# Medicare Inpatient and Postdischarge Outcomes of Elective Percutaneous Coronary Interventions

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## ABSTRACT

**OBJECTIVES:** To compare hospital-level, risk-adjusted inpatient and 90-day postdischarge adverse outcomes in Medicare patients undergoing elective percutaneous coronary interventions (PCIs).

**STUDY DESIGN:** Develop predictive risk models for adverse outcomes during inpatient and 90-day postdischarge care, and use those models to compare hospital performance in elective PCI.

**METHODS:** Elective PCIs in the 2010 to 2012 Medicare Limited Data Set were used to develop logistic prediction models for inpatient deaths, inpatient prolonged-length-of-stay outliers, 90-day postdischarge deaths without readmission, and 90-day readmissions. Observed versus predicted differences for risk-adjusted adverse outcomes were then performed among all hospitals with 50 or more cases during the study period.

**RESULTS:** There were 978 hospitals with 168,518 patients that qualified for this study; 25.9% of all patients had 1 or more adverse outcome. There were 67 hospitals with adverse outcome rates that were 2 or more standard deviations (SDs) better than predicted and 81 hospitals with rates that were more than 2 SDs worse than predicted. The best- and worst-performing deciles of hospitals had median risk-adjusted adverse outcome rates of 17.6% and 35.5%, respectively. Hospital case volume was not independently associated with better outcomes.

**CONCLUSIONS:** Comparison of risk-adjusted adverse outcome rates demonstrated the existence of opportunities for substantial improvements in quality among suboptimal-performing hospitals.

*The American Journal of Accountable Care. 2017;5(2): e7-e15*

Inpatient percutaneous coronary intervention (PCI) was performed on an estimated 515,000 patients in 2013, 50% of whom were 65 years or older.[1] The results of this procedure have progressively improved from the early efforts with coronary angioplasty to the current use of stents. The inpatient mortality rate with PCI is less than 1%, and the rate of inpatient complications, which include technical problems with coronary vessels, hematoma at the vascular entry site, stroke, and contrast-associated nephropathy, is less than 7%.[2,3]

In a study of Medicare coronary artery bypass grafting (CABG) and valve replacement surgery,[4] we found that inpatient adverse outcomes of these major cardiac procedures constituted less than 35% of total adverse events (AEs) when 90-day postdischarge deaths and readmissions were included. Furthermore, there were dramatic differences among hospitals in their rates of overall inpatient and postdischarge adverse outcomes. These data on comparative hospital risk-adjusted outcomes among the best and poorest performances strongly suggested that many of these adverse outcomes were preventable.

In the current study, we similarly evaluated risk-adjusted outcomes among inpatient Medicare patients who underwent PCI to identify comparative hospital performance in both inpatient and 90-day postdischarge events. Differences between top and suboptimal performances among all hospitals should define the margin of preventable AEs. Because it was anticipated that readmissions would be the predominant adverse outcome, we have examined the causes of readmission to better define opportunities for improvement.

## METHODS

The Medicare Limited Data Set for 2010 to 2012 was used in this study. Patients with an *International Classification of Diseases, 9th Revision, Clinical Modification* (*ICD-9-CM*) procedure code of 00.66, 36.06, 36.07, 36.09, and 37.34 for PCI were identified. All patients included in the study were required to have a principal diagnosis code of 414.00-414.05. Patients who had had an acute myocardial infarction were excluded. Cases were also excluded if patients were younger than 65 years, had missing patient or hospital identifiers, were transferred from another facility, or were discharged against medical advice.

Two overlapping databases were designed. Risk-adjustment models were derived using a developmental database that consisted of patients from hospitals that satisfied quality coding criteria and had the 20 or more qualifying cases needed to construct hospital-level moving-range control charts.[5] Final models were used to compare the overall adverse outcome rates of all hospitals that met the minimum volume criteria of 50 evaluable cases required for inclusion in a study database. Hospitals with fewer than 50 qualifying cases were excluded from the study database to avoid skewing final comparisons of hospitals' performance by including hospitals with few qualifying cases and very low predicted numbers of adverse outcomes.

