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A comparison of estimated cost savings from potential reductions in hospital-acquired conditions to levied penalties under the CMS Hospital Acquired Conditions Reduction Program

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Abstract

Background: The Hospital Acquired Conditions Reduction Program (HACRP) from the Centers for Medicare and Medicaid Services reduces Medicare payments to hospitals with high rates of HACs by 1% each year. It is not known how the savings accruing to CMS from such penalties compare to savings resulting from a reduction in HACs driven by this program.

Objective: To compare the reported savings to CMS from financial penalties levied under the HACRP with savings resulting from potential reductions in HACs.

Design: We evaluated the association between HACs and 90-day episode spending (adjusted to 2015 dollars). We then estimated potential annual savings to CMS if there was a relative decrease in incidence of all HACs by 1 – 20% and compared them to the actual collected HACRP penalties reported by CMS in 2015.

Data Sources: 20% Medicare claims data between January 1, 2009 and September 30, 2014.

Participants: Medicare fee-for-service beneficiaries aged 65 – 115 who were discharged from an acute care hospital and who met denominator criteria for any of the eight HACs that comprise

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the AHRQ Patient Safety Indicator (PSI)-90 score that was targeted under the HACRP (n = 7,707,553).

Outcome: Total price-standardized 90-day episode spending.

Results: All HACs were associated with significant increases in total 90-day episode spending, ranging from \$3,183 for iatrogenic pneumothorax to \$21,654 for postoperative hip fracture. The total estimated savings to Medicare from potential reduction in all HACs ranged from \$2 – 44 million per year, an amount much lower than the \$360 million penalties levied upon hospitals per year for HACs.

Conclusion: The penalties levied under the HACRP far exceed the potential cost savings accruing from a 1–20% reduction in HACs that might result from hospitals' efforts in response to the program.

Hospital-acquired conditions (HACs) are a grave threat to patient safety. By requiring additional care to treat, HACs also increase health care spending.¹ The effects of HACs on patient safety and spending are particularly acute among Medicare beneficiaries, who are more likely to experience HACs.² In response, the Patient Protection and Affordable Care Act (ACA) established the Hospital Acquired Conditions Reduction Program (HACRP), which expanded on prior CMS policy of non-payment for HACs. Beginning in fiscal year (FY) 2015, the HACRP reduces all CMS payments to acute care US hospitals falling in the lowest quartile of HAC performance³ by 1%.⁴

However, the effects of the HACRP on spending are unclear. Under the HACRP, potential savings for CMS are two-fold. First, CMS saves by penalizing poor-performing hospitals. Second, reductions in HACs due to the financial incentive imposed by the HACRP could result in incremental savings for CMS. The size and relative magnitude of these savings is unknown. In addition, direct estimates of savings from HAC reductions under the HACRP are challenging given confounding from contemporaneous CMS policies, such as the Hospital Readmission Reduction Program.

In this context, we use national Medicare data to estimate savings to CMS under the HACRP resulting from financial penalties and HAC reductions. We estimate the incidence of HACs targeted in the HACRP and the incremental spending associated with these HACs for Medicare beneficiaries. We sidestep challenges associated with estimating the effects of the HACRP on spending reductions by using assumptions about potential HAC reductions under the HACRP. We then compare the relative magnitude of savings from financial penalties and HAC reductions under the HACRP.

METHODS

Data Source

We used a random sample of 20% of national Medicare claims data for Medicare fee-for-service beneficiaries discharged from acute care hospitals between January 1, 2009 and September 30, 2014, including MedPAR, Carrier, and Outpatient Institutional files. Hospital-level covariates, including teaching status, number of beds, region, urbanicity, proportion of Medicare and Medicaid days, and profit status, were obtained from the 2009–

2014 American Hospital Association Annual Surveys. We used the FY 2009 – FY2013 CMS Impact files to identify hospitals that were paid under the Inpatient Prospective Payment System (IPPS). Under the IPPS, CMS reimburses hospitals based on a fixed fee, which is based on the diagnosis-related group (DRG) to which an admission is assigned. Hospitals are also eligible for outlier payments for extremely costly admissions. DRG and outlier payments are adjusted for a variety of factors, including the wage index for the hospital's geographical location, education of resident physicians, indirect medical education, and hospitals that treat a high percentage of low-income patients.^{5–7}

