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Missing the handoff: post-hospitalization follow-up care among rural Medicare beneficiaries with diabetes

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ABSTRACT

Introduction: Diabetes is a condition that requires adequate care to ensure ideal outcomes. One need is for proper post-discharge follow-up care to reduce unnecessary hospital re-admissions. This care is more difficult in US rural areas due to lower physician and resource availability. The purpose of this analysis was to examine US urban–rural differences in 30 day post-discharge physician follow-up care.

Methods: This analysis utilized data from 2005 Medicare claims files, merged with county-level information from the area resource file. Beneficiaries with diabetes and with a hospitalization served as the study population. Differences in hospitalization rates and 30 day physician follow-up care were estimated across levels of rurality. Multi-level multivariate models estimated the factors that significantly contributed to obtaining such care.

Results: Approximately 90% of the study population had a follow-up physician visit within 30 days; this rate was lower among rural beneficiaries. Adjusted estimates indicated that beneficiaries in rural areas were not less likely to obtain a follow-up visit. Factors associated with obtaining a follow up included having addition comorbidities, being female or White, and living in the US Northeast.

Conclusions: This analysis found evidence that rural Medicare beneficiaries were less likely to obtain post-discharge physician follow-up visits within 30 days. The adjusted result indicate that other factors such as personal demographic and illness

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characteristics are more predictive of this behavior than the rural location itself. More research is needed to identify why these specific factors are associated with visit behavior, and how to design interventions to improve these rates.

Key words: access, demand, hospitals, racial/ethnic differences in health and health care, USA , utilization of services.

Introduction

Diabetes mellitus is one of the most common chronic diseases in the USA, with approximately 26 million diagnosed individuals, representing more than 8% of the total US population. The US Department of Health and Human Services has listed diabetes as one of six targeted priority conditions needing intervention to reduce racial health disparities[1]. Proper diabetes management is essential to prevent complications such as heart disease, renal failure, pregnancy complications, hypertension, blindness, nervous system damage, or metabolic imbalances[2-6]. This is especially important for older persons with diabetes, who have higher rates of heart disease, stroke, and concurrent disease[7-10].

One indicator of inadequate diabetes control is hospitalization. Up to one-third of persons with diabetes require more than one hospitalization per year[4]. Despite a decline in the age-adjusted hospitalization rate among persons with diabetes to 51.9 per 1000 in 2006[11], diabetes accounts for more than 10% of all hospitalizations, second only to circulatory diseases[12]. Diabetes-related admissions also vary by age, income, and type of insurance[4,5,13-15].

Those with complex care needs, such as persons with diabetes, often require care in multiple settings (ie inpatient and outpatient) as well as across specialties (eg primary care and sociality care)[16,17]. When a person with diabetes has been hospitalized, the referral process is key to reestablishing appropriate ambulatory care. Transitional care can be been defined as a set of actions designed to ensure the coordination and continuity of healthcare as patients transfer between locations or different levels of care[18]. When patients navigate these transitions across settings or providers, they are vulnerable to fragmentation of care, incomplete or miscommunications, and other issues that may adversely affect outcomes[16,19-24]. Proper care transitions can improve the quality of care for patients with chronic conditions by decreasing hospitalizations, decreasing emergency department use, increasing the receipt of preventive services, and achieving improved metabolic control[17,25]. These transitions can also be aided by the use of diabetes education programs[26,27].

Several factors contribute to poor transitions of care. Increasing specialization within health care has led many providers, such as hospitalists, to practice in only a single setting. With hospitalists assuming the traditional role of primary care physicians in the treatment of hospitalized patients[23], providers are often unfamiliar with the capacity of other care settings which may result in inappropriate, improper, or incomplete transfers to the community[20]. This, combined with a lack of communication and information transfer between hospital-based and primary care physicians[16,19,22]; inadequate information on discharge summaries[22] inadequate patient education[21]; and patient barriers such as a lack of transportation, financial constraints, lack of health insurance, and access to providers[17,28], can lead to poor follow-up care after hospital discharge.