### Model Derivation

Using the developmental database, prediction models were designed for: 1) inpatient deaths (IpD), 2) prolonged risk-adjusted lengths-of-stay (prLOS), 3) 90-day postdischarge deaths without readmission (PD-90), and 4) 90-day readmission (RA-90). Models were derived using stepwise logistic regression on more than 500 candidate risk factors, including patient age and coded comorbid conditions that were present at admission. Hospital variables were employed to account for hospital effects. The Schwarz criterion was used to avoid overfitting final models,[6] and the discrimination of final models was measured with C statistics. All analyses were performed with SAS version 9.4 (SAS Institute; Cary, North Carolina).

The IpD model included only inpatient deaths. PrLOS was used as a surrogate for severe complications of inpatient care among live discharges. Cases with prLOS were identified by first developing a linear model for inpatient length of stay (LOS) among cases without any coded complications. Predicted LOS for all cases in the developmental database were subtracted from observed LOS, differences were temporally aligned within each hospital, and moving-range control charts were created to identify outliers that exceed the 3 sigma upper control limit.[7-9] Previous studies including cardiac procedures have associated prLOS with severe complications, increased costs,[10] and higher rates of postdischarge deaths and readmissions.[11]

The PD-90 and RA-90 models included AEs occurring within 90 days of discharge. We used 90 days because our previous work demonstrated that following surgical procedures, more than 40% of relevant deaths and readmissions occur between 31 and 90 days after discharge.[12] To study RA-90, we excluded all 90-day readmissions for Medical Diagnostic Categories (MDCs) 2 (Eye Diseases), 17 (Myeloproliferative Diseases), and 22/24 (Burns/Major Trauma), as well as all Medicare-Severity, Diagnosis-Related Groups (MS-DRGs) related to the management of trauma or cancer regardless of MDC. PrLOS events during the index hospitalization were included in PD-90 and RA-90 models to clarify the relationship between inpatient complications and postdischarge AEs and to remove the effects of inpatient complications on coefficients in postdischarge models. MS-DRGs were identified for each readmission. All valid readmissions were divided into those occurring within 30, 60, and 90 days of discharge, but only 90-day readmissions were used in RA-90 model development.

### Comparative Hospital Performance

The 4 PCI prediction models for adverse outcomes from the developmental database were applied to all patients in hospitals in the study database. All hospitals had more than 4.5 predicted total adverse outcomes and more than 4.5 predicted 90-day readmissions; 90% had more than 4.5 predicted prolonged LOS outliers. The IpD model was applied to all cases. The prLOS model was applied to all live inpatient discharges. Live discharges without prLOS were used to predict PD-90, and live discharges without prLOS or PD-90 were used to predict readmissions.

Among all hospitals, total predicted adverse outcomes were adjusted to equal total observed adverse outcomes. For each hospital, a $z$ score was computed as [observed adverse outcomes – predicted adverse outcomes] ÷ standard deviation (SD), where the SD equals and N equals the number of qualifying cases at that hospital. Negative $z$ scores indicated that outcomes were better than predicted; positive $z$ scores indicated that outcomes were poorer than predicted. Each hospital's risk-adjusted adverse outcome (RAAO) rate was computed as [overall observed adverse outcomes rate] × [hospital-observed adverse outcomes ÷ hospital-predicted adverse outcomes]. RAAO rates were grouped into deciles for comparison. To better define the contribution of inpatient and postdischarge adverse outcomes to overall performance, each hospital's total adverse outcomes were subdivided into observed and predicted prLOS and observed and predicted RA-90. To evaluate the influence of case volume on RAAO rates, hospitals were grouped into deciles based on their case volume during the study period.

