

Handling the Handoff:  
Rural and Race-Based Disparities in Post-Hospitalization  
Follow-up Care Among Medicare Beneficiaries with Diabetes



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**Handling the Handoff: Rural and Race-Based Disparities in Post-Hospitalization  
Follow-up Care Among Medicare Beneficiaries with Diabetes**

Kevin J. Bennett, PhD

Robert Chen, MS

Medha Vyavaharkar, MD PhD

Saundra H. Glover, PhD

Janice C. Probst, PhD

**South Carolina Rural Health Research Center**

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### Executive Summary

Diabetes is one of the most common chronic diseases, affecting an estimated 23.6 million people in the United States (7.8% of the total population). Rural African American and Hispanic residents with diabetes are less likely to exhibit good control of their condition, putting them at greater risk for the consequences of this disease, such as kidney failure, blindness and amputation. Effective outpatient care is key to diabetes management. Absence of such care, conversely, may play a role in poorer diabetes control in rural areas.

The present report uses information regarding Medicare beneficiaries with diabetes to examine the provision of care in rural America. It provides estimates of hospital admission rates for rural Medicare beneficiaries with diabetes, tracks the proportion of patients who receive adequate outpatient care post discharge, and assesses subsequent readmissions to the hospital. It also explores the potential for race-based disparities in care for diabetes.

The data were obtained from the 2005 Medicare claims data from the Chronic Condition Warehouse (CCW), merged with the 2007 Area Resource File (ARF). The study population was limited to beneficiaries who did not die during the year and did not have one of the following diagnoses: Alzheimer's disease, dementia, schizophrenia, congestive heart failure, 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. Thus, only beneficiaries who were not hospitalized during the study year, or who were hospitalized and discharged back into the community after hospitalization, are included in the study.

Beneficiaries were characterized as urban or rural based on the county in which they lived, using Urban Influence Codes. Rural counties were further subdivided into micropolitan, small rural adjacent to a metropolitan area, and remote rural counties. We examined the hospitalization rate of all beneficiaries, then subset to just those with diabetes. Among persons who were hospitalized, we studied the time frame in which they might have made a follow-up visit to a physician's office, visited an emergency department, or been hospitalized.

Key findings are highlighted here:

#### Rural – Urban Disparities

- Diabetes is more common among beneficiaries who live in rural counties (16.7%) than among those who live in urban areas (13.5%).
- Among beneficiaries with diabetes, rural residents were slightly more likely to have at least one hospitalization (13.0%) than were urban beneficiaries (12.0%).
- Rural beneficiaries with diabetes were less likely to have physician follow-up within thirty days of a hospital stay (85.5%) than were urban beneficiaries with diabetes (88.3%).

## Executive Summary

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- The proportion of beneficiaries with no follow-up even after 90 days increased as residence became more rural, from 2.3% in micropolitan rural counties to 3.5% in remote rural counties.
- Rural residents with diabetes were less likely to be readmitted within 30 days than were urban beneficiaries (12.3% versus 14.9%), despite being less likely to have prompt physician follow-up.

### Race Disparities

- Diabetes is markedly more prevalent among African American than among white beneficiaries. More than one in four rural African Americans has diabetes (27.4%), versus about one in six (15.9%) among rural white beneficiaries. For both groups, prevalence does not differ across rural county types.
- African American beneficiaries with diabetes were *less* likely to be hospitalized during the year than white beneficiaries. Across all rural residents with diabetes, 11.7% of African American beneficiaries were hospitalized, versus 13.1% of whites.
- Rural African American beneficiaries with diabetes were less likely than white beneficiaries with this condition to have a follow up visit within 30 days of hospitalization (85.0% versus 87.7%).
  - For white beneficiaries with diabetes, prompt follow up was highest at micropolitan counties (88.0%) and lowest in remote rural counties (79.5%).
  - For African American beneficiaries with diabetes, follow up within 30 days was most common in small adjacent rural counties (89.2%); in these counties, African Americans were more likely to receive prompt follow up than were whites (84.6%).
- African American beneficiaries were more likely to be readmitted within 30 days (15.9%) than were white beneficiaries (12.0%); individuals of other race did not differ from whites.

### Policy Implications

- The Triple Aim is a useful framework for identifying gaps in care, shaping interventions, and studying outcomes of the interventions aimed at improving transitions in care and reducing readmissions
- Coordinated care transition programs have been shown to be effective in reducing readmissions, but their current use is sporadic.
- Use of health information technology can aid transitions across levels of care, by enabling sharing of patient data, alerting providers of a discharge, and reminding both providers and patients of necessary care
- Patient empowerment is a vital component of improving transitions in care, and cannot be overlooked.
- Further study regarding the transition from hospital care to the primary treating physician is necessary to understand its potential in improving quality of care.

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### **Introduction**

Diabetes is one of the most common chronic diseases, affecting an estimated 23.6 million people (7.8% of the total population) in the U.S.; nearly 6 million of these have not been diagnosed.<sup>1</sup> The proportion of persons with a diabetes diagnosis is even higher among the elderly; nearly one out of four Americans aged 60 or older have diabetes.<sup>1</sup> As of 2004, diabetes was the sixth leading cause of death and one of the six priority conditions targeted by the U.S. Department of Health and Human Services as a means to address health disparities among racial/ethnic groups.<sup>2,3</sup>

### **Hospitalizations Related to Diabetes**

The comorbidities and complications associated with diabetes often lead to hospitalization; nearly one third of persons with diabetes require at least two hospitalizations in a given year.<sup>4</sup> The age-adjusted hospitalization rate for diabetes-related complications has dropped since 1983, to a rate of 41.8 hospitalizations per 1,000 persons with diabetes in 2003 (29.3 for those 65-75, and 45.5 for those 75+). Overall, diabetes accounts for more than 10% of all hospitalizations, second only to circulatory diseases.<sup>5</sup> These diabetes-related admissions vary by age, race and ethnicity, income, and type of insurance.<sup>4, 6-9</sup>

### **Importance of Transitional Care for Diabetes**

Transitional care has been defined as a set of actions designed to ensure the coordination and continuity of healthcare as patients transfer between different locations or different levels of care within the same location.<sup>10</sup> Persons with continuous and complex care needs, such as Medicare beneficiaries and those with diabetes, frequently require care in multiple settings, as health care services are utilized in both inpatient and outpatient settings.<sup>11,12</sup> Increasing evidence suggests that during transitions between different locations of care, patients are vulnerable to problems of fragmentation and poor quality of care which can adversely affect outcomes.<sup>11,13-18</sup> This problem may be more acute among populations that lack access to high quality outpatient care, contributing to high readmission rates experienced by African American and Hispanic Medicare beneficiaries, compared to their white peers.<sup>19</sup> Research suggests that care coordination 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.<sup>12,20</sup>