Rural residents with diabetes experience difficulties in obtaining needed transitional care. Rural Black adults are less likely to be diagnosed and effectively treated for diabetes than other population groups[29,30]. Similarly, rural Hispanics are also more likely than Whites to have diabetes (either diagnosed or undiagnosed)[31]. Medicare Beneficiaries living in rural areas often have lower incomes and are in poorer health status than their urban counterparts[32]. Rural counties, particularly those with majority non-White populations, are predominantly classified as

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Health Professional Shortage Areas[33], indicating a lack of providers available to residents of those counties. The Dartmouth Atlas also reported wide variation in post-discharge follow-up care across hospital referral regions[34]. Because rural residents comprise a larger proportion of the total Medicare population[35] than of the total national population[32], a more detailed knowledge about the experiences of rural beneficiaries would be beneficial to improve the efficiency of the Medicare program. Improved knowledge regarding issues such as service availability[36], hospitalizations, readmissions, and quality of outpatient care and transitions of care will allow policy-makers to further support rural Beneficiaries, improve their care, and potentially improve the cost efficiency of the Medicare program by shifting care from inpatient to outpatient settings.

These disparities are further exacerbated by barriers faced by non-White patients with diabetes. Non-Whites have historically higher rates of diabetes prevalence and complications from diabetes[3,37]; yet lower rates of diabetic control and adherence to clinical guidelines, lower ambulatory service utilization, and higher hospitalization rates than Whites[4,13,15,38,39].

Few studies have specifically examined post-hospitalization care transitions among rural residents with diabetes, particularly rural minorities. This study estimated both hospital admission rates for rural Medicare Beneficiaries with diabetes and the proportion of hospitalized patients with prompt post-discharge follow up in the outpatient setting. Particular emphasis was given to estimates across race subgroups, to determine if further disparities exist among these rural Medicare Beneficiaries.

Methods

Data and population

This analysis utilized the 2005, 5% Medicare sample, obtained from the Chronic Conditions Warehouse (CCW). The CCW was legislatively created by the US *Medicare Prescription Drug Improvement and Modernization Act of 2003* and is maintained by the Research Data Center (RESDAC). The data included inpatient hospital stay claims, carrier claims (eg physician encounter claims) and beneficiary information such as demographic information and chronic illness diagnoses. Data were merged into one file by beneficiary. Information regarding the county of residence of the beneficiary was drawn from the 2007 Area Resource File (ARF), which contains geographic codes and descriptors which enable it to be linked to many other files and to aggregate counties into various geographic groupings[40]. The ARF contains more than 6000 variables regarding health facilities, health professions, measures of resource scarcity, health status, economic activity, health training programs, and socioeconomic and environmental characteristics.

The study population was limited to Beneficiaries who did not die during the year and did not have one of the following diagnoses: congestive heart failure, Alzheimer's disease, dementia, schizophrenia, chronic kidney disease, or end stage renal disease. Beneficiaries were also excluded if they were discharged to a long term care facility, another hospital, hospice, or with home health services. Theses exclusions reduced the study population to one in which care would only be received if sought at a physician's office or similar setting. Thus, only Beneficiaries who were hospitalized and discharged back into the community, or who were not hospitalized at all (for calculating rates) were included in the study.

Analysis

The dependent variable was the presence of a billed physician visit, in an office setting, within 30 days of discharge of an index hospitalization. Independent variables consisted of the Beneficiary's race (White, Black, Other), sex, age (65-74, 75-84, ≥85), and diabetes diagnosis. The CCW also includes indicators for twenty-one separate comorbid chronic conditions, based upon claims and diagnoses. A sum of the total number of comorbid conditions was used as an indicator of overall patient acuity.

Rurality was defined using the 2003 Urban Influence Codes (UIC)[41]. The UICs of 1 and 2 levels of rurality were classified as 'Urban' while all other UICs were classified as rural. Analysis across levels of rurality used three groups: 'Micropolitan Rural'

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(UICs 3, 5, and 8) 'Small Adjacent Rural' (UICs 4, 6, and 7) and 'Remote Rural' (UICs 9, 10, 11, and 12).