Study Population

The study population included Medicare fee-for-service beneficiaries aged 65 to 115 years who were discharged from an acute care hospital between January 1, 2009 and September 30, 2014, immediately prior to the start of payment reductions under the HACRP, who met denominator criteria for any of the eight HACs that make up the Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicator (PSI)-90 score that was targeted under the HACRP. Because hospitals with higher rates of HACs are financially penalized under the HACRP, using data from the post-penalization would underestimate the relationship between HACs and episode spending. Inclusion criteria were defined in line with the CMS hospital-wide readmission measure, as follows: Patients were excluded from the study if they were not discharged alive, if they were not enrolled in Medicare Parts A and B for at least 90 days after discharge, if Medicare was not the primary payer for the care episode, if the patient was transferred out of the hospital, if the patient was discharged against medical advice, or if the patient's index admission was for the treatment of cancer or a psychiatric illness. Acute care hospitals were included if they were paid under the IPPS, if they had at least one eligible patient discharge during the study period, and if they were not located in Maryland or Puerto Rico.

Outcomes

The primary outcome was total price-standardized 90-day episode spending, defined as the sum of payments related to the index hospitalization; inpatient and outpatient physician services; readmissions; hospital outpatient care, which includes, for example, emergency services, observation stays, and medical supplies provided by a hospital; postacute care spending, which includes rehabilitative or palliative services provided outside of an acute care hospital; and outlier payments, which are determined by hospital-specific fixed loss outlier thresholds. Payments were price-standardized by removing adjustments to hospital payments that were associated with Indirect Medical Education, the Disproportionate Share Index, and cost of living and wage indices.⁸ Price standardization was performed using methods previously described by the Medicare Payment Advisory Commission and the Dartmouth Institute. All payment amounts were adjusted to 2015 dollars to account for inflation across the study period.⁹

Study Design and Statistical Analysis

We first used a generalized linear model (GLM) with a log link and gamma distribution to evaluate the marginal effect of each HAC on price-standardized 90-day spending at the patient-episode level. A modified Park test¹⁰ was used to identify family distribution of

the GLM (Appendix Table 1). Because the relationship between HACs and spending was stable for most HACs over the study period, we held the relationship between HACs and spending to be constant. Each of the following HACs were included in the model as a dummy variable: pressure ulcer (PSI-03) (Appendix Figure 1a), iatrogenic pneumothorax (PSI-06) (Appendix Figure 1b), central line-associated bloodstream infections (CLABSI) (PSI-07) (Appendix Figure 1c), postoperative hip fracture (PSI-08) (Appendix Figure 1d), perioperative pulmonary embolism or deep vein thrombosis (PSI-12) (Appendix Figure 1e), postoperative sepsis (PSI-13) (Appendix Figure 1f), postoperative wound dehiscence (PSI-14) (Appendix Figure 1g), and accidental puncture or laceration (PSI-15) (Appendix Figure 1h). PSIs were calculated using the AHRQ Quality Indicators Software (version 6.0.2). Our models controlled for patient age, sex, race, Elixhauser comorbidities,¹¹ and Medicare Severity Diagnosis Related Groups (MS-DRG), as well as hospital teaching status, number of beds, region, urbanicity, proportion of Medicaid days, proportion of Medicare days, and profit status. In controlling for MS-DRG, we controlled for DRG categories but not for severity levels (in other words, complications and comorbidities) (Table 1). We estimated separate models for total 90-day episode spending and for separate components of spending, including inpatient hospitalization spending, inpatient and outpatient physician services spending, readmissions spending, hospital outpatient care spending, postacute care spending, and outlier payments. We also estimated alternate model specifications for each outcome of interest using a generalized linear model (GLM) with poisson distribution.

After estimating the incremental association between each HAC and 90-day episode spending, we calculated the average yearly incidence of each HAC over the study period (Table 2). The incidence of each HAC penalized under the HACRP was estimated using the AHRQ Quality Indicators Software and multiplying estimates by five to account for the 20% claims data set used in the study. To estimate total potential savings to Medicare, we calculated savings associated with hypothetical 1% to 20% relative reductions in total HAC rates, assuming identical proportional reductions in all HACs. Based on CMS press reports, we assumed that penalties levied by Medicare totaled \$361 million annually¹² (in 2015 dollars). Total savings to Medicare were calculated by adding the savings associated with hypothetical HAC reductions to the savings from financial penalties (Figure 1). We also estimated savings to Medicare by applying estimates of reductions of specific PSIs, using methods outlined by Arnston et al,¹³ to HAC rates during the baseline period.

