

# How Have Hospitals in the Mississippi Delta Fared Under the 2019 Revised Hospital Readmissions Reduction Program?

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## Abstract

In 2013, the Centers for Medicare and Medicaid Services (CMS) implemented the Hospital Readmissions Reduction Program (2013 HRRP), which financially penalized hospitals if their 30-day readmissions were higher than the national average. Without adjusting for socioeconomic status of patients, the 2013 HRRP overly penalized hospitals caring for the poor, especially hospitals in the Mississippi Delta region, one of the poorest regions in the U.S. In 2019, CMS revised the HRRP (2019 Revised HRRP) to stratify hospitals into quintiles based on the proportion of patients that are dual-eligible Medicare and Medicaid beneficiaries. This study aimed to examine the effect of the 2019 Revised HRRP on financial penalties for Delta hospitals using a difference-in-difference (DID) approach with data from the 2018 and 2019 HRRP Supplemental Files. The DID analysis found that relative to non-Delta hospitals, penalties in Delta hospitals were reduced by 0.08 percentage points from 2018 to 2019 (95% CI for the coefficient:  $-0.15, -0.01$ ;  $P = .02$ ), and the probability of a penalty was reduced by 6.64 percentage points (95% CI for the coefficient:  $-9.54, -3.75$ ;  $P < .001$ ). The stratification under the 2019 Revised HRRP is an important first step in reducing unfair penalties to hospitals that serve poor populations.

## Keywords

Medicare, 30-day readmissions, stratification, financial penalty, difference-in-difference

### What do we already know about this topic?

Hospitals in the Mississippi Delta Region were overly penalized under the 2013 Hospital Readmissions Reduction Program that was based on the national average of 30-day readmissions.

### How does your research contribute to the field?

The 2019 Revised Hospital Readmissions Reduction Program that stratified hospitals based on their proportion of dual-eligible Medicare and Medicaid beneficiaries eased financial penalty for hospitals in the Mississippi Delta Region

### What are your research's implications toward theory, practice, or policy?

Payment for penalty based on quality performance of providers should take socioeconomic status of patients into account.

## Introduction

According to 2004 estimates in the United States, the 30-day hospital readmission rate among Medicare fee-for-service beneficiaries was approximately 20%, ranging from 13.3% in the state of Idaho to 23.2% in Washington, DC.<sup>1</sup> The high rate of hospital readmissions represents poor quality of inpatient care and poor transition from hospitals to homes, which is risky to Medicare beneficiaries and cost the Medicare program about \$17 billion.<sup>1</sup> Hospitals are paid by the inpatient prospective payment system through the diagnosis-related groups (DRG) that covers the services during hospitalizations and admission-related outpatient services prior to hospitalization.<sup>2</sup> Therefore,

prior to 2013, hospitals did not have an incentive to collaborate with other health care providers to reduce the probability of a patient having a subsequent hospital stay after discharge.

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Hospital Readmissions Reduction Program (HRRP).

One goal of the Affordable Care Act (ACA) is to reduce 30-day hospital readmissions. The ACA required the Centers for Medicare and Medicaid Services (CMS) to implement the Hospital Readmissions Reduction Program (HRRP) in 2013 (“2013 HRRP”) in order to reduce 30-day hospital readmissions.<sup>3</sup> All acute general hospitals with at least 25 cases for selected conditions were subject to the HRRP, with some exceptions (eg, critical access hospitals and hospitals in Maryland). The selected conditions in 2013 included heart failure, acute myocardial infarction, and pneumonia. Chronic obstructive pulmonary disease and elective total knee and hip replacement were added in October 2014, and coronary artery bypass grafting was added in October 2016. The 2013 HRRP used the excess readmission ratio (ERR), defined as the ratio of predicted-to-expected 30-day readmissions, at the national level and applied financial penalties to hospitals with an ERR greater than 1 for readmissions from the list of selected conditions. The ratio of predicted-to-expected 30-day readmissions at the national level was adjusted by patient demographics (ie, gender and age) and clinical risk factors (eg, comorbidities). The financial penalty based on the total DRG payment was up to 1% in 2013, 2% in 2014, and 3% in 2015 and afterwards.<sup>3</sup>