Multiple factors contribute to poor transitional care. Because a growing number of practitioners limit their practice to a single setting, and because hospitalists are assuming the traditional role of primary care physicians in the treatment of hospitalized patients,<sup>15</sup> primary care providers are often unfamiliar with the capacity of other care settings. This results in inappropriate and improper transfers.<sup>13</sup> This, combined with a lack of communication and information transfer between hospital-based and primary care physicians,<sup>11,14,16</sup> inadequate information on discharge

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summaries,<sup>14</sup> and inadequate patient education,<sup>17</sup> patient barriers such as a lack of transportation, financial constraints, lack of health insurance, and access to providers,<sup>12,21</sup> can lead to poor follow up care after hospital discharge. Studies have also shown that patients living in economically disadvantaged neighborhoods, which typically do not have the primary care resources of other neighborhoods, are more likely to be hospitalized for ambulatory care sensitive conditions such as diabetes.<sup>22</sup> This is a significant problem for rural Medicare beneficiaries, who have lower incomes and are in poorer health than their urban counterparts.<sup>23</sup>

### Disparities Associated with Race and Residence

The prevalence of diabetes is higher among certain racial/ethnic groups, such as African Americans (13.3%), American Indians and Alaska Natives (12.5%), and Hispanic / Latinos (9.5%), than the US average (7.8%).<sup>1,24</sup> Living in a rural area further compounds these disparities. Rural African Americans are less likely to be diagnosed and effectively treated for diabetes than other population groups.<sup>19</sup> Similarly, rural Hispanics are more likely than whites to have diabetes (either diagnosed or undiagnosed).<sup>25</sup>

Hospitalization rates for African American patients with diabetes have been shown to be substantially greater (16.3 per 1,000) than for white patients with diabetes (5.8 per 1,000).<sup>7</sup> Others found that after controlling for disease prevalence and underlying hospital utilization patterns, African Americans and Hispanics have higher rates of potentially avoidable hospitalization for diabetes, suggesting a possible lack of access to quality primary healthcare.<sup>8</sup> Hispanic, African American, and Medicare beneficiaries, after controlling for age, gender, and clinical characteristics, are also more likely to have more than one hospitalization in a year. Among elderly diabetics, Hispanics had the highest likelihood of multiple hospitalizations in a year (37.2%), followed by African Americans (34.0%), when compared to whites (30.9%).<sup>4</sup> While hospitalizations cannot be completely avoided, the rate of hospitalization and subsequent re-hospitalization can be reduced with good outpatient care.

### Purpose of the Analysis

Few studies have specifically addressed the unique challenges faced by rural residents with diabetes, particularly rural minorities. Rural residents make up a higher proportion of the total Medicare population (27%) than of the total national population.<sup>23</sup> To improve the efficiency of the Medicare program, it is important to understand the specific issues pertinent to rural beneficiaries with diabetes, to include service availability,<sup>26</sup> hospitalizations, readmissions, and quality of outpatient care and transitions of care.

The purpose of the research reported here is to provide estimates of hospital admission rates for rural Medicare beneficiaries with diabetes and to estimate the proportion of hospitalized individuals who receive prompt outpatient care post discharge. We also perform sub-estimates by race / ethnicity, to determine if disparities exist among rural Medicare beneficiaries. This analysis will

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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.

The report that follows addresses three questions pertinent to the management of care for persons with diabetes in rural areas:

- Do *inpatient admission rates* per year for persons with diabetes differ by residence and race/ethnicity?
- Does *effective transition from inpatient to outpatient care*, defined as an outpatient visit within 30 days of discharge, occur equally across residence and race/ethnicity?
- Do *readmission rates* vary by residence and race/ethnicity?

### About This Report

The report focuses on Medicare beneficiaries with diagnosed diabetes. Data were obtained from two sources: 2005 Medicare 5 percent sample, obtained from the Chronic Condition Warehouse, and the 2007 Area Resource File. Beneficiaries with diabetes were defined by a dichotomous variable in the CCW data set. The location of care for healthcare services was identified using the standard Line Place of Service Codes. For more details on definitions of variables, see the Technical Notes.

**Urban/rural residence** was defined at the county level using Urban Influence Codes (UICs). “Rural” in the aggregate was defined as UIC Codes 3 through 12 (“All rural”). When differentiated by level of rurality, counties were categorized as “micropolitan” rural (UIC Codes 3, 5 & 8), small rural adjacent to a metro area, called “small adjacent” (UIC Codes 4, 6 & 7), and “remote” rural (UIC Codes 9, 10, 11, & 12). If UIC Codes are 1 or 2, then the county was coded as “urban”. A fuller description of the population levels included in different UIC Codes is provided in the Technical Notes.

**Race** was defined using the race definitions contained in the Medicare Beneficiary File. Due to small sample sizes, only three classifications could be made: Non-Hispanic white (hereafter “white”); non-Hispanic African American (hereafter “African American”); and “other,” a category that included Asian and Pacific Islander, American Indians, Alaska Natives, Hispanics, and all other races. We regret that we were not able to examine issues among Hispanic beneficiaries and other distinct cultures in more detail.

### About the Chronic Conditions Warehouse

The Chronic Conditions Warehouse (CCW) was established in section 723 of the 2003 Medicare Prescription Drug, Improvement, and Modernization Act. The purpose of the warehouse is to make Medicare data more readily available to researchers. Information included in the data

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includes claims information, beneficiary characteristics and enrollment details, and chronic condition information. All files can be linked for comprehensive longitudinal analysis.

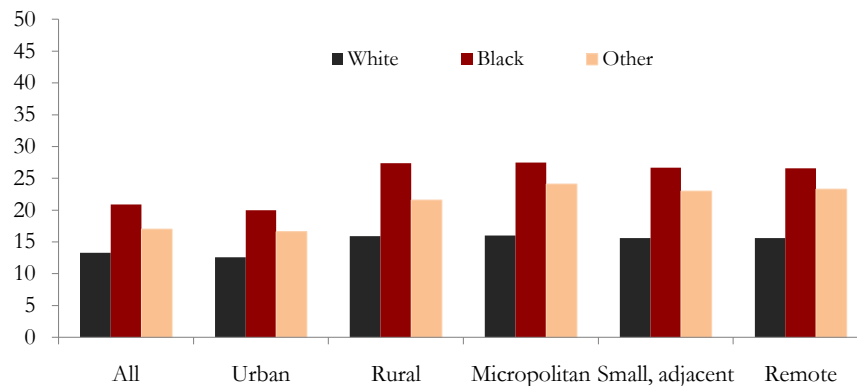
The CCW includes a set of 21 preset chronic conditions, defined according to specific algorithms that utilize time periods, diagnosis and procedure codes, specific qualifying claims, and Part A and B coverage. For more information regarding the CCW, please visit the RESDAC website at <http://www.resdac.umn.edu/CCW/index.asp>.

