverka. 2000). However, it is possible that those with poor health are more likely to have supplemental coverage and drug benefits that shelter them from some of this expense (Stuart, Shea and Briesacher, 2001). Rogowski and colleagues (1997) found that rural beneficiaries assume greater financial burden for their prescription drugs than urban beneficiaries. Possible reasons for this disparity include less generous supplements, restricted access to managed care plans that offer a pharmacy benefit as an enrollment incentive, and less purchasing power for stand-alone pharmacies serving rural communities.

Although most studies indicate that Medicare beneficiaries spend approximately 20% of their income out-of-pocket for medical expenses (Moon, 1996; Gross and Brangan, 1999), the proportion of income used for medical care is significantly greater among low-income beneficiaries. For example, beneficiaries whose income falls below the Federal Poverty Level spent an average of 35 percent of their income on health care in 1997, with substantial differences in the share of income spent out-of-pocket for those with (approximately eight

percent) and without (about 50 percent) Medicaid coverage (Gross, Alecxih, Gibson, Corea, Caplan and Brangan, 1999).

The vast majority (approximately 90 percent) of Medicare beneficiaries obtain some form of public or private supplemental coverage (HCFA, 1998); however, the amount of protection against out-of-pocket expenditures varies greatly by the type of supplemental coverage (Gross and Brangan, 1999; MedPAC, 2000). Beneficiaries without supplemental insurance pay the most out-of-pocket for their health care (Murray and Eppig, 1999). Among those with supplemental policies, beneficiaries with Medigap coverage spend the most out-of-pocket for health care, whereas non-Medicaid beneficiaries who enroll in Medicare+Choice have significantly lower out-of-pocket costs, and beneficiaries receiving full Medicaid coverage have the lowest out-of-pocket health care spending (Gross and Brangan, 1999; MedPAC, 2000).

The share of income beneficiaries spend out-of-pocket also varies by the type of supplemental policy. Beneficiaries with self-purchased Medigap policies spent an estimated 26 percent of their 1999 income out-of-pocket, while those with employer-sponsored supplemental insurance (ESI) spent on average 16 percent, those enrolled in Medicare+Choice spent approximately 12 percent out-of-pocket, and beneficiaries with full year Medicaid coverage spent on average 5 percent of their income out-of-pocket for health care (Gross and Brangan, 1999). This distribution seems plausible since the single largest component of out-of-pocket expenditures is devoted to prescription drug costs, and beneficiaries are more likely to have drug coverage if they have ESI, managed care, or Medicaid to supplement Medicare's basic benefits. Beneficiaries with privately purchased and ESI supplemental policies pay similar amounts out-of-pocket for services (e.g., prescription drugs, dental or vision care). However, the amount of out-of-pocket expenditures attributed to premium payments is substantially higher for those with

privately purchased policies, with an estimated $115 spent per month on private premiums for Medigap policy holders compared to $50 per month for beneficiaries with ESI (Gross and Brangan, 1999).

The opportunity to obtain a prescription drug benefit and reduce out-of-pocket expenditures is greater for beneficiaries who either live in markets with Medicare+Choice plans or live in a state that has a pharmaceutical program for low-income, elderly and disabled residents (Davis et al., 1999) (Table 1). Davis and colleagues (1999) indicate that beneficiaries with Medigap pay 80 percent of their drug expenditures out-of-pocket, while those in Medicare+Choice plans pay about 33 percent.

DATA

This research primarily relies on data from the 1996 MCBS Cost and Use Files, as these were the most recent MCBS data available to the researchers at the time of analysis. The MCBS is an annual, nationally representative panel survey of approximately 12,000 beneficiaries, with approximately 25 percent residing in rural counties. MCBS data collection and dissemination is sponsored by the Centers for Medicare and Medicaid Services (CMS) in the U.S. Department of Health and Human Services. The MCBS is ideally suited for this research, as it contains detailed, verified information regarding health care expenditures by source of payment (i.e, Medicare, Medigap, or out-of-pocket). During the interviews, respondents report insurance status, payments toward premiums, co-payments, deductibles and other out-of-pocket expenses. Data provided in the survey allow us to statistically control for factors associated with health service utilization and spending that would otherwise confound comparisons of rural and urban beneficiaries (e.g., age, gender, education, marital status, income, race, health status, functional status, and the presence of chronic conditions).

