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ACOs' Impact on Hospitalization Rates of Rural Older Adults with Diabetes: Early Indications

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Background

The shift to a focus on value of healthcare services has spurred the dispersion of Accountable Care Organizations (ACOs) and other new models of healthcare delivery that affect rural as well as urban communities. Although many of the features of ACOs may not be new – coordinated care, teams, and health information technology, to name a few – the term “ACO” is new. Across the many types of ACOs, both public and private, the fundamental goals are the same: to provide high quality care and achieve cost savings. To what extent ACOs are meeting the expectation of improving the quality of care and health outcomes of their patients, at the same time improving population health, remains to be determined. Moreover, there is a need to illuminate the impact of ACOs on specific populations that are more vulnerable and have limited access to healthcare, such as rural residents.

Diabetes-related patient outcomes are among those most closely monitored in recent years for healthcare providers, and systems of providers such as ACOs. Diabetes is the seventh leading cause of death in the U.S.¹ In rural areas, where its prevalence is about 17 percent higher than that of urban areas, it is of particular concern.^{2–4} Rural residents with diabetes have higher morbidity from diabetes-related complications.^{5–8}

Within rural communities, ethnic minority residents are particularly vulnerable to developing diabetes and its complications. Diabetes is found more frequently among ethnic

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Our models included dummy variables for each of the eight states in Region 4. In order to include all of these variables in the multiple linear regression models, we indicated that the constant (intercept) not be included or estimated in the models.

minorities including African Americans and Hispanics.⁹ One recent study of African American women living in the rural U.S. revealed many cases of severely uncontrolled diabetes of long-term duration.¹⁰ Elsewhere it was found that Black Medicare beneficiaries with diabetes were more likely to be hospitalized for ambulatory care sensitive conditions (ACSCs), particularly those related to diabetes or cardiovascular diseases.¹¹ Latinos living in rural areas along the U.S.-Mexico border are much more likely to experience lower extremity amputations than whites.^{12,13} Other complications are chronic in nature, such as depression - a common comorbidity among diabetics.¹⁴

One of the goals of Medicare ACOs is to improve the healthcare and overall health of a defined population for which it takes responsibility. Hospital admission rates for patients with chronic conditions can be minimized with effective primary care and coordinated care. In providing effective care, an important question is to what extent ACOs are serving the needs of patients of vulnerable populations, including rural residents and their minority populations.

Study Goals

The purpose of this study was to examine the impact of ACOs, along with other patient- and community-level factors, that may contribute to reducing diabetes-related hospitalization rates for rural older adults. We analyze this outcome for rural populations affiliated with a particular type of ACO: the Medicare Shared Savings Program (SSP) ACO. We focus on populations of the rural Southeast because this region of the country has the highest prevalence of diagnosed diabetes.¹⁵ In addition, we describe the characteristics of RHCs that participated in ACOs and the older adult patients they served.

Methods

Analytical Framework.

The analysis for this study was guided by Andersen's behavioral model for health services use, which originated in the 1960s and revised in the 1990s.^{16,17} This model relates the use of health services to a person's predisposing and enabling factors, needs, and the external environment. Predisposing factors are described as those that predispose a person's health outcomes such as gender, age, race, and health beliefs. Enabling factors that those that facilitate the person's health outcomes, such as individual's income, health insurance coverage, and level of education. Need factors include the individual's perceived health care need and other indicators of their health status, such as comorbidity and self-perceived health. All these individual-level factors are assessed within the context of the external environment, which can be described by such factors as the percentage of the population that is in poverty and the percentage that is older.

Figure 1 illustrates how the Andersen model was used as a basis for this study to measure the use of hospital services for treatment of diabetes-related conditions by older adults who access Rural Health Clinics (RHCs) located throughout the Southeast. The model relates the impact of the healthcare system (where ACO participation is the variable of interest), external environment, and population characteristics on diabetes-related hospitalizations.

Design and Data Sources.

We applied a cross-sectional design using secondary data from multiple sources. The unit of analysis was the Rural Health Clinic (RHC) and the Medicare beneficiaries they serve. This study was part of a larger, longitudinal study concerning the impact of ACO participation by RHCs on the quality of care and clinical outcomes of patients they serve, as well as the cost efficiency in providing that care. For the larger study we created a panel of clinics continuously certified as RHCs during the time period 2007 – 2013 using the 2007 provider of services file.¹⁸ All panel RHCs were located in HHS Region 4 (Tennessee, Kentucky, North Carolina, South Carolina, Georgia, Florida, Mississippi, and Alabama). Approval for the investigation was obtained through the Institutional Review Board of the University of Central Florida (Number SBE-11–07815.)