### Rural Beneficiaries: Characteristics and Prevalence of Diabetes

Most Medicare beneficiaries in 2005 lived in urban counties (80.3%), with the remaining 19.7% living in micropolitan rural (11.4%), small adjacent rural (5.0%), and remote rural counties (3.3%; Table 1). The rural population was slightly more concentrated in the 65 – 74 year age group than was the urban population. The rural population contained proportionately more white beneficiaries than did the urban population (92.4% versus 84.9%; Table 1).

Overall, 14.1% of beneficiaries had a recorded diagnosis of diabetes ( $n = 198,834$ ; Table 2). Proportionately more rural residents (16.7%) had a diabetes diagnosis than urban residents (13.5%,  $p < 0.001$ ). Beneficiaries who were male, younger, and non-white were more likely to have diabetes. (See Table 2, next page, and Figure 1, below).

**Figure 1: Diabetes Prevalence, By Rurality and Race/Ethnicity**



The 2005 5% Medicare sample included 1,736,230 beneficiaries. Our analysis excluded persons who had concurrent end stage renal disease, chronic kidney disease, congestive heart failure, Alzheimer's disease or other dementia related illness, who died during a hospitalization, or who were transferred to another inpatient facility, long term care facility, or into hospice care ( $n = 324,884$ ). The remaining group constituted the denominator population of 1,411,346 beneficiaries used for describing Rural beneficiaries and calculating rates (See Table 1). Among beneficiaries, 6.7% had at least one hospitalization during the year ( $n = 94,121$ ). beneficiaries with at least one hospitalization constitute the population for analysis of follow-up physician care

## Overview of Rural Beneficiaries

**Table 1: Characteristics of Medicare Beneficiaries (5% sample), 2005, in percent**

	All N= 1,411,346	Urban N=1,133,361	All Rural N=277,985	Micropolitan N=161,254	Small Adjacent N=68,875	Remote N=46,856
By residence	100	80.3	19.7	11.4	5.0	3.3
Sex						
Male	38.8	38.4	<b>40.1</b>	<b>39.6</b>	<b>40.7</b>	<b>40.6</b>
Female	61.2	61.6	<b>59.9</b>	<b>60.4</b>	<b>59.3</b>	<b>59.4</b>
Age Group						
65-74	54.8	54.2	<b>57.1</b>	<b>56.7</b>	<b>58.5</b>	<b>56.4</b>
75-84	34.6	35.0	<b>33.0</b>	<b>33.2</b>	<b>32.0</b>	<b>33.5</b>
85+	10.6	10.8	<b>9.9</b>	<b>10.0</b>	<b>9.6</b>	<b>10.1</b>
Race						
White	86.4	84.9	<b>92.4</b>	<b>92.3</b>	<b>91.8</b>	<b>93.7</b>
African American	7.9	8.6	<b>5.1</b>	<b>4.9</b>	<b>6.0</b>	<b>4.1</b>
Other	5.7	6.5	<b>2.6</b>	<b>2.8</b>	<b>2.2</b>	<b>2.2</b>
<b>Bold</b> indicates significantly different from urban, $p < 0.05$ All tests adjusted for multiple comparisons.						

**Table 2: Diabetes prevalence among Medicare beneficiaries, by characteristics and rurality, 2005, in percent**

	All	Urban	All Rural	Micropolitan	Small Adjacent	Remote
All	14.1	13.5	<b>16.7</b>	<b>16.7</b>	<b>16.9</b>	<b>16.2</b>
Sex						
Male	14.9	14.3	<b>17.5</b>	<b>17.8</b>	<b>17.4</b>	<b>16.7</b>
Female	13.6 <sup>a</sup>	13.0 <sup>a</sup>	<b>16.1<sup>a</sup></b>	<b>16.0<sup>a</sup></b>	<b>16.5<sup>a</sup></b>	<b>15.8<sup>a</sup></b>
Age Group						
65-74	13.9	13.3	<b>16.4</b>	<b>16.4</b>	<b>16.7</b>	<b>15.9</b>
75-84	15.2 <sup>b</sup>	14.6 <sup>b</sup>	<b>18.2<sup>b</sup></b>	<b>18.2<sup>b</sup></b>	<b>18.3<sup>b</sup></b>	<b>17.6<sup>b</sup></b>
85+	11.4 <sup>b</sup>	10.9 <sup>b</sup>	<b>13.7<sup>b</sup></b>	<b>13.7<sup>b</sup></b>	<b>13.4<sup>b</sup></b>	<b>13.2<sup>b</sup></b>
Race						
White	13.3	12.6	<b>15.9</b>	<b>16.0</b>	<b>16.0</b>	<b>15.6</b>
African American	20.9 <sup>c</sup>	20.0 <sup>c</sup>	<b>27.4<sup>c</sup></b>	<b>27.5<sup>c</sup></b>	<b>27.4<sup>c</sup></b>	<b>26.7<sup>c</sup></b>
Other	17.1 <sup>c</sup>	16.6 <sup>c</sup>	<b>21.6<sup>c</sup></b>	<b>20.4<sup>c</sup></b>	<b>24.1<sup>c</sup></b>	<b>23.3<sup>c</sup></b>
<b>Bold</b> indicates significantly different from urban, $p < 0.05$						
<sup>a</sup> Significantly different from male, $p < 0.05$			<sup>b</sup> Significantly different from 65-74, $p < 0.05$			
<sup>c</sup> Significantly different from white, $p < 0.05$			All tests adjusted for multiple comparisons.			

## Hospitalizations

### Hospitalization among Rural and Urban Medicare Beneficiaries with Diabetes

Rural beneficiaries with diabetes were more likely to have at least one hospitalization (13.0%) than were urban beneficiaries (12.2%,  $p < 0.001$ ; Table 3, below). White beneficiaries with diabetes were, in general, more likely to have at least one admission (12.5%) than African American (11.5%) or “other” (10.1%) beneficiaries. Rural and urban African American beneficiaries were hospitalized at approximately the same rate (11.7% rural versus 11.4% urban), while rural beneficiaries of “other” race/ethnicity were more likely to be hospitalized than “other” urban residents (13.2% versus 9.7%).

Among beneficiaries with diabetes with a hospitalization in 2005, 23.6% were hospitalized more than once during the year. There were no differences in hospitalizations by levels of rurality (See Table 4).