Other ecological characteristics drawn from the ARF included the ratio for primary care physicians per 1000 residents of a county (divided into quartiles) as a measure of access to physician care; the number of hospitals in the county (0, 1, or ≥2) as a measure of the healthcare infrastructure of the county; per capita income of the county (divided into quartiles) as a proxy for personal income; and region (Northeast, South, Midwest, West) to account for the regional variations that can occur in healthcare delivery[34].

Initial analysis estimated the proportion of beneficiaries with diabetes, by the characteristics of interest, subset by rurality. Estimates of the proportion of those beneficiaries with diabetes that had at least one hospitalization in the year by the characteristics of interest were then calculated, also subset by rurality. Subsequent analyses were limited to those beneficiaries with diabetes and at least one hospitalization. Estimates of the proportion of hospitalized beneficiaries with a 30 day follow-up claim were produced by the characteristics of interest and subset by rurality. All differences across levels of rurality (using urban as the referent group) were tested using Wald $\chi 2$ tests at the $\alpha=0.05$ level and adjusted for multiple comparisons using Bonferroni's method.

Multivariable ordinary least squares logistic regression, controlling for clustering at the county level, was utilized to determine factors associated with having a follow-up claim within 30 days of discharge. This analysis utilized three models, with a dichotomous indicator of having a 30 day follow up as the dependent variable. The first included only the four-level rural variable as the independent variable; the second model added the demographic information of the beneficiary (race, sex, age) as well as the number of comorbidities; the third and final model included the ecological factors (primary care physician to resident ratio, hospitals in the county, per capita income, and region).

All analyses were designated as exempt by the University of South Carolina Institutional Review board (HSA-4983).

Results

Population characteristics and prevalence of diabetes

The initial sample, minus exclusions, totaled 1 411 346 beneficiaries. More than 14% had diabetes; this rate was higher among rural than urban residents (16.7% vs 13.5%, p <0.001; Table 1). Males, those under the age of 75 years, and non-Whites were all more likely to have diabetes. Rural residents, across these demographic characteristics, remained more likely to have diabetes. The prevalence of diabetes was also higher in rural areas across the ecological variables examined (primary care physician to population ratio, hospital availability, per capita income, and region). With the exception of remote rural counties, beneficiaries living in areas with proportionately fewer physicians were more likely to have a diagnosis of diabetes. Similarly, diabetes was more prevalent among beneficiaries living in a county without a hospital. Diabetes prevalence was inversely related to per-capita income. Beneficiaries living in the rural South had the highest rate of diabetes.

Hospitalization and follow-up among persons with diabetes

The estimated proportion of Medicare beneficiaries with diabetes that had at least one hospitalization in 2005 is provided (Table 2). Rural residents had significantly higher rates (13.0%) than urban residents (12.0%); this rate was highest among remote rural residents (13.7%). The hospitalization proportions were higher among females and older beneficiaries. Black beneficiaries were less likely to be hospitalized than their White peers in both urban and rural settings; persons of Other race residing in urban areas were also less likely to be hospitalized. Residents in counties with lower primary care provider ratios, more hospitals, and in the South and Midwest also had higher rates. In general, rural residents had higher rates across all the variables of interest.

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Table 1: Percentage diabetes prevalence among Medicare beneficiaries, by characteristics and rurality, 2005