Table 1

States with Pharmaceutical Assistance Programs for Seniors as of 2000

State	Year Program Enacted
California	1999
Connecticut	1986
Delaware	1981
Florida	2000
Illinois	1985
Indiana	2000
Kansas	2000
Maine	1975
Maryland	1979
Massachusetts	1996
Michigan	1988
Minnesota	1997
Nevada	1999
New Jersey	1975
New York	1987
North Carolina	1999
Pennsylvania	1986
Rhode Island	1985
South Carolina	2000
Vermont	1989
Wyoming	1988

Several important criteria limited the sample size for this research. First, we required Medicare beneficiaries to be enrolled in both the Part A and Part B programs because out-of-pocket expenditure patterns for beneficiaries enrolled in a single program cannot be generalized to the rest of the Medicare population. Also, since we are interested in the impact of rural residence on out-of-pocket spending, we excluded MCBS participants for whom geographic and market information was missing. This includes those living in Puerto Rico, the Virgin Islands, and other U.S. territories in addition to those for whom the ZIP code, county, and self-reported response regarding rural residence is missing. Due to health status differences that could potentially bias our findings, we also excluded MCBS participants under age 65 who are categorically eligible for Medicare because of End-Stage Renal Disease (ESRD) or SSI disability. With the exception of beneficiaries who died during the calendar year, we include only full-year enrollees. We exclude beneficiaries who became eligible for Medicare during the calendar year. The final data set used in our analyses contains 9,076 beneficiary records out of 11,884, or 76 percent of the MCBS sample. This provides a sufficiently large sample for us to differentiate between residents of urban; rural, nonadjacent to urban; and rural, adjacent to urban counties rather than metropolitan versus non-metropolitan comparisons.

METHODS

We explore the issue of how Medicare beneficiaries differ in total expenditures for health care that they pay out-of-pocket both descriptively and with several regression models that control for:

- Health status, both general and condition-specific;
- Income;

- Age, race, education, marital status
- Supplemental and prescription drug coverage; and
- Geographic factors such as AAPCC rates and state drug assistance program availability.

The descriptive results provide an overall depiction of any differences between areas of residence. However, findings of disparities in out-of-pocket spending across county types using this method could be masking other factors. We use multiple regression models to assess the importance of differences in each of these groups of covariates for differences in the out-of-pocket spending of Medicare beneficiaries across the three types of counties.

We define out-of-pocket spending to include all expenses paid by beneficiaries—all deductible and co-payment amounts, as well as expenditures, such as for outpatient drugs, when they are not covered by a supplemental insurance policy, *plus* the cost of premiums for Part B and any supplemental plans that require beneficiaries to pay a premium. We include both costs of medical care and premium payments in our main measure of out-of-pocket spending because of the complexity of the interaction between premiums and utilization. Looking at either alone would provide an incomplete and misleading picture of what the real burden might be for beneficiaries; premiums influence out-of-pocket spending and premiums are also paid out-of-pocket by the sampled beneficiary or someone else on their behalf. The MCBS measure of premium payments by beneficiaries does not include any amount paid by a former employer.

County type (urban, rural-adjacent, rural-nonadjacent) was determined using the ZIP code information from the MCBS. We classify counties by linking ZIP codes to FIPS county codes and then linking these data to the county-level Area Resource File (ARF). Within the ARF, we assigned counties into three types: 1) urban; 2) rural, adjacent to urban areas; or 3)

rural, nonadjacent to urban areas. We base these classifications on each county's associated Rural-Urban Continuum Codes, as defined by the U.S. Department of Agriculture (ARF, 2000).

The complexity of the Medicare supplemental insurance requires additional methodological consideration. There clearly are elements of choice involved in selecting supplemental coverage which suggests that the types of supplemental coverage and the level of out-of-pocket expenditure depend upon each other. Important elements of that choice, however, can only be made at the beginning of one's Medicare eligibility period.

For beneficiaries in later years of their Medicare eligibility—which characterizes the overwhelming majority of the MCBS sample—some supplemental coverage types are pre-determined from the standpoint of their impact on out-of-pocket expenditures. Other aspects of such coverage—specifically the safety-net nature of joint Medicare and Medicaid coverage, and to a lesser degree, VA-coverage—further complicate this relationship. Given this complexity and the relative paucity of variables to disentangle these intricacies of causation, we treat the distribution of supplemental coverage as exogenous or pre-determined in our analyses. We recognize the possibility of selection bias in our model's parameter estimates because of this assumption. However, for this to be of importance for our hypotheses testing, any bias from this approach would need to be non-trivial in magnitude *and* have differential impacts across the county types. Our tests of these conditions suggest that selection bias is not an important concern for these analyses.

All analyses were performed using the Stata 7.0 statistical package, which includes the capability to adjust statistical results to account for the MCBS survey design (StataCorp, 1999).

RESULTS

Descriptive Analysis

We first examined the (unadjusted) average out-of-pocket spending by county type. Rural-nonadjacent Medicare beneficiaries have lower total out-of-pocket spending than urban beneficiaries (Table 2). They spend, on average, $381 less. Rural-nonadjacent beneficiaries also have lower out-of-pocket expenditures than rural beneficiaries in urban-adjacent counties. This annual difference is $514. Both differences are statistically significant. Urban and rural-adjacent Medicare beneficiaries do not have significantly different out-of-pocket expenditures. Holding other factors fixed, geographic barriers to care in rural-adjacent counties should be fewer than those in nonadjacent counties. We suspect that better access may lead to higher utilization and, thus, higher out-of-pocket spending for rural-adjacent residents compared to their counterparts in more remote rural counties.

