Understanding Factors Associated With Readmission Disparities Among Delta Region, Delta State, and Other Hospitals

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The Hospital Readmissions Reduction Program (HRRP) seeks to financially incentivize hospitals to reduce 30-day readmissions. Since 2013, hospitals have received Medicare payment reductions if their 30-day readmissions of selected conditions were higher than the national average. Although the payment reduction was capped at 3% beginning in 2015,[1] the number of selected conditions increased from 3 in 2013 to 6 in 2015. CMS plans to add more conditions going forward.[1]

Since its implementation, HRRP has spurred controversy and has been the focus of many critiques. One of the most common criticisms is that there is inadequate adjustment for factors beyond hospitals' control, as evidence has indicated that patients' sociodemographic status and hospital and community characteristics were associated with 30-day readmissions.[2-13] The Mississippi Delta region is known for poor population health, inadequate healthcare infrastructure, and being among the most impoverished areas in the United States.[14,15] Hospitals in this region likely are located in rural areas and serve as the sole hospital for the surrounding community. How 30-day readmission ratios, defined by CMS in HRRP, may differ between hospitals in this unique region and those in the rest of the nation, and what underlying factors may account for these differences, are largely unknown.

We focused on hospitals in the Delta region (hereafter called Delta region hospitals) and in Delta states. The Delta region, as defined by the Mississippi Delta Regional Authority (MDRA), includes 252 counties in 8 states: Alabama, Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee.[16] Most of these counties are in close physical proximity to the Mississippi River, hence their distinction as Delta region counties. Hospitals located outside of the Delta region but still in those 8 Delta states (hereafter called Delta state hospitals) are likely to be affected by the Delta region's characteristics, as patients may travel within their home state to receive care. For instance, although the eastern counties of Arkansas are part of the Delta region as defined by the MDRA, the western counties of Arkansas are not; thus, the entire state of Arkansas is considered a Delta state. Given evidence from

ABSTRACT

OBJECTIVES: To understand the factors that potentially account for differences in 30-day readmission ratios for pneumonia, heart failure, and acute myocardial infarction (AMI) among hospitals in the Mississippi Delta region (Delta region), in Delta states excluding the hospitals in the Delta region (Delta state), and in the rest of the nation (other).

STUDY DESIGN: A longitudinal study design from 2013 to 2016.

METHODS: The dependent variables were 30-day readmission ratios for AMI, heart failure, and pneumonia. The key independent variables were 2 hospital categories (Delta region and Delta state), year dummies for 2014-2016, and the interactions among hospital categories and year dummies. We conducted 2 analyses for each study condition by estimating models with and without controls for hospital and community characteristics.

RESULTS: The coefficients for the interactions among year dummies and Delta region and Delta state hospitals were negative, indicating that Delta region and Delta state hospitals had higher reductions in readmissions than did other hospitals. After controlling for hospital and community characteristics, the disparities in readmissions for pneumonia and AMI in 2013 between Delta region and other hospitals were weakened (*P* >.05). Major teaching hospitals and percentage of black population were positively associated with readmissions for all study conditions (*P* values ranged from <.05 to <.001).

CONCLUSIONS: Disparities in 30-day readmissions for the study conditions among Delta region, Delta state, and other hospitals were reduced under the Hospital Readmissions Reduction Program (HRRP). However, community factors that are not currently used for adjustment in HRRP were associated with readmission ratios. Revisions of HRRP should consider including community characteristics in risk adjustment models.

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30-day readmission studies and the unique characteristics in the Delta region discussed above,[2-15] we hypothesized that disparities in 30-day readmissions among Delta region, Delta state, and other hospitals exist and that hospital and community factors accounted for those disparities.

TAKEAWAY POINTS

▸ Disparities in 30-day readmissions for pneumonia, heart failure, and acute myocardial infarction among Delta region hospitals and other hospitals in the nation, and Delta state and other hospitals, were reduced from 2013 to 2016.

▸ Adding community characteristics in the analytical models weakened the significant difference in 30-day readmission ratios for all 3 study conditions among Delta region and other hospitals.

▸ Consideration of sociodemographic status and addition of a mechanism that recognizes hospitals' improvement in the Hospital Readmissions Reduction Program would lessen the program's unintended consequences that may threaten the healthcare delivery system in the Mississippi Delta region and Delta states.