The sources of secondary data for the current study included 2013 Medicare beneficiaries' inpatient and outpatient claims research identifiable files (RIF),¹⁹ Area Health Resources Files (AHRF) 2014–2015 edition,²⁰ and the 2013 Centers for Medicare and Medicaid Services (CMS) cost report for RHCs.^{21,22} All claims were for Medicare beneficiaries who had at least one outpatient visit to RHCs located in Region 4. Each was assigned to the RHC that provided the patient with the most outpatient visits during the year. The study variables were measured on the individual, clinic, and state level. The individual level variables from the Medicare beneficiaries' claims were aggregated to the clinic level, and captured such characteristics as state of residence, rurality, dual eligibility, and the risk-adjusted diabetes-related hospitalization rate.

Variables

Outcome Variable: Diabetes-related Hospitalizations.—One of the goals of ACOs is to reduce diabetes-related admissions and identify factors that contribute to their reduction. SSP ACOs are required to report on 34 quality measures that are grouped into four key domains. We used as a dependent variable one of the measures within the care coordination/patient safety domain: all-cause unplanned admissions for patients with diabetes (ACO-36).

This variable was one of several ambulatory care sensitive condition (ACSC) variables we constructed for a related larger study where ACSC variables were used to measure potentially avoidable hospitalizations for ambulatory care sensitive conditions. High rates of hospitalization for these conditions might indicate inadequate access to high quality ambulatory care (CMS, 2013). As measures of ACSCs we used several Prevention Quality Indicators (PQIs), which, along with other measures, are used to assess coordinated care for patients with chronic conditions.²³

We examined 2013 risk-adjusted diabetes mellitus-related hospitalization rates for Region 4. To risk adjust the hospitalization rates, we selected several variables that may impact the rates. The risk-standardization model included the patient's age, gender, Charlson Comorbidity Index (CCI), and the Medicare claims year. The ICD-9-CM codes used to identify hospital discharges with a principal diagnosis code of diabetes were any of the following individual prevention quality indicators (PQIs): PQI 01 (diabetes short-term

complications admission rate), PQI 03 (Diabetes long-term complications admission rate, PQI 14 (uncontrolled diabetes admission rate), and PQI 16 (rate of lower-extremity amputation diabetes). All ICD-9-cm principal diagnosis code for diabetes are in adults ages 65 years and older.

Healthcare System.—ACO participation by RHCs was the independent variable of interest for the current study. The Medicare Shared Savings Program Accountable Care Organization (SSP ACO) is one of six ACO programs offered by Centers of Medicare and Medicaid Services (CMS). It was designed to incentivize ACOs to improve care of Medicare Fee-For-Service (FFS) beneficiaries. The SSP ACO had a start cycle date of April 1, 2012. The service subjects of the SSP ACO are the fee-for-service beneficiaries. Our study population included only those RHCs that joined an SSP ACO in Region 4 in the year 2012 or 2013 – a total of 20 RHCs.

Additional variables in the Healthcare System category included resources and organizational characteristics. Two resource variables were constructed: state (measured by the RHC's state of location), and rurality (measured by the RHC's location and classified into "urban," "large rural," "small rural," and "isolated" areas based on the method of the University of Washington Rural Health Research Center, 2016²⁴). One organizational characteristic - "size" of the RHC – was constructed using data reported in the Cost Report. It was calculated as the total number of physician, physician assistant, and nurse practitioner full-time equivalents (FTEs).

External Environment.—Two external environment factors were included in the study model. Poverty was defined as the percentage of county population that was at a 200% of poverty level in 2013. Elderly was defined as the percentage of county population that was Medicare eligible in 2013 and of age 65 and over.

Population Characteristics.—Finally, one enabling factor – dual eligibility - was included. This variable was defined as the percentage of Medicare program beneficiaries with at least three months of dual eligibility status during 2013.

Analytical Methods.