Characteristic	All *N*=1 411 346	Location				
		Urban n=1 133 361	All rural *N*=277 985	Micropolitan rural *n*=161 254	Small adjacent rural *n*=68 875	Remote rural *n*=46 856
All	14.1	13.5	16.7*	16.7*	16.9*	16.2*
Sex						
Male	14.9	14.3	17.5*	17.8*	17.4*	16.7*
Female	13.6[a]	13.0[a]	16.1*[a]	16.0*[a]	16.5*[a]	15.8*[a]
Age group						
65-74	13.9	13.3	16.4*	16.4*	16.7*	15.9*
75-84	15.2[b]	14.6[b]	18.2*[b]	18.2[b]	18.3*[b]	17.6*[b]
≥85	11.4[b]	10.9[b]	13.7*[b]	13.7*[b]	13.4*[b]	13.2*[b]
Race						
White	13.3	12.6	15.9*	16.0*	16.0*	15.6*
Black	20.9[c]	20.0[c]	27.4*[c]	27.5*[c]	27.4*[c]	26.7*[c]
Other	17.1[c]	16.6[c]	21.6*[c]	20.4*[c]	24.1*[c]	23.3*[c]
PCP per 1000 residents						
<0.48	17.0	16.3	17.5*	18.1*	17.9*	15.9
0.48-0.75	16.7[d]	16.1	17.6*	17.5*	17.6*	18.1*[d]
076-1.12	14.2[d]	13.6[d]	16.5*[d]	16.6*[d]	16.0*[d]	16.4*
>1.12	12.9[d]	12.7[d]	15.2*[d]	15.4*[d]	14.9*[d]	14.7*[d]
Number of hospitals in county						
0	16.7	15.8	17.8*	17.8*	18.1*	17.4*
1	16.4	15.9	16.7*[e]	16.9*	16.9*[e]	16.0[e]
≥2	13.5[e]	13.2[e]	16.4*[e]	16.5*[e]	16.2*[e]	15.9*[e]
Per capita income in county						
<$21,169	18.6	18.0	19.0*	19.8*	19.6*	17.2
$21,169-$24,024	17.9[d]	17.6	18.1*[d]	18.8*	17.5[d]	17.8
$24,025-$27,407	15.5[d]	14.5[d]	16.6*[d]	16.7*[d]	16.5*[d]	16.1*[d]
>$27,407	13.3[d]	13.1[d]	15.3*[d]	15.5*[d]	14.9*[d]	14.3*[d]
Region						
Northeast	13.8	13.5	16.3*	16.1*	16.2*	17.7*
Midwest	15.6[f]	15.3[f]	16.1*	16.6*	15.5	15.8*[f]
South	16.0[f]	15.3[f]	18.3*[f]	18.2*[f]	18.6*[f]	18.2*
West	9.8[f]	9.3[f]	13.4*[f]	13.7*[f]	13.8*[f]	11.6*[f]

PCP, Primary care providers

*Significantly different from urban, $p< 0.05$; a, significantly different from male, $p<0.05$; b, significantly different from 65-74 years, $p<0.05$; c, significantly different from White, $p< 0.05$; d, significantly different from top quartile, $p<0.05$; e, significantly different from 0 hospitals, $p<0.05$; f, significantly different from Northeast, $p<0.05$.

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Table 2: Percentage beneficiaries with diabetes with at least one hospitalization by rurality, 2005

Characteristic	Location					
	All	Urban	All rural	Micropolitan rural	Small adjacent rural	Remote rural
All	12.2	12.0	13.0*	12.9*	12.7*	13.7*
Sex						
Male	12.0	11.9	12.5*	12.4	12.4	13.1*
Female	12.4[a]	12.1	13.3*[a]	13.2*	13.0*	14.1*
Age group						
65-74	11.0	10.8	11.8*	11.5*	12.3*	11.9*
75-84	13.3[b]	13.0[b]	14.3*[b]	14.3*[b]	13.2	15.7*[b]
≥85	15.1[b]	14.9[b]	15.7[b]	15.9[b]	14.1	16.9[b]
Race						
White	12.5	12.3	13.1*	13.0*	12.9	13.9*
Black	11.5[c]	11.4[c]	11.7[c]	12.1	11.4	10.7[c]
Other	10.1[c]	9.7[c]	13.2*	12.4*	14.0*	15.2*
PCP per 1000 residents						
<0.48	12.9	13.3	12.7	11.8	13.0	13.2
0.48-0.75	12.7	12.8	12.6	12.3	12.6	13.7
076-1.12	12.3[c]	12.1[c]	13.0*	13.0*	12.5	13.9*
>1.12	11.9[c]	11.7[c]	13.8*[c]	14.0*[c]	13.0	13.9*
Number of hospitals						
0	12.1	12.6	11.5	10.1*	11.7	12.3
1	12.9[e]	12.7	13.1[e]	13.0[e]	12.7	13.9*
2 or more	12.1	11.9	13.1*[e]	13.0[e]	13.5*	14.0*
Per capita income						
<$21,169	12.7	12.5	12.8	12.0	13.6	12.6
$21,169-$24,024	12.6	12.9	12.5	13.0	12.0	12.1
$24,025-$27,407	12.8	12.4	13.1	12.8	13.1	14.6*
>$27,407	12.0	11.9	13.3*	13.0*	12.6	15.1*[c]
Region						
Northeast	11.6	11.6	11.8	11.8	12.2	10.5
Midwest	13.1[f]	13.0[f]	13.4[f]	13.0	13.5	14.2*[f]
South	12.6[f]	12.4[f]	13.1*[f]	13.4*[f]	12.5	13.3
West	10.7[f]	10.3[f]	12.3*	11.8*	12.4*	14.7*