## 2019 Revised HRRP

Annually, more than 3000 hospitals were subject to the 2013 HRRP. The percent of hospitals receiving financial penalty was increased from 64% in 2013 to 79% in 2017. The total amount of penalties from all hospitals increased from \$290 million in 2013 to \$528 million in 2017.<sup>4</sup> However, the 2013 HRRP did not adjust for social risk factors, and there was a positive association between the percent of dual-eligible beneficiaries hospitals served and the financial penalty among hospitals.<sup>4,5</sup> Financial penalty disproportionately fell on safety-net hospitals and teaching hospitals that care for the poor or people living in disadvantaged communities.<sup>6-10</sup> The American Hospital Association and Medicare Payment Advisory Commission urged CMS to include patient socioeconomic status as risk factors in the penalty calculations for the HRRP program to avoid overpenalizing safety-net hospitals.<sup>5,11</sup>

In response, Congress passed the 21st Century Cures Act in 2016. The Act required CMS to adjust for socioeconomic status in the HRRP.<sup>12</sup> CMS implemented a revision to the HRRP methodology in 2019 (“2019 Revised HRRP”).<sup>13</sup> The primary modification under the 2019 Revised HRRP was to stratify hospitals into 5 peer groups and to use the median ERR calculated within hospital peer groups. The revised approach compares 30-day readmissions to the median ERR within a peer group (quintile), rather than the ERR at the national level. Five peer groups were defined based on quintiles of the proportion of dual-eligible beneficiaries treated

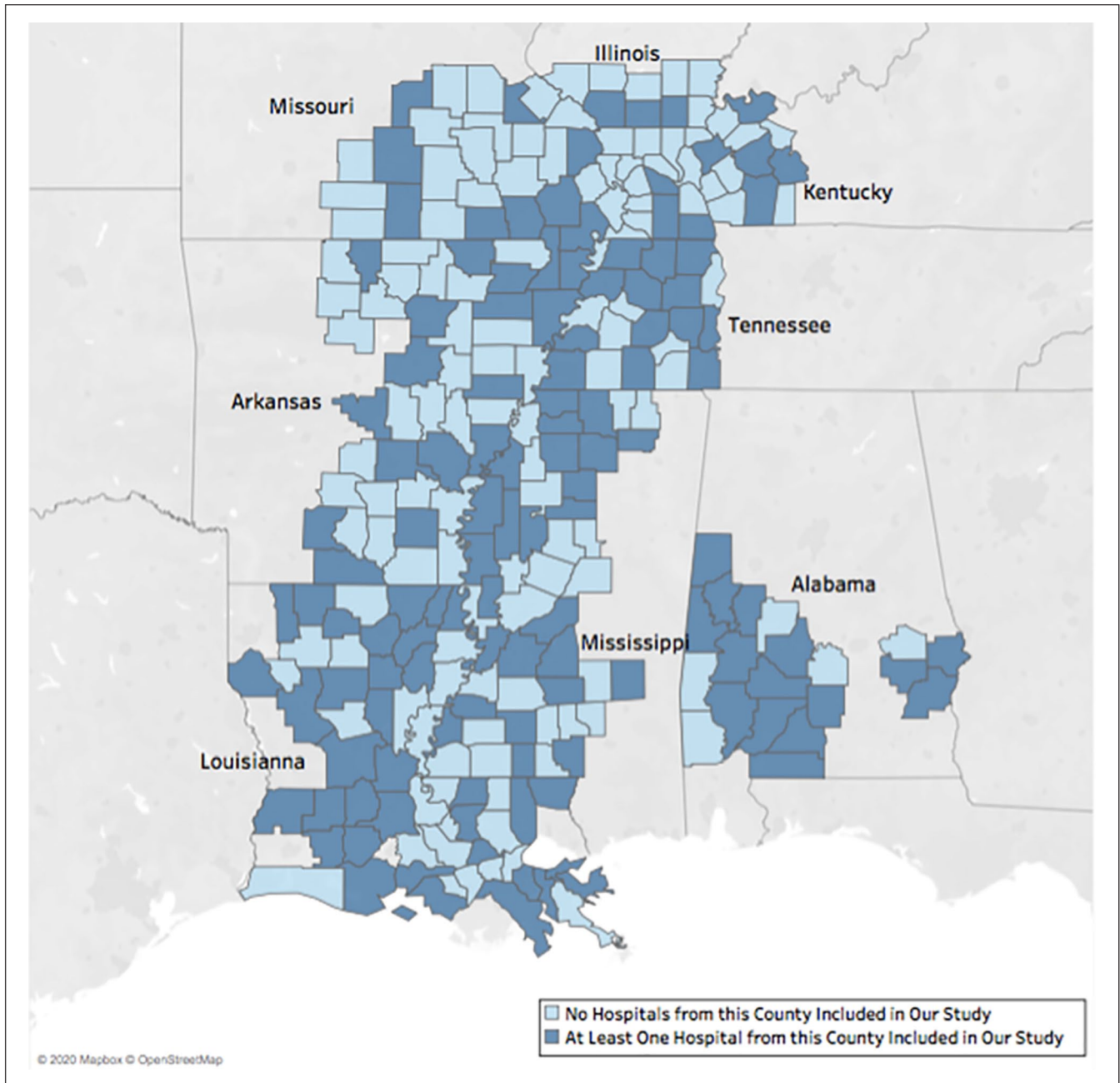
by hospitals. Hospitals in Quintile 1 had the lowest proportion of dual-eligible beneficiaries (ranging from 0.2% to 13.7%), and hospitals in Quintile 5 had the highest proportion (ranging from 31.0% to 93.8%). The quintile stratification has arguably created a more equitable comparison group for hospitals that treat high-risk populations.<sup>14</sup>