We performed supplemental analysis to understand the association between HACs and Medicare spending for the index admission. Under the Hospital Acquired Condition Present-on-Admission (HAC-POA) Initiative, first implemented by CMS in 2008, hospitals were restricted from assigning a care episode to a higher-level and therefore higher-paying MS-DRG based solely on the presence of a HAC. A strong association between HACs and severity level within an MS-DRG would indicate that the program may not be working as intended and that hospitals continue to be paid more for care episodes in which a HAC occurred.^{14–16} We estimated ordered logit models to assess the incremental effect of any HAC on DRG severity coding by using an ordinal outcome variable with three levels (no Complication/Comorbidity [no CC], Complication/Comorbidity [CC], Major Complication/Comorbidity [MCC]) and controlling for the same covariates as above (Appendix Figure 2). Marginal effects from this model yielded the probability of each level of severity coding in

the presence or absence of a HAC. DRGs without at least two severity levels were excluded from analysis.

We performed a sensitivity analysis to assess the robustness of our results across different modeling specifications and estimates of HAC incidence. Because the modified Park test did not indicate a clear superiority of the gamma or Poisson distribution in our GLM, we re-estimated the association between HACs and Medicare spending using a GLM with a Poisson distribution (Appendix Table 2). Second, due to concerns that HACs incidence is underreported using the PSI-90 measures,¹⁷ we estimated hypothetical savings to CMS using data on HAC incidence from AHRQ's National Scorecard of Hospital-Acquired Conditions (Appendix Tables 3 and 4). The scorecard incorporates estimates of HAC incidence from the Medicare Patient Safety Monitoring System, which uses clinical chart review to identify HACs. As a result, HAC rates are much higher than those reported from the PSI-90 measures.¹⁸

Standard errors in our statistical models were robust to hospital-level clustering. *P* values were two-sided with a threshold for significance of < 0.05 . All statistical analyses were conducted using Stata version 15 (StataCorp LLC, College Station, Texas). This study was deemed exempt from review by the University of Michigan Institutional Review Board.

The research presented in this manuscript has met the ethical standards required by, and subsequently deemed exempt by the University of Michigan Institutional Review Board.

RESULTS

A total of 7,781,372 patient discharges from January 1, 2009 to September 30, 2014 were included in our analytical sample. Female patients accounted for 58.2% of all discharges, the mean patient age was 78.61 years, and on average patients had 2.95 Elixhauser comorbidities. At least one HAC occurred in 31,935 (0.4%) discharges (Table 1).

The most common HACs experienced by all eligible patients were perioperative pulmonary embolism (PE) or deep vein thrombosis (DVT) (147.78 per 100,000 discharges), accidental puncture or laceration (144.95 per 100,000 discharges), and iatrogenic pneumothorax (41.88 per 100,000 discharges), while the least common HAC was postoperative hip fracture (1.11 per 100,000 discharges) (Table 1).

Figure 2 shows the incremental change in total 90-day episode spending and its components associated with each HAC targeted under the HACRP. All HACs were associated with significant increases in total 90-day episode spending, index hospitalization spending, inpatient and outpatient physician services spending, and postacute care spending. All HACs except for iatrogenic pneumothorax and postoperative hip fracture were associated with increased readmission spending, and all HACs except for postoperative hip fracture were associated with increased outlier payment spending. In contrast, all HACs except for CLABSI, perioperative PE or DVT, and accidental puncture or laceration, were associated with significant reductions in hospital outpatient care spending. Marginal increases in total 90-day episode spending ranged from \$3,183 (95% confidence interval \$2,554 to \$3,811) for iatrogenic pneumothorax to \$21,654 (\$15,767 to \$27,541) for postoperative hip fracture.