DATA AND METHODS

Data

We used several publicly available data sources. The HRRP Supplemental Data Files provided readmission ratios for conditions included in HRRP and hospital identification numbers for hospitals qualified to participate in HRRP from 2013 to 2016. The MDRA website provided a list of Mississippi Delta states and the counties making up the Mississippi Delta region.[16] CMS Provider of Services (POS) Files (2010-2013) provided hospital characteristics and county and state codes where hospitals were located. The Area Health Resources Files (AHRF) and the Social Characteristics Table from the American Community Survey (ACS) provided county characteristics.

Risk-adjusted 30-day readmission ratios for qualified hospitals are published annually and are based on 3 years of claims data prior to the year published.[1] To account for this lag from measurement to publication, data on hospital and community characteristics were taken from the measurement years for the corresponding publication year. Specifically, we used a midpoint year to represent the value of a given covariate over the 3-year measurement period. For example, the 2013 HRRP Supplemental Data File provides readmission ratios based on data between July 2008 and June 2011; to represent this measurement period, we used 2010 hospital and community characteristics from POS, AHRF, and ACS files. In the present study, we reported the years of readmission ratios that were published rather than the years of claims data used for calculating readmission ratios.

Measures

The dependent variables were 30-day readmission ratios for acute myocardial infarction (AMI), heart failure, and pneumonia, extracted from the CMS HRRP Supplemental Data Files. The readmission ratios in HRRP are based on the predicted readmission from the model with a hospital-specific random effect for a given hospital divided by the expected readmission from the model with an overall average hospital effect from the nation.[1,17] In our study, we chose AMI, heart failure, and pneumonia because HRRP has included these conditions since its inception in 2013. It is expected that hospitals have gained substantial experience with preventing 30-day readmissions for patients with these conditions.

There were 3 categories of independent variables of interest. The first consisted of 2 indicator variables for Delta region hospitals and Delta state hospitals, with other hospitals in the nation (hereafter referred to as other hospitals) as the reference group. The second category contained 3 dummy variables for study years of 2014, 2015, and 2016, with 2013 as the reference group. The final category included the interactions among Delta region hospitals and study years and among Delta state hospitals and study years.

For hospital characteristics, we included ownership (for-profit and public hospitals, with not-for-profit as the reference group), teaching status (major teaching and minor teaching hospitals, with nonteaching hospitals as the reference group), hospital size (defined as the certified bed count), and the percentage of Medicare and Medicaid patients. For county-level community characteristics, we included: (1) number of primary care physicians (PCPs) per 1000 population, (2) number of hospital beds per 1000 population, (3) number of skilled nursing facility (SNF) beds per 1000 population, (4) number of home health agencies, (5) percentage of persons in poverty, (6) percentage of black population, (7) percentage of Hispanic population, and (8) unemployment rate.

Study Sample

We defined the study sample as all hospitals qualified for HRRP. Maryland hospitals are exempted from HRRP as the state has its own hospital readmission reduction incentive program.[17]

Study Design and Analysis

We applied a retrospective longitudinal study design, with the hospital as the unit of analysis. We conducted a trend analysis for risk-adjusted 30-day readmission ratios for AMI, heart failure, and pneumonia separately for each of the 3 hospital groups. For multivariate analyses, we treated hospitals as a random effect factor to control for the correlation of the readmission ratio measures across study periods within each hospital. To identify the underlying factors that may account for the differences in 30-day readmissions among the 3 hospital groups, we conducted 2 analyses for each study condition by estimating models with and without controls for hospital and community characteristics, with clustering of hospitals within the state to adjust standard errors.

