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RESEARCH BRIEF

# The Impact of the Hospital Readmissions Reduction Program across Insurance Types in California

*David S. Zingmond, Li-Jung Liang, Punam Parikh, and José J. Escarce*

**Objective.** Examine 30-day readmission rates for indicator conditions before and after adoption of the Hospital Readmissions Reduction Program (HRRP).
**Data.** California hospital discharge data, 2005 to 2014.
**Study Design.** Estimated difference between pre-HRRP trends and post-HRRP rates of hospital readmissions after hospitalization for indicator conditions targeted by the HRRP (heart attack, heart failure, and pneumonia) by payer among insured adults.
**Principal Findings.** Post-HRRP, reductions occurred for the three conditions among Fee-for-Service (FFS) Medicare. Readmissions decreased for heart attack and heart failure in Medicare Managed Care (MC). No reductions were observed in the younger commercially insured.
**Conclusions.** Post-HRRP, greater than expected reductions occurred in rehospitalizations for patients with Medicare FFS and Medicare MC. HRRP incentives may be influencing system-wide changes influencing care outside of traditional Medicare.
**Key Words.** Medicare, readmission, reduction

Due to their costliness and effects on patient health, reducing hospital readmissions is a target of both quality measurement and performance-based incentives for Medicare and other payers (Yale New Haven Health Services Corporation 2014a; QualityNet 2016). Section 3025 of the Affordable Care Act (ACA) established the Hospital Readmissions Reduction Program (HRRP), which created a system of penalties intended to curb unplanned hospital readmissions. The Centers for Medicare and Medicaid Services (CMS) began assessing penalties in October 2012 on hospitals with high 30-day readmission rates in the preceding 3 years for three target conditions: acute myocardial infarction (heart attack), congestive heart failure, and pneumonia. Additional conditions were added in fiscal year (FY) 2015 (chronic obstructive

pulmonary disease and elective joint replacement), and coronary artery bypass graft surgery in FY 2017 (Centers for Medicare and Medicaid Services 2016). Hospitals that do not meet the readmission standards faced a maximum 1 percent decrease in all Medicare Fee-for-Service (FFS) payments during FY 2013; the maximum penalty was 2 percent in FY 2014 and 3 percent in FY 2015 and thereafter.

To date, much of the focus on the HRRP has been on the success of the program in the Medicare FFS population. Initial reports to Congress have been followed by systematic evaluations showing reductions in hospitalizations nationally without increases in observation stays after the HRRP began (Gerhardt et al. 2013; Zuckerman et al. 2016). A national evaluation of the HRRP demonstrated reductions in readmission rates for Medicare FFS without increases in other types of care (including observation stays) (Zuckerman et al. 2016). Independent evaluation in New York suggested that the policy has decreased readmissions among the Medicare FFS population but increased emergency department visits among hospitals with greater penalties (McGarry, Blankley, and Li 2016). Effects on costs are not yet well understood (Nuckols et al. 2017).

Less is known regarding potential "spillover" effects of the HRRP on non-Medicare FFS patients. In California, an estimated 38 percent of Medicare-eligible older adults are enrolled in Managed Care (MC) plans and, consequently, are not directly affected by the HRRP (Kaiser Family Foundation 2013). In anticipation of the HRRP, health systems began to investigate and implement condition-specific quality improvement programs (Sales et al. 2013; Joynt et al. 2014). Such programs could reduce readmissions across the board if uniformly implemented. Other health insurers track readmissions, but they have not adopted similar payment incentive programs. Early evaluation of readmissions in New York in the first quarter of the HRRP suggested reductions in 30-day readmissions for patients in Medicare FFS and for younger, commercially insured patients (Carey and

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Lin 2015). Little is known regarding trends in readmissions for the non-Medicare FFS patients.

In this study, we examined readmission rates before and after introduction of the HRRP among Medicare FFS patients, Medicare managed care patients, and commercially insured patients under the age of 65 years who were hospitalized in California hospitals between 2005 and 2014. We evaluated the difference between the pre-HRRP trends and the post-HRRP rates of hospital readmissions after hospitalization for the three conditions initially targeted by the HRRP (heart attack, heart failure, and pneumonia) by payer type.

## METHODS

### *Study Sample*

We examined hospital readmissions in California between 2005 and 2014 using the annual state all-payer hospital inpatient file, the Patient Discharge Database (PDD), which includes all hospital discharges from nonfederal general acute care hospitals. Each PDD record includes patient demographics (age, race/ethnicity, residence zip code, and insurance), dates of service, diagnosis codes (ICD9-CM, up to 25), procedure codes (ICD9-CM, up to 21), source of admission, and discharge disposition. Records can be linked longitudinally using a unique patient identifier.

