

CHAPTER

1

**Mandated report:
The effects of the
Hospital Readmissions
Reduction Program**

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Chapter summary

To encourage hospitals to reduce preventable readmissions, CMS began to publicly report hospital-level readmission rates for acute myocardial infarction (AMI), heart failure, and pneumonia in 2009. In 2010, the Congress added a financial incentive to reduce readmission rates when it enacted legislation providing for the Hospital Readmissions Reduction Program (HRRP). The HRRP reduced Medicare payment rates by up to 3 percent for hospitals with above-average readmission rates for these three conditions. At this same time, the Congress also funded programs to help hospitals improve care transitions and reduce preventable readmissions. The end goal of preventing hospital readmissions is to relieve Medicare beneficiaries of the burden of returning to the hospital and to relieve taxpayers of the cost of unnecessary readmissions.

In recent years, hospital administrators have reported that the HRRP has had a “great impact” on their efforts to reduce readmissions (Joynt et al. 2016). These efforts contributed to a large decline in readmissions since 2010, with the greatest declines in conditions initially covered by the policy (AMI, heart failure, and pneumonia). We measured the change in readmission rates from 2010 to 2016 and found that raw (not risk-adjusted) readmission rates fell by 3.6 percentage points for AMI, 3.0 percentage points for heart failure, 2.3 percentage points for pneumonia, and 1.4 percentage points on average across conditions not covered by the program. To evaluate whether the HRRP led to reduced readmission rates, we conducted a series of longitudinal and

In this chapter

- Background
- Prior research on the effects of the HRRP
- Our methodology for evaluating the HRRP effects
- Results
- Policy implications

cross-sectional analyses of both raw and risk-adjusted readmission rates. Taken as a whole, our analyses suggest that the HRRP did contribute to the decline in readmission rates. The evidence supporting the conclusion that the HRRP led to fewer readmissions includes the following:

- The rate of decline in *raw* readmission rates for heart failure, pneumonia, and AMI was faster by a statistically significant amount after HRRP's enactment (2010 to 2016) than in prior years.
- The rate of decline in *risk-adjusted* readmission rates for heart failure was faster by a statistically significant amount after the HRRP's enactment (2010 to 2016) than during prior years. Risk-adjusted pneumonia and AMI readmission rates also declined faster during the 2010 to 2016 period compared with prior years. However, the difference is not consistently statistically significant across different methods of testing.
- Raw readmission rates declined faster, on average, for conditions covered by the program (combining all five conditions in effect in 2016) compared with other conditions. The difference is statistically significant.
- Risk-adjusted readmission rates declined slightly faster for HRRP conditions than for non-HRRP conditions. The difference is also statistically significant.
- In addition, a study found that readmission rates declined faster for hospitals covered by the policy than for critical access hospitals not covered by the policy (Ibrahim et al. 2017).

After the reduction in readmission rates, some researchers expressed concerns that reduced readmission rates may have induced an increase in observation stays or emergency department (ED) use. In the 21st Century Cures Act of 2016, the Congress mandated that the Commission evaluate whether the recent declines in readmission rates were associated with offsetting increases in observation stays and emergency room visits. Our analysis found the following:

- Observation stays increased at a slightly faster rate after introduction of the HRRP. However, the increase in observation stays was small and offset only a small share of the reduction in readmissions. Therefore, we conclude that the reduction in readmission rates reflects real changes in practice patterns and not simply a shifting of short-stay admissions into observation stays to avoid readmission penalties. We also found that patients *without* a recent admission had similar rates of increase in observation stays. The broad-based increase in observation use (including for those without a recent admission) could in part reflect the initiation of the recovery audit contractor reviews of admissions starting in 2010. Therefore, we could not determine conclusively whether the small increase in observation stays was due to the HRRP or to other factors.

- ED visits increased after introduction of the HRRP. However, this increase appears to be due primarily to reasons other than the HRRP. To investigate what share might have been driven by the HRRP, we first compared changes in postdischarge ED use for conditions covered by the HRRP and those not covered by the program. Change in postdischarge ED use was almost identical for HRRP-covered and noncovered conditions. We also compared ED-visit growth for beneficiaries with a recent discharge from a hospital with those growth rates for beneficiaries without a recent hospital discharge. The ED growth rates were approximately equal, and the share of all ED visits that were postdischarge visits was exactly the same (4.8 percent) in 2010 and 2016. Therefore, it appears that the growth in emergency room visits was a broad phenomenon and cannot be primarily attributed to growth in postdischarge ED visits.

Some researchers have raised the question of whether efforts to reduce avoidable readmissions have also reduced necessary readmissions, resulting in higher mortality for heart failure patients. The literature is mixed on this question. One recent study reports a slight nationwide increase in 30-day postdischarge mortality rates for heart failure from 2010 to 2014. The study did not examine in-hospital mortality. Because this period of time coincided with the introduction of the HRRP and because readmission penalties are large relative to mortality penalties in the Medicare program, the study's authors suggested the HRRP may have caused the increase in mortality (Gupta et al. 2017). However, it is not known whether the increase in heart failure mortality reported was caused by the HRRP or other factors, or whether it reflected an increase in patient severity that was not fully reflected by the measure's risk adjustment model. A separate study used the hospital as the unit of analysis and found that reductions in heart failure readmissions were not correlated with increases in heart failure mortality. It concluded that the HRRP did not cause the increase in heart failure mortality from 2010 to 2014 (Dharmarajan et al. 2017).

Using more recent data, we examined readmission and mortality changes from 2010 to 2016. Our measure used a combined inpatient and post-acute mortality. Our findings, which follow, suggest that the HRRP did not negatively affect mortality:

- Although raw rates of heart failure mortality increased (as has been reported), raw rates of pneumonia and AMI mortality decreased rapidly after the HRRP was passed. On average, raw rates of mortality declined across HRRP-covered conditions. In contrast, on average, raw rates of mortality increased across non-HRRP conditions.
- On a risk-adjusted basis, mortality rates declined for all three HRRP-covered conditions from 2010 to 2016. The combination of an increase in the raw rate of heart failure mortality per discharge and a decline in the risk-adjusted rate

may be explained by an increase in the severity of illness for those beneficiaries admitted for heart failure. While the reported increase in severity of illness may in part reflect greater coding intensity, we believe some of the increase in reported severity is real given the large decline in admissions per capita and the reduced share of cases that were one-day stays. During the 2010 to 2016 period, initial hospital admissions for heart failure per capita fell by 14 percent, which implies that practice patterns changed to treat the less severely ill patients on an outpatient basis.

- Our hospital-level analysis also found a slight positive correlation between declining readmission rates and declining mortality across all three conditions, meaning that hospitals with larger than average improvements in readmissions also had larger than average improvements in mortality.

Taken together, we find no compelling evidence to suggest that the readmission reduction policy has had a negative effect on mortality. To the extent that there is a small effect, our data as a whole suggest the HRRP may have done more to improve than harm mortality rates.

In summary, the HRRP gave hospitals an incentive to reduce inappropriate readmissions. Readmission rates declined, and our analysis suggests the decline was in part due to the HRRP. Beneficiaries had to endure fewer readmissions to the hospital, and patient mortality did not increase because of the HRRP. While the HRRP may have contributed slightly to the secular trend of increasing observation use and ED use, the small increases in costs were far outweighed by reduced costs of readmissions. The decline in readmissions across all conditions resulted in net savings to the Medicare program of roughly \$2 billion per year. We conclude that the HRRP contributed to a significant decline in readmission rates without causing a material increase in ED visits, a material increase in observation stays, or a net adverse effect on mortality rates.

While the HRRP has largely been successful, that does not mean that hospitals' financial incentives cannot be improved. In Chapter 7 of this report, we discuss redesigning Medicare's quality improvement programs for hospitals into a single hospital value incentive program that would balance readmission reduction and mortality reduction incentives across conditions, account for patient experience, and adjust penalties to account for the fact that some hospitals serve larger shares of low-income Medicare beneficiaries. The Commission expects to continue to discuss potential changes to hospitals' financial incentives in the Medicare program over the next year. ■

Congressional mandate for this study

The Medicare Payment Advisory Commission shall conduct a study to review overall hospital readmissions described in Section 1886(q)(5)(E) of the Social Security Act (42 U.S.C. 1395ww(q)(5)(E)) and

whether such readmissions are related to any changes in outpatient and emergency services furnished. The Commission shall submit to Congress a report on such study in its report to Congress in June 2018. ■

Background

In 2008, the Commission reported on the need for hospitals, physicians, and post-acute care providers to improve care transitions and coordination across settings (Medicare Payment Advisory Commission 2008). One goal of improved care transitions is to reduce preventable readmissions. Unnecessary readmissions can pose risks of iatrogenic infections, medication errors, muscle weakening, and pressure injuries such as decubitus ulcers. According to researchers at the Centers for Disease Control and Prevention, health care–associated infections in hospitals are a significant cause of morbidity and mortality in the United States (Klevens et al. 2007). In addition, the inpatient environment itself can lead to a reduction in elderly patients’ independence as they cope with functional loss that can stem from extended bed rest.

To create an incentive for hospitals to improve care transitions, the Commission’s June 2008 report recommended publicly reporting readmission rates and reducing payment rates to hospitals with relatively high readmission rates (Medicare Payment Advisory Commission 2008). In the following year, CMS started to publicly report hospital-level readmission rates, and a series of articles documented high levels of readmissions to U.S. hospitals and discussed programs to reduce readmission rates (Jack et al. 2009, Jencks et al. 2009, Kanaan 2009). In 2010, the Congress enacted the Patient Protection and Affordable Care Act (PPACA), which provided for the Hospital Readmissions Reduction Program (HRRP). Under this program, hospitals could be penalized (starting in fiscal year 2013) if their readmission rates for certain specified conditions were above the national average.

After enactment of the readmission reduction program, many studies found that readmission rates declined

(Birmingham and Oglesby 2018, Cary et al. 2018, Ibrahim et al. 2017, Medicare Payment Advisory Commission 2016, Zuckerman et al. 2016). While there is a general consensus that readmission rates have declined, some have questioned whether the readmission reduction program has led to increases in substitute modes of care, such as observation stays and emergency department (ED) visits (Himmelstein and Woolhandler 2015). Others have suggested too many readmissions were avoided, resulting in increased mortality.

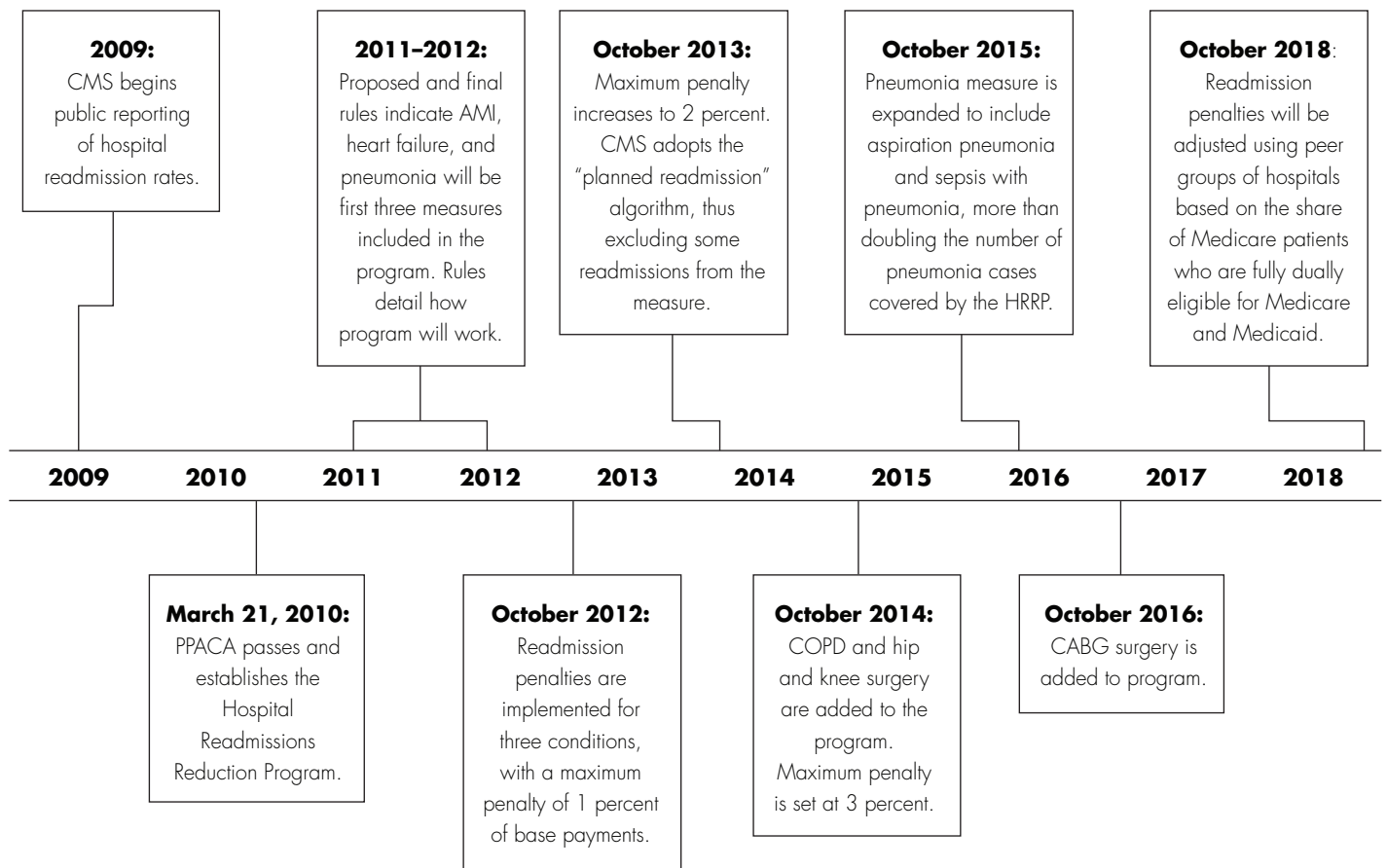
In 2016, the Congress passed the 21st Century Cures Act, which mandated that the Commission examine how the HRRP affected readmissions, observation stays, and ED visits (see text box on the mandate). In response to the mandate, this chapter examines how observation stays and ED use changed after the introduction of the HRRP. We also investigate whether changes in readmission rates are related to changes in mortality rates.