PCP, Primary care providers.
*Significantly different from urban, $p< 0.05$; a, significantly different from male, $p<0.05$; b, significantly different from 65-74 years, $p<0.05$; c, significantly different from White, $p< 0.05$; d, significantly different from top quartile, $p<0.05$; e, significantly different from 0 hospitals, $p<0.05$; f, significantly different from Northeast, $p<0.05$.

Unadjusted 30 day follow-up estimates

Overall, 88.5% of Medicare beneficiaries hospitalized in 2005 had a follow-up visit at a physician's office or in health clinic within 30 days (Table 3). This proportion was lower among rural residents (86.4%) and decreased with rurality; only 82.5% of remote rural Beneficiaries had a follow-up visit within 30 days. The proportion of beneficiaries with a 30 day follow up was lower for males and younger beneficiaries. In urban counties, Black beneficiaries were less likely than Whites to receive a 30 day follow up (86.1% vs 89.5%; Table 3), while beneficiaries of Other race did not differ. In

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rural counties, beneficiaries of Other race were less likely to receive a 30 day follow up than Whites (83.9% vs 86.5%), while Black beneficiaries did not differ. Black beneficiaries residing in small rural counties adjacent to metropolitan areas were more likely to receive prompt follow up than were urban Black beneficiaries. Among all beneficiaries, a 30 day follow up was more common among beneficiaries living in counties with higher physician/population ratios, at least one hospital, higher per capita income, and located in the Northeast. These rates all decreased as rurality increased.

Adjusted 30 day follow-up estimates

The initial unadjusted analytic model found that living in remote rural counties was associated with a reduced odds of a follow-up physician visit within 30 days of discharge, compared with urban residence (Table 4, Model 1). Adding beneficiary characteristics did not significantly change the odds associated with rural residence (Table 4, Model 2). Adding county characteristics rendered rural–urban differences non-significant (Table 4, Model 3). Among county characteristics, only regional effects were significant, with all regions having reduced odds of prompt follow up compared with the Northeast. Beneficiary characteristics associated with reduced odds of 30 day follow up in the full model included male sex and Black race. Each additional comorbidity markedly increased the odds for 30 day follow up.

Discussion

The 30 day post-hospitalization follow-up rate was examined among beneficiaries with diabetes to determine if rural residence was associated with these rates. In the adjusted yet simplified analysis, residents of remote rural counties had a reduced odds for a 30 day follow up when compared to urban residents (OR 0.74, CI 0.60–0.90). However, when factors associated with visit behavior at both the individual and county level were added to the model, residents of rural counties were no less likely to have a follow-up visit within 30 days than their counterparts.

Because all subjects in the analysis were insured via Medicare, the hypothesis was that the remaining barriers to accessing healthcare services, such as access to providers, need, and personal preferences, would be associated with follow-up behavior. These results confirm that personal characteristics, such as race and sex, are associated with follow-up care, and may be indicative of either personal preferences or institutional biases. These findings also confirm a well-documented racial disparity in service utilization[13,15,38]. In addition, measures of need such as additional comorbidities and older age are also associated with seeking care. Physician availability, measured as primary care physicians per 1000 residents, was not associated with seeking care. This may indicate that even in areas with fewer providers, having a stable source of insurance in Medicare provides adequate access to services.