An initial evaluation of the 2019 Revised HRRP found that hospitals in disadvantaged communities and hospitals that treat a higher proportion of dual-eligible beneficiaries were more likely to see a significant reduction in their penalties based on the 2019 Revised HRRP methodology, compared to the ones based on the original 2013 HRRP methodology.<sup>14,15</sup> However, the 2019 HRRP stratification system is influenced by the state-level Medicaid eligibility threshold for aged and disabled adults (hereafter referred to as “eligibility threshold”), which varies across states and may affect financial penalties for hospitals. For example, California is tied for the most generous Medicaid threshold (100% Federal Poverty Level [FPL]) and saw the greatest relative reduction in financial penalties from FY 2018 to FY 2019 while South Dakota, who has the next to least generous threshold (74% FPL), experienced the relatively largest increase in financial penalties.<sup>15</sup>

## The Mississippi Delta Region

The Mississippi Delta region lies between the Mississippi River and Yazoo River (see Figure 1 for the map) and is well known for its poverty and concentration of individuals with multiple adverse social determinants of health.<sup>16,17</sup> The region is one of the most disadvantaged areas in the United States, with poor health infrastructures and high concentrations of at-risk populations, including those of low socioeconomic status and racial/ethnic minorities.<sup>17,18</sup> The region spans 252 counties across 8 states: Alabama, Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee. The state-level Medicaid eligibility thresholds in the Mississippi Delta region, on average, are lower than (ie, less generous) those in other states in the country.<sup>19</sup> A previous evaluation of the 2013 HRRP found that hospitals operating in the Mississippi Delta region (“Delta hospitals”) were more likely to receive a penalty than hospitals outside of the Mississippi Delta region (“non-Delta hospitals”).<sup>20</sup> With high poverty but low generosity in the Medicaid program in the region, differences in penalties among Delta and non-Delta hospitals under the 2019 Revised HRRP is unknown.

Existing evidence based on the 2019 Revised HRRP suggests 2 different possibilities for the likelihood of financial penalties for Delta hospitals.<sup>14,15</sup> One is that the 2019 Revised HRRP reduces the probability of a financial penalty for Delta hospitals compared to non-Delta hospitals because Delta hospitals treat a high proportion of dual-eligible beneficiaries. On the other hand, with less generosity of the Medicaid program among states in the Mississippi Delta region, Delta



**Figure 1.** Map of the Mississippi Delta Region (N=252).

hospitals may not be benefited from the stratification system that shifted financial penalties from states with more generous Medicaid programs to states with less generous Medicaid programs.

The purpose of the present study was to examine changes in financial penalties for Delta hospitals under the 2019 Revised HRRP, by comparing the change in the likelihood of receiving a penalty and the change in percent penalty between Delta and non-Delta hospitals. The findings from the present study provides critical information for policymakers and stakeholders as CMS moves the HRRP forward.

## Material and Methods

### Data Sources

The data for this study come from multiple national data sources. CMS's HRRP Supplemental Files from FY 2018 and FY 2019 contained hospital-level penalties under the HRRP program. CMS's Provider of Services (POS) Files provided hospital-level characteristics (eg, ownership and teaching status). Information from the HRRP Supplemental Files and the POS files were merged using Medicare provider identification numbers.

Except for county-level Delta designation and state-level Medicaid eligibility thresholds as a percent of the FPL,<sup>16,19</sup> we extracted all county-level information from the Area Health Resources File (AHRF). Information from the AHRF and Delta designation were merged to hospitals at the county level using Federal Information Processing Standards codes. State-level Medicaid eligibility thresholds were merged with hospitals at the state level.

