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RESEARCH ARTICLE

The Medicare Hospital Readmissions Reduction Program: Potential Unintended Consequences for Hospitals Serving Vulnerable Populations

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Objective. To explore the impact of the Hospital Readmissions Reduction Program (HRRP) on hospitals serving vulnerable populations.

Data Sources/Study Setting. Medicare inpatient claims to calculate condition-specific readmission rates. Medicare cost reports and other sources to determine a hospital's share of duals, profit margin, and characteristics.

Study Design. Regression analyses and projections were used to estimate risk-adjusted readmission rates and financial penalties under the HRRP. Findings were compared across groups of hospitals, determined based on their share of duals, to assess differential impacts of the HRRP.

Principal Findings. Both patient dual-eligible status and a hospital's dual-eligible share of Medicare discharges have a positive impact on risk-adjusted hospital readmission rates. Under current Centers for Medicare and Medicaid Service methodology, which does not adjust for socioeconomic status, high-dual hospitals are more likely to have excess readmissions than low-dual hospitals. As a result, HRRP penalties will disproportionately fall on high-dual hospitals, which are more likely to have negative all-payer margins, raising concerns of unintended consequences of the program for vulnerable populations.

Conclusions. Policies to reduce hospital readmissions must balance the need to ensure continued access to quality care for vulnerable populations.

Key Words. Readmissions, Medicare, Medicaid, dual eligibles, Affordable Care Act

Reducing preventable hospital readmissions has been a focal point in health policy discussions as a means for improving quality of care while cutting costs. Jencks, Williams, and Coleman (2009) report that nearly one in five Medicare patients discharged from a hospital is readmitted within 30 days (Jencks,

Williams, and Coleman 2009). In its June 2007 Report to Congress, the Medicare Payment Advisory Commission (MedPAC) estimated that Medicare spent $12 billion on potentially preventable readmissions within 30 days after discharge in 2005 (Medicare Payment Advisory Commission [MedPAC] 2007).

In Section 3025 of the Affordable Care Act (ACA), the Centers for Medicare and Medicaid Services (CMS) is mandated to make progressive reductions in Medicare payments to hospitals that have high rates of readmissions for Medicare beneficiaries. The maximum payment reductions are 1 percent in fiscal year (FY) 2013, 2 percent in FY 2014, and 3 percent in FY 2015 and beyond. The payment reductions are based on readmission rates for three conditions—heart failure, acute myocardial infarction (AMI), and pneumonia—and will be expanded to additional conditions in future years. In FY 2013, a total of 2,217 hospitals will be penalized for excessive readmissions, with 307 of these hospitals receiving the maximum penalty of 1 percent of their regular Medicare reimbursement (Rau 2012).

To implement the Hospital Readmissions Reduction Program (HRRP), CMS uses 30-day risk-adjusted all-cause readmission rates endorsed by the National Quality Forum, as currently reported on Hospital Compare (U.S. Department of Health and Human Services 2012). The risk-adjustment method adjusts for age, gender, and comorbidities, but it does not account for other factors, such as race and socioeconomic status, that are associated with higher readmissions.

Previous studies have highlighted the shortcomings of using hospital readmissions measures as quality indicators, particularly for hospitals that serve minorities and disadvantaged patients. In their review of hospital readmissions studies, Bhalla and Kalkut (2010) find several examples of significant relationships between readmissions and socioeconomic variables, such as race, ethnicity, income, and living status. With little control over these variables, they argue that hospitals should be assessed based on changes in their own performance over time, rather than compared with other hospitals' per-

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formance. Using 2008 Medicare data, McHugh, Carthon, and Kang (2010) find that African-American Medicare beneficiaries with heart failure, AMI, and pneumonia were more likely than whites to be readmitted after an initial hospitalization. Hispanic beneficiaries also face higher odds of readmission for AMI. A broad range of other personal and socioeconomic factors that impact readmission rates have been reported in other studies, including social support, education, income, employment status, home stability, and risk behaviors (Schwarz and Elman 2003; Amarasingham et al. 2010; Calvillo-King et al. 2013; Lindenauer et al. 2013). Studies have also reported the impact of socioeconomic factors on other quality measures, such as the Health Plan Employer Data and Information Set quality of care measures (Zaslavsky et al. 2000; Zaslavsky and Epstein 2005).