**Table 3: Beneficiaries with diabetes and at least one hospitalization, by rurality and race, 2005, in percent.**

	All	Urban	All Rural	Micropolitan Rural	Small Adjacent Rural	Remote Rural
Percent of beneficiaries with at least one hospitalization during the year						
All	12.2	12.0	<b>13.0</b>	<b>12.9</b>	<b>12.7</b>	<b>13.7</b>
White	12.5	12.3	<b>13.1</b>	<b>13.0</b>	12.9	13.9
African American	11.5*	11.4*	11.7*	12.1	11.4	10.7*
Other	10.1*	9.7*	<b>13.2</b>	<b>12.4</b>	<b>14.0</b>	<b>15.2</b>
<b>Bold</b> indicates significantly different from urban, $p < 0.05$ *Significantly different from whites, $p < 0.05$						

**Table 4: Frequency of hospitalizations among beneficiaries with at least one hospitalization, by rurality, 2005, in percent.**

	All	Urban	All Rural	Micropolitan Rural	Small Adjacent Rural	Remote Rural
Diabetic beneficiaries						
1 hospitalization	76.4	76.5	76.1	77.4	74.9	76.4
2 hospitalizations	18.0	18.0	18.2	17.3	18.7	18.0
3 or more hospitalizations	5.6	5.5	5.7	5.4	6.4	5.6
<b>Bold</b> indicates significantly different from urban, $p < 0.05$						

## Hospitalizations

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The ten most common principal diagnoses for hospitalizations among Medicare beneficiaries with diabetes are listed in Table 5 (next page). Diabetes Mellitus was the most common primary admission diagnosis, indicated in 10.3% of all hospitalizations. This percentage decreased as rurality increased. Disorders of the cardiovascular system, including Coronary Atherosclerosis, Hypertension, Dysrhythmia, and Chest Pain accounted for approximately 19% of all hospitalizations. Few substantial differences were noted as rurality increased.

## Hospitalizations

**Table 5: Most common diagnostic categories (Clinical Classification System), beneficiaries with diabetes, by rurality, 2005  
in percent of all hospital stays**

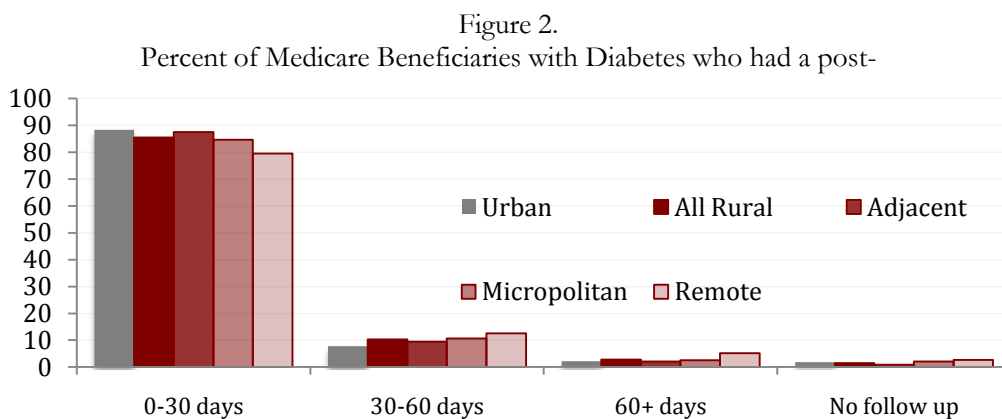
Diagnosis	All, Rank	%	Urban, Rank		All Rural, Rank		Micropolitan, Rank		Small Adjacent, Rank		Remote, Rank	
Diabetes Mellitus	1	10.3	1.0	10.7	1	9.1	1	8.9	1	9.6	1	9.0
Coronary Atherosclerosis	2	6.3	2	6.3	2	6.2	2	6.2	2	6.3	2	5.9
Hypertension	3	5.2	3	5.5	3	4.4	3	4.8	3	4.3	5	2.8
Osteoarthritis	4	3.3	4	3.4	6	3.0	5	3.2	9	2.7	7	2.7
Dysrhythmia	5	3.3	5	3.3	4	3.3	4	3.2	4	3.3	3	3.5
Chest Pain	6	2.8	6	2.7	5	3.0	7	3.0	6	3.1	4	2.9
Connective Tissue Disease	7	2.6	7	2.5	8	2.9	8	2.8	7	3.1	6	2.8
Back Prob.	8	2.4	8	2.3	9	2.7	9	2.8	5	3.1	11	1.7
Follow-up, Other	9	2.4	9	2.2	7	2.9	6	3.0	7	2.9	9	2.4
Joint, Other	10	1.8	10	1.8	10	1.8	10	2.2	18	1.4	18	1.4

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**Physician Follow-Up Care Post Hospitalization**

Among beneficiaries with diabetes who experienced a hospitalization in 2005, 87.6% had a follow-up visit with a physician within 30 days (Figure 2 and Table 6). Prompt follow-up was less common among rural than urban beneficiaries (85.5% versus 88.3%,  $p < 0.001$ ). Conversely, the proportion of beneficiaries with a follow up visit in the 30-60 day range and the 60 or more day range was higher among rural residents than urban residents, particularly among remote rural residents. Results for “no follow-up” varied across rural counties. Beneficiaries with diabetes living in micropolitan counties were less likely than urban residents to lack any follow-up visit during the year (0.9% versus 1.8%), while those in remote rural counties were more likely to lack a visit (2.7%)

**Figure 2: Percent of Medicare Beneficiaries with Diabetes who had a post-hospitalization physician visit within the indicated time frames, by level of rurality, 2005.**



**Table 6: Physician follow-up among hospitalized beneficiaries, by rurality, 2005, in percent**

	All	Urban	All Rural	Micropolitan Rural	Small Adjacent Rural	Remote Rural
Beneficiaries with Diabetes						
0-30 days	87.6	88.3	<b>85.5</b>	<b>87.5</b>	<b>84.7</b>	<b>79.5</b>
30-60 days	8.4	7.8	<b>10.3</b>	<b>9.5</b>	<b>10.6</b>	<b>12.6</b>
60+ days	2.3	2.2	<b>2.8</b>	2.1	2.5	<b>5.2</b>
No follow up	1.7	1.8	<b>1.5</b>	0.9	2.1	<b>2.7</b>
<b>Bold</b> indicates significantly different from urban, $p < 0.05$						

## Follow-Up Care

Across races, African American beneficiaries with diabetes were less likely to have a 30-day follow-up visit than their white counterparts (85.0% versus 87.7%; Table 7). Within white beneficiaries, the proportion of hospitalized diabetic patients with a 30-day follow-up varied with rurality. In this group, 88.0% of residents of micropolitan counties had a follow-up visit within 30 days, declining to 79.5% in remote rural counties. Among African American beneficiaries, prompt follow-up was most common among residents of small adjacent counties, where it exceeded the urban rate (89.2% versus 85.5%). Beneficiaries of other race showed the opposite pattern. For these individuals, prompt follow-up was least common in small adjacent rural counties (75.0%).