To determine hospital-level financial penalties for the HRRP program, CMS assesses Medicare claims retrospectively. Specifically, the HRRP penalties for FY 2018 were based on Medicare claims data from July 1, 2013 through June 30, 2016, and penalties for FY 2019 were based on Medicare claims data from July 1, 2014 through June 30, 2017. Therefore, to coordinate area-level information with the HRRP penalties for FY 2018 and FY 2019, we used information from the POS and AHRF from 2015 and 2016, respectively, which represents the last full year of the associated claims data for each penalty year.

### Study Design and Study Sample

The study was a balanced panel study design, and the unit of analysis was the hospital. The study sample included all acute-care hospitals that were subject to the HRRP in both FY 2018 and FY 2019. Hospitals not qualified for the HRRP (eg, critical access hospitals, hospitals in Maryland, or hospitals with less than 25 cases annually for an individual condition selected by CMS) are not captured in the HRRP Supplemental Files and were excluded from the study.

### Variable Measures

**Dependent variables.** The primary outcomes of this study included (1) the percent financial penalty incurred by a hospital and (2) a binary variable indicating whether the hospital incurred any financial penalty. The payment adjustment factor in the 2018 and 2019 HRRP Supplemental Files ranged from 1 (ie, no penalty) to 0.97 (ie, the maximum penalty of 3% of the total DRG payment). The percent financial penalty used in our study was determined by subtracting the penalty adjustment factor from 1, and multiplying that value by 100, resulting in a range of 0% to 3%. Our binary variable was equal to 1 for hospitals receiving any financial penalty and equal to 0 for hospitals that did not receive a financial penalty.

**Independent variables.** The primary exposure variable was the interaction of Delta hospitals and fiscal year (FY) 2019. Specifically, Delta status was a binary variable equal to 1 for hospitals operating in a Delta designated county (0 for hospitals outside of the Delta designated county). The binary variable for FY 2019 (1 for FY 2019 and 0 for FY 2018) represents the year under the 2019 Revised HRRP.

Hospital-level covariates from the POS files included ownership (not-for-profit, for-profit, and public), the number

of certified beds (<200, 200-399, and  $\geq$ 400), and teaching status (non-teaching and teaching). From the HRRP Supplemental Files, we obtained the hospital peer group quintile (Quintiles 1 through 5) and the total number of the 6 CMS-selected conditions for which the hospital was eligible for the HRRP penalty by having at least 25 cases in a year. Note that the hospital peer group quintile was only available in the HRRP Supplemental File for the 2019 Revised HRRP, which we used for both years of data. Community characteristics at the county level from the AHRF included the percentage of persons in poverty, number of primary care physicians per 1000 residents, acute-care hospital beds per 1000 residents, skilled-nursing facility beds per 1000 residents, percentage of the non-Hispanic Black population, percentage of the Hispanic population, and the unemployment rate. The Medicaid Eligibility Threshold was determined at the state-level and was taken from 2015.<sup>19</sup>

**Analytical approach.** Descriptive statistics compared characteristics of hospitals in Delta counties to those in non-Delta counties in FY 2018 (ie, penalty under the 2013 HRRP with no stratification by dual-eligibility peer group) and in FY 2019 (ie, penalty under the 2019 Revised HRRP with stratification by dual-eligibility peer group). Descriptive tests included *t*-tests for continuous variables and chi-squared tests for categorical variables. Next, we used *t*-tests to compare the difference in financial penalties between FY 2018 and FY 2019, stratified by Delta county status and by hospital peer group.

This study used a difference-in-differences (DID) approach, which is commonly used to examine the impact of an intervention or policy change on 2 groups.<sup>21,22</sup> We used DID to compare changes in financial penalties and the probability of receiving a financial penalty between Delta and non-Delta hospitals following the introduction of the revised HRRP. The DID approach can be used to control for secular changes that may impact HRRP penalties outside of the changes in the HRRP program itself. The DID models were estimated using multivariable random-effects linear regression controlling for hospital and area-level factors with robust standard errors clustered at the state level. In the DID approach, the key coefficient of interest is the interaction between the binary variables indicating Delta hospital status and FY 2019.

Analyses were completed in Stata version 12.0. A 2-sided  $P \leq .05$  was considered statistically significant.

### Results

From the 3420 hospitals in the FY 2018 and FY 2019 HRRP Supplemental Files, 277 hospitals with only 1 year of penalty information were removed from the study. The final study sample had 3143 hospitals, including 2967 hospitals from non-Delta counties and 176 hospitals from Delta counties. All 8 Delta states were represented in the study data.