Enactment of and changes to the HRRP

The HRRP was enacted in 2010 and required that Medicare payments to hospitals with above-average risk-adjusted readmission rates be reduced starting in 2013. The 2013 reductions would depend on readmission rates during three previous years (July 2008 to June 2011) for three conditions (heart failure, acute myocardial infarction (AMI), and pneumonia). CMS continues to set penalties for a given year based on readmission performance during the most recent three-year period of data available (e.g., fiscal year 2018 penalties are based on discharges from July 1, 2013, through June 30, 2016). The HRRP was later expanded to include three more conditions (chronic obstructive pulmonary disease (COPD), planned hip and knee replacement surgery, and coronary artery bypass graft (CABG) surgery). A time line of changes to the HRRP is shown in Figure 1-1 (p. 8).

**FIGURE
1-1**

Timeline for the Hospital Readmissions Reduction Program



Note: AMI (acute myocardial infarction), PPACA (Patient Protection and Affordable Care Act of 2010), FY (fiscal year), COPD (chronic obstructive pulmonary disease), CABG (coronary artery bypass graft).

The HRRP caps the maximum penalty for an individual hospital at 3 percent of total base Medicare inpatient operating payments. In fiscal year 2018, 81 percent of hospitals will have payments reduced because of the HRRP. Most of the penalties are small, with 48 percent of those hospitals receiving less than a 0.5 percent penalty. About 6 percent of the penalized hospitals receive the largest penalties (between 2 percent and 3 percent of base payments) for their relatively poor performance. The average penalty is \$217,000 for those hospitals receiving a penalty in 2018. Total penalties are expected to be \$556 million in 2018, or 0.3 percent of hospitals' overall Medicare payments.

CMS computation of risk-adjusted readmission rates

The HRRP measures a hospital's readmission performance using the National Quality Forum–endorsed risk-adjusted 30-day readmission measures for six conditions.¹ Measures are for all-cause readmissions for beneficiaries age 65 or older, with limited exclusions such as planned readmissions for patients with AMI. Risk adjustment is based on the use of hierarchical regression models using selected hierarchical condition categories to adjust for patient characteristics. Conditions are identified based on the principal discharge diagnosis, which is not necessarily

the diagnosis related group (DRG) assigned to the case for payment.² A detailed discussion of how the penalty is computed is included in online Appendix 1-A, available at <http://www.medpac.gov>.

Commission discussions of potential changes to the readmission reduction program

In its June 2013 report to the Congress, the Commission suggested several improvements to the HRRP (Medicare Payment Advisory Commission 2013). The first called for setting a fixed target for readmission rates, so aggregate penalties would go down when industry performance improved. A second suggestion was to fix the current formula by removing the “multiplier,” which sets the readmission penalty equal to a multiple of the price associated with the initial admission. As the policy currently stands, the penalty for each excess readmission is disproportionately large relative to the cost of the readmission. For example, under current law, the penalty for one excess heart failure readmission equals almost 5 times the cost of the initial heart failure admission, and the penalty for one excess hip or knee readmission is over 20 times the cost of an initial admission. Removing the multiplier and setting the penalty equal to the cost of excess readmission would reduce the penalty for a single excess heart failure readmission by about 70 percent and reduce the penalty for a single excess hip/knee readmission by about 95 percent. A discussion of the penalty multiplier is in online Appendix 1-A, available at <http://www.medpac.gov>.

Third, the Commission suggested using an all-condition readmission measure to increase the number of data points and reduce the random variation that single-condition readmission rates face under current policy. The extra savings from shifting to an all-condition measure would fund the cost of removing the multiplier, resulting in budget neutrality. A fourth improvement would be to evaluate hospitals’ readmission rates against rates for peer hospitals with similar shares of low-income patients as a way to adjust penalties for the effects of socioeconomic status. The Congress has acted on only one of these options. The 21st Century Cures Act (Public Law 114–255) includes a provision (Section 15002) requiring the Secretary of the Department of Health and Human Services to adjust readmission penalties using peer groups of hospitals based on the share of Medicare patients who are fully dual-eligible for Medicare and Medicaid starting in fiscal year 2019. Descriptions of the problems each policy option aims to address are shown in the text box (p. 10).

Prior research on the effects of the HRRP

There is general agreement in the literature that readmission rates declined after the passage of the HRRP and that conditions covered under the readmission penalty saw the greatest reduction in readmissions (Medicare Payment Advisory Commission 2016, Zuckerman et al. 2016). A survey of hospital administrators found that most believed the HRRP had a “great impact” on their efforts to reduce readmissions, suggesting that at least part of the reduction in readmissions after the HRRP was due to the program’s incentives (Joynt et al. 2016). Readmission rates have also declined for Medicare Advantage and privately insured patients, suggesting that factors in addition to the HRRP are acting to reduce readmissions or that the effect of the HRRP may have “spilled over” to the Medicare Advantage and private insurer markets (Chen and Grabowski 2017). As we have stated in the past, reductions in readmissions generated more savings for the program than did the readmissions penalties (Medicare Payment Advisory Commission 2015). The more controversial questions involve how the readmissions penalty affects hospitals serving large shares of low-income patients, whether the reduction in readmissions simply reflects a shifting of patients to observation status or ED status, and whether reduced readmissions lead to increased mortality.

Social risk factors and readmission rates

In our initial examination of the readmissions policy, the Commission found that hospitals with larger shares of low-income Medicare patients tended to have systematically higher readmission rates because of individual effects, neighborhood effects, or both (Medicare Payment Advisory Commission 2013). Numerous studies have similar findings (Gu et al. 2014, Hu et al. 2018, Hu et al. 2014, Sheingold et al. 2016). The Office of the Assistant Secretary for Planning and Evaluation, which evaluated social risk factors under the hospital value-based purchasing programs, found that lower income patients did tend to have worse outcomes, but they also found that hospitals serving more lower income patients tended to have worse outcomes even after controlling for patient mix (Office of the Assistant Secretary for Planning and Evaluation 2016). While hospitals serving the poor tend to have higher levels of readmissions, they have also been able to improve readmission rates faster than other hospitals (Salerno et al. 2017).

Policy options previously discussed by the Commission to improve the program

In its June 2013 report to the Congress, the Commission published a chapter on the Hospital Readmissions Reduction Program (HRRP) that discussed how the program was successful in motivating hospitals to reduce readmissions. But we also discussed several problems with the current program and how the HRRP could be revised to work better. Table 1-1 summarizes some of the Commission’s concerns and policy options to address those concerns.

In 2011, the Commission recommended redesigning the Quality Improvement Organization program so that the Secretary could fund time-limited technical assistance directly to providers and communities to help

improve quality of care (Medicare Payment Advisory Commission 2011b). Such a reform could increase the likelihood that providers and communities receive the technical assistance that hospitals deem relevant to their quality improvement efforts. Other sources of federal funding for readmission reduction efforts (such as the Partnership for Patients and Community-Based Care Transitions Program) encourage hospitals to improve care coordination with providers outside the hospital (and thus reduce readmissions) and make other quality improvements. These programs provide funds for external organizations to help support hospitals’ efforts to improve patient outcomes. ■

**TABLE
1-1**

Readmission policy issues and proposed solutions

Concern	Description of the problem	Proposed solution
Small number of observations	It is difficult to distinguish between random variation and true performance improvement when examining a small number of cases for a small number of conditions.	<ul style="list-style-type: none"> • Use all-condition readmissions. • Continue to use 3 years of data. • Allow hospitals to aggregate performance within a system.
Lack of a fixed target	The readmission rates hospital must achieve to avoid penalties decrease as industry performance improves.	Create a prospective target. The target could be set below current readmission rates to maintain budget neutrality.
Computation of the penalty	The penalty is a multiple of the cost of each excess readmission. As national readmission rates decline, the multiplier increases. Thus, penalties per readmission increase.	Drop the multiplier and set the penalty equal to the cost of excess readmissions. Use all-condition readmissions to offset the cost of removing the multiplier.
Correlation between socioeconomic status and readmission rates	Lower income patients have higher readmission rates.	<ul style="list-style-type: none"> • Report all hospital risk-adjusted rates without an SES adjustment. • Compute targets to determine the penalty for peer groups of hospitals with similar low-income shares (SSI beneficiaries). (<i>The Congress enacted a similar policy that will start in October 2018.</i>)

Note: SES (socioeconomic status), SSI (Supplemental Security Income).

To protect hospitals serving the poor from experiencing disproportionate penalties, the Commission has discussed measuring hospitals’ performance against a peer group

of hospitals with a similar share of low-income patients. Under this construct, the actual readmission scores (unadjusted for social risk factors) would continue to be

reported on Hospital Compare, but the thresholds hospitals would have to meet to avoid readmission penalties would be more lenient for hospitals serving more low-income patients (Medicare Payment Advisory Commission 2013). The Congress mandated that this type of peer grouping be incorporated in the HRRP beginning in October 2018.

Evidence suggests that increased observation care and ED visits are largely due to factors other than the HRRP

Some researchers have contended that the decline in readmissions can be largely attributed to the rapid increase in use of observation, which means that the patient receives care in the hospital but is not formally admitted (Himmelstein and Woolhandler 2015). Their concern is that clinicians are not truly taking steps to improve care and care transitions. The hypothesis is that the number of events requiring a readmission has not truly been reduced, but instead, ED clinicians opt to treat these events by keeping the patients in an outpatient observation status rather than readmitting them. If that hypothesis were the case, the decline in readmissions might result in Medicare program savings but might not reflect any true gains in the quality of care for beneficiaries. However, the Commission's 2016 analysis of the increase in observation stays and decline in readmissions from 2011 to 2013 found that readmission rates declined substantially, even after adjusting for the growth in observation stays (Medicare Payment Advisory Commission 2016). In general, only 20 percent to 25 percent of the readmissions decline could be accounted for by increased use of one-day or longer outpatient observation stays. Moreover, we found that in that 3-year period, growth in the use of 24-hour-plus observation stays occurring within 30 days of discharge from a hospital (22.2 percent) was essentially the same as the overall per capita growth rate in 24-hour-plus observation stays (22.1 percent). Thus, the increased use of observation care was not systematically higher for patients with a prior admission than for the Medicare population overall. Similarly, Zuckerman and colleagues examined data through May 2015 and found “no significant association between changes in observation-service use and changes in readmission rates” after implementation of PPACA (Zuckerman et al. 2016). In accordance with our mandate, we reexamined whether reduced readmissions were associated with increased observation stays or increased ED visits after a hospital discharge. We are not aware of any literature that has examined growth in ED visits after introduction of the HRRP.

Prior studies are inconclusive regarding the relationship between reduced readmissions and increased mortality

A goal of the HRRP is to improve care transitions and coordination between the hospital, physicians, and post-acute care providers. The benefits of reconciling medication before discharge, ensuring postdischarge appointments with primary care physicians, and coordinating care plans with post-acute care providers have been well documented (Coleman et al. 2006, McHugh et al. 2017, Naylor et al. 2011, Zuckerman et al. 2017). To the extent that the HRRP improves care coordination—including reconciling medication before discharge—it should reduce readmissions and reduce (or at least not increase) mortality. However, some have raised concerns that hospitals may avoid appropriate readmissions, possibly by encouraging ED physicians to send patients home rather than readmit them, which could lead to higher mortality and lower readmissions. Another possibility is that the HRRP induces both positive and negative changes in practice patterns, such as better care transitions and medication reconciliation but also the discouragement of readmissions that are medically appropriate.