**Table 7: Physician follow-up among hospitalized beneficiaries with diabetes, by rurality and race, 2005, in percent**

	All*	Urban*	All Rural*	Micropolitan Rural	Small Adjacent Rural*	Remote Rural*
Whites						
0-30 days	87.7	88.5	<b>85.7</b>	<b>88.0</b>	<b>84.6</b>	<b>79.5</b>
30-60 days	8.2	7.5	<b>10.1</b>	<b>9.0</b>	<b>10.8</b>	<b>12.5</b>
60+ days	2.4	2.3	2.8	2.2	2.6	<b>5.4</b>
No follow-up	1.7	1.7	1.4	<b>0.8</b>	2.1	<b>2.6</b>
African Americans						
0-30 days	85.0	85.5	<b>83.2</b>	<b>81.0</b>	<b>89.2</b>	<b>78.8</b>
30-60 days	11.2	10.7	<b>13.2</b>	<b>15.2</b>	<b>8.6</b>	<b>15.2</b>
60+ days	1.6	1.5	1.9	1.6	<b>2.2</b>	<b>3.0</b>
No follow-up	2.2	2.3	1.6	2.2	<b>0.0</b>	<b>3.0</b>
Other						
0-30 days	90.1	90.8	<b>84.9</b>	<b>89.3</b>	<b>75.0</b>	<b>81.3</b>
30-60 days	6.5	6.1	<b>9.2</b>	<b>8.0</b>	n/a	n/a
60+ days	1.6	1.5	<b>2.5</b>	<b>2.7</b>	n/a	n/a
No follow up	1.8	1.6	<b>3.4</b>	<b>0.0</b>	n/a	n/a

**Bold** indicates significantly different from urban,  $p < 0.05$  \*Significantly different from whites,  $p < 0.05$   
n/a indicates a sample size too small for a stable estimate.

## Readmissions

### Hospital Readmissions

#### All Beneficiaries

Nationally, Beneficiaries with diabetes had a 30-day readmission rate of 14.3%, with Rural Beneficiaries being less likely to experience readmission (12.3%) than Urban Beneficiaries (14.9%) (See Table 8). The readmission rate was lowest among Beneficiaries living in Remote Rural counties (9.9%). There were few differences in readmission rates by race. Among Beneficiaries with diabetes, the only difference was among African American Beneficiaries in the total Rural category (15.9%), who had higher readmission rates than white Beneficiaries (12.0%).

**Table 8: 30-Day Readmission rates among hospitalized beneficiaries with diabetes, by race and rurality, in percents**

	All	Urban	All Rural	Micropolitan Rural	Small Adjacent Rural	Remote Rural
All beneficiaries with diabetes	14.3	14.9	<b>12.3</b>	<b>12.2</b>	14.2	<b>9.9</b>
White	14.2	15.0	<b>12.0</b>	<b>11.9</b>	13.9	<b>9.5</b>
African American	14.8	14.6	15.9*	16.0	14.4	n/a
Other	14.5	14.7	13.4	12.2	20.9	n/a
<b>Bold</b> indicates significantly different from urban, $p < 0.05$ *Significantly different from whites, $p < 0.05$ n/a indicates a sample size too small for a stable estimate.						

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### Community Characteristics

We investigated whether three community characteristics were associated with hospitalization rates, follow-up, and readmission rates among Medicare beneficiaries with diabetes: region of the US, physician supply and hospital supply. Our findings were not consistent and point to the need for further research in this area. We speculate in the paragraphs below on possible reasons for the absence of significant differences for these characteristics. Details for region, physician supply and hospital supply are presented on the following pages.

Many rural individuals seek care in urban areas, even bypassing a local hospital to seek care in an urban setting. This behavior would reduce the influence of many of county-level variables, such as physician and hospital availability, on hospitalization rates. We did not examine the location of hospitalization or physician follow-up among beneficiaries for the current report. We hope to explore this area in more detail in a forth-coming study of dually eligible beneficiaries.

Another factor that may act to reduce local variation among Medicare beneficiaries is the relative homogeneity of their insurance benefits. While some variation exists depending upon enrollment in managed care plans or supplemental plans, the basic Part A and Part B benefits remove many financial barriers to seeking care. In general, more physicians are willing to accept Medicare patients than are willing to care for Medicaid or uninsured individuals. It is possible that hospitalization, follow-up and readmission rates are more robustly associated with hospital and physician availability among a larger and heterogeneously insured population, where market factors can be more influential.

## Community Characteristics

### Regional Differences

Regional differences among services used by Medicare beneficiaries with diabetes were most evident for hospitalization: rates were lowest in the Northeast and West, and higher in the Midwest and South, across both urban and rural counties (Table 9, below).

Medicare beneficiaries living in the Northeast were more likely than residents of any other region to receive prompt post-discharge follow-up care, a pattern that was consistent across all urban counties. Within all rural counties, residents of the South and West are slightly less likely to receive timely follow-up than beneficiaries living in the Northeast, but this pattern was not consistent across micropolitan, small and remote counties.

Little regional variation was seen in readmission rates. Admission rates were modestly higher in urban counties in the Midwest than in the Northeast. However, readmission rates within rural counties did not differ statistically across regions.

**Table 9: Regional differences in hospitalization rates, physician follow-up care, and rehospitalization within 30 days among Medicare beneficiaries with diabetes, 2005**

Region	All	Urban	All Rural	Micropolitan Rural	Small Adjacent Rural	Remote Rural
Percent of beneficiaries with at least one hospitalization						
Northeast (ref)	11.6	11.6	11.8	11.8	12.2	10.5
Midwest	13.1*	13.0*	13.4*	13.0*	13.5	14.2
South	<b>12.6*</b>	<b>12.4*</b>	<b>13.1*</b>	<b>13.4*</b>	<b>12.5</b>	<b>13.3</b>
West	<b>10.7*</b>	<b>10.3*</b>	<b>12.3*</b>	<b>11.8*</b>	<b>12.4</b>	<b>14.7</b>
Percent of beneficiaries with a physician visit within thirty days						
Northeast (ref)	90.8	91.3	87.1	87.5	<b>85.2</b>	90.0
Midwest	88.7*	89.2*	87.6	90.7	<b>85.3</b>	<b>83.0</b>
South	87.5*	88.4*	<b>85.3*</b>	85.8*	<b>85.8</b>	<b>82.4</b>
West	88.1*	88.4*	<b>86.8*</b>	89.0*	<b>85.7</b>	<b>79.1</b>
Percent of hospitalized beneficiaries who were readmitted within 30 days						
Northeast (ref)	16.4	16.9	<b>12.8</b>	13.2	11.1	n/a
Midwest	11.1*	11.8*	<b>9.6</b>	10.0	13.7	n/a
South	15.2	15.7	<b>13.9</b>	<b>13.3</b>	14.7	14.4
West	15.1	15.5	13.2	12.4	16.1	12.7
<b>Bold</b> indicates significantly different from urban, $p < 0.05$ All significance testing adjusts for multiple comparisons.						
* Significantly different from top quartile, $p < 0.05$						

## Community Characteristics

### Primary Care Physician/Population Ratios

At the national level and within urban residents, Medicare beneficiaries with diabetes who lived in counties in the two highest quartiles for primary care physician to population ratio were slightly less likely to be hospitalized than those in the lowest quartile (Table 10). However, the situation was reversed for rural residents: beneficiaries in the top two quartiles *were* more likely to be hospitalized than those with the lowest levels of physician availability. This pattern repeated among micropolitan rural counties, while rates among smaller rural counties were not statistically different.