TABLE 1. Descriptive Analysis for Delta Region Hospitals, Delta State Hospitals, and Other Hospitals in the Nation from 2013 to 2016

	Delta Region Hospitals	Delta State Hospitals	Other Hospitals	
	Mean (SD)	Mean (SD)	Mean (SD)	P[a]
Dependent Variables				
Pneumonia readmission ratio	1.018 (0.070)	1.022 (0.080)	0.996 (0.074)	<.001
Heart failure readmission ratio	1.036 (0.071)	1.018 (0.081)	0.996 (0.080)	<.001
AMI readmission ratio	1.020 (0.068)	1.018 (0.072)	0.998 (0.078)	<.001
Hospital Characteristics				
Not-for-profit hospitals, %	30.78 (0.46)	55.95 (0.50)	58.74 (0.49)	<.001
For-profit hospitals, %	33.17 (0.47)	23.33 (0.42)	22.77 (0.42)	<.001
Public hospitals, %	36.06 (0.48)	20.72 (0.41)	18.49 (0.39)	<.001
Major teaching hospitals, %	5.65 (0.23)	10.77 (0.31)	13.29 (0.34)	<.001
Minor teaching hospitals, %	15.58 (0.36)	16.00 (0.37)	18.83 (0.39)	.002
Size in number of certified beds	167.48 (200.90)	236.68 (221.15)	229.77 (224.14)	<.001
Percentage of Medicare patients	42.42 (13.92)	40.74 (11.33)	35.73 (12.04)	<.001
Percentage of Medicaid patients	20.50 (12.40)	17.63 (11.03)	12.47 (10.02)	<.001
Community Characteristics				
PCPs per 1000 population	0.61 (0.26)	0.70 (0.28)	0.76 (0.32)	<.001
Acute care hospital beds per 1000 population	4.04 (2.35)	3.47 (1.89)	2.90 (2.29)	<.001
SNF beds per 1000 population	8.78 (4.44)	6.89 (2.98)	5.70 (3.33)	<.001
Home health agencies	4.58 (5.92)	55.30 (144.97)	50.67 (134.06)	<.001
Percentage of persons in poverty	23.07 (6.05)	17.81 (5.11)	16.19 (5.47)	<.001
Percentage of black population	33.57 (20.39)	14.49 (12.72)	11.04 (11.80)	<.001
Percentage of Hispanic population	3.01 (2.17)	7.03 (7.46)	16.44 (16.66)	<.001
Unemployment rate (among residents ≥16 years)	9.29 (2.61)	8.72 (2.05)	8.49 (2.60)	<.001

AMI indicates acute myocardial infarction; PCP, primary care physician; SNF, skilled nursing facility.
[a]P value for analysis of variance or χ^2 test.

RESULTS

Delta Region and Delta State Hospitals' Performance Relative to Other Hospitals on Readmissions

Table 1 presents the means and SDs of study variables from 2013 to 2016 for each hospital group and the statistical differences among the 3 hospital groups (P values ranged from <.01 to <.001). Given the definition of 30-day readmission ratios in HRRP, a ratio greater than 1 indicates that the hospital's predicted 30-day readmission is higher than the national expected 30-day readmission, and vice versa. During the study years for all study conditions, Delta region and Delta state hospitals had higher readmission than the national average, whereas other hospitals had lower readmission than the national average. For example, the average 30-day readmission ratio for heart failure from 2013 to 2016 was 1.036 and 1.018 for Delta region hospitals and Delta state hospitals, respectively, whereas it was 0.996 for other hospitals.

The **Figure** consists of 3 subfigures that show the number of qualified hospitals and present the trend in risk-adjusted 30-day readmission ratios for each study condition for each hospital category

in each year from 2013 to 2016. The 30-day readmission ratios in the Figure were extracted from CMS without adjusting for hospital and community characteristics. For Delta region hospitals, there were about 170 hospitals per year for pneumonia and heart failure and about 80 hospitals per year for AMI. For Delta state hospitals, there were about 445 hospitals per year for pneumonia and heart failure and about 300 per year for AMI. The total numbers of other hospitals per year for pneumonia, heart failure, and AMI were about 2410, 2380, and 1800, respectively.

Part A of the Figure shows that, for pneumonia, Delta state hospitals had an average readmission ratio of 1.028 in 2013 but gradually reduced it to 1.016 in 2016, whereas Delta region hospitals maintained a consistent average readmission ratio of 1.018 during the study period. As seen in part B of the Figure, Delta region hospitals reduced readmission ratios for heart failure from 1.041 in 2014 to 1.027 in 2016. However, their average readmission ratios were still higher than those of Delta state hospitals, which remained stable at approximately 1.018 from 2013 to 2016. For AMI in part C of the Figure, average readmission ratios for Delta state hospitals were reduced from 1.023 in 2013 to 1.014 in 2016, but they remained

high for Delta region hospitals, ranging from 1.017 to 1.023 across the study years.