Table 2 suggests that the lower total out-of-pocket expenditure among rural-nonadjacent beneficiaries is not based on lower average amounts paid for total premiums (supplemental premiums plus Part B monthly payment). Rural-nonadjacent and urban beneficiaries are not significantly different in their average spending on total premiums. Only rural-adjacent and urban beneficiaries differ significantly, with rural-adjacent beneficiaries paying on average $126 more per year in total premiums than urban beneficiaries.

From the preceding results, it is clear that beneficiaries in rural areas not adjacent to urban counties spend a higher proportion of their total out-of-pocket expenditures on premium contributions of all kinds compared to beneficiaries in urban counties. This may result, at least partially, from the lack of variation in the monthly Part B premium by geography, but the substantial variation in costs of service, based on AAPCC rate calculations, by geography.

Table 2

Descriptive Differences in Out-of-Pocket Spending Across County Type

	Spending By Region			Contrasts					
Outcomes:	Urban	Rural Adjacent	Rural Nonadjacent	Urban-Rural Nonadjacent	P-value	Rural-Adjacent	P-value	Rural Nonadjacent-Adjacent	P-value
Total OOPS	$2,930	$3,063	$2,549	$381	**0.04**	($133)	0.31	($514)	**0.03**
Premiums (Supplement and Part B)	$1,145	$1,271	$1,201	($56)	0.35	$126	**0.01**	($70)	0.27
OOP Health Services Expenditures	$1,785	$1,799	$1,349	$436	**0.00**	($14)	0.91	($450)	**0.02**
Total Health Services Expenditures	$9,287	$8,168	$7,095	$2,192	**0.00**	$1,119	**0.04**	($1,073)	0.10
Premiums/Total OOPS	0.39	0.42	0.47	-0.08	**0.00**	-0.02	0.21	0.06	**0.04**

P-values in boldface type indicate differences that are significant at the 5% level or less.
Numbers in parentheses indicate negative values.

However, this also implies that there are even larger differences between these rural beneficiaries and their urban counterparts in the amount of out-of-pocket spending accounted for by health services delivery. The descriptive table includes the proportion of total out-of-pocket spending accounted for by premium costs across county types. We note that the difference between rural (nonadjacent) and urban areas of eight percentage points and the six-point percentage difference between rural-nonadjacent and urban-adjacent areas are both statistically significant. The average amounts spent out-of-pocket on health services (non-premium expenditures) were similar for beneficiaries living in urban and urban-adjacent areas. However, rural-nonadjacent beneficiaries spent approximately $450 less, on average, than beneficiaries from other types of counties for health services. These differences are, again, statistically significant.

Multivariate Analysis

We hypothesized that there were several reasons why rural beneficiaries would spend less out-of-pocket than their counterparts in other areas. We formally tested these hypotheses using standard statistical approaches, primarily Ordinary Least Squares (OLS) regression. For these regression analyses, we use total out-of-pocket spending, which includes all premiums and health services expenditures, as the dependent variable. We explored using a log transformation of our dependent variable and found it produced no substantial differences in our conclusions. Since slightly less than 1% of our sample observations had zero levels of OOPS, we did not explore the use of more complicated modeling strategies (e.g. Tobit). Finally, the linear regression survey estimator within STATA uses a robust variance approach that adjusts for generalized heteroscedasticity.

Model 1 of Table 3 includes only the rural-nonadjacent and rural-adjacent indicator variables. The coefficients and p-values for these two variables replicate those provided in Table 2. We include them here for ease of reference.

Model 2 adds variables on available income, demographic, and health characteristics from the MCBS. Within a multiple linear regression model, the indicator variables for rural-nonadjacent and rural-adjacent measure the "residual" difference in out-of-pocket spending between beneficiaries in these two areas (compared to the omitted area, urban) after controlling for all the covariates that are included within the model. As such, they represent the difference due to all possible influences *not* included in the present model. Of interest, the coefficient for rural-nonadjacent, compared to Model 1, drops slightly from -$381 to -$369 and the p-value increases slightly from .04 to .06. While it is no longer statistically significant at the conventional five percent two-tailed level, it suggests that after controlling for personal characteristics and family income, rural-nonadjacent beneficiaries are still likely to have *lower* overall out-of-pocket expenditures than their urban counterparts.