Certain hospitals serve a large number of patients with low socioeconomic status and thus are likely to have higher readmission rates. A recent report from the Commonwealth Fund found that safety-net hospitals are approximately 30 percent more likely to have 30-day readmission rates higher than the national average as compared with non-safety-net hospitals. The authors argued that it may be especially difficult for safety-net hospitals to reduce readmission rates because they serve a disproportionate share of vulnerable and medically complex populations and have historically operated under slim financial margins (Berenson and Shih 2012).

These findings have implications for the use of the Hospital Compare readmission rates in the HRRP. Without adjustments to account for characteristics associated with higher readmission rates, the HRRP could adversely impact hospitals that serve a disproportionately larger share of patients from vulnerable populations.

In this study, we explore the potential unintended consequences of the HRRP for hospitals that serve vulnerable populations by focusing on elderly individuals (i.e., 65 and older) enrolled in Medicare and Medicaid (hereafter, dual eligibles). Elderly dual eligibles, who number over 5 million (Kaiser Family Foundation 2011), are poor and in poor health. Over half of elderly dual eligibles have annual incomes no more than $10,000, compared with fewer than 10 percent of other elderly Medicare beneficiaries. They are about 10 times more likely than other elderly Medicare beneficiaries to reside in a nursing facility. In addition, elderly dual eligibles are significantly more likely to be afflicted with chronic conditions, such as heart disease, diabetes, lung disease, and mental disease, than other elderly beneficiaries. Moreover, elderly duals are more likely to be limited in multiple ADLs (activities of daily living) than elderly nonduals. As a result, average total Medicare and Medicaid

spending for elderly dual eligibles is nearly five times the total spending for other elderly Medicare beneficiaries, due to higher hospital admissions and other types of care (Kaiser Family Foundation 2009). By focusing on elderly dual eligibles and modeling the payment effects of the HRRP, this article adds to the literature on hospital readmissions and our understanding of the implications of the HRRP as currently constructed.

Study Data and Methods

Data Source and Study Population

We used 2009 100 percent Medicare inpatient claims data to identify Medicare beneficiaries admitted to short-term acute care hospitals with a principal diagnosis of one of seven conditions: the initial three conditions included in the program (acute myocardial infarction, pneumonia, and heart failure) and four conditions suggested by MedPAC (Medicare Payment Advisory Commission [MedPAC] 2007)—chronic obstructive pulmonary disease (COPD), coronary artery bypass grafting (CABG), percutaneous transluminal coronary angioplasty (PTCA), and other vascular conditions (see Supplemental Material for a list of diagnosis codes used in this study). Hospitals are more likely to face higher penalties when conditions are added, because the overall penalty is determined by a hospital's readmission rate on all conditions covered by HRRP. Only hospitals with a readmission rate below the national average (or with insufficient number of index admissions) on all conditions under consideration will be exempted from penalty under HRRP.

To develop the analytic sample, we applied inclusion and exclusion criteria consistent with the Medicare readmission measures endorsed by the National Quality Forum and used by CMS (National Quality Forum [NQF] 2012a). To be eligible for an index admission, the admitted patients must be 65 years and older, discharged alive and not against medical advice, and discharged to a post-acute care setting or home. Additionally, the admitted patients must be covered continuously by Medicare Fee-for-Service Parts A and B for 12 months prior to the index admission and 1 month (30 days) after the index discharge. Readmissions for rehabilitation and psychosis within 30 days from the discharge were excluded because these conditions are not typically treated in short-stay acute care hospitals. For beneficiaries who had been diagnosed with a heart attack, scheduled admissions for PTCA or CABG were excluded from our readmission calculations.

Demographic and other characteristics of Medicare beneficiaries, such as age, gender, race, and dual eligible status were obtained from the 2009 Medicare denominator file. Medicare beneficiaries were considered dual eligible if they were entitled to Medicare Part A and/or Part B and are eligible for some form of Medicaid benefit. Dual eligible status of beneficiaries was determined using the state buy-in indicator in the Medicare denominator file. Although the state buy-in indicator in the denominator file underestimates the total number of duals, it demonstrates a high predictive power for identifying duals relative to existing benchmarks (O'Donnel, Schneider, and Roozeboom 2012). We calculated the number of hospital admissions in 2008 for each beneficiary with at least 1 index admission in 2009, using the 2008 100 percent Medicare inpatient claims.