## RESULTS

### Prediction Models

Of the 150,903 patients in the developmental database, 503 (0.33%) died during their index admission; 10,341 (6.8%) had prLOS; 730 (0.5%) died within 90 days of discharge without a readmission; and 31,124 (20.6%) were readmitted within 90 days of discharge. The significant risk factors ($P$ <.001) in each of the predictive models for these outcomes are summarized in **eAppendix Table 1** (**eAppendi-**

**Table.** MS-DRGs of Readmissions After Percutaneous Coronary Interventions

| READMISSION CAUSE (MS-DRG) | TOTAL PATIENTS | TOTAL READMITS | 30-DAY READMITS | 31- TO 60-DAY READMITS | 61- TO 90-DAY READMITS |
|---|---|---|---|---|---|
| **Cardiothoracic Events (58.0% of patients)** | | | | | |
| Percutaneous coronary intervention (246-51) | 6189 | 7075 | 3647 | 2089 | 1339 |
| Coronary artery bypass grafting (231-6) | 400 | 499 | 199 | 147 | 153 |
| Cardiac arrhythmias (308-10) | 1103 | 1484 | 703 | 436 | 345 |
| Heart failure and shock (291-3) | 1764 | 2753 | 1186 | 854 | 713 |
| Acute myocardial infarction or chest pain (280-284; 311-3) | 2562 | 3400 | 1762 | 856 | 782 |
| Cardiothoracic subtotal | 18,044 | 22,841 | 11,141 | 6628 | 5072 |
| **Pulmonary Events (3.1% of patients)** | | | | | |
| Respiratory system diagnoses (003-004; 189; 204-9) | 555 | 829 | 358 | 265 | 206 |
| Major chest procedures (163-5) | 134 | 152 | 26 | 77 | 49 |
| Pleural effusion/pneumothorax (186-8; 199-201) | 77 | 127 | 53 | 42 | 32 |
| Pulmonary embolism (175-6) | 136 | 188 | 103 | 49 | 36 |
| Pulmonary events subtotal | 979 | 1408 | 585 | 467 | 356 |
| **Gastrointestinal Events (8.6% of patients)** | | | | | |
| Gastrointestinal hemorrhage (377-9) | 1266 | 1782 | 844 | 512 | 426 |
| Digestive system disorders (391-5) | 1039 | 1395 | 666 | 405 | 324 |
| Gastrointestinal obstruction | 149 | 218 | 77 | 69 | 72 |
| Gastrointestinal subtotal | 2677 | 3700 | 1660 | 1127 | 913 |
| **Medical Conditions (7.7% of patients)** | | | | | |
| Acute renal failure (682-4) | 556 | 811 | 366 | 237 | 208 |
| Chronic lung disease (190-8) | 745 | 1065 | 408 | 343 | 314 |
| Metabolism, nutrition, fluids (640-1) | 345 | 523 | 211 | 160 | 152 |
| Hematologic/red cell disorders (802-13) | 366 | 543 | 224 | 168 | 151 |
| Complications of treatment (919-21) | 157 | 224 | 136 | 45 | 43 |
| Medical condition subtotal | 2408 | 3512 | 1483 | 1073 | 956 |
| **Infections (7.4% of patients)** | | | | | |
| Pneumonia (177-9; 193-5; 202-3) | 938 | 1339 | 496 | 410 | 433 |
| Septicemia (870-2) | 497 | 760 | 307 | 203 | 250 |
| Postoperative infection (856-63) | 90 | 159 | 81 | 42 | 36 |
| Urinary tract infection (689-90) | 355 | 487 | 218 | 133 | 136 |
| Infection subtotal | 2302 | 3380 | 1345 | 982 | 1053 |
| **Cerebrovascular Events (4.2% of patients)** | | | | | |
| Stroke; intracranial bleed (062-069) | 591 | 767 | 320 | 238 | 209 |
| Neurovascular procedures (025-7; 034-9) | 646 | 768 | 245 | 333 | 190 |
| Cerebrovascular events subtotal | 1293 | 1619 | 593 | 599 | 427 |
| All others (11.0% of patients) | 3421 | 4814 | 1889 | 1535 | 1390 |
| All readmissions after exclusions | 31,124 | 41,274 | 18,696 | 12,411 | 10,167 |

MS-DRG indicates Medicare Severity–Diagnosis-Related Group; readmits, readmissions.