This model specification—personal characteristics only—explains 11 percent of the variance in spending. A number of quantitatively *and* statistically significant predictors are included: being African American (compared to all other races), being within ages 65-74 and ages 75-84 (compared to 85+), self-report of having had a mental disorder, congestive heart disease, arthritis, or a broken hip. Income, while it is significant statistically, has only a modest effect on out-of-pocket spending: for example, raising income by $10,000 a year is associated with only a $64 a year increase in beneficiary outlays. In summary, although this model has a number of quantitatively important explanatory variables, controlling for them has very little

Table 3

Linear Regression Models Predicting Total Out-of-pocket Spending

Variable	Model 1			Model 2			Model 3		
	Coefficient	Std. Err.	P>|t|	Coefficient	Std. Err.	P>|t|	Coefficient	Std. Err.	P>|t|
Rural-nonadjacent	-381	183	**0.04**	-369	194	0.06	-541	192	**0.01**
Rural-adjacent	133	132	0.31	194	122	0.11	95	145	0.51
Female				221	125	0.08	119	117	0.31
African American				-868	116	**0.00**	-894	144	**0.00**
Married				-101	108	0.35	-70	107	0.51
No High School Diploma				-257	131	**0.05**	-202	138	0.14
Excellent Health				-861	88	**0.00**	-788	102	**0.00**
Poor Health				114	291	0.70	56	293	0.85
Age 65-74				-2527	225	**0.00**	-2170	210	**0.00**
Age75-84				-1642	226	**0.00**	-1434	213	**0.00**
Hardening of the Arteries				284	193	0.14	309	189	0.10
Hypertension				-297	103	**0.00**	-285	104	**0.01**
Heart Attack				-162	191	0.40	-140	184	0.45
Coronary Heart Disease				874	194	**0.00**	902	188	**0.00**
Other Arterial Disease				221	118	**0.06**	227	118	**0.05**
Stroke				767	184	**0.00**	612	179	**0.00**
Cancer				120	139	0.39	105	144	0.47
Diabetes				81	165	0.62	110	153	0.47
Rheumatoid Arthritis				-507	134	**0.00**	-417	121	**0.00**
Osteo-arthritis				-798	123	**0.00**	-726	114	**0.00**
Mental Disorder				3326	584	**0.00**	3056	530	**0.00**
Osteoporosis				299	188	0.11	312	178	0.08
Broken Hip				2292	387	**0.00**	2111	367	**0.00**
Parkinson's Disease				1090	817	0.18	1327	800	0.10
Emphysema				-117	148	0.43	-64	142	0.66
Partial paralysis				851	389	**0.03**	836	376	**0.03**
Income (in $1000's)				4	1	**0.00**	3	1	**0.00**
Medicare Only							1196	437	**0.01**
Medicare & Medicaid							-1018	196	**0.00**
Employer Sponsored							-334	147	**0.02**
HMO							-134	173	0.44
VA Only							-1106	269	**0.00**
Other							4252	524	**0.00**
AAPCC Rate (Part A)							0	1	0.72
AAPCC Rate (Part B)							0	2	0.83
MDs per 1000 population							80	49	0.11
Plan includes Rx							-1255	155	**0.00**
Rx assistance in state							99	128	0.44
Constant	2930	64	0.00	4801	269	0.00	5014	376	0.00
	R-squared = 0.0006			R-squared = 0.1104			R-squared = 0.1722		

P-values in boldface type indicate differences that are significant at the 5% level or less.

impact on the amount by which rural beneficiaries have lower out-of-pocket spending (OOPS) than urban beneficiaries.

Model 3 adds the supplemental insurance coverage indicators (privately purchased coverage is the omitted reference category), the AAPCC rates for both Part A and Part B services, the number of doctors per 1000 population in the county, whether the supplemental insurance plan has a pharmacy benefit, and whether the state has a drug assistance program for elders. We observe that including these additional covariates *increases* the magnitude and significance of rural-nonadjacent coefficient that measures the "residual" difference in out-of-pocket spending between beneficiaries in rural-nonadjacent areas compared to urban areas. This is because differences in these added covariates across areas—when they are not included in the model—are in effect offsetting or masking some of the true differences that exist. Specifically, we estimate that rural-nonadjacent beneficiaries spend $541 less than urban beneficiaries, a substantial increase from the Model 2 estimate of -$369; moreover, the p-value is now 0.01, or alternatively, the 95 percent confidence interval for the difference between rural-nonadjacent and urban beneficiaries, controlling for all of the explanatory variables, is now -$919 to -$164.