Two 2017 studies examined changes in readmissions and mortality from 2008 to 2014. Both studies found that risk-adjusted mortality during the 30 days after hospital discharge increased slightly from 2010 to 2014 (they ignored in-hospital mortality changes).³ The question is whether that increase in postdischarge mortality is related to the passage of the HRRP or to other factors. The first study, by Dharmarajan and colleagues, examined hospital-level changes in mortality and readmission rates related to AMI, pneumonia, and heart failure (Dharmarajan et al. 2017). The researchers examined Medicare discharges at approximately 3,500 hospitals, including 3 million heart failure discharges, and found a slight positive correlation between changes in mortality and changes in readmissions. This finding indicates that hospitals that reduced readmissions more than average tended to reduce mortality more than average. The magnitude of the correlation for heart failure is small (0.066), but statistically significant. Dharmarajan and colleagues concluded that the increasing rate of postdischarge heart failure mortality was not related to reductions in readmission rates.

The second study, by Gupta and colleagues, which examined a smaller data set and a narrower question, focused only on heart failure mortality (Gupta et al. 2017). The Gupta study looked only at national trends

among heart failure patients using 115,245 discharges over 9 years from a sample of 416 hospitals. Gupta and colleagues found that risk-adjusted mortality rates increased after the readmission reduction program was started. Relative to 2010, they found that one-year raw rates of mortality increased by 3.6 percentage points (from 34.5 to 38.1 percent) and risk-adjusted rates increased by 5 percentage points (from 31.3 percent to 36.3 percent) after the HRRP's passage.⁴ Because the national trend of increasing risk-adjusted mortality coincided with the national trend toward lower readmission rates, the authors conclude that, "if further confirmed, these findings may require reconsideration of the HRRP in HF [heart failure]." Unlike the Dharmarajan study, however, the Gupta study did not conduct a hospital-level analysis to determine whether hospitals with greater readmission reductions also had greater mortality increases.

One concern with the Dharmarajan and Gupta studies is that the 2010 to 2014 time frames they used coincided with a large national drop in initial admissions and a shift in the types of patients treated by the hospitals in the studies' samples. This change in admission patterns could result in a difference in the severity of patients that may not be fully picked up by the risk adjuster (as acknowledged by Dharmarajan and colleagues). The changing patient mix and practice patterns were reflected in the Gupta study by a doubling of hospice use from 2010 to 2014. When Gupta and colleagues removed all hospice patients from their model, the change in 30-day mortality rates after the HRRP's introduction was no longer statistically significant. For one-year mortality, the excess risk of mortality was reduced, but was still slightly positive and remained statistically significant. It is not clear why the HRRP would have a larger effect on one-year mortality than 30-day mortality. An alternative explanation for increasing heart failure mortality is that patient severity could have changed over the 2010 to 2014 period in ways that were not fully accounted for by the risk adjuster (Dharmarajan and Krumholz 2017, Dharmarajan et al. 2017).

A more recent study looked at Medicare's Hospital Compare data to examine changes in mortality for heart failure and AMI from 2009 through 2015 (Chatterjee and Joynt Maddox 2018). This study used Hospital Compare data to show that, on average, AMI mortality fell during the period, but heart failure mortality increased. However, heart failure mortality fell for the subset of hospitals that initially had high heart failure mortality. Unlike the Gupta and Dharmarajan studies, this study examined

mortality for the period during the hospital admission and extending 30 days postdischarge. However, the Hospital Compare risk adjustment method produces data that are not designed for longitudinal comparisons. The risk adjustment method is as follows: "The [risk-standardized mortality measure] is calculated as the ratio of the number of 'predicted' deaths to the number of 'expected' deaths at a given hospital, multiplied by the national observed mortality rate" (QualityNet 2017). Because the ratio of predicted to expected deaths is multiplied by each year's national raw rate of mortality for the year, when reviewed over time, the data are indicative of trends in raw unadjusted mortality rates. Therefore, the Chatterjee study indicates that raw (not risk-adjusted) AMI mortality rates appear to have declined while raw (not risk-adjusted) heart failure mortality rates increased from 2009 through 2015. On average (across baseline poor performers and baseline good performers), the study suggests that raw rates of heart-failure mortality increased slightly. This finding is consistent with the data we show in this chapter. However, as we discuss in the chapter, raw rates of mortality are not fully illustrative of trends in risk-adjusted mortality due to increasing severity of patients admitted for heart failure.

In an epidemiological study, Khera and colleagues reported that one-year mortality following an inpatient admission for heart failure increased slightly from 2010 to 2012 among a 5 percent sample of Medicare patients (Khera et al. 2017). However, that article examined all heart failure cases, including cases that are not subject to the readmissions policy, such as those where heart failure was a secondary diagnosis on admission. In addition, the study ended before the implementation of the HRRP penalties. Thus, the primary article contending that the HRRP may have resulted in an increase in risk-adjusted mortality continues to be the article by Gupta and colleagues. Later in this chapter, we also examine whether lower readmission rates are associated with higher risk-adjusted mortality.

Our methodology for evaluating the HRRP effects

To examine Medicare trends over time (in readmissions, observation stays, ED visits, and mortality), and hospital-specific correlations between readmission and mortality changes (as Dharmarajan and colleagues did), we examined changes in readmissions and mortality

from 2010 to 2016. Our mortality analysis examined changes in mortality during the admission and 30 days postdischarge. As we explain in online Appendix 1-B, available at <http://www.medpac.gov>, we believe looking at the combination of inpatient and postdischarge mortality will reduce problems that can be caused by a shift in the site of mortality (for example, from the inpatient setting to hospice, which may have the effect of increasing postdischarge mortality). We also put our findings in context by discussing other Medicare program changes happening at that time. Changes include the Medicare Recovery Audit Contractor (RAC) Program in 2010 (which started challenging whether hospital short stays were medically necessary) and more intense coding under the Medicare severity–diagnosis related group (MS–DRG) system implemented in 2008. Because these factors coincided with the HRRP, we also conducted a hospital-level analysis. We examined whether changes in readmission rates correlated with changes in mortality rates, as did Dharmarajan and colleagues. If declines in risk-adjusted readmissions are correlated with increases in mortality, that would be of concern. In contrast, if declines in readmission rates are associated with declines in mortality, that would be reassuring. (Online Appendix 1-B, available at <http://www.medpac.gov>, provides more detail on why we have chosen this methodology.) In this report, we show four types of analyses: (1) trends in raw rates of readmission and mortality; (2) trends in risk-adjusted readmissions and mortality (because we expect the severity of admitted patients to be increasing, we expect risk-adjusted readmissions and mortality to fall faster than raw readmissions and mortality); (3) trends in observation stays and ED visits; and (4) a cross-sectional analysis of hospital performance. We examine cross-sectional performance because the time trends for readmissions, observation, ED visits, and mortality may be affected by concurrent policy and coding changes, as discussed in online Appendix 1-B.

Risk adjustment is necessary but imprecise

To evaluate the HRRP’s effects, we started with a population of admissions that are subject to the HRRP incentives. This population was identified using the list of International Classification of Diseases (ninth and tenth revisions) codes that CMS uses to identify eligible cases. We focused our analysis on the five conditions covered by the HRRP through fiscal year 2016: AMI, heart failure, pneumonia, COPD, and planned hip and knee replacement surgery (the latter two conditions were added in 2014).

The population is further limited to beneficiaries at least age 65 who were covered by fee-for-service Medicare (both Part A and Part B) for 12 months before their admission.

Risk adjustment is necessary because the severity of patients admitted to the hospital has been increasing in recent years. While some of the increase in patient risk profiles over time could be because of coding, much of the increased severity of illness appears to be real. One potential cause of a real increase in patient severity is the large decline in admission rates since 2010; declining admission rates may have raised the severity of illness of patients who were admitted. The decline in initial admissions may have been partially caused by the RAC Program that started in 2010—the same year the HRRP was enacted. The RAC Program gave hospitals incentives to keep less severely ill patients who enter the emergency room as observation patients rather than admit those patients into the inpatient system. After introduction of the RAC Program, the share of patients discharged after a one-day stay declined and the share of patients staying longer than one day increased (see online Appendix 1-B, available at <http://www.medpac.gov>). Because patients discharged after only one day tend to be less sick, the one-day stays probably had lower risk of readmission and mortality. As expected, hospitals reported that the risk profile of the admitted patients increased over this time frame. However, some of the increase over time may have been due to changes in coding practices. The changes in coding pressure and RAC pressure differed over time. The changes could be divided into three key periods:

- **2008 to 2010**—In 2008, Medicare introduced MS–DRGs. The new DRGs created greater incentives for complete coding. We and CMS have documented the increased coding that occurred from 2008 to 2010 (Centers for Medicare & Medicaid Services 2012, Medicare Payment Advisory Commission 2011a). For that reason, the more rapid decline in risk-adjusted compared with raw readmission rates during that period may in part reflect coding changes.
- **2010 to 2014**—From the end of 2010 to 2014, hospitals were having the medical necessity of short stays challenged by the RACs, resulting in denial of some payments (see Appendix online Appendix 1-B, available at <http://www.medpac.gov>). During this period, Medicare admissions per capita declined materially, with the largest declines being for one-day stays. This trend suggests that increased severity

of cases during this period was not simply a coding phenomenon, but a real increase in patient complexity.

- **2014 to 2016**—RAC pressure was reduced in 2014. While there continued to be a material decline in medical admissions per capita during this period, the share of cases that were one-day stays actually increased slightly in 2016. The faster decline in risk-adjusted readmission rates in 2016 (compared with earlier years) could in part be because the share of admissions that needed to stay only one day was no longer falling in 2016.

Given the uncertainty about how much of the changes in risk-adjusted readmissions was due to coding, we conducted cross-sectional analyses in addition to the time series analyses to determine whether hospital-level differences in readmission rates over time were related to some combination of hospital-level differences in rates of observation stays, ED use, and mortality after discharge.

Our categorical risk adjustment model

We used a categorical risk adjustment model based on one developed by 3M and used by the Agency for Healthcare Research and Quality to risk adjust mortality rates. In our model, we calculated an expected rate of readmission for a group based on the group's three-year historical average (e.g., 2010 to 2012) rate of readmission. Cases were grouped by base all-patient refined–diagnosis related group (APR–DRG), severity of illness, age, sex, and mental health diagnosis (if any). These classifications allowed us to examine the average rate of readmission for each category—for example, a male age 75 to 84 in base APR–DRG 194 (heart failure) at severity of illness level 3 with no mental health diagnosis. A clinical categorical model is similar to a regression in its approach but with many more interaction terms. For any given base DRG, readmission rates increase with patient severity (and in general increase with age), are higher for men, and are higher again if the patient has a mental health diagnosis. To get a reasonably reliable average readmission rate for each category, we required at least 25 cases in each category. (See online Appendix 1-B, available at <http://www.medpac.gov>, for more details on risk adjustment methods).

Unplanned versus potentially preventable

In our analysis we examined three types of readmissions: all-cause, unplanned, and potentially preventable. We did this to examine whether the rate of change in readmissions

is sensitive to type of readmission measure used. All-cause readmissions include all returns (except transfers) to the hospital after a qualifying initial admission. CMS initially used this approach to track readmissions; however, under the legislation establishing the HRRP, CMS was not supposed to count readmissions that were “unrelated to the prior discharge (such as a planned readmission or transfer to another applicable hospital).” As a result, CMS developed the planned readmission algorithm, which was implemented in the second year of the HRRP. The planned readmission algorithm eliminates readmissions for transplants, maintenance chemotherapy, rehabilitation, and a set of 59 surgical procedures that are generally considered planned. However, if the surgical procedures are accompanied by a selected set of medical diagnoses as the principal discharge diagnosis, the readmission is considered unplanned. We find that only about 5 percent of readmissions are removed with the planned-readmission algorithm.

As a cross-check on the robustness of the unplanned-readmission methodology, we compared trends in unplanned readmissions with an alternative metric of potentially preventable readmissions (PPRs) developed by 3M. The PPR methodology captures readmissions that were clinically related to the prior admission and for which there is a reasonable expectation that it could have been prevented.