The three HACs associated with the largest marginal increase in total 90-day episode spending were postoperative hip fracture (\$21,654 [\$15,767 to \$27,541]), CLABSI (\$17,806 [\$15,996 to \$19,616]), and postoperative sepsis (\$14,923 [\$13,878 to \$15,967]) (Figure 2). Average total annual cost to Medicare associated with each HAC ranged from \$1,619,335.10 for postoperative hip fracture to \$83,897,176.98 for perioperative pulmonary embolism or deep vein thrombosis (Table 2). Alternate model specifications using a Poisson distribution yielded largely similar results, though the three HACs associated with the largest marginal increase in total 90-day episode spending using the alternate model were postoperative hip fracture (\$17,315 [\$12,935 to \$21,694]), postoperative wound dehiscence (\$11,552 [\$9,549 to \$13,555]), and CLABSI (\$10,771 [\$9,484 to \$12,057]) (Appendix Figure 3).

Hypothetical reductions in rates of each individual HAC yielded large variations in potential savings to Medicare. Potential savings were greatest for reductions in perioperative pulmonary embolism rate, ranging from \$839,000 per year for a 1% reduction to \$17 million per year for a 20% reduction (Figure 3). In contrast, potential savings were lowest for reductions in postoperative hip fracture rate, ranging from \$22,000 per year for a 1% reduction to \$325,000 per year for a 20% reduction. This low potential savings from reductions in postoperative hip fracture rate is driven largely by the low baseline incidence of the HAC (1.11 per 100,000 discharges), given its high marginal cost (\$21,654 [\$15,767 to \$27,541]).

Total savings to Medicare resulting from hypothetical reductions in total HAC rates ranged from \$2.2 million per year from a 1% HAC rate reduction to \$44 million per year from a 20% reduction (Figure 1). Applying empirical estimates of the association between the HACRP and specific HACs, we estimate savings of \$12.6 million per year (see Exhibit S2 in Appendix for details). However, regardless of hypothetical reductions in HAC rates, savings to Medicare accrued disproportionately from penalties levied against lowest performing quartile hospitals, which total approximately \$361 million annually (Figure 1). Total annual savings to Medicare therefore ranged from \$363 million, assuming a 1% reduction in HAC rates, to \$405 million, assuming a 20% reduction in HAC rates (Figure 1). Using incidence data AHRQ's National Scorecard of Hospital-Acquired Conditions yielded much larger hypothetical savings to Medicare and are reported in Appendix Figures 4 and 5. These larger estimated savings are driven entirely by much greater incidence of pressure ulcer, iatrogenic pneumothorax, CLABSI, and accidental puncture or laceration reported in the Scorecard (Appendix Figures 6a, 6b, 7a, and 7b).

Ordered logit models showed that the presence of a HAC was associated with a much higher probability of increased severity coding within a DRG category. When HACs occurred, the probability of the coded DRG including an MCC was 0.52, the probability of a CC was 0.22, and the probability of no CC was 0.26. In contrast, in the absence of a HAC, the probability of a MCC was 0.26, the probability of a CC was 0.25, and the probability of no CC was 0.49 (Appendix Figure 2). This explains why a substantial share of spending increases associated with HACs occurred for the index hospitalization.

DISCUSSION

In this national study of potential savings associated with reductions in hospital-acquired conditions under the Hospital Acquired Condition Reduction Program, we report three main findings. First, the incidence of HACs were associated with substantial increases in 90-day episode spending, ranging from \$3,200 for iatrogenic pneumothorax to over \$21,000 for postoperative hip fracture (Table 2). Increases in spending were largely driven by increases related to the index admission (which were the result of HACs increasing severity coding of MS-DRGs), outlier spending, and post-acute care spending. Second, potential savings varied substantially across the HACs targeted under the HACRP. Finally, CMS savings associated with penalties to hospitals far exceed savings associated with plausible reductions in HACs under the HACRP.

To our knowledge, this is the first study to estimate the incremental cost to CMS associated with HACs targeted under the HACRP. Previous work estimated that the annual incremental cost to CMS of six of the most common HACs totaled \$146 million over a 90-day care episode.¹ In contrast, we estimate the annual cost to CMS of the eight HACs targeted under the HACRP to be over \$218 million. The difference in estimates can be explained by the inclusion of eight HACs targeted under the HACRP, as opposed to the six HACs included in the study by Kandilov et al., as well as by the specific numerator and denominator criteria of the PSI-90 score components used to calculate HAC incidence under the HACRP.