Potential Factors Associated With Variation in Readmission Across the Hospital Groups

Hospital characteristics among Delta region, Delta state, and other hospitals were different. Table 1 shows that Delta region hospitals had a higher percentage of public hospitals (36.06%), had a lower percentage of major teaching hospitals (5.65%), and were relatively smaller (168 beds) than Delta state (20.72%, 10.77%, and 237 beds, respectively) and other hospitals (18.49%, 13.23%, and 230 beds, respectively). Delta region and Delta state hospitals had a higher percentage of Medicare patients (42.42% and 40.74%, respectively) than other hospitals (35.73%). Delta region and Delta state hospitals also had a higher percentage of Medicaid patients than other hospitals (20.50%, 17.63%, and 12.47%, respectively).

Community characteristics where hospitals operated were quite different across the 3 hospital categories. Delta region hospitals operated in communities with fewer PCPs per 1000 population (0.61), a higher percentage of persons in poverty (23.07%), and fewer home health agencies (4.58), but a higher number of SNF beds per 1000 population (8.78), than communities where Delta state and other hospitals operated (0.70 PCPs per 1000 population, 17.81% persons in poverty, 55.30 home health agencies, and 6.89 SNF beds per 1000 population for Delta state hospitals; and 0.76, 16.19%, 50.67, and 5.70, respectively, for other hospitals). Delta region hospital communities had a significantly higher black population (33.57%) and a lower Hispanic population (3.01%) than the other 2 hospital categories (14.49% and 11.04% black population and 7.03% and 16.44% Hispanic population for Delta state and other hospital communities, respectively).

In **Table 2**, the coefficients for Delta region and Delta state hospitals represent the differences in 2013 readmission ratios between Delta region and other hospitals and between Delta state hospitals and other hospitals, respectively (coefficients and standard errors in Table 2 were multiplied by 10). The coefficient for the interaction between Delta region hospitals and year dummy variable for 2014 indicates the difference in mean readmission ratios from 2013 to 2014 between Delta region and other hospitals. The same interpretation applies to the interaction among Delta region hospitals and year dummy variables for 2015 and 2016 and interactions among Delta state hospitals and year dummy variables for 2014, 2015, and 2016.

Without controlling for hospital and community factors, the results from the models showed that, compared with other hospitals, Delta region and Delta state hospitals had 2.1% (P <.01) and 3.2% (P <.001) higher readmission ratios, respectively, for pneumonia; 4.2% (P <.001) and 2.2% (P <.05) higher readmission ratios for heart failure; and 2.1% (P <.05) and 2.6% (P <.01) higher readmission ratios for AMI. The differences in mean pneumonia readmission ratios