From Model 3, we also note important differences in out-of-pocket spending associated with different supplemental types. Compared to privately purchased coverage (the reference category), the joint Medicare plus Medicaid coverage and VA-only coverage both have between $1018 and $1106 lower out-of- pocket spending; beneficiaries with Medicare-Only coverage have $1196 more spending, and the "Other" category has a very large ($4252 more) increase in spending compared to those with privately-purchased coverage. With one exception all these relative effects are as we would expect, the exception being the impact for "Other." "Other" coverage was assigned when the beneficiary reported having both privately purchased and

employer-sponsored coverage at the same time for any month, or when both were present for part of the year. The large effect associated with "Other" coverage might reflect either or both of two effects. First, it is possible that a beneficiary could have been in transition from one supplement to another and had no coverage some intervening months. More likely, multiple supplements could reflect a form of "selection effect": those with double coverage had large expenditures and/or "low" coverage within one of the coverage types, providing them with a reason, related to health expenditure, for wanting double coverage. In summary, none of these relative supplemental coverage effects reduces or "explains" why rural-nonadjacent beneficiaries have lower out-of-pocket spending compared to urban beneficiaries. Further, the result of no significant difference in expenditures between urban and rural-adjacent beneficiaries also persists in this model.

The remaining explanatory variables, including the AAPCC rates, the number of doctors per thousand population in the county, the presence of a specific drug benefit, or a state-assisted pharmacy program, add little explanatory power to the model. Of these five additional covariates, only the supplemental pharmacy benefit had a significant effect; it reduces expected out-of-pocket expenditures by $1255 per year. Again, this can reflect significant amounts of "selection effects" into supplemental plans with a drug benefit. As such, it does not necessarily measure a population-wide expected effect.

Before considering more carefully the hypotheses previously given for lower spending by rural beneficiaries, we present the results of a sub-analysis regarding how differences in the covariates in our model vary across the three geographic areas and thus impact expected out-of-pocket expenditure. Specifically, using the regression results from Model 3, we chose

coefficients for certain explanatory variables to assess the importance for expected out-of-pocket spending differences across county types evaluated at their means.

We start with differences in the distribution of supplemental coverage (Table 4). We answer the question: by how much are a rural-nonadjacent beneficiary's out-of-pocket expenditures expected to be higher or lower than that of an urban beneficiary due to differences in the distribution across supplemental coverage categories in urban areas compared to rural areas?

If the regression coefficients accurately reflect the impact of each supplemental plan in each of the three county types, on net very little difference in out-of-pocket expenditures is accounted for by differences in supplemental coverage (independent of drug coverage). This is due to some offsetting effects, but even the gross expenditure-increasing amounts and expenditure-decreasing amounts are not large. For rural-nonadjacent areas relative to urban areas, the expenditure-increasing effects consist of the higher proportion of beneficiaries in Medicare-only, and "Other", and the lower proportions in employer and Medicare HMO plans. Together, these four expenditure-increasing effects increase relative expected payouts for rural beneficiaries by $123 a year. But the greater proportion of rural-nonadjacent beneficiaries who have Medicare & Medicaid and VA-Only coverage are expected to have $99 less in outlays compared to urban beneficiaries. The net effect of these differences in supplemental coverage across rural non-adjacent and urban areas is only $24. A very similar effect is established for rural-adjacent relative to urban areas. We emphasize that these are *marginal* effects (i.e. measures of the independent effect of these supplemental coverage differences after accounting for *all* the other explanatory variables in the model, including the presence of a pharmacy benefit). Finally, we also estimate how large an impact the pharmacy benefit has on

Table 4

Impact on Out-of-pocket Spending of Differences in Supplemental Coverage

	% Beneficiaries			Expected difference in OOPs due to rural nonadjacent – urban differences in supplemental coverage	Expected difference in OOPS due to rural-adjacent - urban differences in supplemental coverage
	Urban	Rural-Adjacent	Rural-Nonadjacent		
Medicare Only	4.7	6.1	6.9	$26.00	$17.55
Medicare & Medicaid	12.5	15.0	19.1	($67.22)	($25.70)
Employer-Sponsored	27.0	23.6	19.0	$26.69	$11.37
Medicare HMO	22.5	5.9	3.5	$25.43	$22.25
VA Only	2.0	3.7	4.9	($32.06)	($18.49)
Other	6.5	6.9	7.6	$45.46	$17.25
			Net Effect of Differences in Supplemental Coverage	$24.30	$24.23
Pharmacy Benefit	56.4	40.3	36.1	$253.57	$201.09
			Total Net Effect	**$277.88**	**$225.32**

Numbers in parentheses indicate negative values.

expected out-of-pocket expenditures. It adds $254 for rural-nonadjacent and $201 for rural-adjacent beneficiaries compared to beneficiaries in urban areas.

We also individually assessed the differences in the means of the remaining explanatory variables that were statistically significant in the full model (Model 3) in Table 5. We aggregated the effects of all 16 of the specific condition indicators, although not all are significant. For the remaining variables in the model that did not have statistical significance, we show the combined impact of differences in their means across the geographic regions for OOPS.