Recent findings by AHRQ suggest cost savings of approximately \$7.7 billion resulting from HAC reductions from 2015 to 2017, and that a 20% reduction in HACs from 2014 to 2019 would result in savings of \$19.2 billion over 5 years¹⁸ (\$3.84 billion per year). In contrast, our findings suggest that the savings to CMS resulting from a 20% reduction in HACs targeted under the HACRP would be less than \$405 million per year, of which \$361 million would be due to penalization. Our estimates for the incremental cost of CLABSI, pressure ulcers, and VTE did not differ substantially from those of AHRQ. Instead, the stark disparity in potential savings from HAC reductions stems from the larger set of HACs analyzed by AHRQ compared with those targeted under the HACRP, AHRQ's use of a national patient population, large differences in the estimates of the incidence of HACs between the Medicare patient safety monitoring system (MPSMS) used by AHRQ and the PSI-90 used under the HACRP,¹⁸ and the fact that Medicare reimbursements on average fall short of hospital costs.¹⁹ Other literature using the MPSMS data to examine the incremental cost of hospital-acquired pressure ulcers also yielded much larger estimates than ours, further highlighting measurement differences between the MPSMS data and the PSI-90 score as well as stark differences between HAC-related costs to hospitals and subsequent reimbursement.²⁰

Using incidence data from AHRQ's National Scorecard of Hospital-Acquired Conditions, we found that HAC reductions under the HACRP would be associated with much greater savings to Medicare (approximately \$1.34 billion per year using our measure-level estimates of HAC reduction under the HACRP) (Appendix Table 3). Nonetheless, we are not confident combining HAC incidence from AHRQ's National Scorecard of Hospital-Acquired Conditions with estimates of the incremental effects of HACs on spending using

the PSI-90 measures. Despite their limitations, HAC incidence rates derived from the PSI-90 measures are more appropriate for the current analysis because they are used to penalize hospitals under the HACRP and because our estimates of the association between HACs and spending are based on this identification of HACs. There is likely heterogeneity in the severity of HACs that are identified using the PSI-90 (based on Medicare claims) and those identified using the Scorecard (based on chart review). Specifically, we expect that, because far fewer HACs are identified using the PSI-90, these are likely to be the more severe cases. As a result, these cases would tend to have a greater impact on episode spending. Thus, if we applied our estimates of the effects of HACs on spending (based on claims) to AHRQ's estimates of HAC incidence, we would likely overstate the magnitude of HAC reduction on Medicare spending.

Nonetheless, the best strategy to estimate the financial impact of HACs remains elusive. Using data on HAC incidence from the PSI-90 will undercount HAC occurrence and lead to an underestimation of the aggregate spending impact of HACs.²¹ Using data on HAC incidence from the MPSMS data will likely capture HAC incidence more accurately. But assuming that the marginal impact of HACs on spending is the same in the MPSMS is problematic, and will likely lead to an overestimation of the aggregate spending impact of HACs. Recent literature estimating incremental 30-day Medicare expenditures associated with any of the 21 adverse events captured by the MPSMS yielded estimates similar to ours.²² However, the MPSMS does not contain data on all of the same HACs as the PSI-90 score and contains data on adverse events other than HACs, making direct cost and spending comparisons difficult.²³

Our finding that most HACs were associated with significant reductions in hospital outpatient care spending is also consistent with the literature.¹ This is likely explained by the fact that these patients have longer lengths of stay, increased readmission rates, and greater use of post-acute care, decreasing the amount of time they can receive outpatient care in a 90-day care episode. In sum, our findings are consistent with previous literature suggesting that HACs pose a significant financial burden for CMS and add to it by directly estimating the cost burden associated with each HAC targeted under the HACRP.

We also found that a substantial share of the incremental spending associated with HACs occurs for the index hospitalization. Moreover, the presence of a HAC increases the probability that a patient will be classified as having a CC or MCC and therefore fall into a higher-paying DRG. These findings suggest that hospitals are still paid more for admissions with HACs. CMS' implementation of the Hospital Acquired Condition-Present-On-Admission (HAC-POA) program in 2008 – which dictated that Medicare discharges could not be assigned to a higher severity and higher paid MS-DRG due solely to the presence of a HAC¹⁴ – may not be working as intended.