FIGURE. Trends in Readmission Ratios for Pneumonia, Heart Failure, and AMI Among Delta Region Hospitals, Delta State Hospitals, and Other Hospitals in the Nation[a]
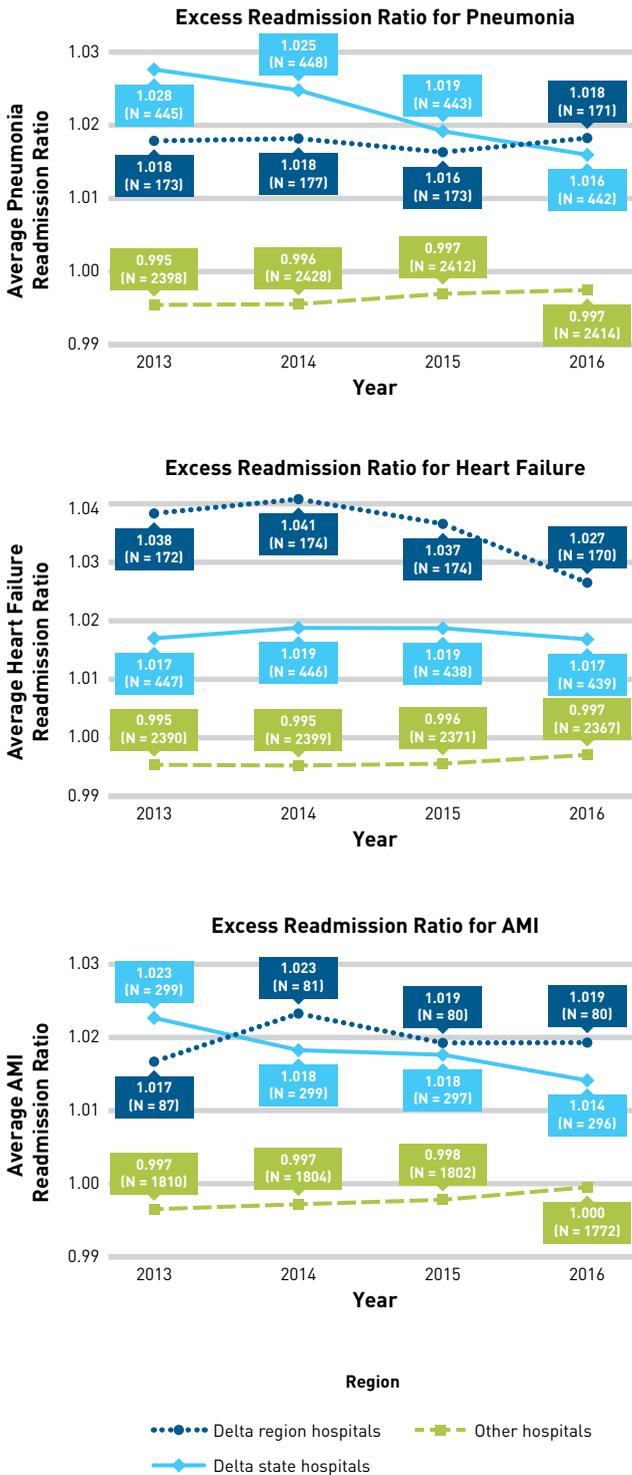
AMI indicates acute myocardial infarction.
[a]N indicates number of qualified hospitals.

TABLE 2. Results for Pneumonia, Heart Failure, and AMI From the Multivariate Regression Models[a]

	Pneumonia (n = 11,487)		Heart Failure (n = 11,382)		AMI (n = 8362)	
	Coefficient (SE)		Coefficient (SE)		Coefficient (SE)	
	Model Without Hospital and Community Factors	Model With Hospital and Community Factors	Model Without Hospital and Community Factors	Model With Hospital and Community Factors	Model Without Hospital and Community Factors	Model With Hospital and Community Factors
Delta region hospitals	0.21** (0.07)	0.03 (0.07)	0.42*** (0.09)	0.21* (0.10)	0.21* (0.10)	0.05 (0.10)
Delta state hospitals	0.32*** (0.009)	0.27*** (0.09)	0.22* (0.09)	0.21* (0.09)	0.26** (0.09)	0.25*** (0.07)
2014	0.01 (0.01)	0.01 (0.01)	−0.00 (0.01)	0.00 (0.01)	0.01 (0.02)	0.02 (0.02)
2015	0.02 (0.02)	0.04 (0.03)	0.00 (0.02)	0.02 (0.02)	0.02 (0.03)	0.04 (0.04)
2016	0.02 (0.02)	0.06 (0.04)	0.02 (0.03)	0.05 (0.03)	0.03 (0.04)	0.07 (0.06)
Delta region hospitals × 2014	0.01 (0.03)	0.02 (0.03)	0.03 (0.02)	0.03 (0.02)	0.05 (0.04)	0.07 (0.05)
Delta region hospitals × 2015	−0.02 (0.05)	−0.02 (0.04)	−0.02 (0.04)	−0.02 (0.04)	−0.00 (0.06)	0.01 (0.06)
Delta region hospitals × 2016	−0.01 (0.06)	−0.02 (0.05)	−0.15* (0.06)	−0.16** (0.06)	−0.02 (0.09)	−0.01 (0.09)
Delta state hospitals × 2014	−0.03 (0.02)	−0.02 (0.02)	0.02 (0.03)	0.01 (0.03)	−0.06 (0.04)	−0.06 (0.04)
Delta state hospitals × 2015	−0.10** (0.04)	−0.08* (0.04)	0.01 (0.05)	0.01 (0.06)	−0.07 (0.06)	−0.07 (0.05)
Delta state hospitals × 2016	−0.14*** (0.04)	−0.13** (0.05)	−0.03 (0.07)	−0.04 (0.08)	−0.12 (0.07)	−0.12 (0.08)
Hospital Characteristics						
For-profit hospitals		0.05 (0.04)		0.06 (0.04)		0.06 (0.04)
Public hospitals		−0.05 (0.03)		−0.03 (0.04)		−0.05 (0.03)
Major teaching hospitals		0.12** (0.04)		0.09* (0.05)		0.12* (0.05)
Minor teaching hospitals		0.04 (0.02)		−0.01 (0.03)		−0.03 (0.03)
Size in number of certified beds[b]		0.04 (0.02)		−0.04 (0.02)		−0.02 (0.02)
Percentage of Medicare patients		0.25* (0.13)		−0.11 (0.13)		−0.02 (0.17)
Percentage of Medicaid patients		0.05 (0.11)		−0.04 (0.12)		0.02 (0.12)
Community Characteristics						
PCPs per 1000 population		−0.44 (0.04)		−0.11* (0.05)		−0.01 (0.07)
Acute care hospital beds per 1000 population		0.01* (0.01)		0.01 (0.01)		0.01 (0.01)
SNF beds per 1000 population		0.01* (0.01)		0.00 (0.01)		0.01 (0.01)
Home health agencies		−0.00 (0.00)		0.00 (0.00)		0.00 (0.00)
Percentage of persons in poverty		−0.00 (0.00)		0.00 (0.00)		−0.01* (0.04)
Percentage of black population		0.84** (0.28)		0.91** (0.34)		1.19*** (0.29)
Percentage of Hispanic population		0.07 (0.23)		0.18 (0.26)		0.40 (0.23)
Unemployment rate (among residents ≥16 years)		0.02* (0.01)		0.02 (0.01)		0.02 (0.01)