When the effects of *all* the explanatory variables are included, the differences in the means of the other explanatory variables across the three regions produce the expectation that rural-nonadjacent beneficiaries would have $163 *higher* annual expenses than urban beneficiaries. Similarly the difference in the means implies that rural-adjacent beneficiaries would have $42 higher expenditures than urban beneficiaries. These two adjustments help explain the change from Model 1—where rural beneficiaries had, with no controlling covariates, $381 lower expenditures than the urban group —to Model 3 where this 'residual' difference climbed to $541.

Testing Alternative Hypotheses for Rural/Urban OOPS Differentials

Several of the hypotheses we developed for this research required additional analysis. We tested whether rural supplemental coverage is more generous in ways that do not simultaneously drive up premium costs, such as through higher participation rates in Medicare & Medicaid, or VA-Only, or through greater likelihood of living in states that have state-assisted drug programs. Alternatively, there could be important differences in the impact that supplemental coverage category has on expenditures across county type, which the model ignores by forcing one impact for all areas. The first possibility is tested with the full model

Table 5

Impact on OOPS of Differences in Other Explanatory Variables

Variable	Mean Values			Expected difference in OOPS due to rural nonadjacent - urban differences in other explanatory variables	Expected difference in OOPS due to rural-adjacent - urban differences in other explanatory variables
	Urban	Rural-Adjacent	Rural-Nonadjacent		
African American	8.2%	7.1%	5.8%	$21.83	$9.91
Excellent health	17.3%	14.5%	14.2%	$24.29	$21.90
Age 65-74	49.0%	51.5%	46.5%	$54.66	($52.76)
Age 75-84	37.4%	36.0%	39.1%	($24.11)	$20.69
Income in 1000s	25.9	21.3	19.4	($19.25)	($13.51)
Doctors per 1000 pop.	2.46	0.84	0.98	($117.30)	($128.70)
All specific diseases	-	-	-	($33.93)	($10.69)
All remaining variables	-	-	-	($21.25)	($29.86)
Total Net Effect				**($115.05)**	**($183.08)**

Numbers in parentheses indicate negative values.

since we include all of the supplemental coverage categories (relative to private-purchase), including Medicare & Medicaid and VA-Only. Clearly we can conclude that little overall differences in OOPS (approximately $24 in Table 4) are due to differences in the distribution of rural non-adjacent and urban beneficiaries. Testing the second issue required that we include interactions of the supplemental coverage categorical variables with the county type indicator and test for significance among these interactions.

Table 6 presents the results of three models for these tests. First, in Model 3* we repeat the full model results with just the "main" effects of supplemental coverage. In this specification we omitted a number of the variables that were insignificant in the original Model 3 (Table 3) and there is no change in the rural coefficient (–$541). In Table 6, we only present the coefficients of interest in these tests, namely the "main" supplemental coverage effects and the interactions. We tested the rural-nonadjacent and rural-adjacent interactions with all the supplemental coverage categories, ultimately excluding those that were not significant. In the case of rural-nonadjacent, the coefficient for interaction with "Other" was significant. There were no significant interactions for rural-adjacent.

Model 4 includes the interaction of rural-nonadjacent and "Other" supplemental coverage and in Model 5 we include this interaction and an interaction to reflect a rural-specific drug benefit. Since both interactions are significant, we will discuss the fuller results from Model 5. From the first test we observe that the large 'main' effect of "Other" supplemental coverage (in Model 3* it has an increase of $4262) overestimates the effect of "Other" coverage on OOPS for rural non-adjacent beneficiaries (the combined rural effect of "Other" is $4524 – $2649 = $1875). Whatever causes having this "Other" coverage to result in higher out-of-pocket

Table 6

Testing Heterogeneity in Supplemental Coverage Impact by County Type

	Model 3*			Model 4			Model 5		
	Coeff.	Std. Err.	P>|t|	Coeff.	Std. Err.	P>|t|	Coeff.	Std. Err.	P>|t|
Rural-Nonadjacent	-541	185	**0.00**	-366	175	**0.04**	-725	223	**0.00**
Rural-Adjacent	83	122	0.49	90	122	0.46	76	122	0.53
Medicare Only	1189	438	**0.01**	1191	438	**0.01**	1203	438	**0.01**
Medicare & Medicaid	-1017	193	**0.00**	-1015	192	**0.00**	-995	191	**0.00**
Employer-Sponsored	-326	146	**0.03**	-319	146	**0.03**	-304	147	**0.04**
Medicare HMO	-144	166	0.39	-129	166	0.44	-92	168	0.58
VA Only	-1101	267	**0.00**	-1110	268	**0.00**	-1083	267	**0.00**
Other	4262	524	**0.00**	4491	566	**0.00**	4524	570	**0.00**
Pharmacy Benefit	-1258	156	**0.00**	-1253	155	**0.00**	-1346	169	**0.00**
Other * Rural-Adjacent	-	-	-	-2241	606	**0.00**	-2649	664	**0.00**
PharmacyBenefit * Rural-Nonadjacent	-	-	-	-	-	-	1031	286	**0.00**
Constant	5004	297	0.00	4987	296	0.00	5027	296	0.00
	R-squared = 0.1719			R-squared = 0.1729			R-squared = 0.1736		

P-values in boldface type indicate differences that are significant at the 5% level or less.
* Abbreviated model similar to data presented in Table 3, Model 3

expenditures is not as important quantitatively in rural-adjacent areas as in urban and rural-adjacent ones. We have no explanations for this result.