Our finding that financial penalization of poorly performing hospitals is the predominant driver of potential savings to CMS from the HACRP has important policy implications. This finding, combined with evidence suggesting that financial penalization under the HACRP does not result in subsequent hospital reductions in HAC rates,²⁴ the fact that the HACRP disproportionately penalizes teaching hospitals and safety-net hospitals, and the inherent

instability of the HACRP score, challenges the underlying logic of the HACRP. To reduce spending, CMS may be better off making across-the-board payment reductions larger rather than levying dubious penalties on the basis of poorly specified HAC measures.^{24–26}

Limitations

This study must be interpreted in the context of several limitations. First, we may be underestimating the annual cost to CMS associated with each HAC due to the specific HACs that are identified under the PSI-90 used by the HACRP.^{17,27} This issue is lent further credence by the fact that MPSMS estimates of pressure ulcer incidence, for example, are over 100-fold higher than PSI-90 estimates.¹⁸ PSI-90-derived estimates of HAC incidence may differ in accuracy by HAC as well. However, this only underscores measurement issues inherent to the PSI-90 that underlies the HACRP.^{17,19} Second, in estimating potential savings associated with hypothetical reductions in HAC rates, we assume that the rates of all HACs will decline equally. This may not be the case, as hospitals may choose to focus their quality improvement efforts on specific HACs, such as those that are weighted most heavily by the PSI-90 composite²⁸ or those that occur most frequently. To address this issue, we estimated Medicare savings associated with empirical estimates of HAC reductions under the HACRP. Third, we cannot exclude the possibility that a variable other than the presence of a HAC is driving the increased coding of CCs and MCCs. Previous studies have noted that up to half of CMS claims with a HAC would still be assigned to a higher-severity MS-DRG even after removing the HAC diagnosis due to other patient comorbidities and complications.¹ However, whether or not these hypothetical omitted variables are causally related to HAC occurrence is unknown. If omitted variables that drive coding of CCs and MCCs are causally related to HAC occurrence, it is possible that a reduction in HAC rates would not be borne out by a subsequent reduction in episode spending.

CONCLUSION

Our findings provide insight into how the HACRP might be improved. Potential savings to CMS vary greatly by HAC. By targeting a smaller set of HACs with the greatest financial burden, CMS could potentially build a more effective data collection system around those HACs, and hospitals would have a smaller set of HACs on which to target quality improvement efforts. Evidence suggests that pay-for-performance programs with a simpler design may be more effective in spurring change.^{29,30} Although HACs remain a significant burden to CMS, providers, and patients, the HACRP may be suboptimally designed to improve patient safety. CMS should consider redesigning it to address its shortcomings in identification strategy and incentive structure.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1:

This graph shows the estimated total annual savings to CMS from hypothetical reductions in all hospital-acquired conditions targeted in the Hospital Acquired Condition Reduction Program

Figure 2:

Shown here is the estimated association between specific hospital-acquired conditions (HACs) targeted in the Hospital Acquired Condition Reduction Program and components of 90-day total episode spending. Point estimates and 95% confidence intervals are shown. Because separate models were estimated for total 90-day episode spending and each component of spending, the marginal effects of HACs each component of spending shown may not sum to the marginal effect of HACs on total 90-day episode spending. Not all components of spending appear in this figure.

Figure 3:

This graph shows the estimated annual savings to Centers for Medicare and Medicaid Services from hypothetical reductions in each hospital-acquired condition (HAC) targeted in the Hospital Acquired Condition Reduction Program