AMI indicates acute myocardial infarction; PCP, primary care physician; SE, standard error; SNF, skilled nursing facility.

*P <.05; **P <.01; ***P <.001.

[a]Coefficients and SEs were multiplied by 10.

[b]Log-transformed.

between 2015 and 2013 and between 2016 and 2013 for Delta state hospitals were 1.0% (P <.01) and 1.4% (P <.001), respectively, lower than those for other hospitals. The difference in mean heart failure readmission ratios between 2016 and 2013 for Delta region hospitals was 1.5% (P <.05) lower than that for other hospitals.

After controls for hospital and community factors, the significant difference in readmission ratios for pneumonia and AMI between Delta region and other hospitals in 2013 became insignificant (P >.05). The significance level between Delta and other hospitals for heart failure in 2013 weakened from P <.001 to P <.05. The differences in

mean readmission ratios for heart failure between 2016 and 2013 for Delta region hospitals were 1.6% (P <.01) lower than those for other hospitals. For pneumonia and AMI, the results for differences in mean readmission ratios from 2014 to 2013 and from 2015 to 2013 between Delta region and other hospitals remained unchanged after controlling for hospital and community characteristics. For Delta state and other hospitals, the difference in readmission ratios for the study conditions between these 2 hospital groups in 2013 remained significant (P <.05 for heart failure and P <.001 for pneumonia and AMI). Additionally, the difference in mean readmission ratios between Delta state and other hospitals during the study period remained similar from the models with and without controls for hospital and community characteristics.

Some hospital and community characteristics were significantly associated with 30-day readmission ratios. The factors that were positively associated with readmission ratios were major teaching hospitals (P <.01 for pneumonia and P <.05 for both heart failure and AMI) and the percentage of black population (P values ranged from <.01 to <.001) for all 3 study conditions. The percentage of Medicare patients, number of acute care hospital beds, number of SNF beds, and unemployment rate were each positively associated with 30-day readmission ratios for pneumonia (P <.05 for all). However, an increase in the number of PCPs per 1000 population was associated with lower readmission ratios for heart failure (P <.05). Unexpectedly, increases in the percentage of persons in poverty were associated with lower readmission ratios for AMI (P <.05).