**Table 1.** Average of 2018 and 2019 Percent Financial Penalty<sup>a</sup> among Hospitals Within Delta and Non-Delta Counties in Years 2018 and 2019, by Hospital Peer Group (N=Number of Hospitals in Each Group).

Peer group	Delta hospitals					Non-delta hospitals				
	N	2018	2019	Difference (95% CI)	P-value <sup>b</sup>	N	2018	2019	Difference (95% CI)	P-value <sup>b</sup>
1	13	0.43	0.40	-0.02 (-0.62, 0.58)	.94	608	0.54	0.61	0.07 (-0.02, 0.16)	.13
2	16	0.83	0.91	0.08 (-0.54, 0.70)	.79	613	0.55	0.60	0.06 (-0.14, 0.13)	.12
3	25	0.58	0.53	-0.05 (-0.32, 0.22)	.72	605	0.58	0.59	0.02 (-0.06, 0.09)	.70
4	51	0.74	0.76	0.18 (-0.29, 0.33)	.91	582	0.63	0.58	-0.05 (-0.13, 0.03)	.20
5	71	0.66	0.38	-0.28 (-0.48, -0.09)	<.01	559	0.67	0.50	-0.18 (-0.25, -0.11)	<.001

<sup>a</sup>Percentage of financial penalty = (1 - penalty adjustment factor) × 100.

<sup>b</sup>P-value from 2-sided t-test.

Table 1 provides *t*-tests for differences in unadjusted financial penalties between FY 2018 and FY 2019, stratified by hospital peer group quintiles and Delta county status. A statistically significant difference in penalty between FY 2018 and FY 2019 was only found for Delta and non-Delta hospitals in Quintile 5. Specifically, there was a 0.28 percentage point reduction ( $P=.004$ ) for Delta county hospitals in Quintile 5, and a 0.18 percentage point reduction for non-Delta hospitals in Quintile 5 ( $P<.001$ ).

Table 2 provides the descriptive statistics comparing Delta hospitals and non-Delta hospitals, stratified by penalty year. In both years, Delta and non-Delta hospitals were different with respect to the majority of hospital-level characteristics. In FY 2018, Delta hospitals were less likely to be not-for-profit (36.36% vs 61.54%;  $P<.001$ ), more likely to have fewer than 200 beds (73.30% vs 55.95%;  $P<.001$ ), and more likely to be a non-teaching hospital (77.84% vs 66.46%;  $P<.001$ ) compared to non-Delta hospitals. Hospitals in Delta counties additionally were eligible for fewer of the 6 CMS selected conditions relative to non-Delta hospitals (3.82 vs 4.53;  $P<.001$ ). Of significance, Delta counties were more likely to be in peer group quintiles with higher percentages of dual-eligible beneficiaries. Specifically, 40.34% of Delta hospitals were in Quintile 5 while 18.84% of non-Delta hospitals were in Quintile 5 ( $P<.001$ ).

Delta and non-delta counties differed on all area-level characteristics (Table 2; examples in text from FY 2018). Delta-designated counties had a higher proportion of individuals in poverty (23.38% vs 15.86%;  $P<.001$ ), fewer primary care physicians per 1000 residents (0.54 vs 0.67;  $P<.001$ ), a greater number of hospital beds per 1000 residents (4.36 vs 3.28;  $P<.001$ ) and skilled nursing facility beds per 1000 residents (9.43 vs 6.65;  $P<.001$ ), a higher proportion of the non-Hispanic Black population (31.50 vs 9.74;  $P<.001$ ), a lower proportion of the Hispanic population (2.96 vs 10.89;  $P<.001$ ), a higher unemployment rate (7.38 vs 5.51;  $P<.001$ ), and a lower Medicaid eligibility threshold as a percent of FPL (77.08 vs 84.86;  $P<.001$ ).

Table 3 provides the adjusted percentage point changes in financial penalties and the adjusted percentage point changes in the probability of a financial penalty for each of the

independent variables in the study. Delta hospitals had a reduction of 0.08 percentage points from FY 2018 to FY 2019 (95% CI: -0.15, -0.01;  $P=.02$ ) relative to the change in a financial penalty for non-Delta hospitals. With respect to the change in the probability of receiving a financial penalty, Delta hospitals had a reduction of 6.64 percentage points from FY 2018 to FY 2019 (95% CI -9.54, -3.75;  $P<.001$ ) relative to non-Delta hospitals.