Table 1:**Patient and Hospital Characteristics**

Patient Characteristics	Statistic
Number of episodes, n	7,781,372
Age, mean (SD)	78.61 (8.60)
Female, n (%)	4,528,275 (58.2%)
Non-White, n (%)	1,144,106 (14.7%)
White, n (%)	6,637,266 (85.3%)
Count of Elixhauser comorbidities, mean (SD)	2.95 (1.75)
Proportion of episodes in which at least one HAC occurred, n (%)	31,935 (0.4%)
Count of HACs per 100,000 admissions	
PSI 03 Pressure Ulcer Rate	19.03
PSI 06 Iatrogenic Pneumothorax Rate	41.88
PSI 07 Central Venous Catheter-Related Blood Stream Infection Rate	15.97
PSI 08 Postoperative Hip Fracture Rate	1.11
PSI 12 Perioperative Pulmonary Embolism or Deep Vein Thrombosis Rate	147.78
PSI 13 Postoperative Sepsis Rate	42.15
PSI 14 Postoperative Wound Dehiscence Rate	6.14
PSI 15 Accidental Puncture or Laceration Rate	144.95
Spending Characteristics (\$)	
Standardized Total 90-day episode payment (hospital payment + physician payment + post payment), mean (SD)	21,146.91 (21,594.45)
Standardized Index payment based DRG/MS-DRG from Medpar depending on the discharge, mean (SD)	8,343.54 (8,514.53)
Standardized inpatient and outpatient physician amount, mean (SD)	3,489.76 (3,394.05)
Standardized 90-day Readmission payment based on DRG/MS-DRG from Medpar, mean (SD)	3,703.89 (9,337.35)
Standardized 90-day outpatient payment, mean (SD)	977.14 (2,497.46)
Standardized 90-day post care payment, mean (SD)	4,632.58 (10,687.99)
Outlier payment, mean (SD)	311.39 (3,656.77)
Hospital Characteristics	
Teaching status (Resident-to-bed ratio)	
Non-Teaching Hospital, n (%)	6,397,046 (82.2%)
Teaching Hospital, n (%)	1,384,326 (17.8%)
Number of Beds	
< 200, n (%)	2,260,224 (29.0%)
200–349, n (%)	2,255,456 (29.0%)
350–499, n (%)	1,416,356 (18.2%)
> 500, n (%)	1,849,336 (23.8%)
Region	
Midwest, n (%)	1,899,284 (24.4%)
Northeast, n (%)	1,587,096 (20.4%)
South, n (%)	3,120,462 (40.1%)
West, n (%)	1,174,530 (15.1%)
Urban Hospital, n (%)	7,590,492 (97.5%)

Patient Characteristics	Statistic
Proportion of Medicaid Days, mean (SD)	0.18 (0.10)
Proportion of Medicare Days, mean (SD)	0.51 (0.12)
Profit Status	
For-profit, n (%)	1,203,986 (15.5%)
Not-for-profit, n (%)	5,742,824 (73.8%)
Other, n (%)	834,562 (10.7%)

Note: Table includes discharges between January 1, 2009 and September 30, 2014

HAC, hospital-acquired condition; , SD, standard deviation; DRG, diagnosis-related group; MS-DRG, Medicare severity diagnosis-related group.

Table 2.

Estimated Association Between Specific Hospital-Acquired Conditions Targeted in the Hospital Acquired Condition Reduction Program, Episode Spending, and Total Annual Savings to CMS

Patient safety indicators	Incremental effect on episode spending (\$)	Average number of HACs per year	Annual cost to Medicare (\$)	Estimated % change in # of HACs	Annual savings associated with reductions in HACs (\$)
PSI 03 Pressure Ulcer	\$10,428	1,288	\$13,429,301.62	-17.82	\$2,392,830.28
PSI 06 Iatrogenic Pneumothorax	\$3,183	2,834	\$9,019,659.43	0.00	-\$103.38
PSI 07 Central Venous Catheter-Related Blood Stream Infection	\$17,806	1,081	\$19,246,293.15	-13.90	\$2,675,075.00
PSI 08 Postoperative Hip Fracture	\$21,654	75	\$1,619,335.10	-28.68	\$464,371.71
PSI 12 Perioperative Pulmonary Embolism or Deep Vein Thrombosis	\$8,390	9,999	\$83,897,176.98	-9.78	\$8,203,833.43
PSI 13 Postoperative Sepsis	\$14,923	2,852	\$42,561,724.47	23.63	-\$10,056,863.06
PSI 14 Postoperative Wound Dehiscence	\$14,916	416	\$6,200,072.86	-11.04	\$684,764.57
PSI 15 Accidental Puncture or Laceration	\$4,310	9,808	\$42,269,881.76	-19.49	\$8,238,552.13
Total	\$95,610	28,352	\$218,243,445.37		\$12,602,460.67

Estimates of the association between hospital-acquired conditions and episode spending are derived from a generalized linear model using a gamma distribution.

HAC, hospital-acquired condition.