We used a variety of data sources for measures of hospital characteristics. Teaching status, bed size, and urban/rural location were obtained from the CMS fiscal year (FY) 2011 hospital Inpatient Prospective Payment System final rule impact file. Consistent with the MedPAC definition, hospitals with intern and resident-to-bed ratios equal to or greater than 0.25 were classified as major teaching institutions (Medicare Payment Advisory Commission [MedPAC] 2012). Hospitals with intern and resident-to-bed ratios greater than 0 and less than 0.25 were classified as other teaching institutions. We identified hospital ownership type using data from the CMS's Hospital Compare website (March 2011 release). The number of ambulatory care sensitive conditions (ACSCs)[1] per 1,000 Medicare enrollees at the hospital referral region (HRR) level was obtained from the Dartmouth Atlas of Health Care (The Dartmouth Institute for Health Policy and Clinical Practice 2012). We used ACSCs to measure the accessibility and effectiveness of local primary health care. For each condition, we used a measure of ACSCs that excluded that condition to reduce the problem of endogeneity.

To be included in our payment impact analysis, a hospital must have a total of 25 or more discharges in 2009. In addition, a hospital needed more than eight discharges in 2009 for a specific condition to be included in the condition-specific analyses. This approach approximates the CMS requirement that a hospital have 25 or more discharges for each condition over a 3-year period.

Risk Adjustment

The purpose of risk adjustment is to standardize for differences in patient severity across hospitals, which facilitates comparisons of readmission rates

across hospitals. The CMS model adjusts for some differences in patient risks unrelated to their hospital care. Factors included in the CMS risk-adjustment model include age, gender, and comorbidities that patients had when they arrived at the hospital and that increase their risk of readmission. Comorbidities are included in the model using CMS's Hierarchical Condition Categories (HCCs) and a history of certain procedures. Medicare patients are assigned to 1 or more HCCs based on ICD-9 codes obtained by the patients' discharge claims, and from the Medicare inpatient, outpatient, and physician claims submitted for the patient up to 12 months prior to the admission.

We were unable to use CMS's risk-adjustment methodology because 100 percent Medicare physician claims were not available to us. Instead, we used the Elixhauser comorbidity index for risk adjustment. The Elixhauser comorbidity measure is widely used in the literature as a risk-adjustment method for its proven predictive power of inpatient mortality. A recent JAMA study reported comparable predictive power for a model using the Elixhauser method and one using the risk adjustment model used by CMS to calculate risk-adjusted 30-day readmission rates (Joynt, Orav, and Jha 2011). We used the Elixhauser comorbidity software developed by the Agency for Health care Research and Quality (AHRQ 2012) to create 29 comorbidity indicators using the secondary diagnosis codes from the claims for index inpatient stays. In addition to the Elixhauser comorbidity indicators, we included age and gender in the models.

Statistical Analysis

We assessed the impact of dual eligible status on the probability of readmission using logistic regression analysis. In addition to age, gender, and comorbidities, we added the dual eligible status to assess its effects on the probability of readmission at the individual level. We also included a hospital's share of Medicare discharges identified as dual eligible to assess the effects of treating dual eligible patients at the hospital level. Models were estimated including dual-eligible status and a hospital's dual share separately and then in a single model.

Following the approach used by CMS, we then computed risk-standardized readmission rates (RSRRs) and excess readmissions for each hospital and condition using a hierarchical logistic regression model, which included hospital-level random effects. Additional hierarchical logistic regression models were estimated to assess the impact of dual eligibles on RSRR and excess readmissions.

Using the regression results, we calculated the predicted probability of a readmission for each case using a patient's characteristics and the hospital's estimated quality effect. We also computed the expected probability of a readmission for each case using a patient's characteristics and an overall average quality effect. We summed the predicted and expected probabilities of readmission across patients for each hospital to estimate predicted and expected numbers of readmissions for each hospital respectively.

The predicted number of readmissions represents total hospital readmissions after accounting for a hospital's patient mix and its estimated level of quality. The expected number of readmissions represents the number of readmissions given a hospital's patient mix and the average level of quality across all hospitals. Excess readmission ratios (ERRs) were calculated using the ratio of the predicted number of readmissions to the expected number of readmissions. An ERR less than 1 means a hospital has fewer readmissions than expected and therefore no excess readmissions. On the other hand, an ERR greater than 1 means a hospital has a greater number of readmissions than expected; for example, an ERR of 1.1 means the actual number of readmissions was 10 percent higher than expected.