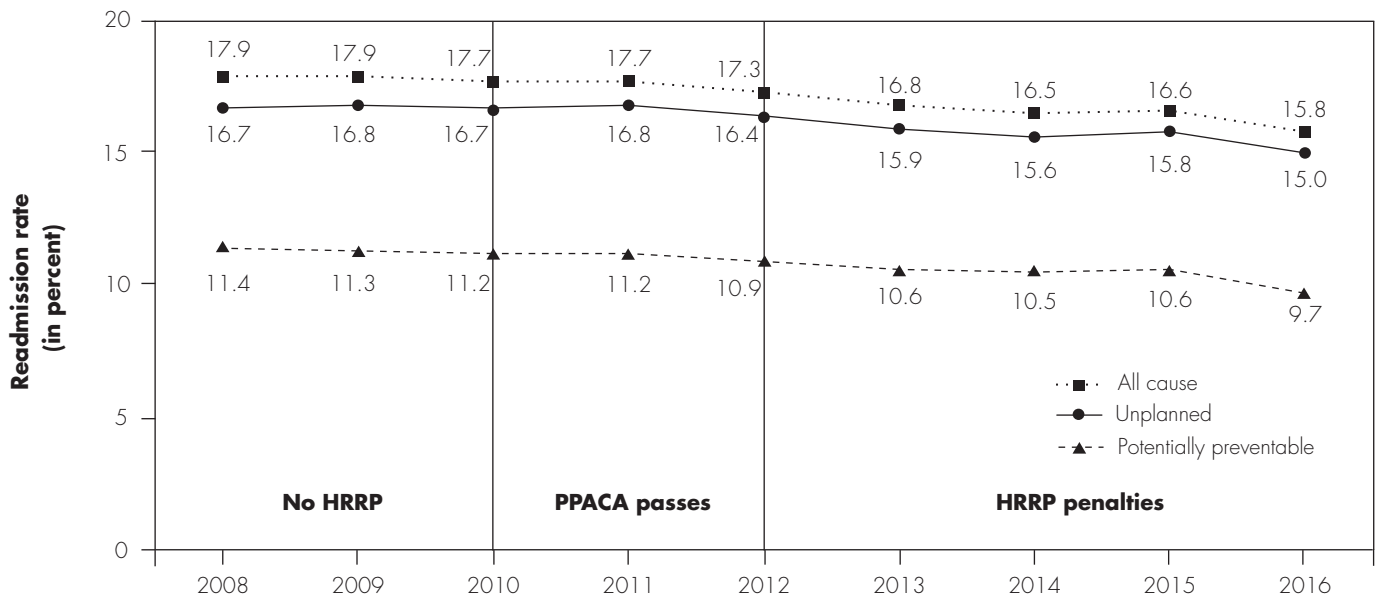
Results

Raw all-cause, unplanned, and potentially preventable measures of readmissions all show similar rates of decline

The trends in the raw all-cause, unplanned, and potentially preventable readmission rates from 2008 to 2016 were similar, although the magnitudes differed (Figure 1-2). The unplanned readmission rate was slightly lower than the all-cause rate, which is as expected since the number of exclusions for planned surgeries is relatively small. The PPR rate was about 5 percentage points lower than the unplanned readmission rate. This lower rate is the result of counting only clinically related readmissions that are potentially preventable and not counting subsequent readmissions that are part of a readmission chain.⁵ Over the period examined, the basic trend lines for all of these measures of readmissions were similar, suggesting that using either of the two risk-adjusted measures of readmissions would yield similar results. Historically, the

FIGURE 1-2

Trends in raw rates of readmission across all conditions, 2008–2016



Note: HRRP (Hospital Readmissions Reduction Program), PPACA (Patient Protection and Affordable Care Act of 2010).

Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

Commission has reported the trend in PPR rates. However, because our mandate is to evaluate the HRRP, we used the unplanned readmission rate for this report. Doing so allowed us to examine changes in readmissions, mortality, and service use for the specific population of admissions subject to the HRRP.

The average unplanned readmission rate was flat before the start of the HRRP (16.7 percent in 2008 and in 2010). After the HRRP passed in 2010, the raw unplanned readmission rate declined by an average of 0.15 percentage point per year from 2010 and 2012. After the penalties started to take place in 2013, the rate declined by 0.35 percentage point per year on average.

In the 2010 to 2016 period, raw rates of readmission fell for each condition covered by the HRRP (Figure 1-3, p. 16). Of the conditions initially included in the HRRP, AMI saw the largest decline in raw rates of readmission during that period, falling from 19.0 percent to 15.4 percent. Readmission rates for heart failure also declined substantially, falling from 23.6 percent to 20.6 percent. Pneumonia, the third condition initially covered by the HRRP, also saw a sizable decline, falling 2.3 percentage

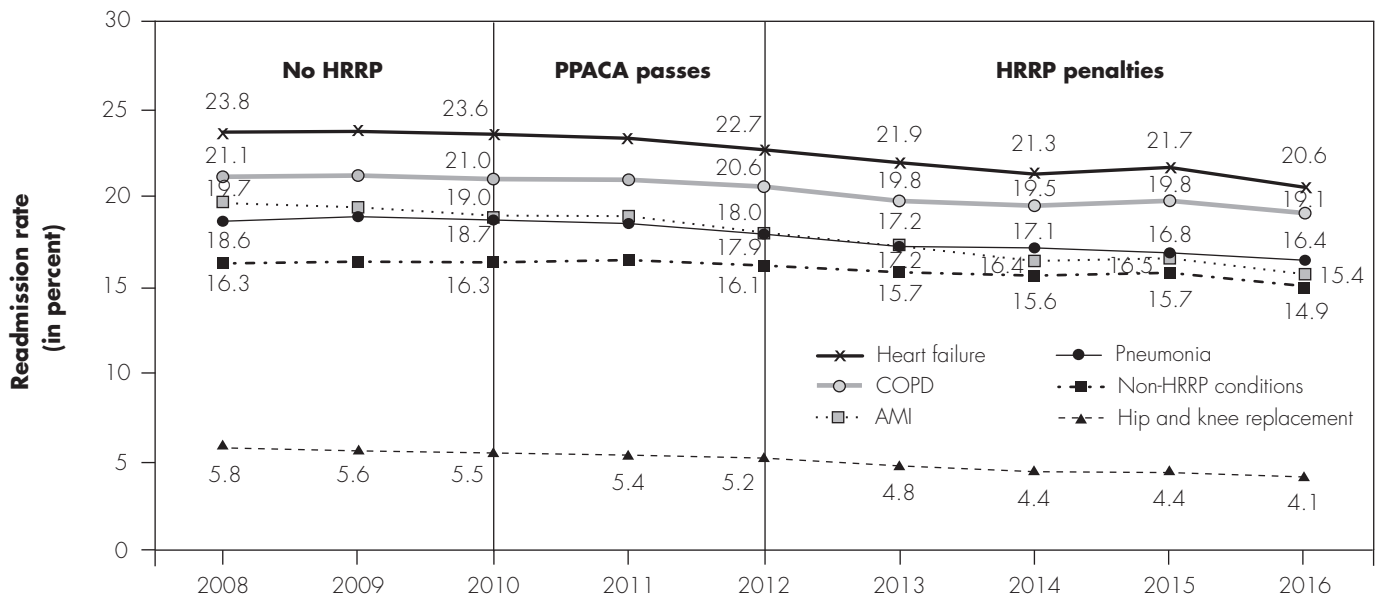
points. Across conditions not covered by the program, unplanned readmissions fell at a slower rate than for HRRP conditions, from 16.3 percent to 14.9 percent.⁶

A comparison of pre-HRRP rates of change (2008 to 2010) with rates after the HRRP was introduced (2010 to 2016) shows an accelerated annual rate of decline in raw rates of unplanned readmission: 0.3 percentage point faster on average after 2010 when the Act was passed. Specifically, we examined readmission rates for all inpatient prospective payment system hospitals with available data from 2010 to 2016. For the 1,819 hospitals with more than 50 heart failure discharges in 2008, 2010, and 2016, the rate of decline in heart failure readmissions was faster after 2010. The difference is statistically significant using a Wilcoxon signed-rank test ($p < 0.01$). Similarly, for the 2,270 hospitals with more than 50 pneumonia discharges, the rate was faster after 2010 ($p < 0.01$). For the 946 hospitals with more than 50 AMI discharges in each year, the rate of decline in AMI readmissions was also greater after 2010 ($p = 0.03$).

However, raw rates of readmission are not fully illustrative because the mix of cases admitted to hospitals has

FIGURE 1-3

Raw unplanned readmission rates for conditions covered by the HRRP, 2008-2016



Note: HRRP (Hospital Readmissions Reduction Program), PPACA (Patient Protection and Affordable Care Act of 2010), COPD (chronic obstructive pulmonary disease), AMI (acute myocardial infarction). The pneumonia measure reflects the expanded definition used starting in fiscal year 2016, which includes simple pneumonia, aspiration pneumonia, and sepsis with pneumonia as a secondary diagnosis.

Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

changed. From 2010 to 2016, Medicare admissions per capita fell by 17 percent, suggesting that the easier cases were no longer being treated on an inpatient basis. Admission rates for the three HRRP-covered conditions also declined substantially: Per capita heart failure admission rates dropped 14 percent, per capita pneumonia rates fell 11 percent, and per capita AMI rates declined 9 percent. A number of factors contributed to this decline in inpatient admissions, including technological improvements, general practice pattern changes, accountable care organizations (ACOs), the impact of RACs denying the necessity of certain admissions, and the “two-midnight” rule that discouraged short-stay admissions.⁷ Many of these policies occurred concurrently with implementation of the HRRP.

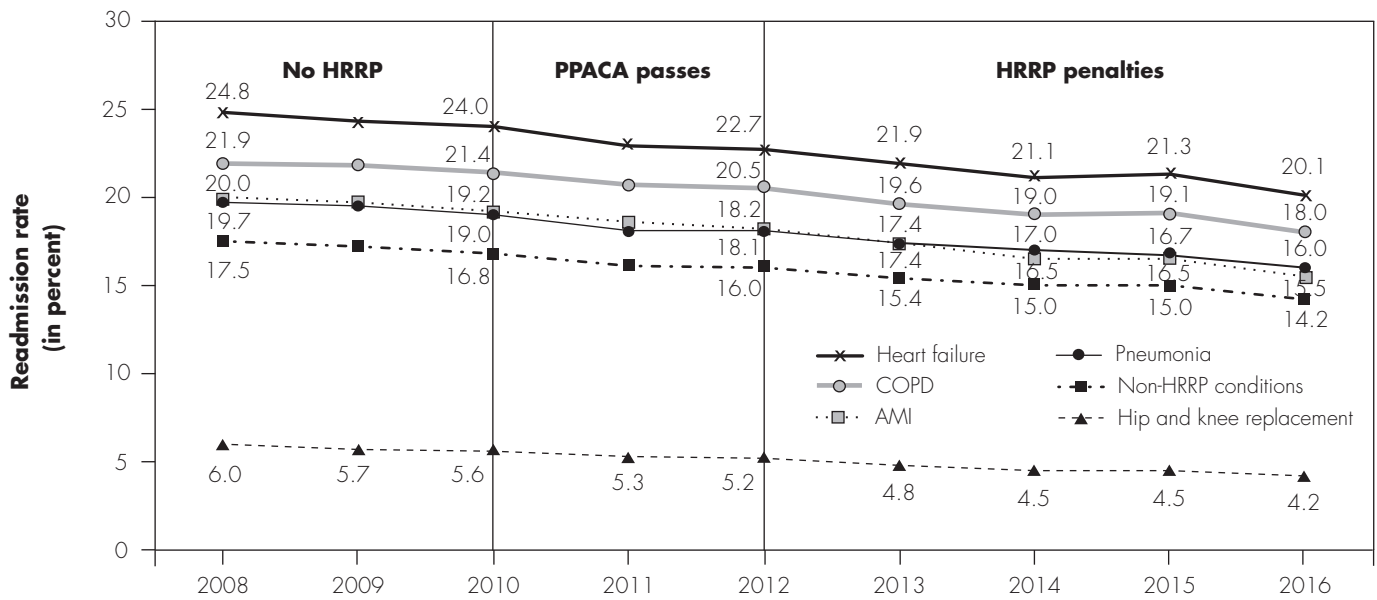
The steep decline in admission rates underscores the importance of adjusting for the change in mix of patients because those admitted after the more restrictive policies would generally have a higher severity of illness with a greater likelihood of being readmitted (that is, higher expected readmission rates).

The decline in risk-adjusted readmission rates was steeper than that in raw readmission rates. Between 2010 and 2016, across non-HRRP conditions, risk-adjusted readmissions fell 2.6 percentage points, from 16.8 percent to 14.2 percent. As shown in Figure 1-4, the declines were even greater for the HRRP-covered conditions as of 2010: heart failure (3.9 percent), AMI (3.7 percent), and pneumonia (3.0 percent). Even the rate of readmissions for hip and knee replacements, which was already low, fell 1.4 percentage points. The trends in raw readmission rates and the trend in risk-adjusted readmission rates suggest that the HRRP helped to contribute to the reduced hospital readmission rates.