Additionally, several control variables were significantly associated with the primary outcome measures. For example, public hospitals had relatively higher financial penalty (0.18 percentage points; 95% CI: 0.11, 0.24;  $P<.001$ ) and probability of receiving a financial penalty (4.56 percentage points; 95% CI: 1.16, 7.96;  $P=.009$ ) compared to not-for-profit hospitals. Additionally, there was an increase in financial penalties by 0.09 percentage points (95% CI: 0.06, 0.11;  $P<.001$ ) and an increase in the probability of receiving financial penalty by 12.03 percentage points (95% CI: 10.86, 13.20;  $P<.001$ ) for each additional condition for which a hospital was eligible for the HRRP penalty. For community characteristics at the county level, a 1 standard deviation (SD) increase in the percentage of people in poverty (SD=5.18) was associated with a 2.18 percentage point ( $=-0.42 \times 5.18$ ) reduction in the probability of receiving a financial penalty (95% CI for the coefficient: -0.73, -0.10;  $P=.009$ ). A 1 SD increase in the percentage of the non-Hispanic Black population (SD=13.41) was associated with an increase in the probability of receiving financial penalty by 3.22 percentage points (95% CI for the coefficient: 0.12, 0.36;  $P<.001$ ). Finally, a 1 SD increase in the unemployment rate (SD=1.60) was associated with a 0.06 percentage point increase in financial penalties (95% CI for the coefficient: 0.01, 0.07;  $P=.006$ ) and a 2.40 percentage point increase in the probability of receiving a financial penalty (95% CI for the coefficient: 0.37, 2.63;  $P=.009$ ).

## Discussion

This study found that under the 2019 Revised HRRP, Delta hospitals had a reduction in financial penalties for DRG payments as well as a reduction in the probability of receiving a

**Table 2.** Descriptive Statistics of Hospitals and Counties, by Year and Delta County Status.

	2018 HRRP penalty year			2019 HRRP penalty year		
	Delta (N=176)	Non-delta (N=2967)	P- value <sup>a</sup>	Delta (N=176)	Non-delta (N=2967)	P- value <sup>a</sup>
Dependent variables						
Percent financial penalty <sup>b</sup>	0.67 (0.05)	0.59 (0.01)	.15	0.56 (0.5)	0.58 (0.01)	.74
Receiving financial penalty	84.66	81.02	.23	78.98	82.61	.22
Hospital-level characteristics						
Ownership						
Not-for-profit <sup>c</sup>	36.36	61.54	<.001	36.93	62.29	<.001
For-profit	35.80	17.93		34.66	17.39	
Public	27.84	20.53		28.41	20.32	
Number of beds						
Small (<200) <sup>c</sup>	73.30	55.95	<.001	73.30	55.68	<.001
Medium (200-399)	15.34	26.96		15.34	27.17	
Large (≥400)	11.36	17.09		11.36	17.16	
Teaching status						
Non-teaching <sup>c</sup>	77.84	66.46	.002	78.41	65.69	.001
Teaching	22.16	33.54		21.59	34.31	
Total number of eligible conditions <sup>d</sup>	3.82 (0.12)	4.53 (0.03)	<.001	3.80 (0.12)	4.52 (0.03)	<.001
Peer group assignment						
Quintile 1 <sup>c</sup>	7.39	20.49	<.001	7.39	20.49	<.001
Quintile 2	9.09	20.66		9.09	20.66	
Quintile 3	14.20	20.39		14.20	20.39	
Quintile 4	28.98	19.62		28.98	19.62	
Quintile 5	40.34	18.84		40.34	18.84	
County-level community factors <sup>e</sup>						
Percent of individuals in poverty	23.38 (0.60)	15.86 (0.16)	<.001	23.16 (0.58)	15.28 (0.15)	<.001
Primary care physicians per 1000	0.54 (0.02)	0.67 (0.01)	<.001	0.54 (0.02)	0.66 (0.01)	<.001
Hospital beds per 1000	4.36 (0.37)	3.28 (0.09)	<.001	4.30 (0.36)	3.23 (0.09)	<.001
Skilled nursing facility beds per 1000	9.43 (0.43)	6.65 (0.11)	<.001	9.56 (0.43)	6.67 (0.11)	<.001
Percent Black	31.50 (1.95)	9.74 (0.33)	<.001	31.58 (1.98)	9.75 (0.34)	<.001
Percent Hispanic	2.96 (0.18)	10.89 (0.38)	<.001	3.00 (0.18)	11.00 (0.38)	<.001
Unemployment rate	7.38 (0.18)	5.51 (0.05)	<.001	6.77 (0.18)	5.22 (0.05)	<.001
Medicaid eligibility threshold <sup>f</sup>	77.08 (0.00)	84.86 (0.00)	<.001	77.08 (0.00)	84.86 (0.00)	<.001

<sup>a</sup>Tests for significance included *t*-tests for continuous variables and chi-squared tests for categorical variables. Values for continuous variables including mean and standard errors, and values for categorical variables include percentages.