Sample.—For the year 2013, there were 20 RHCs participating in Region 4 SSP ACOs. After eliminating one RHC for which there were missing data for all study variables, the study sample was reduced to 19. To allow us to better account for unobserved confounders, we matched each of the 19 RHCs in ACOs with its closet match RHC (non-ACO participant) to create a matched dataset. We used data for clinics located throughout Region 4 and one-to-five propensity score matching to create this resulting matched dataset of 95 clinics. The propensity score was created using logistic regression with the following covariates: number of years the clinic was Medicare certified for participation in the RHC program, type of RHC (provider-based RHC and independent RHC), total patients assigned to the RHC, and type of control (profit, non-profit, and government). The propensity score matching process was performed in R, version R i386 3.2.3.²⁵

Analyses.—Descriptive statistics were calculated to describe the organizational characteristics of the study RHCs in SSP ACOs (or “ACO RHCs”), and those of the patients and populations they serve. In addition, we conducted univariate analyses of the admissions variable as well as for each of the predisposing and enabling factors.

To examine the impact of ACO participation on diabetes-related hospitalization rates, we conducted multiple linear regression analysis of the relationship between health care system, external environment, and population characteristics.ⁱ Most patients accessing RHCs in the rural Southeast are of two ethnic groups: Whites and African Americans. We created a separate statistical model for each ethnic group. All data management and regression analyses were carried out using SPSS, version 22.0.²⁶

Results

Organizational Characteristics of RHCs in ACOs.

We analyzed the characteristics of the Region 4 RHCs that participated in SSP ACOs during the study period and the characteristics of the Medicare patients they served. In this section is a brief description of some of those characteristics.

State of Location.—Most of the RHCs in ACOs (the “ACO RHCs”) were located in just two states: Florida (70%) and Tennessee (15%). The concentration of RHCs in ACOs located in Florida and Tennessee is explained, in part, by at least two factors: 1) there is a high percentage of SSP ACOs serving Florida and Tennessee, and 2) there are high numbers of Medicare beneficiaries in those states. (See Figure 2.)

Ownership and Affiliations.—Of the study ACO RHCs, only 10% were nonprofit, whereas nonprofits made up 28.6% of the non-ACO RHCs. Consideration was also given to whether the study RHCs were affiliated with other healthcare providers, as such affiliations may facilitate their becoming part of systems such as ACOs. RHCs are of two classifications: independent (freestanding) and provider-based (those affiliated with hospitals, nursing homes, or home health agencies).

For the region as a whole, the number of independent RHCs is more than twice that of provider-based RHCs. Among the ACO RHCs, independent RHCs represented a higher percentage of the total (73.7%) as compared to the Non-ACO RHCs (70.8%).

Practice Size.—RHCs are typically small; the median “size” (total physician, physician assistant, and nurse practitioner FTEs) for the 2013 Region 4 study panel was 3.31 (n = 362). The study ACO RHCs ranged in “size” from 1.00 to 23.25; the median size was 3.3 (n = 8).

Patient Characteristics of RHCs in ACOs.—Several characteristics of the patients served by the study RHCs were examined. A brief description of some of these characteristics follows.

ⁱ.Endnotes

Poverty.—Of the counties in which the ACO RHCs were located, approximately 18% of the Medicare beneficiaries (aged 65 and over) were below 200% of the federal poverty level in 2013. This percentage is lower than the percentage of persons in poverty in non-ACO RHC counties (24%).

Patient Age.—For the study sample, the mean patient age in 2013 was 76.6 (n = 19); for all other Region 4 Medicare beneficiary patients it was 74.8 (n = 484).

Patient Ethnicity.—The percentage of patients from three ethnic groups served by RHCs was examined: Whites, African-Americans, and Hispanics. In Region 4 as a whole, RHC Medicare patients are predominantly White. For ACO-RHCs, Whites composed a higher percentage of all older adult patients (86.6%) as compared to those of non-ACO RHCs (73.81%).

Figure 3 illustrates the percentage of Medicare patients by ethnic group served by ACO RHCs as compared to those of non-ACO RHCs. Of the minority groups served by RHCs in the region as a whole, most are African-American. The mean percentage of African-American Medicare beneficiaries served by ACO RHCs in 2013 was 10.9% (n = 20), whereas for non-ACO RHCs it was 23.7% (n = 685). A much smaller percentage of beneficiaries were Hispanic: 6.2% of the beneficiaries served by ACO-RHCs in 2013 were Hispanic, whereas they made 4.7% of beneficiaries served by non-ACO RHCs in Region 4.

Impact of ACO Participation and Other Factors on Diabetes-related Hospitalization Rates

Table 1 presents results from the multiple regression analysis of risk-adjusted diabetes-related hospitalization rates for African American patients; Table 2 presents the results for White patients. Both models were found to have adequate fit ($R^2 = 80.2\%$ and 88.7% respectively).