Even if the patient is motivated to seek proper follow-up care, additional barriers may reduce their ability to fulfill this desire. These barriers may include the lack of a usual source of care, not fulfilling a visit scheduled by the inpatient care team, inability to access the care itself, and lower levels of health literacy that would reduce their perceived need for the care[39,40]. For rural and non-White residents, travel difficulties exacerbate these barriers, further reducing the likelihood of a follow up[42]. Rural residents also lack adequate diabetes educational support, further exacerbating outcomes[26,27].

Despite these indications, evidence remains that the transition from inpatient to outpatient care is not ideal in smaller rural areas. Research has documented several barriers to proper outpatient care, such as inadequate or unavailable discharge summaries and inadequate communication[16,19-24,43]. Further work is warranted to determine if these rural difficulties are compounded by regional differences. The Dartmouth Atlas indicated such a regional difference, but it is unknown if rurality and region compound or lessen these effects[34]. The findings do indicate a potential compounding effect, particularly in the West and Midwest; further examination of regional effects could lead to more targeted interventions.

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Table 3: Percentage physician follow-up within 30 days among hospitalized beneficiaries with diabetes, 2005, by rurality

Characteristic	All	Location				
		Urban	All rural	Micropolitan rural	Small adjacent rural	Remote rural
All	88.5	89.2	86.4*	87.8	85.6	82.5*
Sex						
Male	87.9	88.9	84.9*	86.8	84.6	78.4*
Female	88.9[a]	89.4[a]	87.6[a]	88.5[a]	86.4	85.8*
Age group						
65-74	86.9	87.5	85.4	86.3	84.3	84.1
75-84	90.2[b]	91.1[b]	87.2*[b]	89.2	88.3	79.6*
≥85	90.4[b]	90.7[b]	89.3	91.4[b]	85.0*	86.8*
Race						
White	88.7	89.5	86.5*	88.3	85.4*	82.3*
Black	86.0[c]	86.1[c]	85.4	82.0	91.2*	85.0
Other	89.3[c]	90.1	83.9*[c]	87.0[c]	73.7	85.7
PCP per 1000 residents						
<0.48	86.9	90.1	84.3	86.6	83.1	83.5
0.48-0.75	88.6	90.4	85.8*	86.5*	87.1	80.9*
076-1.12	88.1	88.0	88.3	89.6	87.0	83.5*
>1.12	89.0	89.4	85.6	86.8	84.9	82.5
Number of hospitals						
0	86.3	89.3	82.6	80.0	84.3	81.8
1	86.8	88.5	85.8	87.9	84.4	82.4*
2 or more	89.1	89.3	87.9	88.1	89.3	83.3
Per capita income						
<$21,169	87.7	95.0	83.5*	81.4*	86.3	81.6*
$21,169-$24,024	86.3	90.1[d]	84.4	85.4	86.8	77.7*
$24,025-$27,407	87.1	87.2[d]	86.9	88.2	85.6	83.4*
>$27,407	89.2	89.3[d]	88.1[d]	89.5[d]	83.1	86.2
Region						
Northeast	90.8	91.3	87.1	87.5	85.2	90.0
Midwest	88.7[f]	89.2	87.6	90.7	85.3	83.0
South	87.5[f]	88.4[f]	85.3*[f]	85.8[f]	85.8	82.4*
West	88.1[f]	88.4[f]	86.8[f]	89.0[f]	85.7	79.1*

PCP, Primary care providers.
*Significantly different from urban, $p< 0.05$; a, significantly different from male, $p<0.05$; b, significantly different from 65-74 years, $p<0.05$; c, significantly different from White, $p< 0.05$; d, significantly different from top quartile, $p<0.05$; e, significantly different from 0 hospitals, $p<0.05$; f, significantly different from Northeast, $p<0.05$.