<sup>b</sup>Percentage of financial penalty = (1 - penalty adjustment factor) × 100.

<sup>c</sup>Reference group in multivariable analyses.

<sup>d</sup>A hospital must have at least 25 hospitalizations to be eligible for penalty for 1 of the 6 hospitalization conditions.

<sup>e</sup>County-level information, with the exception of Medicaid-eligibility, came from the Area Health Resources File. County-level data that corresponds with the HRRP penalties for 2018 came from 2015, and data corresponding with the HRRP penalties for 2019 came from 2016.

<sup>f</sup>Medicaid eligibility threshold for aged adults as a percent of the Federal Poverty Level were at the state-level and were from 2015.

penalty compared to non-Delta hospitals. The findings support the assumption that the 2019 Revised HRRP eased the financial penalty for Delta hospitals. Although states in the Delta region, on average, were less generous than other states in non-Delta region, our study did not support the second assumption—Delta hospitals may not be benefited from the 2019 Revised HRRP—because Delta hospitals operated in the region with a high poverty rate. Among all Delta hospitals, about 40% of Delta hospitals were grouped in Quintile 5, the peer group with the highest percentage of dual-eligible patients.

We found high reductions in the penalties for both Delta and non-Delta hospitals in Quintile 5, which is consistent with existing evidence regarding greater reductions in penalties among hospitals with a higher proportion of dual-eligible beneficiaries.<sup>14</sup> In the 2013 HRRP that used the ERR at the national level, the hospitals in Quintile 5 had high penalties that were likely related to the relatively higher-risk patients. By comparing the ERR within peer groups, the 2019 Revised HRRP takes patient socioeconomic status into account, which would avoid overly penalizing safety-net hospitals that care for the poor.

**Table 3.** Difference-in-Differences Estimates from Multivariable Linear Regression: Percentage Point Change in Financial Penalty<sup>a</sup> and Percentage Point Change in Probability of Receiving a Financial Penalty between Delta and non-Delta Hospitals under the 2019 Revised Hospital Readmissions Reduction Program (n = 6286).

	Percentage point change in financial penalty			Percentage point change in probability of receiving a financial penalty		
	Percentage point change	95% CI	P-value <sup>a</sup>	Percentage point change <sup>b</sup>	95% CI	P-value <sup>a</sup>
Delta hospital	-0.10	(-0.33, 0.12)	.37	-1.46	(-9.61, 6.70)	.73
FY 2019	-0.00	(-0.03, 0.03)	.97	2.05	(0.18, 3.92)	.03
Delta hospital*FY 2019	-0.08	(-0.15, -0.01)	.02	-6.64	(-9.54, -3.75)	<.001
Ownership						
Not-for-profit	Ref	Ref	Ref	Ref	Ref	Ref
For-profit	-0.01	(-0.07, 0.05)	.81	2.01	(-1.33, 5.34)	.24
Public	0.18	(0.11, 0.24)	<.001	4.56	(1.16, 7.96)	.009
Number of beds						
Small (<200)	Ref	Ref	Ref	Ref	Ref	Ref
Medium (200-399)	0.00	(-0.05, 0.06)	.96	-4.63	(-7.78, -1.48)	.004
Large (≥400)	-0.15	(-0.22, -0.07)	<.001	-8.82	(-13.36, -4.28)	<.001
Teaching status						
Non-teaching	Ref	Ref	Ref	Ref	Ref	Ref
Teaching	-0.09	(-0.14, -0.04)	.001	-1.60	(-3.79, 0.59)	.15
Total number of eligible conditions <sup>c</sup>	0.09	(0.06, 0.11)	<.001	12.03	(10.86, 13.20)	<.001
Peer group assignment						
Quintile 1	Ref	Ref	Ref	Ref	Ref	Ref
Quintile 2	-0.06	(-0.15, 0.03)	.19	6.65	(2.92, 10.38)	<.001
Quintile 3	-0.04	(-0.15, 0.08)	.52	8.46	(3.86, 13.07)	<.001
Quintile 4	-0.03	(-0.14, 0.07)	.54	11.66	(6.72, 16.59)	<.001
Quintile 5	-0.03	(-0.16, 0.11)	.68	16.90	(10.94, 22.85)	<.001
Percent of individuals in poverty	-0.00	(-0.01, 0.00)	.22	-0.42	(-0.73, -0.10)	.01
Primary care physicians per 1000 population	-0.07	(-0.15, 0.02)	.13	-2.66	(-7.73, 2.42)	.30
Hospital beds per 1000 population	0.01	(-0.01, 0.02)	.21	-0.10	(-0.70, 0.51)	.75
Skilled nursing facility beds per 1000 population	-0.01	(-0.01, 0.00)	.06	-0.42	(-0.80, -0.05)	.03
Percent Black	0.00	(-0.00, 0.01)	.16	0.24	(0.12, 0.36)	<.001
Percent Hispanic	-0.00	(-0.00, 0.00)	.27	-0.11	(-0.19, -0.03)	.01
Unemployment rate	0.04	(0.01, 0.07)	.006	1.50	(0.37, 2.63)	.009
Medicaid eligibility threshold	-0.15	(-0.57, 0.27)	.50	-5.40	(-28.09, 17.28)	.64