The RSRRs were computed by taking the ERR and multiplying by the national readmission rate. For example, if the national 30-day readmission rate for a condition was 20 percent, the RSRR for this hospital would be 22 percent for a hospital with an ERR of 1.1.

We simulated the payment impact of each hospital in FY 2015 under the HRRP using the RSRR computed from the regression analysis and the payment policy rules. We chose to use FY 2015 because it was anticipated that the MedPAC-suggested additional conditions beyond the initial three would be included by then and because it is the first year of the long-term, maximum penalty of 3 percent. We then compared the payment reductions of hospitals with the lowest and the highest share of dual eligible patients. Hospitals were grouped into quartiles based on the percent of all Medicare discharges that were identified as dual eligible.

All statistical analyses were performed using Stata 11.0 (College Station, TX, USA).

Study Results

Table 1 reports average hospital 30-day risk-adjusted readmission rates for heart attack, pneumonia, and heart failure and patient characteristics by

Table 1: Characteristics of Medicare Patients by Dual Eligible Status, 2009

	AMI		*Pneumonia*		*Heart Failure*	
Characteristics	*Non-Dual Eligible*	*Dual Eligible*	*Non-Dual Eligible*	*Dual Eligible*	*Non-Dual Eligible*	*Dual Eligible*
Readmission rate*	18.9	23.1	17.6	20.3	23.9	27.2
Average age	78.7	78.1	80.1	79.0	80.9	78.9
Female (%)	46.8	65.4	51.7	66.4	51.9	70.7
Black (%)	5.4	18.1	4.9	14.9	8.8	24.6
Number of admissions in 2008 (%)†						
0	69.3	57.4	55.1	45.7	46.6	37.9
1–2	24.7	30.1	33.8	36.7	37.2	37.8
3 or more	6.0	12.4	11.1	17.5	16.2	24.2
Number of index admissions‡	116,043	26,079	198,797	66,018	268,866	81,724

*30-day all-cause readmission rate adjusted for age, gender, and comorbidities.
†Admissions to any hospital for any condition.
‡For each condition, index admissions were identified according to the 30-day risk-adjusted readmission measures endorsed by the National Quality Forum.
AMI, acute myocardial infarction.
Source. Authors' analysis.

dual-eligible status. For each of the three conditions, dual-eligible patients experienced higher readmission rates than non-dual-eligible patients even after being adjusted for age, gender, and comorbidities. Dual eligibles were substantially more likely to be female and to be African-American. Additionally, dual eligibles utilized significantly more inpatient care in the previous year (2008). Hospitals show large variation in the share of dual-eligible patients treated (Figure S1). While most hospitals lie in the 20- to 30-percent range, about a quarter of hospitals have a share of dual eligibles higher than 40 percent.

Table 2 shows hospital characteristics by quartile of dual-eligible share of Medicare discharges. Major teaching hospitals represent 3.9 percent of hospitals in the bottom quartile and 11.5 percent of hospitals in the top quartile. Rural hospitals represent 16.8 percent of hospitals in the bottom quartile and 41.2 percent of hospitals in the top quartile. Major teaching hospitals are small in number but are typically large hospitals. On the other hand, rural hospitals are larger in number but tend to have a small number of beds. Taken together, the average number of beds tends to be smaller in hospitals treating a large share of dual eligibles compared with those with a low share of duals.

An interesting observation from Table 2 is that hospitals in the top quartile were located in hospital referral regions with a high number of discharges

Table 2: Characteristics of Hospitals by Quartiles of Percent of Dual Eligible Patients, 2009

	Percent of Hospitals			
Characteristics	*1st (Lowest) Quartile*	*2nd Quartile*	*3rd Quartile*	*4th (Highest) Quartile*
Teaching status (%)*				
Nonteaching	68.5	66.1	67.4	74.6
Other teaching	27.6	27.3	22.5	14.0
Major teaching	3.9	6.6	10.1	11.5
Number of beds (%)				
0–99	36.0	31.7	35.5	44.6
100–399	54.4	56.0	50.8	47.8
400 or more	9.6	12.4	13.7	7.6
Ownership (%)				
For-profit	21.2	14.6	18.4	25.8
Government	7.5	15.5	20.8	30.4
Not-for-profit	71.3	69.9	60.8	43.8
Geographic location (%)				
Large urban area	49.5	33.9	33.3	38.6
Other urban area	33.7	38.7	36.2	20.2
Rural area	16.8	27.4	30.5	41.2
Number of ACSC discharges/ 1,000 Medicare enrollees†	68.5	71.7	76.7	79.4
Average % of dual eligible patients (%)‡	13.9	23.6	33.0	54.7
Number of hospitals	840	840	840	839