Interventions aimed at improving the care provided have been shown to be effective, particularly for non-Whites and those with diabetes[44]. Additionally, in these areas technological solutions such as Health Information Exchanges and electronic communications[45] are adopted in lower proportions than in larger areas with more resources. Little research, to date, has examined how healthcare providers in rural communities communicate for the purpose of transitions of care. Developing and implementing successful models that facilitate provider communication in a cost effective manner is critical to improving follow-up care among residents of smaller rural counties.

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Table 4: Adjusted odds of having a follow-up physician claim within 30 days among hospitalized beneficiaries with diabetes, 2005

Characteristic	Model OR (95% CI)		
	1	2	3
Rurality			
Urban	Ref.	Ref.	Ref.
Micro	0.99 (0.87, 1.13)	0.97 (0.85, 1.10)	1.06 (0.91, 1.23)
Small Adj	0.90 (0.75, 1.08)	0.92 (0.76, 1.11)	1.01 (0.81, 1.25)
Remote	0.74 (0.60, 0.90)*	0.71 (0.58, 0.87)*	0.81 (0.65, 1.02)
Sex			
Male		0.88 (0.81, 0.96)*	0.89 (0.82, 0.96)*
Female		Ref.	Ref.
Age group			
65-74		Ref.	Ref.
75-84		1.07 (0.98, 1.17)	1.07 (0.98, 1.17)
≥85		1.09 (0.93, 1.29)	1.09 (0.93, 1.28)
Race			
White		Ref.	Ref.
Black		0.71 (0.63, 0.80)*	0.71 (0.62, 0.80)*
Other		0.95 (0.80, 1.13)	0.98 (0.82, 1.17)
Each additional comorbidity		1.51 (1.45, 1.56)*	1.51 (1.45, 1.56)*
PCP per 1000 residents			
<0.48			Ref.
0.48-0.75			1.12 (0.84, 1.50)
076-1.12			1.05 (0.79, 1.39)
>1.12			1.24 (0.93, 1.66)
Number of hospitals			
0			Ref.
1			0.98 (0.76, 1.26)
≥2			1.04 (0.80, 1.34)
Per capita income			
<$21,169			Ref.
$21,169-$24,024			1.12 (0.84, 1.50)
$24,025-$27,407			1.05 (0.79, 1.39)
>$27,407			1.24 (0.93, 1.66)
Region			
Northeast			Ref.
Midwest			0.80 (0.68, 0.94)*
South			0.84 (0.72, 0.98)*
West			0.72 (0.60, 0.87)*

PCP, Primary care providers; Ref., reference.
*Significant difference from the referent group, $p<0.05$.

With proper follow up, subsequent hospitalization would be reduced, as would other inappropriate utilization of healthcare services such as emergency department visits[17] Such care would also serve to prevent further morbidity via preventive service delivery and metabolic control of the patient's disease[25]. If the issue of inadequate follow-up care among rural Medicare beneficiaries is not addressed, the potential for higher hospitalization rates, morbidity, and

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premature mortality is increased. Programs and interventions improving post-hospitalization care would not only reduce the services and, thus, the costs associated with such care, but also improve the quality of life experienced by residents of these smaller rural areas.

Limitations

The analysis has several limitations. First, the data used were claims-based, and not intended to fully document clinical encounters. Second, detailed information regarding the beneficiaries in the analysis was not available; information such as household income, having a usual source of care, or personal preferences regarding health care would be important to more fully understand the topic at hand. Finally, it is unknown what proportion of those discharged had a true need for follow-up care. The assumption was that 100% of those discharged needed such care, but it is possible that different groups needed the care at different rates. A sub-analysis of only those instructed to obtain such care may yield differing results.

Conclusions

Despite the limitations, the findings from this analysis indicate that residents of smaller rural areas are less likely to obtain follow-up care within 30 days of a hospital discharge. It was possible to identify those factors related to follow-up care that were more common among these rural residents, such as sex, race, and comorbidities. Interventions and programs aimed at improving the rate of post-hospitalization follow-up care would be beneficial for the Medicare system, the beneficiaries, and the areas in which they live.

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