**ces** available at **ajmc.com**). The IpD model had 10 significant risk factors and a C statistic of 0.748 after removal of hospital variables. The prLOS model had 66 significant risk factors and a final C statistic of 0.747. The PD-90 model had 13 significant risk factors and a final c-statistic of 0.768. The RA-90 model had 43 risk factors and a final C statistic of 0.644. PrLOS was a significant predictor of 90-day readmissions (odds ratio [OR], 1.62) and 90-day postdischarge mortality without readmission (OR, 3.99).

The **Table** details the MS-DRGs of qualifying readmissions in the developmental dataset. There were 31,124 patients readmitted 41,274 times, with 18,696 (45.3%) readmissions occurring during the first 30 days following discharge; 12,411 (30.1%) between days 31 and 60; and 10,167 (24.6%) between days 61 and 90. The majority of readmissions (58%) had cardiovascular principal diagnoses.

### Hospital Comparisons

The study database consisted of 168,518 patients from 978 hospitals, with each having 50 or more qualifying cases (average of 172 cases per hospital; median of 119 cases). There were 571 (0.34%) inpatient deaths; 11,603 (6.9%) patients with prLOS; 1613 (1.0%) postdischarge deaths without readmission; and 34,841 (20.7%) patients with 1 or more readmissions. There were 820 deaths after readmissions. Inpatient and 90-day postdischarge deaths totaled 3004 (1.8%). There were 43,613 (25.9%) patients who had 1 or more adverse outcomes after PCI.

**Figure 1** demonstrates the distribution of *z* scores for observed versus expected adverse outcomes rates. *Z* scores for study hospitals ranged from –6.2 for the best performing hospital to +6.3 for the poorest performing hospital. There were 67 hospitals with differences more than 2 SDs better than the average and 81 hospitals with differences more than 2 SDs poorer than average.

**Figure 2** demonstrates the distribution of RAAO rates among hospitals by decile of performance. The best performing decile had a median adverse outcome rate of 17.6%, while the poorest performing decile had a median adverse outcome rate of 35.5%. Error bars represent the interquartile range within each decile.

**Figure 3** demonstrates the relationship between risk-adjusted rates of prLOS and comparable rates of RA-90. The ratio of observed to predicted length of stay outliers are strongly correlated with the ratio of observed to predicted 90-day readmissions. Hospitals that have low risk-adjusted rates of inpatient complications of care have comparable low risk-adjusted rates of postdischarge readmissions. Hospitals with higher risk-adjusted inpatient complication rates have higher rates of risk-adjusted 90-day postdischarge readmissions.

**Figure 4** illustrates the relationship of adverse outcomes and hospitals' case volumes. There is very little variation in outcomes across decile groups organized by volume. Each decile had a standard error of the mean of 0.5%. Analysis of variance demonstrated no significant relationship between the case volume of each hospital and its RAAO rates ($P = .86$).

## DISCUSSION

In this study, 4 objectively defined, risk-adjusted adverse outcomes were used to compare hospital performance in PCI. These adverse outcomes were treated as no-fault events, each of which may or may not have been preventable. However, when risk-adjusted outcomes at hospitals were compared, remarkable differences in measured performance suggested that there were substantial opportunities for quality improvement at many facilities.