On average, across HRRP conditions, the rate of decline in the risk-adjusted readmission rates was faster after the program’s passage (2010 to 2016) than in the earlier period (2008 to 2010) by about 0.2 percentage point per year. The decline in heart failure readmissions was steeper after 2010 and was statistically significant when measuring the percentage point change or percentage change in heart failure readmission rates.

FIGURE 1-4

Risk-adjusted changes in unplanned readmission rates by condition, 2008–2016



Note: HRRP (Hospital Readmissions Reduction Program), PPACA (Patient Protection and Affordable Care Act of 2010), COPD (chronic obstructive pulmonary disease), AMI (acute myocardial infarction). The pneumonia measure reflects the expanded definition used starting in fiscal year 2016, which includes simple pneumonia, aspiration pneumonia, and sepsis with pneumonia as a secondary diagnosis.

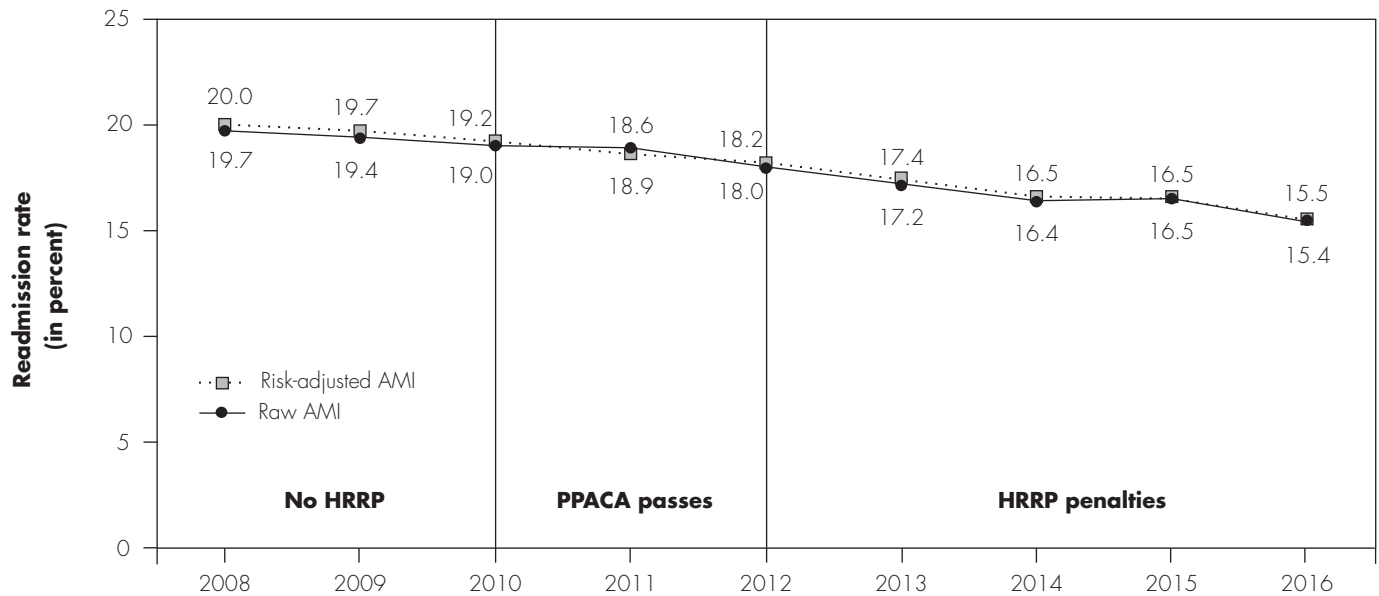
Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

Pneumonia and AMI readmission rates also fell faster after 2010, but the tests for statistical significance were mixed. For pneumonia, if we measure the change in percentage points, the readmission rate fell faster after 2010, but not by a statistically significant amount ($p = 0.12$). However, it was harder to achieve the same percentage point reduction in readmissions in later years because of declining readmission rates. Therefore, we also measured the percentage change in the rate of decline in readmission rates (as opposed to percentage point change). Using this percentage change method, pneumonia readmission rates fell faster after 2010 by a statistically significant amount ($p < 0.01$). Similarly, the risk-adjusted readmission rate for AMI declined 0.2 percentage point per year faster after 2010 on average. The difference is not statistically significant when measuring change in percentage points ($p = 0.09$) but is significant when measuring the percentage change ($p < 0.01$). Therefore, while readmission rates for AMI and pneumonia were falling more rapidly after 2010, the difference is statistically significant only when using one of the two methods of statistical testing.

An interesting finding is that raw readmission rates were generally not declining before 2010, but risk-adjusted rates were declining. The difference could be in part due to increasing complexity of patients, but another possibility is that the introduction of MS-DRGs in 2008 affected the rates. The MS-DRGs may have caused greater increases in coding during the years immediately after their introduction (2008 to 2010), which in turn may have resulted in overstating the decrease in risk-adjusted readmission rates during these years (Centers for Medicare & Medicaid Services 2012, Medicare Payment Advisory Commission 2011a). By 2010, the effect of the new MS-DRGs on coding had largely been built into the system, which could explain the slower growth of coding from 2010 onward.

The decline in readmission rates reflects more than coding changes

To gain some insight into the degree that coding changes affected risk-adjusted rates, we examined raw and risk-adjusted readmission rates for AMI. AMI readmissions are less discretionary than pneumonia or heart failure

FIGURE 1-5**Reduction in AMI readmission rates was not driven by coding, 2008-2016**

Note: AMI (acute myocardial infarction), HRRP (Hospital Readmissions Reduction Program), PPACA (Patient Protection and Affordable Care Act of 2010).

Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

readmissions. For example, a readmission that was preceded by a test indicating an ST-elevation myocardial infarction would be seen as less discretionary and less likely to be challenged by the RAC. Therefore, unless coding changed, we would expect profiles of AMI-admitted patients to change relatively little, causing raw and risk-adjusted readmission rates to be similar. However, if coding had driven the change in risk profile, we would have expected even AMI raw and risk-adjusted readmission rates to diverge.

In fact, the risk-adjusted and raw rates for AMI tracked closely after 2010 (Figure 1-5). For this reason, we contend that the increased risk profile in other conditions, such as heart failure and pneumonia, at least partially reflects true differences in the characteristics of admitted patients from 2010 through 2016.

Because the reported characteristics of inpatient admissions have changed, we also examined changes in admissions per capita. For all conditions other than hip and knee replacements, admissions per capita between 2010 and 2016 declined (Figure 1-6). Interestingly, the fall in admission rates for the three initial HRRP-covered

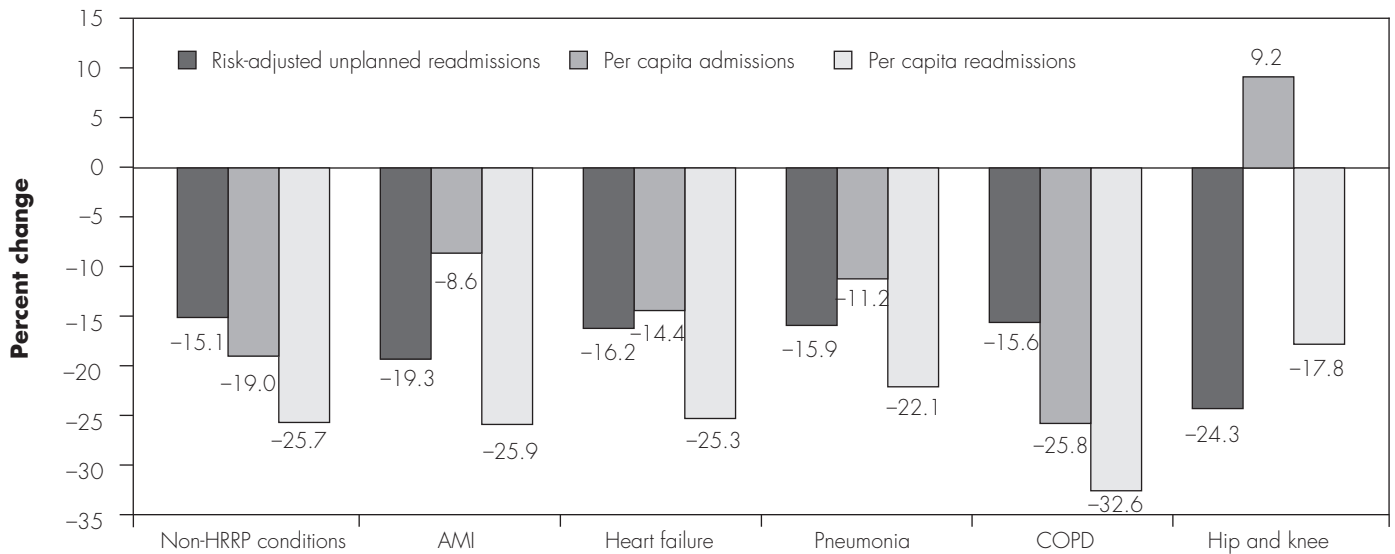
conditions (AMI, heart failure, and pneumonia) was smaller than the decline observed across conditions not covered by the HRRP. If hospitals were avoiding admitting patients in these conditions to potentially circumvent readmission penalties, we would have observed a larger reduction for the HRRP-covered conditions. The combined effect of falling admission rates and decline in readmission rates meant the number of readmissions per Medicare beneficiary (across all beneficiaries) declined by more than 20 percent on average. For example, from 2010 to 2016, heart failure admissions declined by 14.4 percent per capita. Among this smaller number of admissions, readmissions fell by 16.2 percent. The combined effect of fewer admissions and fewer readmissions per admission was a 25.3 percent reduction in heart failure readmissions per capita (Figure 1-6).

Admission rates declined while observation stays and emergency department visits increased

Along with the drop in admission rates, the Medicare program has seen a steady rise in beneficiaries' use of observation stays and EDs (Figure 1-7). These trends in rising observation and ED use started before the HRRP was implemented.

FIGURE 1-6

Percent change in per capita admission and readmission rates, 2010-2016

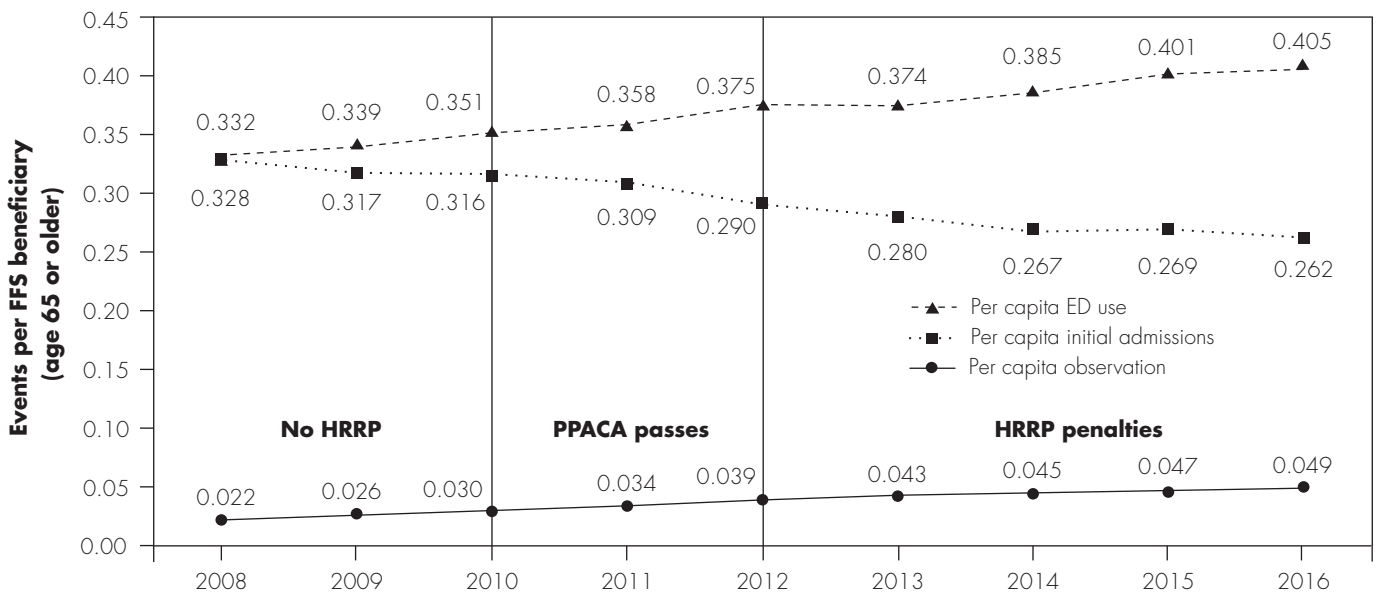


Note: HRRP (Hospital Readmissions Reduction Program), AMI (acute myocardial infarction), COPD (chronic obstructive pulmonary disease). Pneumonia measure reflects the expanded definition used starting in fiscal year 2016, which includes simple pneumonia, aspiration pneumonia, and sepsis with pneumonia as a secondary diagnosis.

Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

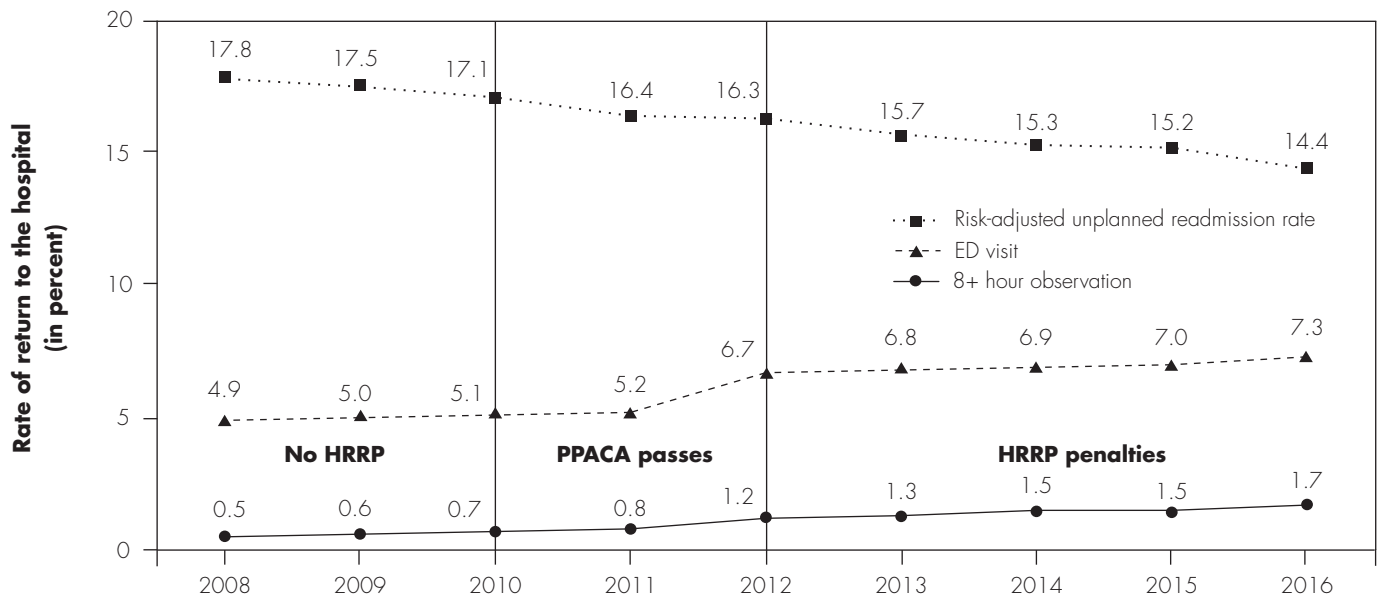
FIGURE 1-7

Per capita admission rates fell, while observation and ED use increased, 2008-2016



Note: ED (emergency department), FFS (fee-for-service), HRRP (Hospital Readmissions Reduction Program), PPACA (Patient Protection and Affordable Care Act of 2010).

Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

FIGURE 1-8**Readmissions per discharge declined as observations and ED visits increased, 2008-2016**

Note: ED (emergency department), HRRP (Hospital Readmissions Reduction Program), PPACA (Patient Protection and Affordable Care Act of 2010).

Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

Between 2010 and 2016, per capita admission rates (initial admission for qualifying conditions) dropped 17 percent, from 0.316 per capita to 0.262 per capita (Figure 1-7, p. 19). At the same time, however, per capita use of observation care grew 63 percent, from 0.030 per capita to 0.049 per capita. The increase in observation stays may have been partially a response to the RAC audits and two-midnight rule implemented by CMS during this period. Because observation stays increased steadily from 2008 to 2016 (including the period before the RAC incentive), we expect that more than the RAC incentive was at work. Per capita use of ED between 2010 and 2016 also increased, rising 15 percent, from 0.351 visits per capita to 0.405. Almost half of this increase took place from 2010 to 2012. The joint timing of a decline in inpatient admissions with an increase in observation stays and ED visits suggests that there was some substituting of outpatient care for inpatient care. From the Medicare patients' perspective, patients may prefer avoiding a hospital stay if they can achieve an equal or better outcome in an outpatient setting. From the Medicare program's financial perspective, avoiding an inpatient stay helps to reduce program spending since the cost of an observation stay is about 20 percent of the cost

of the average inpatient admission and the cost of an ED visit is about 5 percent of the cost of an inpatient stay.

Observation and ED use increased for both those admitted and those not admitted to the hospital

As readmission rates declined, use of observation and the ED after inpatient stays increased (Figure 1-8). The largest increases occurred in 2012, two years after the HRRP was passed. From 2012 on, the increases in observation and ED use have been more modest.

In 2010, for beneficiaries who were not readmitted, about 0.7 percent of cases were followed by an eight-hour or longer observation stay. By 2016, 1.7 percent of cases were followed by an eight-hour or longer observation stay. In that same period, ED use increased from 5.1 percent of cases to 7.3 percent of cases with a prior admission.

However, this ED growth appears to be broad based and not focused on ED visits after discharge. We compared Medicare beneficiaries' ED-visit growth for those discharged from a hospital and those not discharged from a hospital within the prior 30 days. We found that the

**TABLE
1-2**

Change in risk-adjusted rate of return to the hospital for non-HRRP and HRRP conditions, 2010-2016

Percentage point change in the share of patients returning to the hospital within 30 days categorized as:

	Readmissions	Readmission or observation	Readmission, observation, or ED visit
Non-HRRP admissions	-2.5	-1.5	0.6
HRRP conditions	-3.1	-2.1	0.1
AMI	-3.7	-2.0	0.6
Heart failure	-3.9	-2.7	-0.7
Pneumonia	-3.0	-2.1	-0.1
COPD	-3.3	-2.2	0.0
Hip or knee replacement	-1.4	-1.1	1.0

Note: HRRP (Hospital Readmissions Reduction Program), ED (emergency department), AMI (acute myocardial infarction), COPD (chronic obstructive pulmonary disease).

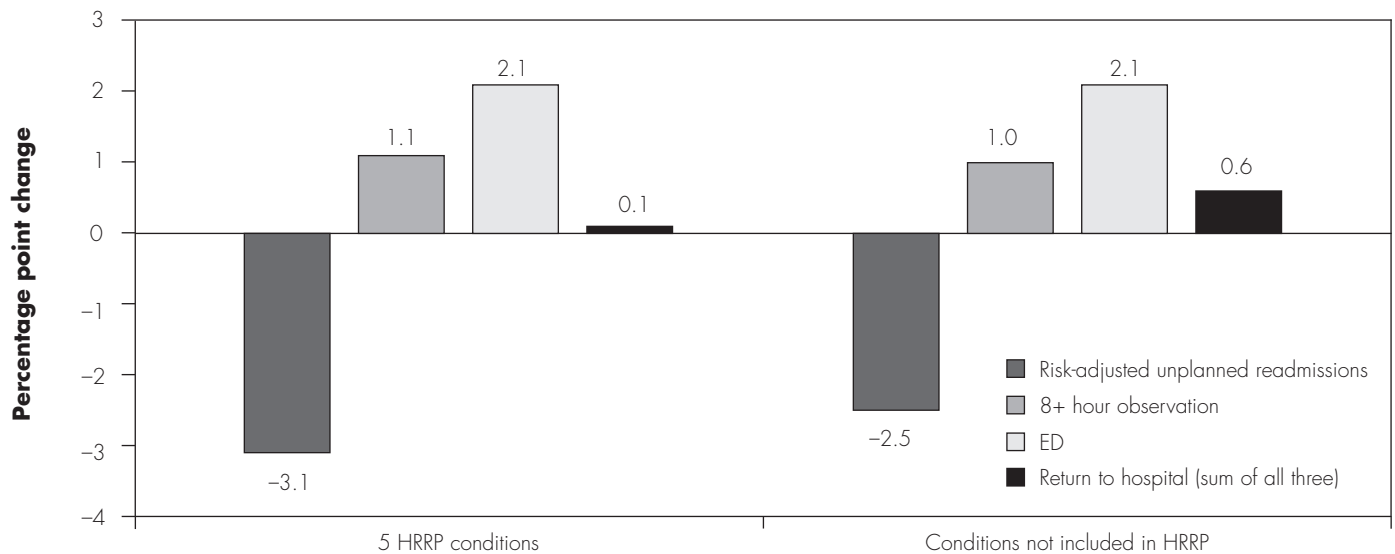
Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

growth rates were similar for the two groups. In fact, the shares of ED visits that were postdischarge visits in 2010 and 2016 were exactly the same (4.8 percent, data not shown). Therefore, it appears that the growth in ED use is a broad phenomenon and cannot be primarily attributed to growth in postdischarge ED visits.

The decline in readmission rates coincided with increases in the rate of observation and the rate of ED use (Figure 1-8). The next question is: To what degree did the increase in observation and ED use offset the decline in readmissions? Looking across conditions not covered by the program, we see a 2.5 percentage point reduction in readmissions (Table 1-2). For those covered by the program, the reduction averaged 3.1 percentage points. At the same time, observation stays rose 1.0 percentage point and ED use within 30 days after discharge, by 2.3 percentage points (data not shown). However, adding together 3.1 percentage point decline in readmissions and the 1.0 percentage point increase in observation stays results in a combined decline of 2.1 percentage points in the sum of inpatient stays and observation stays (Table 1-2). We also saw an increase in ED use within 30 days postdischarge of about 2.3 percentage points (data not shown). The net effect was that the share of Medicare patients returning to the hospital for some type of care (readmission, observation, or ED) within 30 days of

discharge increased by 0.1 percentage point for HRRP conditions and 0.6 point for other conditions. From 2010 to 2016, the change in rates of return to the hospital varied by HRRP condition: AMI returns to the hospital rose, and heart failure returns to the hospital fell.

While the increase in ED and observation use coincided with the decline in readmissions, we cannot conclude that the decrease in readmissions caused the increase in observation visits or ED use. Observation and ED use increased for all Medicare beneficiaries in this time period, not just for those who were admitted to the hospital. For example, from 2010 to 2016, the share of discharges that were followed by an observation visit grew by 1 percentage point. At this same time, the share of all observation stays (including stays by beneficiaries never admitted to a hospital) grew by 1.9 percentage points, meaning observation stays grew faster for patients who had not been admitted. Similarly, the share of beneficiaries with a postdischarge ED visit increased 2.1 percentage points, and the per capita ED use for all Medicare beneficiaries grew by 5.4 percentage points. The faster growth in ED visits and observation stays for those without a recent admission to the hospital allows us to conclude that the readmission policy was not likely the driver behind the ED and observation growth experienced.

**FIGURE
1-9****HRRP conditions have unusually large declines in readmissions without unusually large increases in observation or ED stays, 2010-2016**

Note: HRRP (Hospital Readmissions Reduction Program), ED (emergency department), AMI (acute myocardial infarction), COPD (chronic obstructive pulmonary disease). The five HRRP conditions include pneumonia, heart failure, AMI, COPD, and hip and knee replacement. The reasons for returning to the hospital are all measured in events per 100 initial admissions.

Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

Small correlations were found between reductions in readmissions and increases in observation and ED visits

In addition to looking at national trends, we examined the data on readmissions, observation stays, and ED visits at the hospital level to determine whether the hospitals with the biggest declines in readmissions also had unusually large increases in observation and ED use rates. In this analysis, we found a small negative correlation coefficient (-0.13) between changes in readmission rates and changes in postdischarge observation use. Similarly, adding changes in observation use and ED visits together, we found a small negative correlation coefficient (-0.19) with changes in readmission rates, suggesting that hospitals with above-average declines in readmissions did tend to have increases in observation and ED use. However, taken together with the data in Figure 1-6 (p. 19) and the national growth rates in observation and ED use for those *without* a recent admission, the data suggest that only a small share of the increase in observation and ED use was related to the HRRP.