The initial three indicator conditions tracked by the HRRP—acute myocardial infarction, congestive heart failure, and pneumonia—were defined following the approach used by CMS (Yale New Haven Health Services Corporation 2013; Yale New Haven Health Services Corporation/Center for Outcomes Research & Evaluation 2014a,b). If a patient was transferred for acute care at another hospital in California, then a summary record of care was created to correspond to the entire acute inpatient stay. For a transfer patient, the hospital credited for readmission is the hospital that ultimately discharges the patient from acute inpatient care. Using the CMS definitions, we measured 30-day unplanned readmission for each of these cohorts (Yale New Haven Health Services Corporation 2016).

The primary cohort determinant was payer (Medicare FFS, Medicare MC, and commercial insurance). We defined the Medicare FFS cohort as those age 65 years and older with payer defined as Medicare FFS at admission. Similarly, we identified the MC population as those age 65 years and older with payer defined as a Medicare MC plan at admission. Medicare beneficiaries

younger than 65 years were excluded from the cohort. Finally, we identified patients from 18 to 64 years of age with commercial insurance, who represent a plurality of working-age patients hospitalized with these conditions.

### *Data Analysis*

All analyses were stratified by payer and indicator condition. The pre-HRRP period included data from 2005 through the third quarter of calendar year 2012 (31 quarters), while the post-HRRP period included the fourth quarter of calendar year 2012 through 2014 (nine quarters). We used a generalized estimating equation (GEE) model with a probit link to model the probability of an unplanned readmission within 30 days of hospital discharge between 2005 and 2014 for each of the stratified samples. Unadjusted models included only study period (pre- vs. post-HRRP). Each adjusted model included a quarterly linear time trend, patient age, gender, race, comorbidities, and season of year.

For each calendar quarter after the HRRP was implemented (i.e., beginning with the fourth quarter of 2012), we calculated the difference between the predicted risk-adjusted readmission rate based on extending the pre-HRRP trend and the actual risk-adjusted rate post-HRRP introduction. This approach allows for flexibility in estimating the evolution of the policy's effects over time. Each GEE regression model included an exchangeable correlation structure to account for correlation among index admissions to the same hospital. For the nine calendar quarters of data after implementation of the HRRP, we aggregated the estimated policy effects for adjacent quarters into three periods of three calendar quarters each. We did so because effect estimates for adjacent quarters were usually similar and this approach enabled us to describe the evolution of policy effects with less random fluctuation. Within each stratified sample, we generated 95 percent confidence intervals for difference measures using a clustered bootstrap method accounting for clustering of visits within hospitals (Sherman and leCessie 1997; Chambers and Chandra 2013). Given the large number of observations, we used 500 bootstrap samples for all cohorts.

All statistical analyses were carried out with the SAS System for Windows (Version 9.4), and all graphs were generated using R (R Development Core Team, 2017). Approval for this research was obtained from local and state institutional review boards.

# RESULTS

## *Descriptive Data*

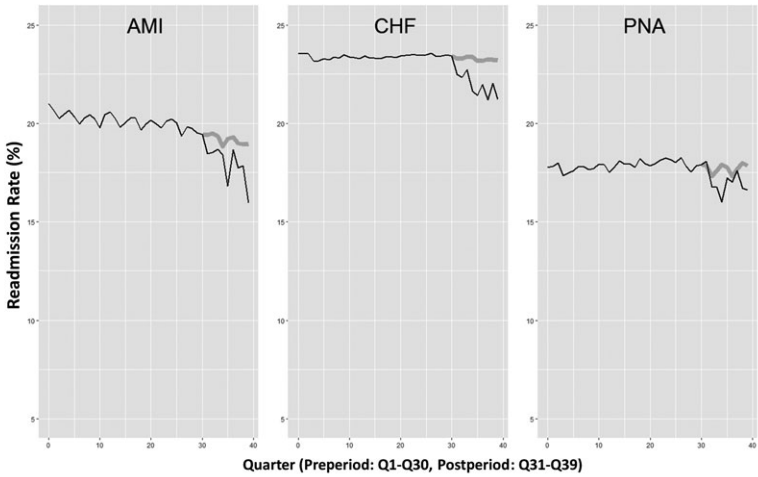
The study sample consisted of 333,640 heart attack (262,067 pre-HRRP: 71,573 post-HRRP), 558,904 heart failure (446,159 pre-HRRP: 112,745 post-HRRP), and 510,062 pneumonia (423,975 pre-HRRP: 86,087 post-HRRP) admissions (Table S1). Mean post-HRRP readmission rates were lower than the pre-HRRP readmission rates for Medicare FFS patients with heart attack (decreased from 19.8 percent to 17.6 percent, $p < .0001$), heart failure (decreased from 23.4 percent to 22.0 percent, $p < .0001$), and pneumonia (decreased from 17.6 percent to 16.7 percent, $p = .0003$). Similarly, we observed reductions in readmission rates in the post-HRRP for Medicare MC patients with heart attack (18.1 percent vs. 15.7 percent, $p < .0001$), heart failure (21.4 percent vs. 19.8 percent, $p < .0001$), and pneumonia (17.2 percent vs. 16.5 percent, $p = .005$). Commercially insured patients with heart attack and heart failure experienced reductions in mean readmission rates from pre- to post-HRRP (9.6 percent vs. 7.8 percent, $p < .0001$ and 17.2 percent vs. 16.5 percent, $p = .103$, respectively) as well.