The adverse outcomes of PCI have many similarities to those that we have reported previously in open CABG surgery.[4] The overall adverse outcomes rate was 25.9% for PCI and 27.2% for CABG. There was a 1.8% inpatient and 90-day postdischarge mortality rate with PCI, and an overall 3.4% death rate for CABG. PrLOS was identified in 6.9% of PCI cases and 8.2% in CABG. A total of 20.9% of PCI patients were readmitted compared with 20.0% of CABG patients. Analysis of variance identified no difference in adverse outcomes between PCI and CABG. The comparable adverse outcome rates between the 2 populations of patients illustrates the high risk that is posed by coronary artery patients for any intervention.

In this study, 90-day postdischarge adverse outcomes exceeded the inpatient adverse outcomes. This finding may be due, in part, to progressive reductions in inpatient LOS, which result in more AEs first becoming evident after patients have been discharged. Increased awareness of the importance of postdischarge adverse outcomes has resulted in CMS imposing penalties to hospitals for excessive readmission rates for selected patient groups.[13] This new focus on postdischarge AEs and the rapid evolution of accountable care organizations and bundled payment initiatives have put a premium on successful care redesign that improves important postdischarge

**Figure 1. Frequency of Hospitals Within Each *Z* Score Category in Observed to Predicted Adverse Outcomes**

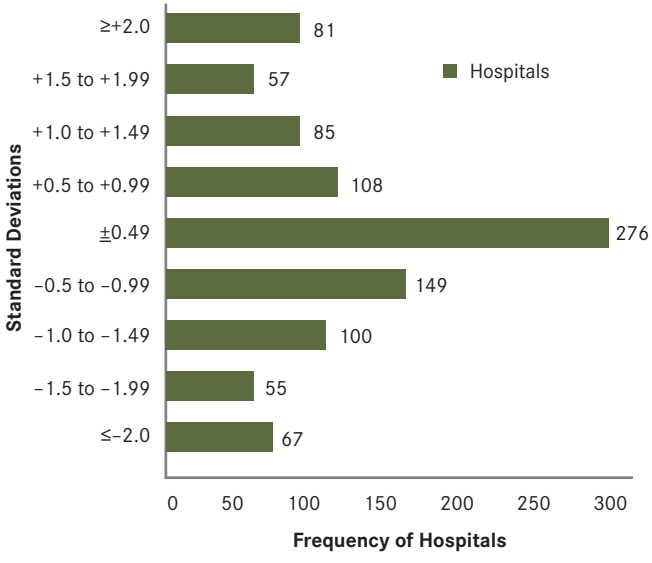
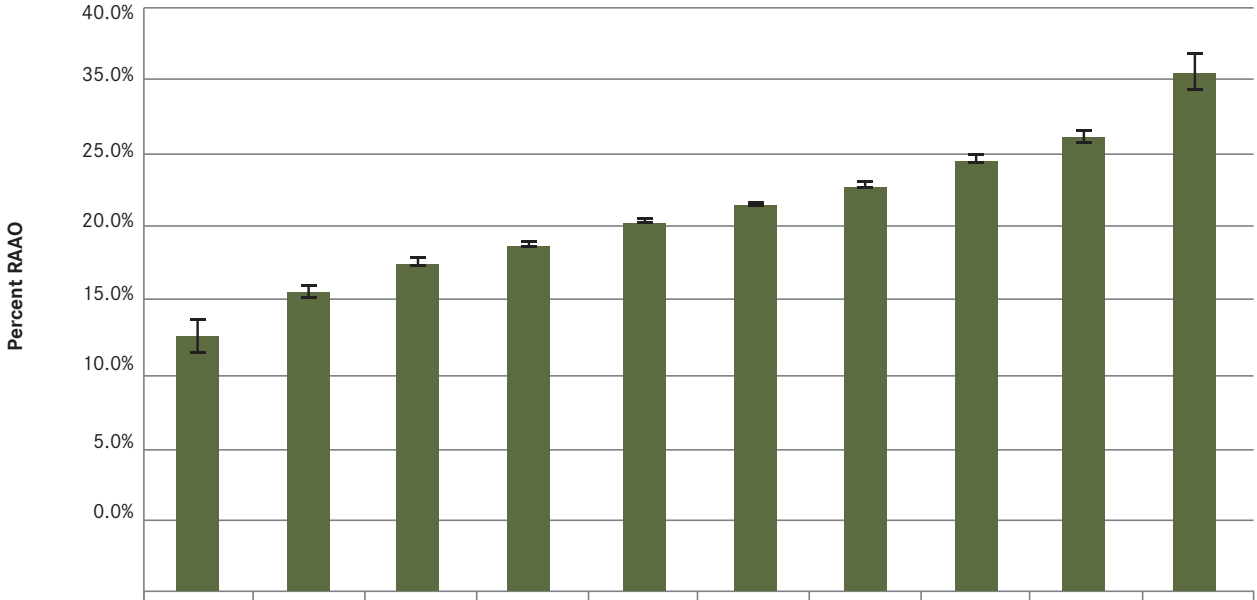