For neither model was ACO affiliation found to have a statistically significant impact on diabetes-related hospitalization rates. However, the two analyses revealed other factors that impacted diabetes-related hospitalization rates, although these factors differed between the models.

In the model for African American patients, being served by clinics located in Alabama or Florida was positively and significantly associated with diabetes-related hospitalization rates (Std. $\beta = 0.66$, $p < 0.01$; Std. $\beta = 0.61$, $p < 0.05$). In the model for White patients, being served by clinics in Alabama was positive and significant as well (Std. $\beta = 0.27$, $p < 0.05$). In addition, the RHC's rural location (large, small, and isolated) was negative and statistically significant in its impact on the hospitalization rates. Of these, classification of the RHC in a large rural location had the greatest impact (Std. $\beta = -.33$, $p < .01$). Among the enabling factors, dual eligibility was positive and statistically significant in its impact (Std. $\beta = .45$, $p < .01$).

Discussion

The purpose of this study, broadly speaking, was to examine the impact of ACOs on patient outcomes. Specifically, we investigated whether rural older adults diagnosed with diabetes and served by SSP ACOs experienced reduced diabetes-related hospitalizations.

We found that at this early stage of ACO history, ACO participation by RHCs had not yet contributed to a reduction of diabetes-related hospitalization rates of the older diabetic adult patients they serve. However, other factors emerged as contributors. During the study period, for both African American and White Medicare patients, the geographic location of the RHC where they receive most of their care appears to have played a larger role than their affiliation with an ACO.

For the African American patients with diabetes, being served by RHCs located in Alabama or Florida appears to have had more bearing on these hospitalizations than the other predisposing and enabling factors we analyzed. This is not necessarily a reflection of the quality of primary care they receive, as there are a number of possible explanations. One point is that there is evidence that admission rates vary across the U.S., while at the same time patient demographic differences are accounted for.^{27–30} Another consideration is that access to needed primary care services varies considerably from clinic-to-clinic and across geographic areas. The availability of same-day appointments and extended hours that help to deter the need for hospitalization is largely determined by the supply of professional clinical staff in the clinic's service area. Another possible explanation is that the sample patients in these two states had lower incomes, lower education levels, and/or greater transportation needs – all of which are barriers to preventive care in rural areas.³¹ Further research will clarify the explanations for the state-level differences in diabetes-related hospitalization rates we found.

The degree to which ACOs can influence patient outcomes and reduce health disparities among African Americans and other ethnic minorities is not clear. There is evidence that Medicare beneficiaries served by ACOs are more likely to be White and of higher socioeconomic levels.³¹ In addition, even if the new payment incentives offered to ACO participants contribute to improvements in quality of care, it must be determined whether these improvements translate into health disparities reductions. Many factors in addition to the patient's involvement in an ACO play a part in patient outcomes and health disparities, such as behavioral factors and a myriad of community characteristics. African American women from impoverished rural communities who have limited education may have poorer dietary and medication adherence habits¹⁰ that may limit the effect of improved quality care available through ACOs. Lower levels of trust between the African American patients and their physicians as compared to Whites³² may compromise medication adherence and enhanced continuity of care.^{33–36}

For White patients, being served by RHCs located in large, small, or isolated rural areas was related to lower diabetes-related hospitalization rates. Rural location as a negative contributor begs the question as to whether rural Medicare patients are receiving needed hospitalizations for diabetes-related conditions. That is, given the high numbers of diabetic

residents in rural areas and the geographic barriers to healthcare they face, this finding may indicate that patients are not accessing hospitals for needed treatment of complications related to diabetes.

In addition, for Whites, dual eligibility status as an enabling factor appears to positively relate to diabetes-related hospitalizations. This finding is in keeping with previous research that has shown that almost 10% of dual eligible had at least one potentially avoidable hospitalizations over a period of one year.³⁷ It is imperative that this relationship be monitored because hospitalizations, particularly for dual eligible beneficiaries, are a major factor in U.S. health care spending.

It is early in ACO history and, for that reason, plausible that the lack of evidence of ACO impact on clinical outcomes may largely be attributed to the short “life” ACOs have spanned. Formation of one of the earliest Medicare ACO models, the SSP ACO, was first announced in April of 2012, so that the earliest RHCs to participate had only one and one-half years’ experience with ACOs at the time of our study. The implementation of new operational systems within participant organizations of an ACO, and the communication and coordination between participants, may require multiple years before measurable impact on hospitalizations and other clinical outcomes are demonstrated.