When we also include an interaction to reflect a rural-nonadjacent specific drug benefit (Model 5), we observe that rural-nonadjacent beneficiaries obtain substantially less expenditure-reducing effects of pharmacy coverage than urban and rural-adjacent beneficiaries. While urban and rural-adjacent residents have an expected reduction of $1346 in out-of-pocket spending from having a pharmacy benefit, remote rural residents have an expected reduction of only $315 (-$1346 + $1031), or about one-quarter as much. We caution that this difference could result from a number of factors. Pharmacy coverage may be less generous in rural non-adjacent areas but there could also be differences in the selection into such coverage in different regions. In terms of the "residual" rural-nonadjacent coefficient, the inclusion of both interactions has the effect of increasing even more the amount by which rural-nonadjacent residents have lower out-of-pocket expenditures compared to urban residents. The increase from Model 3* to Model 5 is from -$541 to -$725, with a p-value = .001, and a 95 percent confidence interval from –$1162 to –$288.

We could not directly test the issue of affordability of care as an explanation of beneficiary outlays across geographic settings. However, we performed some useful indirect tests. Without any knowledge of other expenditures Medicare beneficiaries might have made (in addition to those for non-covered health services and premiums),we cannot control for them. Nor do we have data on amounts or availability of assets or of funds from others that might be used to help purchase health services. As a general rule, however, one could argue that absent systematic differences in expenditures for other goods and services across areas, affordability should be related to the level of out-of-pocket spending relative to available income. A finding of

significant differences in the ratio of out-of-pocket expenditures to available income between beneficiaries across regions is—in this proximate and conditional sense—consistent with the hypothesis that affordability differs across areas, holding all other "needed" expenditures constant.

An important issue related to the assessment of affordability differences across regions is the possibility of measurement error in the self-reported amount of income provided by the MCBS participants (Goldman and Smith, 2001). Prior research by Goldman and Smith (2001) suggests that there is likely to be both systematic under-reporting of income as well as simple random error in the MCBS measure of income. Their results suggest that both of these forms of measurement error for income can significantly bias the ratio of uncovered expenses to income. This problem is magnified when these assessments are made for subgroups of the MCBS based on reported income. Under-reporting of income can be a serious concern when undertaking comparisons of the ratio of out-of-pocket expenditures to income across sub-populations defined by self-reported income. To impact assessments of differences across georgraphical areas in the ratio of out-of-pocket expenditures to income, there would need to be systematic differences in under-reporting by county type. We think this is unlikely to be the case.

We undertake several alternative tests to assess affordability, using beneficiary-reported income as a proxy measure of resources available for non-covered health and other expenses. First, we use the ratio of OOPS to income as our dependent variable and relate it in a regression model to our full set of explanatory variables (less income). Second, we define alternative thresholds of "high" values of the ratio of out-of-pocket expenditures to reported income (e.g. 30 percent) and use a logistic regression model to assess the degree to which exceeding this "high" ratio threshold is significantly related to county type, after controlling for the full model

specification. We use alternative values for this 'high' threshold as a test of sensitivity of the measure.

Table 7 provides the results of an OLS regression of the ratio of OOPS to income on the full set of explanatory variables, displaying only the two county-type indicators to test for the difference between beneficiaries residing in urban vs. rural-nonadjacent and urban vs. rural-adjacent areas. The corresponding logistic regression coefficients from the full model to assess the degree to which exceeding a "high" level of out-of-pocket spending relative to income is significantly related to area residence are also provided. We chose thresholds of .30, .40, .50 and .70 for these tests (we only provide the raw logistic coefficients for the regional indicators).

Although we know from our other analyses that rural-nonadjacent beneficiaries generally had lower out-of-pocket expenditures than urban residents, it could still be possible that lower income in rural counties could result in a higher ratio of out-of-pocket expenditure to income. However, rural-nonadjacent residents in the sample had on average a .158 lower ratio of uncovered health expenditures to income, controlling for all of the model's covariates (95 percent CI is -.28, -.04). We emphasize that this is the "marginal" impact of residing in a rural non-adjacent county after controlling for all of the model's covariates. Focusing on various portions of the upper tail of the distribution of this ratio within the four logistic models, there is no evidence that rural-nonadjacent residents are more likely to have higher ratios, after controlling for the model covariates. Even at the very highest threshold of .70, rural-nonadjacent residents are significantly less likely to be in this high range than urban residents.