## *Regression Results*

The regression analyses enable us to determine whether the differences in pre- and post-HRRP readmission rates reported in the preceding section represent simply a continuation of pre-HRRP time trends or, instead, reflect a break in those trends in the period after the HRRP was implemented. We base our estimates of HRRP effects on the deviation of the readmission rates from the extrapolation of pre-HRRP time trends. In the figures, we present the pre-HRRP trends extended graphically for comparison with the post-HRRP trends. Below each graphical comparison are the three-quarter change estimates with 95 percent confidence intervals.

For Medicare FFS, effects of the HRRP were smallest in the first three-quarter period after the policy was implemented and increased thereafter (Figure 1). By the third three-quarter period, the readmission rate after heart attack was 1.8 percentage points lower than it otherwise would have been (95 percent CI: −2.8, −0.7). The corresponding reductions were 1.8 percentage points (95 percent CI: −2.5, −0.9) for heart failure and 0.9 percentage points for pneumonia (95 percent CI: −1.8, −0.01).

Figure 1: Medicare Fee-for-Service



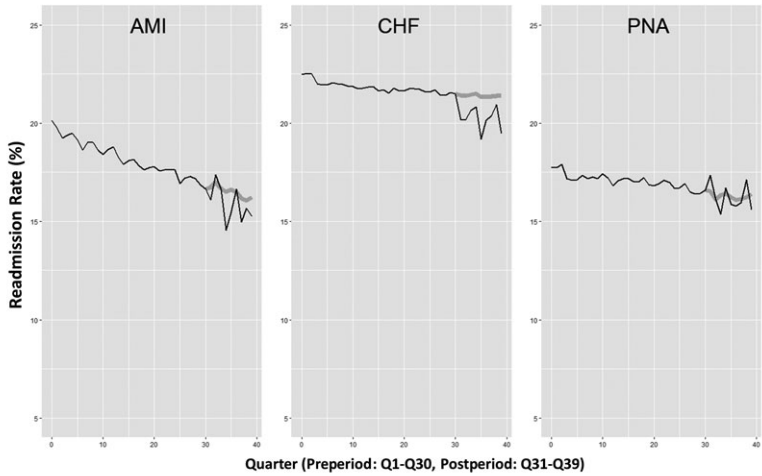

| Postperiod (Quarter 31-39) | Estimated Difference* | 95% CI | Estimated Difference* | 95% CI | Estimated Difference* | 95% CI |
|---|---|---|---|---|---|---|
| Oct 12 - Jun 13 (Q31-Q33) | -0.87 | (-1.73, 0.03) | **-0.80** | **(-1.53, -0.04)** | -0.39 | (-1.00, 0.24) |
| Jul 13 - Mar 14 (Q34-Q36) | **-1.15** | **(-2.16, -0.13)** | **-1.57** | **(-2.42, -0.78)** | **-0.91** | **(-1.66, -0.23)** |
| Apr 14 -Nov 15 (Q37-Q39) | **-1.79** | **(-2.78, -0.71)** | **-1.76** | **(-2.53, -0.89)** | **-0.87** | **(-1.80, -0.01)** |

*Note.* *Deviation of the readmission rates from the extended pre-HRRP time trend (gray line); average across three quarters.