Note. Sample includes 3,359 short-term acute care hospitals with at least 25 discharges in 2009.
*Hospitals with intern and resident-to-bed ratios equal to or greater than 0.25 were classified as major teaching institutions. Hospitals with intern and resident-to-bed ratios greater than 0 and less than 0.25 were classified as other teaching institutions.
†Number of ACSC discharges per 1,000 Medicare enrollees comes from 2007 Dartmouth Atlas of Health Care data and was calculated at the Hospital Referral Region level. The overall average is 74.1.
‡Overall percent of dual eligible patients is 31.3%.
ACSC, ambulatory care sensitive condition.
Source. Authors' analysis.

associated with ACSCs. The number of ACSC discharges per 1,000 people was 79.4 in regions where hospitals in the top quartile were located, as compared with 68.5 in regions where hospitals in the bottom quartile were located. Since ACSC discharges can be used as a measure of accessibility and quality of local primary care, this observation suggests a lack of primary care or a low quality of primary care in the communities where the hospitals with the highest share of dual eligibles are located. Lack of primary care or low quality of primary care could be partially responsible for the higher readmission rates of

Table 3: Effect of Dual Eligibles on Probability of Readmission: Logistic Regression Analysis

	AMI			*Pneumonia*			*Heart Failure*		
Dual Eligible Controls	*Model 1*	*Model 2*	*Model 3*	*Model 1*	*Model 2*	*Model 3*	*Model 1*	*Model 2*	*Model 3*
Logit regression coefficients									
Dual eligible (patient level; range: 0–1)	0.259* (0.018)	–	0.228* (0.019)	0.174* (0.012)	–	0.153* (0.013)	0.178* (0.010)	–	0.151* (0.010)
Fraction of dual patients (hospital level; range: 0–1)	–	0.552* (0.064)	0.352* (0.067)	–	0.356* (0.046)	0.205* (0.048)	–	0.405* (0.037)	0.261* (0.038)
Changes in readmission rate									
Change from nondual to dual patient (%)	4.2	–	3.7	2.6	–	2.3	3.4	–	2.8
Change from 25th to 75th of fraction of dual patients at hospital level (%)	–	1.8	1.1	–	1.1	0.6	–	1.6	1.0
Overall readmission rate (%)		19.7			18.3			24.7	
Sample size		142,504			265,498			351,472	

Note. Clustered standard error at hospital level is reported in parenthesis.
*$p < .01$. All models include age, gender, and Elixhauser comorbidity indicators (coefficients not shown).
Source. Authors' analysis.

hospitals treating dual eligibles, although inpatient quality of care can also affect outpatient quality of care in the local community.

Table 3 shows that both patient dual status and hospital dual share are significant predictors of readmissions for all three conditions, even after controlling for age, gender, and comorbidities. Take AMI as an example: with patient dual status added (model 1), it was estimated that the readmission rate was 4.2 percentage points higher in duals than nonduals. With hospital dual share added (model 2), it was estimated that a change from 18 to 39 percent (i.e., a change from the 25th to 75th percentile of hospital dual share) would increase the probability of readmission rate by 1.8 percentage points.

When both patient dual status and hospital dual share were added (model 3), the coefficients on both variables decreased, although the decrease was relatively more significant for the variable measuring a hospital's dual-eligible share of Medicare discharges. Nevertheless, even with patient dual status controlled, hospital dual share still has a statistically significant impact on readmission rates.