SUMMARY

We designed a series of analyses to better understand disparities in out-of-pocket expenditures between rural and urban Medicare beneficiaries. Dividing beneficiaries according

Table 7

OLS and Logistic Regression Models of OOPS/Income by County Type*

	OLS Model: OOPS/Income		
	Coefficient	Std. Error	P>|t|
Rural-Nonadjacent	-0.158	0.061	**0.01**
Rural-Adjacent	-0.014	0.054	0.80
	Logistic Model: OOPS/Income > .3		
	Coefficient	Std. Error	P>|t|
Rural-Nonadjacent	-0.251	0.213	0.24
Rural-Adjacent	0.187	0.121	0.12
	Logistic Model: OOPS/Income > .4		
	Coefficient	Std. Error	P>|t|
Rural-Nonadjacent	-0.267	0.217	0.22
Rural-Adjacent	0.118	0.118	0.32
	Logistic Model: OOPS/Income > .5		
	Coefficient	Std. Error	P>|t|
Rural-Nonadjacent	-0.269	0.231	0.25
Rural-Adjacent	0.163	0.138	0.24
	Logistic Model: OOPS/Income > .7		
	Coefficient	Std. Error	P>|t|
Rural-Nonadjacent	-0.454	0.201	**0.02**
Rural-Adjacent	0.091	0.171	0.59

*These models also control for gender, race, education, health status, age, supplemental coverage, medical conditions, and state pharmacy programs, as listed in Table 2.

to three geographic county types, we compared expenditures for each group using descriptive statistics and multiple regression analysis. Not controlling for other factors, on average rural-nonadjacent beneficiaries spent $381 less than their urban counterparts, while rural-adjacent beneficiaries spent $133 more than urban beneficiaries. Hypothesized reasons for differences in spending include: differences in personal characteristics, Medicare payment (AAPCC rates), cultural differences in care seeking attitudes, reduced access to care, or differences in supplemental coverage. We highlight the findings related to each potential explanation in Table 8. Within the multivariate model, the coefficients for county type measure "residual" differences in out-of-pocket expenses across areas due to all the factors. This summary interpretation of the findings refers to the impact of the variables involved in each hypothesis in terms of "explaining away" or "unmasking" the unadjusted differences in out-of-pocket spending across the three county types.

The full regression model to test the impact of county type on out-of-pocket expenditures implied that after controlling for other factors, Medicare beneficiaries in rural-nonadjacent counties were expected to have $541 less in OOPS than those in an urban county. For residents of rural-adjacent counties, this residual difference was $83, but was not statistically different from expected expenditures by beneficiaries living in urban counties. Since the full regression model leaves 83% of the variance unexplained (i.e. $R^2 = 0.17$), there are many unmeasured factors that exert important effects on the 'residual' differences in out-of-pocket spending between urban, rural-adjacent, and rural-nonadjacent areas.

It is not completely clear why rural Medicare beneficiaries in counties not adjacent to urban counties spend less than other beneficiaries on out-of-pocket cost-sharing obligations. This research systematically ruled out the possibility that differences in medical care spending by

Table 8

Summary of Findings

Hypothesis Related to Lower OOPS	Model	Table	Key Variable(s)	Statistical Finding	Impact on Out-of-Pocket Spending
Rural residents have characteristics related to lower utilization	2	3	Age, race, gender, education, health status, income	Most variables significant at $p<0.05$ or better	Minimal overall impact on spending residual
Lower health care prices in rural areas	3	3	AAPCC, Part A AAPCC Part B	Not Significant (NS)	No impact on spending residual
Reduced access to providers in rural areas	3	3	Physicians per thousand population	NS ($p=.11$), but substantively important	$117 to $128 lower for rural beneficiaries, but included in overall residual
Generosity of supplemental coverage in rural areas	4	6	Interaction: Area*Supplemental Pharmacy Benefit	NS except for "Other" Category Less generous for nonadjacent rural	Increases the overall residual for rural nonadjacent beneficiary to -$725
Affordability of services is lower in rural areas		7	OOPS/income	NS	No evidence that rural beneficiaries spend more of their resources on OOP medical expenses
Differing values or culture across areas	Not tested – Insufficient data				
Reduced access to costly technologies in rural areas	Not tested – Insufficient data				

rural non-adjacent beneficiaries are largely attributable to several commonly believed reasons. Further, we found that considering rural-nonadjacent and rural-adjacent beneficiaries separately in measuring expenditures is important because expenditures by rural-adjacent beneficiaries are similar to that of urban residents. Further research should explore the two hypotheses that we were not able to test with the MCBS and other data sources available for this research:

- Do cultural differences in care-seeking account for the difference?
- Are their barriers to accessing newer and more costly services and technologies for beneficiaries in nonadjacent rural counties?

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