In the Medicare MC population, the HRRP decreased heart failure readmissions in the initial three-quarter period and continued to do so through the last three-quarter period in the study. By the third three-quarter period, the readmission rate for heart failure was 1.1 percentage points lower than it otherwise would have been (95 percent CI: −2.1, −0.3) (Figure 2). There was little initial decrease in the readmission rate after heart attack, but by the third three-quarter period, the point estimate corresponded to a nonstatistically significant decrease of 0.9 percentage points (95 percent CI: −1.9, 0.2). There was no decrease in pneumonia readmission rates among Medicare MC patients.

In the commercially insured population, there was a nonsignificant trend toward a decrease in readmissions of 0.7 percentage points after a heart attack by the third three-quarter period (95 percent CI: −1.5, 0.01) (Figure 3). No reductions in readmissions after hospitalization for heart failure or pneumonia were apparent.

Figure 2: Medicare Managed Care




| Postperiod (Quarter 31-39) | Estimated Difference* | 95% CI | Estimated Difference* | 95% CI | Estimated Difference* | 95% CI |
|---|---|---|---|---|---|---|
| Oct 12 - Jun 13 (Q31-Q33) | -0.10 | (-1.03, 0.89) | **-1.08** | **(-1.91, -0.23)** | -0.06 | (-0.97, 0.74) |
| Jul 13 - Mar 14 (Q34-Q36) | -0.99 | (-1.97, 0.04) | **-1.34** | **(-2.24, -0.52)** | -0.12 | (-1.08, 0.80) |
| Apr 14 -Nov 15 (Q37-Q39) | -0.86 | (-1.88, 0.23) | **-1.11** | **(-2.06, -0.27)** | -0.05 | (-1.26, 1.05) |

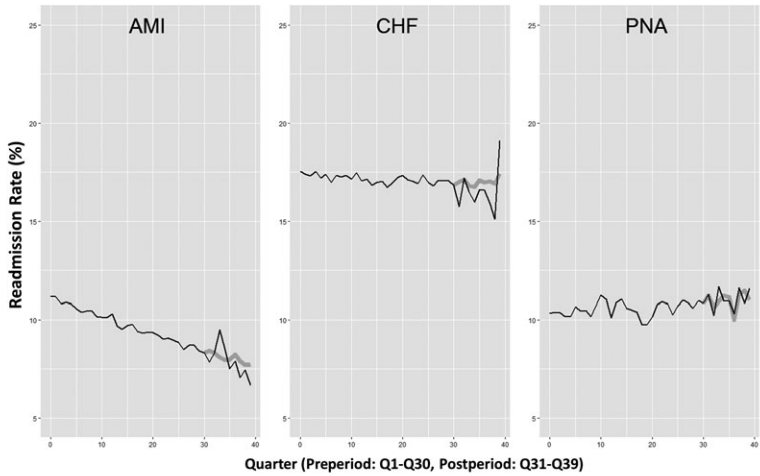
*Note.* *Deviation of the readmission rates from the extended pre-HRRP time trend (gray line); average across three quarters.

## DISCUSSION

In this statewide evaluation of readmissions relative to the adoption of the HRRP, we found significant and sustained reductions in 30-day readmission rates among Medicare FFS beneficiaries for each of the original three target conditions in the post-HRRP period relative to expected trends before the HRRP. These findings are substantially similar to findings from prior Medicare FFS only studies. Smaller reductions were observed in the Medicare MC population in two of the three target conditions (heart attack and heart failure) relative to that expected if the pre-HRRP trends had continued. The younger commercially insured population had no significant reductions relative to expected trends.

Prior to the introduction of the HRRP, payers, providers, and policymakers had significant lead-time regarding the nature of proposed indicator conditions and tracking of care. Prior to the ACA, MedPAC had

Figure 3: Commercial (Younger)




| Postperiod (Quarter 31-39) | Estimated Difference* | 95% CI | Estimated Difference* | 95% CI | Estimated Difference* | 95% CI |
|---|---|---|---|---|---|---|
| Oct 12 - Jun 13 (Q31-Q33) | 0.27 | (-0.71, 1.20) | -0.49 | (-1.90, 0.91) | 0.13 | (-0.81, 0.99) |
| Jul 13 - Mar 14 (Q34-Q36) | -0.06 | (-0.99, 0.92) | -0.56 | (-2.06, 1.01) | -0.05 | (-1.23, 1.20) |
| Apr 14 -Nov 15 (Q37-Q39) | -0.71 | (-1.52, 0.01) | -0.41 | (-2.27, 1.29) | 0.09 | (-1.62, 1.85) |

*Note.* *Deviation of the readmission rates from the extended pre-HRRP time trend (gray line); average across three quarters.