At the national level and among urban counties, the association between physician ratios and prompt follow-up visits was not consistent, with the highest follow-up rates found at the bottom and at the top quartile for physician availability. Within rural counties as a whole, greater physician availability was associated with higher rates for prompt follow-up after hospitalization. At the national level and among residents of urban counties, there was no relationship between physician availability and readmission within 30 days.

**Table 10: Differences in hospitalization rates, physician follow-up care, and rehospitalization within 30 days at differing levels of primary care physician availability, among Medicare beneficiaries with diabetes, 2005**

Primary care physicians per 1,000 residents, in quartiles	All	Urban	All Rural	Micropolitan Rural	Small Adjacent Rural	Remote Rural
Percent of beneficiaries with at least one hospitalization						
<0.48 (ref)	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
0.76-1.12	<b>12.3*</b>	<b>12.1*</b>	<b>13.0*</b>	<b>13.0*</b>	<b>12.5</b>	<b>13.9</b>
>1.12	<b>11.9*</b>	<b>11.7*</b>	<b>13.8*</b>	<b>14.0*</b>	<b>13.0</b>	<b>13.9</b>
Percent of beneficiaries with a physician visit within thirty days						
<0.48 (ref)	87.7	95.0	83.5	81.4	86.3	81.6
0.48-0.75	86.3*	90.1*	<b>84.4*</b>	<b>85.4</b>	86.8	<b>77.7</b>
0.76-1.12	87.1*	87.2*	86.9*	88.2	85.6	<b>83.4</b>
>1.12	89.2*	89.3*	88.1*	89.5	83.1	86.2
Percent of hospitalized beneficiaries who were readmitted within 30 days						
<0.48 (ref)	14.7	15.3	14.2	15.2	16.5	1.8
0.48-0.75	13.7	14.0	13.3	13.1	16.0	9.4
0.76-1.12	13.9	17.9	<b>10.5</b>	<b>12.1</b>	<b>10.4*</b>	10.5
>1.12	14.8	15.2	<b>10.7*</b>	<b>11.3</b>	12.1	<b>8.3</b>
<b>Bold</b> indicates significantly different from urban, $p < 0.05$ All significance testing adjusts for multiple comparisons. * Significantly different from top quartile, $p < 0.05$ n/a indicates sample size too small for stable estimate.						

## Community Characteristics

Hospital presence in the county of residence The likelihood that a beneficiary would be hospitalized was associated with the number of hospitals in the county in different ways among urban and rural counties. In urban counties, beneficiaries living in a county with two or more hospitals were slightly but significantly *less* likely to be hospitalized than those living in counties with no hospital. In rural counties as a whole and in micropolitan counties, beneficiaries in counties with a hospital were significantly *more* likely to be hospitalized than those in a county with no hospital. The same pattern was present for small and remote rural counties, though values did not reach statistical significance.

The number of hospitals in a county was not related to the likelihood of prompt physician follow-up, in either urban or rural counties.

Hospital availability in the beneficiary's county of residence was not associated with the likelihood of re-hospitalization among urban residents. Across all rural residents, beneficiaries in a county with one hospital or two or more hospitals were less likely to be re-hospitalized than those in a county with no hospital. This pattern was observed in both micropolitan and small rural hospitals. The number of readmissions at remote rural counties with no hospital or two or more hospitals was too small for study.

**Table 11: Differences in hospitalization rates, physician follow-up care, and re-hospitalization within 30 days at differing levels of hospital availability, among Medicare beneficiaries with diabetes, 2005**

Number of hospitals in county of residence	All	Urban	All Rural	Micro-politan Rural	Small Adjacent Rural	Remote Rural
Percent of beneficiaries with at least one hospitalization						
No hospital (ref)	12.1	12.6	11.5	10.1	11.7	12.3
1 hospital	12.9*	12.7	13.1*	13.0*	12.7	13.9
2 or more hospitals	<b>12.1</b>	<b>11.9*</b>	<b>13.1*</b>	<b>13.0*</b>	<b>13.5</b>	<b>14.0</b>
Percent of beneficiaries with a physician visit within thirty days						
No hospital (ref)	84.6	89.3	<b>76.7</b>	80.0	84.3	n/a
1 hospital	86.8	88.5	<b>85.8</b>	87.9	<b>84.4</b>	<b>82.4</b>
2 or more hospitals	89.1	89.3	<b>87.9</b>	88.1	89.3	<b>83.3</b>
Percent of hospitalized beneficiaries who were readmitted within 30 days						
No hospital (ref)	15.6	15.3	16.1	22.9	19.1	n/a
1 hospital	12.5*	13.5	11.9*	11.7*	13.3	10.7
2 or more hospitals	14.7	15.1	12.1*	<b>12.1*</b>	13.8	n/a
<b>Bold</b> indicates significantly different from urban, $p < 0.05$ All significance testing adjusts for multiple comparisons. * Significantly different from referent (ref), $p < 0.05$ <b>n/a</b> indicates sample size too small for stable estimate.						

## Summary and Conclusions

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### Summary and Conclusions

#### *Summary of Findings across Levels of Rurality*

In 2005, the prevalence of diabetes was higher among rural than among urban Medicare beneficiaries (16.7% versus 13.5%), and was particularly high among rural African American beneficiaries (27.4%; See Table 2). In the long term, the problem of excess rates of diabetes among rural populations needs to be addressed through prevention. In the short term, it is essential to monitor the care provided to persons with diabetes through assessment of hospitalization rates, re-hospitalization rates, and correct handling of the transition between inpatient and outpatient care.

Diabetes is considered an ambulatory care sensitive condition, that is, a disease for which hospitalization rates at the population level should be lower where the quality and accessibility of ambulatory care is better. The present research yields mixed findings for adequacy of primary care access, based on hospitalization rates among rural Medicare beneficiaries. Overall, rural beneficiaries with diabetes were more likely to be hospitalized at least once than were urban beneficiaries (13.0% versus 12.0%, see summary Table 12, next page), suggesting poorer access to care. Supporting the notion of poorer access, rural beneficiaries with diabetes were also less likely to have prompt physician follow-up after hospitalization (85.5%) than were urban beneficiaries with diabetes (88.3%). Nonetheless, rural residents with diabetes, as a whole, were *less* likely to be readmitted within 30 days than were their urban peers (12.3% versus 14.9%, See Table 12), suggesting that the care they do receive while hospitalized and afterward is appropriate for their clinical needs.