At an individual level, the results indicate a larger effect of patient dual-eligible status than a hospital's dual-eligible share of discharges. The impact on total hospital readmissions, however, is greater from the dual-eligible share of discharges because this effect contributes to higher readmission rates for all Medicare discharges and not only to dual eligible patients. We estimated hos-

Table 4: Percent of Hospitals with Excess Readmissions by Quartiles of Percent of Dual Eligibles

	AMI		*Pneumonia*		*Heart Failure*	
Risk Adjustment Method	*Hospitals in Lowest Quartile*	*Hospitals in Highest Quartile*	*Hospitals in Lowest Quartile*	*Hospitals in Highest Quartile*	*Hospitals in Lowest Quartile*	*Hospitals in Highest Quartile*
CMS method	40	64	40	59	41	61
CMS method + patient dual eligible status	43	58	43	55	43	57
CMS method + patient dual eligible status + hospital share of dual eligibles	45	51	47	51	49	50
Number of hospitals	593	361	725	763	721	754

Note. For each condition, only hospitals with at least eight index discharges were included in the calculations.
AMI, acute myocardial infarction.
Source. Authors' analysis.

pitals' dual-eligible share of discharges contribute to over 60 percent of total additional readmissions from dual eligibles.[2]

In Table 4, we present the share of hospitals with excess readmissions (i.e., actual readmissions higher than expected) for hospitals in the top ("high dual hospitals") and bottom quartile ("low dual hospitals") in terms of dual-eligible share of Medicare discharges. Under the current CMS risk adjustment model, high dual hospitals were 24 percentage points more likely to have excess readmissions than low dual hospitals for AMI patients (64 vs. 40 percent). When patient dual status was added, the difference is reduced to 15 percentage points (58 vs. 43 percent). The addition of hospital dual share in the risk adjustment model reduced the difference close to zero as expected since we are comparing hospitals with varying level of share of duals. A similar trend was observed for patients treated for pneumonia and heart failure.

Hospitals in the top quartile of percent of dual eligibles will be disproportionally subject to Medicare payment reductions under the HRRP. In fiscal year 2015 (Table 5), we estimate that about 23 percent of hospitals in the bottom quartile of dual eligibles will experience no payment reduction, while 10 percent of hospitals in the top quartile will experience a zero payment reduction. About 6 percent of the hospitals in the bottom quartile would experience payment reductions over 2 percent, compared with 11 percent of hospitals in the top quartile.

Table 5: Distribution of Medicare Payment Reduction by Quartiles of Percent of Dual Eligible Patients

	Percent of Hospitals			
Percent Reduction	*1st (Lowest) Quartile*	*2nd Quartile*	*3rd Quartile*	*4th (Highest) Quartile*
No reduction	23.1	14.5	11.0	10.4
0.01–1	57.4	63.7	62.0	58.0
1.01–2	13.8	15.2	18.0	21.1
2.01–3	5.7	6.5	9.0	10.5
Number of hospitals	840	840	840	839

Note. Sample includes 3,359 short-term acute care hospitals with at least 25 discharges in 2009. Table reports percent reduction in Medicare base operating DRG payment in FY 2015 with a floor adjustment factor of 0.97. The analysis assumes the applicable conditions under the Hospital Readmissions Reduction Program will expand from the initial three conditions to include four additional conditions (chronic obstructive pulmonary disease, coronary artery bypass grafting, percutaneous transluminal coronary angioplasty, and other vascular conditions) in FY 2015, as specified in the Affordable Care Act. For each condition, hospitals with fewer than eight index admissions are not subject to a payment adjustment for that condition. The average percent of dual eligibles was 14%, 24%, 33%, and 55% for the 1st through the 4th quartiles, respectively.
Source. Authors' analysis.

While these payment reductions are modest, hospitals with the highest share of dual eligibles tend to have lower total all-payer margins (Figure S2). Over half of hospitals in the top quartile had a negative average total profit margin in fiscal year 2008 and 2009, compared with a quarter of hospitals in the bottom quartile. Additionally, one in five hospitals in the top quartile had a total profit margin lower than negative 5 percent compared with less than 10 percent in the bottom quartile.

DISCUSSION

This study contributes to the literature on hospital readmissions by demonstrating the effects of dual-eligible status at the individual- and hospital-level on readmissions in the context of the Medicare Hospital Readmissions Reduction Program. Consistent with prior research demonstrating a relationship between income and readmissions, we find a positive effect of patient dual-eligible status on readmissions. This effect could reflect dual eligibles' higher frailty and use of nursing homes. Moreover, we demonstrate a positive relationship between a hospital's share of dual-eligible discharges and readmission rates, and that this effect has a large, independent contribution to a hospital's total readmissions.