recommended tracking readmissions (Medicare Payment Advisory Commission 2007). The ACA formalized tracking of readmissions prior to the start of the HRRP (Patient Protection and Affordable Care Act 2010). In this environment, attempts began to identify interventions that could decrease readmissions (Hansen et al. 2011; Brewster et al. 2016; Jayakody et al. 2016). Interventions tended to be condition-based to the exclusion of insurance (Sales et al. 2013; Balaban et al. 2015; Jayakody et al. 2016). Of note, in one study examining paid patient navigators to ensure postdischarge continuity and outpatient follow-up, older patients (60 + years of age) incidentally had successful reduction in readmissions, while younger patients had increased readmissions (Balaban et al. 2015). Hospitals may logically chose to implement age-based interventions in the absence of knowing definitively which Medicare coverage that they have chosen, but there is little evidence that readmission reduction attempts were tailored in this way. The HRRP appears to have increased the quarter-to-quarter volatility in readmission rates. This may be viewed as at least suggestive evidence that hospitals are

doing something regarding readmission, even in cases where the difference is not yet statistically distinguishable. It could be interventions to actually reduce readmission. Alternatively, hospitals may be learning to code hospitalizations differently.

The mechanism of potential spillover effects of the HRRP on the Medicare MC population is not known. There is little evidence that Medicare MC plans adopted the financial incentives such as the HRRP as many plans lack sufficient numbers of patients to rank hospitals in the way the HRRP does. Rather, observed reductions in non-Medicare FFS populations are more likely due to the adoption of approaches to reduce rehospitalizations based upon shared quality improvement efforts that are focused on clinical care rather than payer. Hospitals can reduce readmissions through specific quality improvement interventions (Kociol et al. 2012; Bradley et al. 2013a,b, 2015; Kripalani et al. 2014). Successful interventions involve multidisciplinary teams who work together to improve care management and coordination, offer evidence-based patient and family education, medication management, timely follow-up primary care, frequent communication between care coordinators with patients and physicians, and timely and comprehensive transitional care after hospitalizations (Naylor et al. 2011; Brown et al. 2012; Bronstein et al. 2015; Brewster et al. 2016). For example, a comprehensive statewide quality improvement initiative appeared to reduce readmissions for heart attack, heart failure, and COPD across South Carolina involved acute care hospitals plus home health organizations, nursing facilities, hospices, and other health care organizations, although the effects could not be differentiated from national trends as the implementation occurred at the same time as HRRP adoption (Axon et al. 2016). A prospective evidence-based quality improvement program for reducing heart failure readmissions for all patients was implemented in Michigan 5 months before HRRP began. As measured among Medicare FFS patients, mean readmission rates decreased across all hospitals but were greater in the participating hospitals (Pollard et al. 2015). The investigators did not examine readmission rates in the non-Medicare FFS patients. Nevertheless, hospitals may in fact be treating Medicare FFS patients differently.

Condition-specific differences in rate reductions likely reflect the effectiveness of targeted interventions. Heart failure and heart attack are associated with anatomic and functional cardiac abnormalities that require specific and often ongoing medical management, including regular monitoring by a physician, a medication regimen, and implementing lifestyle changes. The

available evidence suggests that assiduous monitoring and management after discharge can reduce readmissions for heart failure (Kociol et al. 2012; Bradley et al. 2013a, 2015; Feltner et al. 2014). By contrast, pneumonia is often an acute illness that resolves, while the underlying illnesses putting patients at risk are varied and less amenable to single overall disease management interventions.

## LIMITATIONS

This is a retrospective study of hospital readmissions using data from a single, albeit large, state. Findings may not generalize outside of California. These retrospective data cannot assign causality to the observed trend changes. Results seen cannot be ascribed to the HRRP or potentially to other Medicare policy enacted around this time that may be partly responsible for the differences in the observed differences. Nevertheless, the large sample and extended lookback allowed the research team to make projections based upon observed trends in California and to have reasonable certainty regarding the strength of these results rather than simply comparing mean changes that ignore underlying trends or have a limited lookback period.

## CONCLUSIONS

In the period after the introduction of the HRRP, greater than expected reductions have occurred in unplanned rehospitalizations both for patients with Medicare FFS and for those in Medicare MC. Significant changes in the Medicare MC population suggest that system-wide changes incentivized by the HRRP may be impacting the non-Medicare FFS population. Future work should focus on the underlying mechanisms mediating these changes.

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*Disclosures:* None.

*Disclaimer:* None.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the supporting information tab for this article:

Appendix SA1: Author Matrix.

Table S1: Demographics and Comorbidities for Hospitalized Patients with AMI, CHF, or PNA by Payer, 2005–2014, in California.