It must be noted that the information available for the current research, which is drawn from Medicare billing data, is not fully sufficient to capture differences between patients that may account for our findings. It is possible, for example, that rural providers, perceiving that greater travel distances and fewer available emergency services increase the consequences of under-estimating disease severity, have a lower threshold for deeming that hospitalization is needed. Patients who were less sick when admitted would be less likely to require readmission. This combination of circumstances could explain our apparently contradictory findings. Further research with additional access to clinical information is needed to clarify the experience of rural Medicare beneficiaries.

## Summary and Conclusions

### *Summary of Findings across Race/Ethnicity*

Similarly perplexing findings emerged from analysis across race/ethnicity. Rural African American beneficiaries with diabetes were less likely to be hospitalized at least once during the year

**Table 12: Summary of findings among Medicare beneficiaries with diabetes, by race, 2005**

	All	Urban	All rural	Micropolitan rural	Small adjacent rural	Remote rural
Percent of beneficiaries with at least one hospitalization						
All with Diabetes	12.2	12.0	<b>13.0</b>	<b>12.9</b>	<b>12.7</b>	<b>13.7</b>
White	12.5	12.3	<b>13.1</b>	<b>13.0</b>	12.9	13.9
Black	11.5*	11.4*	11.7*	12.1	11.4	10.7*
Other	10.1*	9.7*	<b>13.2</b>	<b>12.4</b>	<b>14.0</b>	<b>15.2</b>
Percent of beneficiaries with a physician visit within thirty days						
All with Diabetes	87.6	88.3	<b>85.5</b>	<b>87.5</b>	<b>84.7</b>	<b>79.5</b>
White	87.7	88.5	<b>85.7</b>	<b>88.0</b>	<b>84.6</b>	<b>79.5</b>
Black	85.0	85.5	<b>83.2</b>	<b>81.0*</b>	<b>89.2*</b>	<b>78.8</b>
Other	90.1	90.8	<b>84.9</b>	<b>89.3</b>	<b>75.0</b>	<b>81.3</b>
Percent of hospitalized beneficiaries who were readmitted within 30 days						
All with Diabetes	14.3	14.9	<b>12.3</b>	<b>12.2</b>	14.2	<b>9.9</b>
White	14.2	15.0	<b>12.0</b>	<b>11.9</b>	13.9	<b>9.5</b>
Black	14.8	14.6	15.9*	16.0	14.4	n/a
Other	14.5	14.7	13.4	12.2	20.9	n/a
<b>Bold</b> indicates significantly different from urban, $p < 0.05$ All significance testing adjusts for multiple comparisons. * Significantly different from referent (ref), $p < 0.05$ n/a indicates sample size too small for stable estimate.						

than their white peers (11.7% versus 13.1%, Table 12), an unexpected finding. More consistent with theory, rural African American beneficiaries with diabetes were less likely than white beneficiaries with this condition to have a follow up physician visit within 30 days of hospitalization (83.2% versus 85.7%), and more likely to be re-hospitalized within 30 days, (15.9% versus 12.0%). Again, additional research with greater use of clinical information is required.

## Summary and Conclusions

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### *Summary of findings regarding community characteristics*

While the overall picture of rural / urban and race-based disparities is complicated, a key component in diabetes care, the transition from inpatient to outpatient follow-up, may be related to provider availability. Primary care provider to resident ratio was related to higher rates of post-hospitalization follow-up within thirty days. Within rural counties as a whole, the probability of prompt follow-up increased with physician availability. Rural disparities are most evident among small adjacent and remote rural counties, where there are generally fewer providers. Residents in these areas also face additional barriers in seeking care, such as increased travel distances or times to get such care.<sup>27</sup>

### **Limitations**

The present analysis, as has been noted, was limited by several factors. First, information about the beneficiary was limited to just age, race, and gender; additional information such as health status, income, educational level, and health seeking beliefs would have been beneficial to the study. Also, a relatively small sample size precluded more in-depth analysis of race and ethnicity, in particular Hispanic ethnicity. The use of claims data also limits the ability to ascertain the reasons for seeking care; while the primary diagnosis of each visit is recorded, it is not clear if a physician visit subsequent to a hospital discharge is related to that discharge or to another complaint. Similarly, it is unclear if a readmission is due to the same complaint, or a new manifestation of a similar complaint. Finally, we were able to identify several factors related to the beneficiary's county of residence that were associated with seeking care. We were not, however, able to identify the location of where the care was actually delivered; i.e. if rural residents sought care in urban areas. Thus, having adequate primary care providers in a county may not be a reliable predictor of seeking follow-up care since these residents may travel to obtain care in another county.

### **Conclusions**

Our study did not pinpoint a single distinct cause for differences in hospitalization rates and follow-up care between rural and urban. In the section below, we draw from the general literature regarding chronic disease to offer suggestions that may be of use to rural practitioners.

## Summary and Conclusions

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### *Improving Care*

Both the quality of care received during an inpatient stay<sup>28,29</sup> and discharge planning are associated with preventable hospital readmissions.<sup>30</sup> Written discharge summaries that describe hospital treatment for use by the provider in the community can be incomplete, illegible, or even not available at the time of the follow-up appointment.<sup>31,32</sup> Further, it is possible for discharged patients to be readmitted to the same hospital without the knowledge of the attending physicians who handled the original episode of care. This lack of communication results in missed opportunities to share information about readmitted patients.<sup>33</sup>

The transition from inpatient to outpatient care is ripe for intervention using the Triple Aim framework, which seeks to improve patients' care experiences, improve the health of entire populations, and improve the financial efficiency of the system as a whole.<sup>34</sup> To properly implement this framework, hospitals, providers, and patients must work together to identify gaps in the system, while working with policy makers to identify interventions that would eliminate these gaps.

Care transitions programs focus on reducing readmission rates by developing effective methods for communication among providers in different settings, as well as communication with the patients themselves. The principal benefit of care transitions programs for hospitals is financial. Medicare considers risk-adjusted 30-day readmission rates a key element of quality and is moving to consider readmission rates when setting reimbursement levels. Evaluators for one communication program, The Care Transitions Intervention Model, estimated the yearly expenses to operate the program at \$74,310, producing overall savings of \$289,594, noting that patients with diabetes and African American patients are among those anticipated to benefit.<sup>35</sup>

Health information technology (HIT) development may also help with inter-level communication, as hospitals and physicians move to meet requirements of the Health Information Technology for Economic and Clinical Health (HITECH) Act. A Colorado program funded by the John A. Hartford Foundation assists patients as they transition across levels of care with internet-based tools.<sup>a</sup> This program is an evolution of an earlier program providing patient materials and coaching.<sup>36</sup> In the interim, even simple tools such as emailed discharge summaries have the potential to improve communication between providers.<sup>37</sup>

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<sup>a</sup> <http://www.caretransitions.org/>

## Summary and Conclusions

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At present, the engagement of rural hospitals in structured discharge planning, programs focused on helping patients transition back to community care, and use of HIT for inter-level communication is not known. Similarly, little research has explored mechanisms used to link rural residents who are hospitalized in urban settings to providers in their home communities. Identification of successful models that facilitate provider communication in a cost effective manner is critical to improving follow-up and reducing re-hospitalization rates among residents of rural small and remote counties.