<sup>a</sup>Percentage of Financial Penalty = (1 - penalty adjustment factor) × 100.

<sup>b</sup>Coefficients from the linear probability model were multiplied by 100 to provide percentage point changes.

## Limitations

There are limitations to this study. First, we were not able to measure the change in the amount of financial payment because we did not have the total dollar amount of DRG payment for each hospital. Nevertheless, the percentage change in payment reductions between FY 2018 and FY 2019 is still informative since the total DRG payment for each hospital is unlikely to dramatically change in such a short time frame. Second, we are limited to only 1 year of data under the 2019 Revised HRRP as the program is still in its infancy. Future studies using additional years of data may allude to the long-term impact of the 2019 Revised HRRP on financial penalties. Finally, we controlled the characteristics of the county

in which a hospital operated because we were not able to obtain patient-level data. Although most patients seek care from hospitals near them, patients may also travel between counties to seek care, especially for high risk conditions such as coronary artery bypass grafting or treatment for acute myocardial infarction. Readers need to be aware of the limitations from the county-level characteristics.

## Policy Implications

Despite the limitations, our findings have implications. First, not every Delta hospital in the region was assigned to hospital peer groups with high proportions of dual-eligible beneficiaries. For example, 16% (29/176) of Delta hospitals were

assigned to 1 of the 2 peer groups with the lowest percentage of dual-eligible beneficiaries, which indicated that there is a variation in socioeconomic status among residents as well as community resources in the Delta region. In order to help policymakers address disparities within the Delta region, as well as address the disparities between Delta and non-Delta regions, future studies that focus on variations in the Delta region and identify areas with the poorest health care infrastructure and population health within the Delta region are recommended.

Second, although the stratification system eased the penalty for hospitals in Quintile 5, the variation in the proportion of dual-eligible beneficiaries within the peer group was high in Quintile 5, which ranged from 31.0% to 93.8%.<sup>14</sup> Additionally, several county-level characteristics were significantly associated with the likelihood of penalty and percent penalty in our study. The wide range of the proportion of dual-eligible beneficiaries in Quintile 5 and the county-level characteristics significantly associated with penalty suggest that this quintile stratification system in the 2019 Revised HRRP still have inadequate penalty adjustments. Collecting socioeconomic status and other social risk factors at the patient level and included them in the HRRP is recommended. Finally, the HRRP is a single value-based purchasing programs for hospitals. As CMS and other payers continue to increase the use of value-based reimbursement for other care settings, such as nursing home and home health,<sup>23</sup> the findings from our study can help elucidate the need to adjust for socioeconomic status in other value-based program.

## Conclusion

This study assessed the 2019 Revised HRRP methodology on changes in financial penalties among hospitals in the Mississippi Delta region. We found that Delta hospitals had relatively greater reductions in penalties relative to non-Delta hospitals. Stratification by the proportion of dual-eligible patients under the 2019 Revised HRRP has been an important first step in reducing unfair penalties to hospitals that treat vulnerable populations.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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## Data Availability Statement

The data that support the findings of this study are available upon request from the National Center for Health Statistics of the Centers for Disease Control and Prevention. Restrictions apply to the availability of these data, which were used under for this study. Data are available at <https://www.cdc.gov/nchs/nvss/nvss-restricted-data.htm> with the permission of the National Center for Health Statistics.

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