Greater readmission declines among HRRP conditions did not trigger greater observation-stay or ED-visit growth

Risk-adjusted readmission rates fell more for conditions covered by the HRRP (i.e., 3.1 percentage points for HRRP conditions versus 2.5 percentage points for non-HRRP conditions) (Figure 1-9).⁸ The difference is modest, suggesting there may be some spillover of behavior from HRRP conditions to non-HRRP conditions. Nevertheless, a hospital-level analysis indicates that the difference between 3.1 and 2.5 percentage points is statistically significant using a Wilcoxon signed-rank test ($p < 0.01$). While the HRRP conditions had bigger reductions in readmissions, changes in observation and ED visits were almost exactly the same for HRRP conditions and other conditions (Figure 1-9). If hospitals were using observation and ED visits to avoid readmission penalties, we would expect to see larger increases for conditions covered by the program, but we did not. Because the greater reduction in readmission rates did not trigger a greater growth in observation stays and ED visits, the

observation and ED-use growth does not appear to be primarily a function of declining readmission rates.

Sensitivity of findings to different methods of statistical testing

Our congressional mandate is to examine whether reductions in readmissions caused an offsetting increase in ED visits and observation stays. Therefore, the method to test for offsetting increases in observation stays and ED visits needed to use a unit of analysis that is comparable across readmissions, ED visits, and observation stays. As a result, Figure 1-9 presents data that are measured as events per 100 stays. The changes in events are equivalent to percentage point changes in readmission, ED-use, and observation rates. When we tested for percentage point differences between HRRP and non-HRRP conditions, we found that the difference (3.1 percentage points vs. 2.5 percentage points) is statistically significant.

However, there is a question of how robust the two findings (that readmission rates for HRRP conditions fell faster than for non-HRRP conditions and the finding that the readmission reductions did not trigger large increases in ED visits and observation stays) are to different methodological approaches. Therefore, we first estimated whether the difference in rate of decline for HRRP conditions and non-HRRP conditions would be statistically significant if we measured change in percentage rather than percentage points. Second, we investigated whether the finding—that greater readmission declines for HRRP conditions did not trigger more ED or observation stays—held for raw (not risk-adjusted) data.

When using percentage changes rather than percentage point changes, we found that the risk-adjusted readmission rate for HRRP conditions declined by 16.9 percent from 2010 to 2016 compared with a 15.1 percent decline for non-HRRP conditions. The difference (1.8 percent) is modest and statistically significant.⁹ The fact that the percentage differences are modest could reflect HRRP incentives spilling over into other conditions, coding difference across conditions, and other factors outside of the HRRP such as ACOs' practices also affecting readmission rates (Winblad et al. 2017).

One concern is that the difference (1.8 percent) may be due to greater coding changes for conditions covered by the HRRP. We found no evidence of this concern given that the difference in the change in raw rates of readmission for HRRP and non-HRRP conditions was larger than the risk-adjusted differences. The raw

readmission rate for HRRP conditions declined by 16.4 percent compared with an 8.3 percent decline for non-HRRP conditions. The difference in the rate of decline of raw readmission rates is statistically significant ($p < 0.01$).

Next, we examined whether the decline in raw readmission rates was offset by a raw increase in ED visits or observation stays. As with the risk-adjusted model, the raw change in postdischarge ED use and observation was almost identical for HRRP conditions and non-HRRP conditions. A version of Figure 1-9 using raw (not risk-adjusted) data is provided in online Appendix 1-C, available at <http://www.medpac.gov>. Looking at the totality of the different tests, there is fairly consistent evidence that the HRRP caused some reduction in readmissions, with most of the tests showing statistical significance. However, given the differences in the magnitude of the effects across different methods of testing for a HRRP effect on readmissions, it is not possible to say what portion of the reduction in readmissions was due to the HRRP and what portion was due to other concurrent factors such as ACOs or changes in coding practices.¹⁰

Medicare program costs declined as readmissions declined

The Medicare program's savings from the drop in readmissions was much greater than the increase in payments for the additional observation stays and ED visits. As shown in Table 1-3 (p. 24), the program spent \$2.28 billion less on readmissions in 2016 than it would have if readmissions had occurred at the same rate as in 2010. Even though use of observation and ED visits increased, the effect had a relatively small impact on spending, with observation spending increasing postdischarge by \$170 million and ED spending increasing by \$70 million. The net reduction in spending on readmissions was \$2.04 billion. While it is clear that readmission spending was reduced, it is not clear what share of the reduction was due to the HRRP. Other factors such as ACOs or technological changes may have contributed to the reduction in readmission rates.

Changes in mortality rates and readmissions rates are not highly correlated

We also examined whether there was any relationship between changes in readmissions and changes in mortality, using two prior studies cited earlier as a starting point. Both studies found a slight increase in risk-adjusted heart

**TABLE
1-3**

Changes in costs after the 2010 enactment of the HRRP, 2010-2016

Type of care	Change in the cost of return visits to the hospital (in billions)
Readmissions within 30 days of the initial admission	\$-2.28
Observation stays, initial and postdischarge	0.17
Emergency department visits (without admission), initial and postdischarge	0.07
Net change in spending	-2.04

Note: HRRP (Hospital Readmissions Reduction Program). Reductions in spending on readmissions, observation stays, and emergency use pertain to reductions for all conditions including those not covered by the HRRP. It is not clear the degree to which these reductions are due to the HRRP or other factors.

Source: MedPAC analysis of Medicare claims data.

failure mortality from 2010 through 2014. One study, which conducted a hospital-level analysis regarding the relationship between readmissions and increased mortality, did not find a correlation (Dharmarajan et al. 2017). We repeated the time-trend analysis and the hospital-level correlation analyses with two changes. First, our analysis extended through 2016. Second, we measured mortality as the combination of mortality during the inpatient stay and 30 days after the stay ended. This approach addressed the problem of a possible shift in the location of the mortality due to hospice use increasing during this time period (as discussed in online Appendix 1-B, available at <http://www.medpac.gov>).

We found that, after the HRRP’s introduction, raw rates of mortality materially increased for one of the HRRP conditions (heart failure) but materially declined for two other HRRP-covered conditions (pneumonia and AMI) (Figure 1-10). On average, raw rates of mortality declined for the five HRRP conditions and increased for non-HRRP conditions. The increase in raw rates of mortality for heart failure and non-HRRP conditions may have been related to the decline in initial admissions and increases in the severity level of those admitted. The literature has tended to focus on the one metric where mortality increased (heart failure) rather than the conditions for which mortality declined.

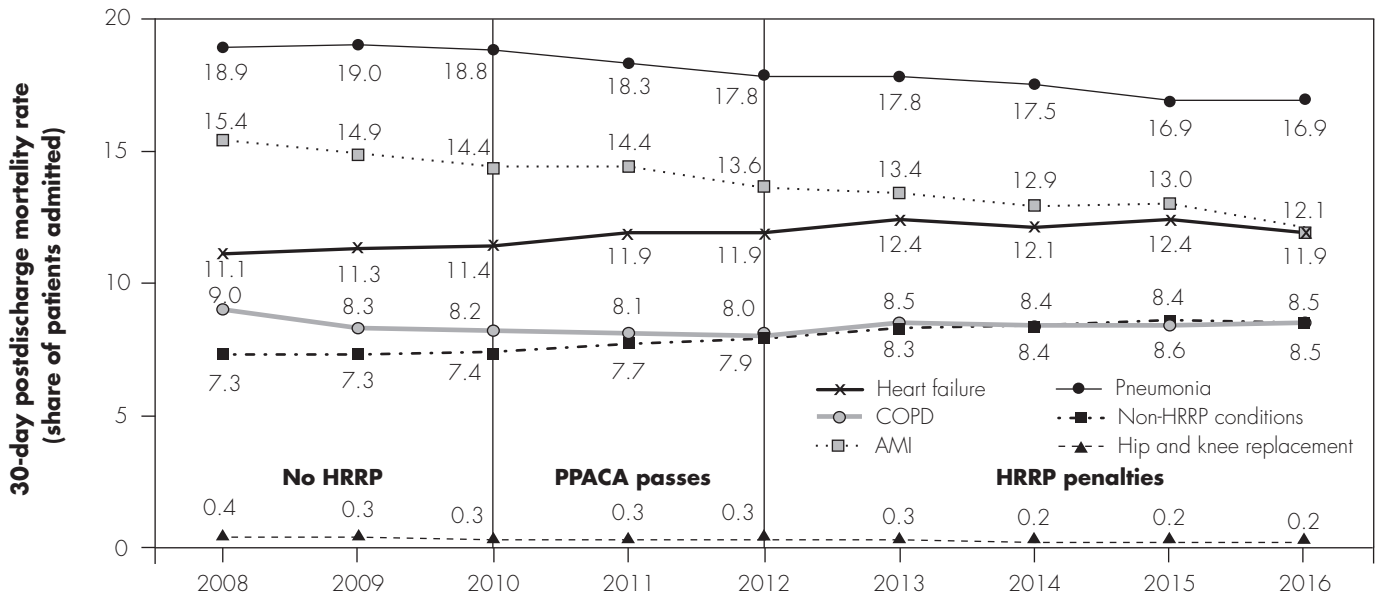
From 2010 to 2016, we found that risk-adjusted mortality rates during the inpatient stay and the following 30 days declined for all conditions (Figure 1-11). While greater coding intensity over time may be responsible for some of the decline in risk-adjusted mortality, we believe that

a portion of the decline in mortality is real. We believe the decline in risk adjusted rates is real due to consistent evidence that the patients admitted in 2016 had a higher risk of mortality than the patients admitted in 2010.

Our finding of declines in risk-adjusted heart failure mortality rests on a finding that the patients admitted in 2016 had a higher risk of mortality than the patients admitted in 2010. From our data, it appears that the large decline in initial heart failure admissions per capita caused the 2016 cohort of heart failure admissions to consist of patients with higher expected mortality than the 2010 cohort of heart failure admissions. In other words, it appears that hospitals were admitting fewer easy cases in 2016. While our categorical model’s finding of higher expected mortality for the 2016 cohort compared with the 2010 cohort could partially be due to greater coding intensity, we also find that patients admitted in 2016 tended to have higher risk scores based on the prior year’s diagnoses, tended to have greater intensive care unit use, and were less likely to be discharged home for self-care than the cohort of patients admitted in 2010.¹¹ These factors all suggest that the 2016 cohort of heart failure admissions were less healthy than the 2010 cohort. Therefore, our findings of both increasing raw rates of mortality and declining risk-adjusted mortality for heart failure admissions is plausible. These findings do not mean that no clinician ever erroneously failed to admit a patient, or even that the HRRP did not affect the rate of appropriate readmissions. It means only that, on net, care continued to improve during the time the HRRP was in effect. This improvement could indicate that the positive effects of

FIGURE 1-10

Raw 30-day mortality (in-hospital through 30 days postdischarge) rates have risen for some and fallen for other conditions covered by the HRRP

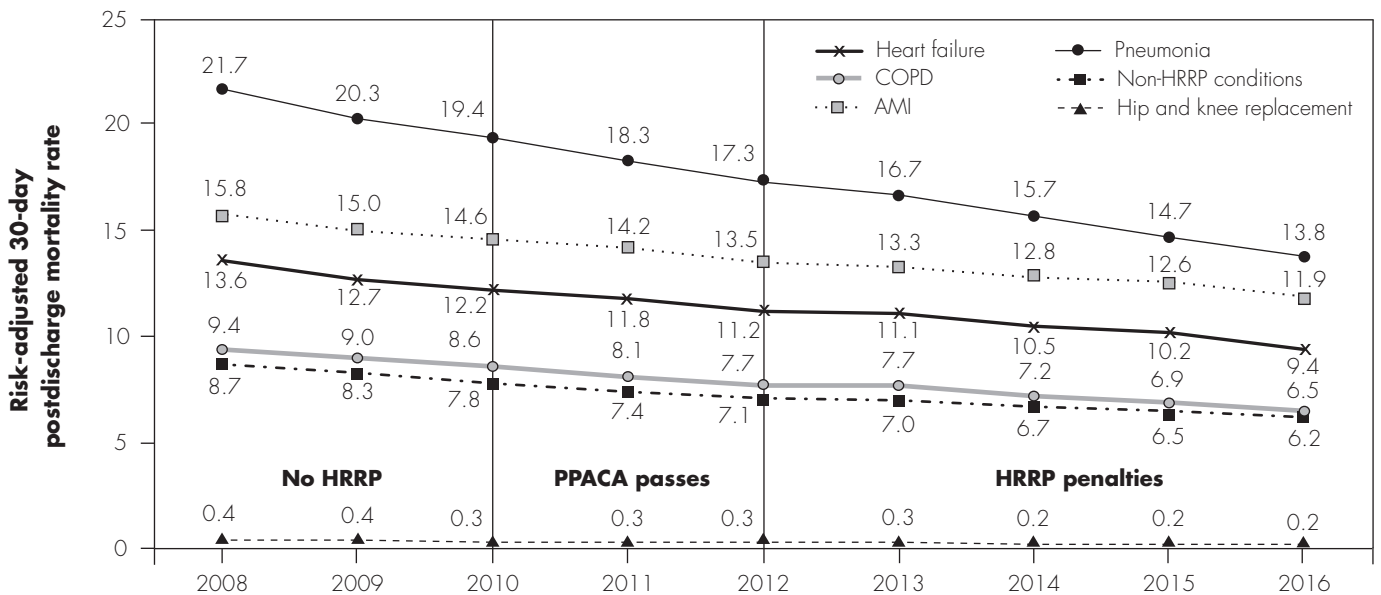


Note: HRRP (Hospital Readmissions Reduction Program), COPD (chronic obstructive pulmonary disease), AMI (acute myocardial infarction), PPACA (Patient Protection and Affordable Care Act of 2010). The pneumonia measure reflects the expanded definition used starting in fiscal year 2016, which includes simple pneumonia, aspiration pneumonia, and sepsis with pneumonia as a secondary diagnosis.

Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older, 2008–2016.

FIGURE 1-11

Risk-adjusted mortality (in-hospital through 30 days postdischarge) fell for conditions covered by the HRRP

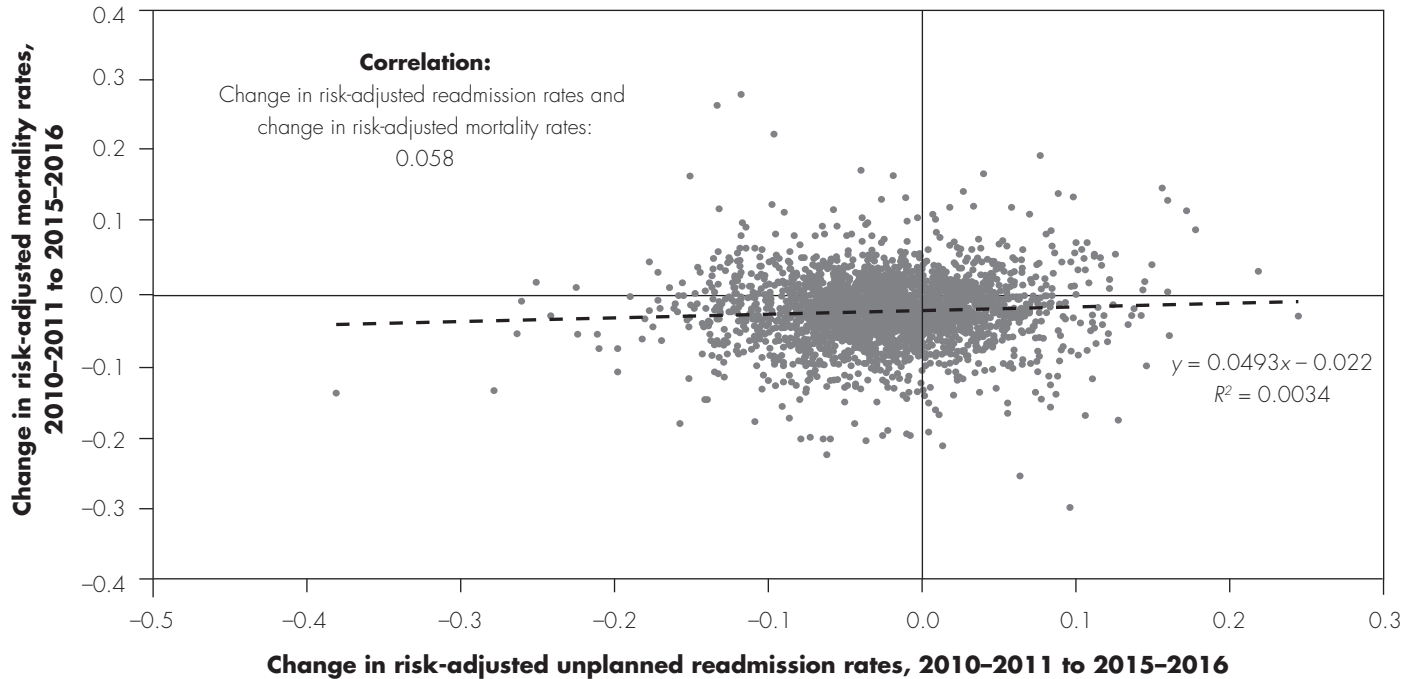


Note: HRRP (Hospital Readmissions Reduction Program), COPD (chronic obstructive pulmonary disease), AMI (acute myocardial infarction), PPACA (Patient Protection and Affordable Care Act of 2010). The pneumonia measure reflects the expanded definition used starting in fiscal year 2016, which includes simple pneumonia, aspiration pneumonia, and sepsis with pneumonia as a secondary diagnosis.

Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older, 2008–2016.

**FIGURE
1-12**

No material relationship between hospital-level changes in heart failure readmission rates and hospital-level changes in mortality



Source: MedPAC analysis of Medicare claims files for Medicare fee-for-service beneficiaries ages 65 or older.

changes in care patterns (better prescription reconciliation, better care transitions, and better coordination with post-acute care providers) may have outweighed any negative changes in care patterns. Our finding for heart failure differs from the earlier two studies, which found a slight increase in risk-adjusted heart failure rates. It could be due to our combination of inpatient and post-acute mortality, differences in risk adjusters, or simply our use of two more years of data. The 2016 data may differ in that the RAC audits had been removed by that time.

Little hospital-level correlation was found between changes in readmission rates and changes in mortality

In addition to looking at national trends—which can be confounded by many concurrent changes—we conducted a hospital-level analysis of the relationship between change in readmission rates and mortality rates over time. As shown in Figure 1-12, we found almost no correlation. The small correlation between changes in readmission rates and changes in mortality rates that we did see was positive, meaning that hospitals that improved

their readmission rates more than average tended to also improve their mortality rates a bit more than average. While statistically significant, the magnitude of the correlation is small (0.058). The correlations for mortality and readmissions for the other four HRRP conditions are also small (and positive), but also statistically significant. Interestingly, the correlation found by the Dharmarajan study, which used a different measure of mortality and different years of data, was almost the same (0.066) (Dharmarajan et al. 2017).

Policy implications

Readmission rates clearly declined from 2010 to 2016. Given the totality of the evidence and the findings in the literature, it appears that at least some of this reduction was due to the incentives in the HRRP. The exact share that is due to the HRRP and the share due to other factors is difficult to disentangle. The reduction in readmission rates appears to have been achieved without an increase in

risk-adjusted mortality or a material increase in spending on other services. While use of observation care and ED postdischarge increased after the HRRP was introduced, these increases were program wide and likely strongly influenced by other factors such as the RAC audits and two-midnight policy implemented by CMS over this period. While the program has achieved some of its objectives, the program could still be improved. As we discussed in 2013, the program could be expanded to

cover all conditions, and the magnitude of the penalty for each excess readmission could be reduced. This budget-neutral change would create a broader incentive for providers to reduce readmissions and would allow the Medicare program to reduce penalties to a level that is more proportionate to the cost of excess readmissions. In addition, as we discuss in Chapter 7 of this report, the system of hospitals' financial incentives could be adjusted to balance readmission, mortality, and patient experience incentives. ■

Endnotes

- 1 The 30-day measures used for the Hospital Readmissions Reduction Program (HRRP) are essentially the same measure as reported on the Hospital Compare website except that readmissions to Veterans Health Administration hospitals and critical access hospitals are not included. A person who is discharged from a prospective payment system hospital and is later readmitted to a critical access hospital is not considered a readmission for purposes of the HRRP.
- 2 The use of principal discharge diagnosis raises an issue of double counting admissions when the policy was expanded to include chronic obstructive pulmonary disease (COPD) in fiscal year 2015 and coronary artery bypass graft (CABG) surgery in fiscal year 2016. For example, many patients who are admitted to the hospital with a heart attack receive either percutaneous transluminal coronary angioplasty or a CABG during their stay. The principal discharge diagnosis for these patients is usually AMI. Thus, these cases could be counted under both the current AMI readmission measure and the CABG readmission measure.
- 3 During the 2008 to 2014 time frame, heart failure admissions dropped significantly. Dharmarajan and colleagues report a decline in their data set of roughly 16 percent, from 449,135 to 385,222 (Dharmarajan et al. 2017). The cases that may have continued to be admitted may have been the more difficult cases. It is not clear that the risk adjuster would have fully accounted for changes in case mix over time. This issue is discussed further in the online Appendix 1-B, available at <http://www.medpac.gov>.
- 4 Gupta and colleagues found that risk-adjusted mortality rates increased faster than raw mortality rates. This combination of findings implies that the expected rate of mortality decreased, meaning the post-HRRP group had a lower risk of death than the pre-HRRP group. The conclusion that the post-HRRP group had a lower expected one-year mortality is difficult to reconcile with the descriptive statistics stating that the post-HRRP group had an older mean age (80.9 years compared with 80.1 years), was more likely to have had a previous stroke/transient ischemic attack (17.2 percent compared with 15.6 percent), was more likely to be discharged to hospice (4.6 percent compared with 2.5 percent), and less likely to be discharged to home (63.7 percent compared with 69.0 percent) (Gupta et al. 2017). However, the post-HRRP group did have a shorter length of stay: 4.8 days versus 5.4 days for the pre-HRRP group. It is not clear what factors in the Gupta model led to the post-HRRP group being assigned a lower one-year mortality risk.
- 5 While the rates of change in the PPR and HRRP methods are similar, the rates of readmission in the PPR program are generally lower because the PPR methodology excludes more cases (e.g., trauma) and counts a sequence of readmissions as only one readmission. Instead of counting individual readmissions, the PPR approach counts readmission chains, which are defined as sequences of one or more PPRs that are all clinically related to the same initial admission. In calculating PPR rates, readmission chains rather than individual readmissions are used as the numerator. For more information, see: <https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/HealthCareFinancingReview/downloads/08Fallpg75.pdf>.
- 6 We also examined the percentage change (rather than the percentage point change) and again found the raw rate of decline is about twice as fast for HRRP conditions as non-HRRP conditions.
- 7 The two-midnight rule specified that CMS would not target admissions that lasted two midnights or longer for medical necessity review. In online Appendix 1-B, available at <http://www.medpac.gov>, we illustrate how the share of heart failure readmissions that were one-day stays fell during the period that the RAC medical necessity reviews of inpatient stays were occurring.
- 8 The differences in raw rates were even larger (2.9 percentage points for HRRP conditions and 1.3 percentage point for non-HRRP conditions).
- 9 The percentage decline in readmission rates was larger for HRRP conditions using a Wilcoxon signed-rank test ($p < 0.01$).
- 10 Ibrahim and colleagues suggested that about two-thirds of the reduction in risk-adjusted readmission rates was due to patients being coded as being more severely ill, which could reflect true changes in the severity of illness among admitted patients or changes in coding practices (Ibrahim et al. 2017). Only about one-third of the change in readmission rates was not related to coded severity. The study was conducted by comparing inpatient prospective payment system hospitals to critical access hospitals that were not affected by the HRRP. As we discuss in online Appendix 1-B, available at <http://www.medpac.gov>, critical access hospitals are an imperfect comparison group, and the share of the readmissions reduction caused by the more intensive coding practices cannot be precisely estimated. The fact that we also found large changes for raw readmission rates suggests that the effect of coding practices may have been modest (see online Appendix 1-B, available at <http://www.medpac.gov>).
- 11 The 3M risk of mortality measure we use to examine expected mortality indicates that the severity of illness of heart failure patients increased from 2010 to 2016. However, some of this

increase may be due to greater coding rather than truly greater health needs. Therefore, we also examined indicators that are based on patient conditions before admission and indicators that are not dependent on coding. We found that the average hierarchical condition category score for patients admitted with heart failure increased from 2.74 in 2010 to 2.88 in 2012 and to 3.06 in 2016. This means that the diagnoses codes and other factors from the year before admission indicated that 2016 cohort of heart failure patients had higher expected annual healthcare costs (relative to the national average for that year) than the 2010 cohort. To examine factors unrelated to coding, we also examined intensive care unit use. We found the share of heart failure admissions with one or more days in the intensive care unit increased from 34.3 percent in 2010 to 35.5 percent in 2012 to 35.8 percent in 2016. We

also examined discharge destination as another indicator of health that is not dependent on coding. We saw the share of heart failure patients that were discharged home for self-care decreased by 3.9 percentage points from 46.5 percent of patients in 2010 to 42.6 percent of patients in 2016. In contrast, the share discharged to hospice increased by 1.1 percentage points; the share of those discharged to home with home health care increased by 1.8 percentage points; the share discharged to an inpatient rehabilitation facility increased by 0.8 percentage points; and the share discharged to a skilled nursing facility increased by 0.5 percentage points. The coding-based indicators of health and the indicators that are not dependent on coding both point toward the 2016 cohort of patients being less healthy than the 2010 cohort.

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