### *Empowering Patients*

Effective outpatient and inpatient care is facilitated by a positive relationship between the patient and the provider.<sup>38</sup> When hospitalized, however, the patient may be dealing with many providers whom he or she has never before met, while at the same time dealing with the stress of serious illness. After discharge, the patient must take actions to comply with follow-up appointments, or possibly may be expected to arrange follow-up without assistance.

Barriers to patient completion of the transition from hospital to community care include lack of a usual source of care, forgetting about the advised visit, or the inability to access the care.<sup>39</sup> These factors are often amplified for non-white and rural residents due to travel difficulties.<sup>40</sup> Health literacy is also a concern; vulnerable groups have been shown to have lower levels than other groups, which may reduce the likelihood of seeking necessary follow-up care.<sup>41</sup>

Structured patient empowerment programs, such as the web-based Care Transitions tools offered in Colorado, can help patients plan for post-discharge care. Additional work is needed, however, to ascertain patient centered models that have been applied successfully in rural settings, or which overcome communication barriers associated with hospitalization outside of the individual's home community.

### *Assessing the Impact of Interventions*

The U.S. Department of Health and Human Services currently tracks and disseminates information regarding readmissions (along with other measures) via its Hospital Compare website.<sup>b</sup> The results from this analysis indicate a need to not only track readmissions, but also to track the

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<sup>b</sup> <http://www.hospitalcompare.hhs.gov/hospital-search.aspx>

## Summary and Conclusions

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post-discharge follow-up care. Tracking of follow-up care is compatible with the purpose of the Triple Aim framework by identifying areas where population health is less than adequate. Hospital Compare could also be further improved by tracking the experience of rural facilities and providers specifically, while acknowledging and adjusting for factors that make care delivery in rural areas more problematic.

### *Moving to prevention*

Obesity is more prevalent across rural America than in urban areas.<sup>42</sup> Higher rates of diabetes in rural populations are one consequence of obesity. There continues to be an urgent need for culturally relevant obesity prevention programs that recognize the socioeconomic and environmental constraints experienced by rural residents. Reduction in unnecessary morbidity among persons with diabetes requires messages of prevention, education, and self-management of both diabetes and general health.

Access to healthy food choices, safe activity environments,<sup>43-45</sup> and access to health care services (both inpatient and outpatient)<sup>46</sup> play important roles in health maintenance and prevention of adverse outcomes. Addressing each of these contributors to effective diabetes management will require long term commitments to improving local infrastructure on the part of local communities, coupled with equitable reimbursement policies for rural providers.

### Technical Notes

#### *Data*

The data were drawn from the 2005 Medicare Claims file obtained from the Chronic Condition Warehouse (CCW). The CCW was legislatively created by the Medicare Prescription Drug Improvement and Modernization Act of 2003 and is maintained by the Research Data Center (RESDAC). This data included inpatient hospital stay claims, carrier claims (e.g. physician encounter claims) and beneficiary information such as demographic information and chronic illness diagnoses. This data was merged into one file by beneficiary.

Information regarding the county of residence of the beneficiary was drawn from the 2007 Area Resource File (ARF). The ARF is a database containing more than 6000 variables for each of the nation's counties with few exceptions (Alaska). Overall there are 3142 records and more than 6000 variables on file pertaining to health facilities, health professions, measures of resource scarcity, health status, economic activity, health training programs, and socioeconomic and environmental characteristics. The basic file also contains geographic codes and descriptors which enable it to be linked to many other files and to aggregate counties into various geographic groupings.<sup>26</sup>

#### *Analysis*

The population of interest for this analysis is rural residents as defined by the 2003 urban Influence Codes (UIC). rural residence was classified at the county level using the 2003 urban Influence Codes for the U.S. Department of Agriculture's Economic Research Service.<sup>27</sup> These UIC codes divide the 3141 counties county equivalents and the independent cities in the United States into 12 groups based on population and commuting data from the 2000 Census of the Population in the case of metropolitan counties and adjacency to metro area in the case of nonmetropolitan counties. Metro-nonmetro definition is based on the official metro status

## Technical Notes

announced by the Office of Management and Budget on June 1, 2003. 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 (UICs 3 5 and 8), small adjacent rural, a.k.a “small adjacent” (UICs 4 6 and 7), and “remote” rural (UICs 9 10 11 and 12) (See Table Below).

Rural Grouping	UIC	Definitions
urban	1	In large metro area of 1+ million residents
	2	In small metro area of less than 1 million residents
micropolitan rural	3	micropolitan area (urban cluster of 10000 population or more) adjacent to large metro area
	5	micropolitan area adjacent to small metro area
	8	micropolitan area not adjacent to a metro area
small adjacent rural	4	Noncore adjacent to large metro area
	6	Noncore adjacent to small metro area and contains a town of at least 2500 residents
	7	Noncore adjacent to small metro area and no town of at least 2500 residents
remote rural	9	Noncore adjacent to micro area and contains a town of at least 2500 residents
	10	Noncore adjacent to micro area and no town of at least 2500 residents
	11	Noncore not adjacent to metro or micro area and contains a town of at least 2500 resident
	12	Noncore not adjacent to metro or micro area and no town of at least 2500 residents

Race was defined using the race definitions contained in the Medicare Beneficiary File. Due to small sample sizes, only three classifications could be made: Non-Hispanic white (hereafter “white”); non-Hispanic African American (hereafter “African American”); Asian and Pacific Islander, American Indians, Alaska Natives, Hispanics, and all other races were collectively classified as “other.”

The study population was limited to beneficiaries who did not die during the year and did not have one of the following diagnoses: Alzheimer’s disease, dementia, schizophrenia, congestive

heart failure, 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. Thus only beneficiaries who were not hospitalized during the study year or who were hospitalized and discharged back into the community after hospitalization are included in the study.

Initial analysis described the population by basic demographics including race, gender, age groups and diabetes diagnosis. Subsequent analysis examined the hospitalization rate of the population; these rates were further subset to just those with diabetes and to all hospitalizations of any diagnosis or complaint. Among those with a hospitalization we then examined the rate of follow up physician encounters the time to such an encounter and subsequent re-hospitalizations or emergency department visits. Time to follow up was divided into 30 day increments; 0-30 days, 31-60 days, 60 or more days and no follow-up. All analyses were subset by rurality. Differences were tested using Wald Chi Square tests at the  $p < 0.05$  level.

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