This study had a few limitations. As previously described, our data were limited to the first 2 years of ACO participation. Although 36 additional Region 4 RHCs participated in SSP ACOs during 2014 and 2015 (email communication with CMS, Jan. 23, 2015), there were few RHCs in SSP ACOs that formed the sample for the current study. Also, the analysis was cross-sectional, so that we cannot draw causal inference regarding the association between the contributing factors and diabetes-related hospitalization rates. In addition, our study was limited to the experiences of patients in the Southeastern U.S. Thus the findings cannot be generalized to the U.S. as a whole.

Despite these limitations, the findings of this study serve as benchmarks for documenting the progress and performance of ACOs in rural areas. The findings have value in setting a baseline for performance of ACOs. They help us to gain an understanding of realistic expectations for the time that may be required to realize benefits of ACOs concerning patient outcomes.

Conclusions

To meet the Healthy People 2020 goals of reducing the disease and economic burden of diabetes, healthcare delivery systems must increase the effectiveness of primary care in rural, as well as urban, areas. ACOs are one of the newer models for healthcare delivery that are intended to improve patient outcomes while reducing healthcare costs. They are designed to encourage the use of primary care services and coordinate care so as to minimize costs of unnecessary hospitalizations and ED visits. The findings of our study did not show that ACO participation by RHCs reduced diabetes-related hospitalizations for the older adult patients they serve. This study provides baseline measures for patient outcomes during the initial

years of ACO formation. Future research will clarify the benefit that ACO participation by RHCs may have on their patients and communities, as well as their performance overall.

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Figure 1.
Framework for ACO Impact on Diabetes-Related Hospitalization Rates Variables

Figure 2.
State of Location

Figure 3.
Patient Ethnicity, 2013

Table 1.Risk-Adjusted Diabetes Hospitalization Rate for African-Americans[/]

		Unstandardized Coefficients		Standardized Coefficients	P-value
		B	Std. Error	Beta	
Health Care System					
Policy: ACO Participation					
	Non-ACO (reference group)				
	ACO Participant	-.013	.011	-.152	.238
Resources					
State					
	AL	.055	.016	.658	.003
	FL	.046	.020	.608	.031
	GA	.033	.021	.248	.129
	KY	.028	.019	.148	.162
	MS	.026	.017	.420	.139
	NC	.029	.018	.407	.132
	SC	.032	.019	.451	.099
	TN	.026	.019	.198	.185
Rurality					
	Urban (reference group)				
	Large Rural	-.016	.010	-.312	.141
	Small Rural	-.016	.009	-.357	.073
	Isolated	-.008	.011	-.074	.493
Organization					
	Size of RHC (Number of Physician + PA + NP FTEs)	.000	.000	.055	.652
External Environment					
	Poverty	.000	.000	-.142	.718
	% of elderly	.002	.058	.014	.971
Population Characteristics					
	Dual Eligibility	.029	.024	.291	.231

Model summary. Adjusted R Square: 80.2%

[/]Linear regression through the origin (the no-intercept model). In other words, this model excluded a constant term (intercept) in this equation to prevent a dummy variable trap.

Table 2.Risk-Adjusted Diabetes Hospitalization Rate for Whites¹

		Unstandardized Coefficients		Standardized Coefficients	P-value
		B	Std. Error	Beta	
Health Care System					
Policy: ACO Participation					
	Non-ACO (reference group)				
	ACO Participant	.000	.004	.006	.922
Resources					
State					
	AL	.018	.008	.272	.024
	FL	.013	.010	.179	.224
	GA	.014	.010	.126	.166
	KY	.007	.009	.062	.458
	MS	.016	.009	.260	.073
	NC	.010	.009	.135	.272
	SC	.016	.009	.230	.069
	TN	.015	.008	.230	.071
Rurality					
	Urban (reference group)				
	Large Rural	-.015	.004	-.332	.001
	Small Rural	-.013	.004	-.300	.003
	Isolated	-.018	.005	-.243	.001
Organization					
	Size of RHC (Number of Physician + PA + NP FTEs)	.000	.000	.055	.449
External Environment					
	Poverty	.000	.000	.298	.194
	% of elderly	.009	.027	.068	.734
Population Characteristics					
	Dual Eligibility	.040	.012	.453	.002

Model summary. Adjusted R Square: 88.7%

¹Linear regression through the origin (the no-intercept model). In other words, this model excluded a constant term (intercept) in this equation to prevent a dummy variable trap.