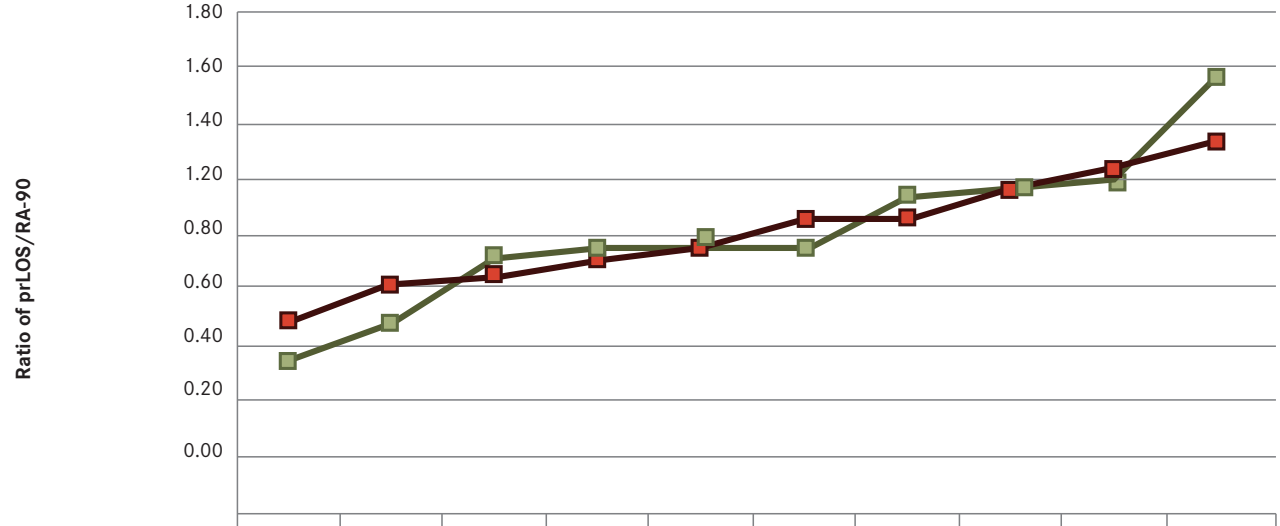
**Figure 2.** Risk-Adjusted Adverse Outcome Rates of Study Hospitals by Decile of Performance[a]




| | Decile 1 | Decile 2 | Decile 3 | Decile 4 | Decile 5 | Decile 6 | Decile 7 | Decile 8 | Decile 9 | Decile 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Median | 17.6% | 20.7% | 22.4% | 23.6% | 24.9% | 26.3% | 27.5% | 29.3% | 31.3% | 35.5% |

RAAO indicates risk-adjusted adverse outcome.
[a]The error bars indicate the interquartile range.