There are two possible interpretations of the finding that a hospital's dual-eligible share has a significant effect on readmissions, after controlling for patient dual-eligible status. First, the dual-eligible share is likely a proxy for income of patients in a hospital's catchment area. Low-income patients from poorer communities may have higher readmission rates because of the lack of access to important social support and barriers to timely access to quality care. Second, it may be that dual-eligible patients have access to low-quality hospitals. Our observation that hospitals with a high-dual share were located in areas that, on average, had higher discharge rates associated with ACSCs is consistent with the first explanation. However, we cannot reject the hypothesis that dual eligible patients have access to lower quality hospitals. More research is needed to disentangle the effects of hospital quality from patient and community factors on readmissions.

The need to "bend the cost curve" will put increasing pressure on the federal government to both increase the cap on the penalties as well as the number of conditions covered by the HRRP. In fact, policy options circulated by the U.S. Senate Finance Committee prior to passage of the ACA called for more significant readmission payment penalties than those that were ulti-

mately included in the legislation (U.S. Senate Committee on Finance 2009). Furthermore, the ACA grants the Department of Health and Human Services the authority to expand the policy to additional conditions. To this end, CMS has included, in its FY 2014 acute care inpatient prospective payment system proposed rule, the addition of two conditions in FY 2015: COPD and elective total hip arthroplasty and total knee arthroplasty (Centers for Medicare & Medicaid Services [CMS] 2013).[3]

Expanding the HRRP in its current form may have negative effects on dual eligibles and other vulnerable populations for a number of reasons. First, hospitals treating a high share of dual eligibles have below-average profit margins and, thus, may be unable to absorb the existing reductions in Medicare payments under the readmissions program. Second, many of the factors associated with readmissions appear to be largely outside the control of hospitals (Benbassat and Taragin 2000). A recent systematic review concluded that only 27 percent of readmissions were potentially avoidable (van Walraven et al. 2011). Third, the CMS risk-adjustment models account for little of the variation in hospital readmissions (QualityNet 2012) and attribute the remaining variation to hospital quality, without recognizing the potential contribution of broader social, health, and health care delivery system factors. Collectively, these factors suggest that the HRRP may, at best, be ineffective in reducing readmissions at hospitals treating a high percentage of duals and, at worst, could restrict patient access.

CMS could consider a number of options to improve the Hospital Readmissions Reduction Program. Adding socioeconomic status (SES) to the risk-adjustment model used by CMS in the HRRP would appear to be the most direct way to improve its risk adjustment approach. However, simply including dual-eligible status in the model may be insufficient as the effect of treating a high share of dual eligible patients on readmissions is large and may reflect patient and community factors and not just hospital quality. Regardless of potential limitations of this approach, policy makers are reluctant to make any adjustment for SES to hospital performance measures, because doing so—it is argued—could remove incentives to reduce disparities, introduce opportunities to game the system, and engender a two-tiered system where disadvantaged groups are not provided the same quality care as others (Romano 2000; Centers for Medicare & Medicaid Services [CMS] 2011). On the other hand, not adjusting for SES but penalizing hospitals for high readmissions runs the risk of reducing access to care for dual eligibles as hospitals are incentivized to limit the number they treat.

The literature discusses potential alternatives for improving the HRRP without explicitly adjusting for SES in the risk-adjustment model. Fiscella et al. (2000) propose the stratification of quality measures by SES. For example, readmission rates would be reported separately by dual-eligible status. In this way, the health disparities are highlighted rather than masked. The National Quality Forum also recommended stratifying quality measure by race or socioeconomic status in its "2012 Measure Evaluation Criteria" (National Quality Forum [NQF] 2012b). Berenson, Paulus, and Kalman (2012) propose that Medicare adopt a single-episode price for hospital admissions that covers the payments for readmissions over a 15- or 30-day period. The Berenson, Paulus, and Kalman (2012) approach, which is based on the Geisinger Health System's ProvenCare program, would establish the episode price after eliminating or reducing payments for readmissions within a designated interval after discharge.

Each of these alternatives has advantages and disadvantages for policy makers to consider. Stratification may be more politically achievable since the National Quality Forum, which must endorse all measures used in the HRRP, recommends its use. In fact, CMS is incorporating the NQF-endorsed hospital-wide readmission measure for dual eligibles in the Medicare-Medicaid Financial Alignment Demonstration (Medicare-Medicaid Coordination Office [MMCO] 2012; National Quality Forum [NQF] 2012c). However, there may be small sample issues with stratifying, by dual-eligible status, the condition-specific measures currently included in the HRRP.