DISCUSSION

Our findings showed that disparities in readmissions among the 3 hospital groups exist and that hospital and community factors contribute to those disparities. In the models without controls for hospital and community characteristics, the findings showed that Delta region and Delta state hospitals had poorer performance on 30-day readmissions for all study conditions than did other hospitals. After controlling for those characteristics, the differences in 30-day readmission ratios between Delta region and other hospitals were weakened for all study conditions and became insignificant for pneumonia and AMI. However, the differences in 30-day readmission ratios between Delta state and other hospitals remained unchanged after controlling for hospital and community characteristics. A possible explanation is that community factors in our study were based on hospitals' locations rather than on patients' residential areas. Some patients in the Delta region might bypass regional hospitals and travel to Delta state hospitals for treatment, then return after hospitalization to the Delta, where there is a lack of postacute care resources. Under HRRP, hospitals are accountable for their patients' readmissions after the initial hospitalization, regardless of where patients reside and where they receive postacute care. Further studies based on patient-level data to examine this potential explanation are needed.

Our findings, consistent with those of previous studies,[2,8,9] showed that major teaching hospitals and a higher percentage of black population were associated with higher 30-day readmission ratios for all study conditions. Major teaching hospitals are part of the safety net that serves indigent populations. The variables of major teaching hospitals and percentage of black population may reflect community contextual factors that affect health outcomes but are not currently well measured. Although 30-day readmissions may be the result of poor transitions from the hospital to the community, our findings indicate that 30-day readmissions were also affected by community resources beyond the hospitals' control. CMS has implemented HRRP and continues payment reform toward value-based purchasing. To avoid unduly penalizing hospitals serving the poor, adjusting outcome measures to include measures of community contextual factors needs to be considered.

Unexpectedly, we found that an increase in the percentage of persons in poverty was associated with lower readmission ratios for AMI. Mortality rates are high for patients who have had an AMI if they cannot access treatment in a timely manner. Although evidence indicates that a hospital's mortality rate is not associated with 30-day readmissions for the general Medicare population with AMI,[18] future studies focusing on the relationship between mortality and readmissions for low-income individuals with AMI are recommended.

Although Delta region and Delta state hospitals have higher readmission ratios than other hospitals, the trends in the Figure, along with the negative coefficients for the interaction terms between study years and Delta region and Delta states in Table 2, indicate that Delta region and Delta state hospitals reduced 30-day readmissions more than other hospitals did over the study period. That is, overall disparities in 30-day readmissions for the study conditions among Delta region, Delta state, and other hospitals were reduced from 2013 to 2016 under HRRP.

Limitations

Our study has limitations. First, the 30-day readmission ratios in our study were extracted from CMS, which weights the ratios by a Bayesian hierarchical shrinkage approach that aligns small hospitals closer to the national average.[1,17] Delta region hospitals might receive higher weights than Delta state and other hospitals given the smaller average size of Delta region hospitals (Table 1). Second, we used county-level community characteristics. It is recommended that future studies measure community characteristics at a smaller geographic level, such as zip code or census tract, and sociodemographic status at the patient level to more precisely quantify the impact of these factors on readmissions among regions. Finally, there were variations in 30-day readmission ratios within each hospital group. Investigating the underlying factors associated with such variations within hospital groups is strongly recommended.

CONCLUSIONS

Despite these limitations, the findings from our study have implications for future studies and the revision of HRRP. Although our study and previous studies found that community factors matter, how these factors affect readmissions for each study condition is not fully understood. Future studies using multilevel approaches to investigate the pathways from disadvantaged communities to 30-day readmissions for CMS selected conditions are recommended.

Regarding policy implications, the goal of HRRP is to motivate hospitals to reduce 30-day readmissions. Evidence shows that readmissions for the study conditions have been reduced nationwide each year[19,20] and, thus, reach a new lower benchmark annually. To continue to motivate Delta region and Delta state hospitals and help them avoid Medicare patient revenue loss from HRRP penalties, stakeholders and policy makers should consider crediting hospitals for continuously reducing 30-day readmissions, even if their readmission rates are above the national average. Such an approach is consistent with CMS' adoption of an improvement score in the Hospital Value-Based Purchasing Program.[17] The inclusion of an improvement mechanism that can be used to compare hospitals' current readmission rates with their past readmission rates could mitigate limitations from unobserved factors associated with 30-day readmissions and would recognize the health needs of unique geographical areas. This would likely reduce the unintended consequences of HRRP that may, with reductions in Medicare reimbursement, threaten the healthcare delivery system in the Mississippi Delta region and other similarly underserved areas. ∎

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