The Berenson, Paulus, and Kalman (2012) approach would measure readmission performance against a hospital's own historical performance, which has been argued by others (Bhalla and Kalkut 2010). However, many patients are readmitted to a different hospital than their index hospital stay, which would need to be addressed in the process of establishing Medicare payments. Although this approach would reward hospitals that reduce their readmissions but are still inferior to other hospitals, it would provide incentives for all hospitals to reduce readmissions, including hospitals that are already performing well. The Berenson, Paulus, and Kalman (2012) proposal also represents a significant departure from the HRRP as legislated by Congress.

An incremental proposal could be to maintain the current risk-adjustment approach but modify the creation of the excessive readmission rates. For example, in establishing the expected readmission rate (the denominator in the ERR), CMS could use the average quality for hospitals with similar dual-eligible shares or other measures of SES. This is similar to one of

the approaches suggested by MedPAC in its March 2013 public meeting (Medicare Payment Advisory Commission [MedPAC] 2013). This ERR could be used as in the current HRRP approach or compared with the prior-year ERR for a hospital. The advantage of this approach is that it accounts for changes in patient readmission-risk profiles over time, while comparing a hospital to itself or to hospitals similar in terms of patient SES.

Our study has a number of limitations, although we view them as having a negligible impact on our conclusions. First, while CMS used 3 years of Medicare claims data to compute readmission rates, our estimates of readmission rates relied only on 2009 Medicare claims data. The HRM approach adjusts readmission rates of small hospitals so that their RSRRs tend to be closer to the national average than their actual observed rates. As a result, the study may underestimate the impact of the HRRP on small hospitals. Second, the Elixhauser comorbidity index that we used for risk adjustment relies on information from inpatient claims, not outpatient and physician claims. However, the predictive power of a model using Elixhauser method is comparable to the CMS model (Joynt, Orav, and Jha 2011). Additionally, our analysis of the risk-adjusted readmission rates reported by CMS revealed similar findings with respect to excessive readmission ratios for high-dual hospitals. Third, we focus on dual eligibles because they are a significant vulnerable population. However, this population is not a perfect proxy for examining the relationship between socioeconomic status and readmissions.

Public policy efforts to reduce readmissions in Medicare are important, considering the impact of readmissions on beneficiaries and program spending. In achieving lower readmissions, the Medicare program has the potential to reduce ethnic and racial disparities, as minorities and low-income Medicare beneficiaries have higher readmission rates than their counterparts. The challenge is in developing effective public policies that provide strong and well-targeted incentives to improve quality while limiting the potential of negatively affecting access to care. Modifying the HRRP to account for differences in the socioeconomic status of patients could help the program better achieve its objectives.

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NOTES

1. ACSCs are conditions for which good outpatient care can potentially prevent the need for hospitalization, or for which early intervention can prevent complications or more severe disease.
2. Assume (1) P_0 is the predicted probability of readmission when both individual dual status and hospital dual share is 0; (2) P_{IND} is the predicted probability of readmission when individual dual status takes its actual value and hospital dual share is 0; and (3) P_{HOSP} is the predicted probability of readmission when individual status is 0 and hospital dual share takes its actual value. The value of all other variables was kept at their actual values. The effect attributable to individual dual status is then the difference between P_{IND} and P_0 and the effect attributable to hospital dual share is the difference between P_{HOSP} and P_0. We then sum up the effects attributed to individual dual status and hospital dual share across all hospitals and calculated the share of effect attributable to either individual dual status or hospital dual share.
3. In 2012, the National Quality Forum endorsed a measure, codeveloped by CMS and researchers at Yale University, related to unplanned, hospital-wide all-cause readmissions (HWR) to a hospital. CMS will report the HWR measures on Hospital Compare and include it in the HRRP in the future.

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SUPPORTING INFORMATION

Additional supporting information may be found in the online version of this article:

Appendix SA1: Author Matrix.

Figure S1: Distribution of Hospitals by Percent of Dual Eligibles, 2009.

Figure S2: Distribution of Hospital Profit Margin by Quartiles of Percent of Dual Eligibles.