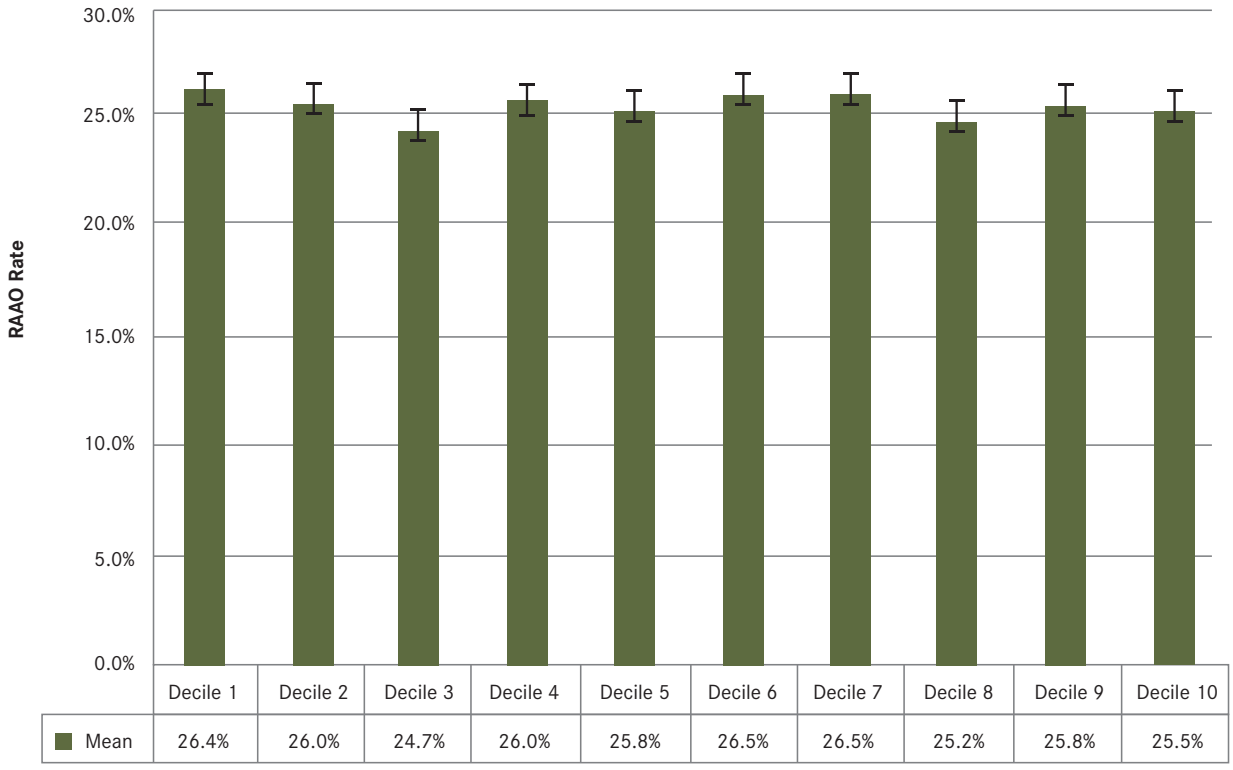
**Figure 3.** Observed to Predicted Ratios of Prolonged Length of Stay to 90-Day Readmissions by Decile of Hospital Performance




| | Decile 1 | Decile 2 | Decile 3 | Decile 4 | Decile 5 | Decile 6 | Decile 7 | Decile 8 | Decile 9 | Decile 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| O/P prLOS | 0.55 | 0.69 | 0.90 | 0.94 | 0.98 | 0.94 | 1.13 | 1.14 | 1.20 | 1.57 |
| O/P Readmits | 0.67 | 0.82 | 0.86 | 0.90 | 0.96 | 1.03 | 1.05 | 1.13 | 1.22 | 1.32 |

O/P indicates observed-to-predicted ratio; prLOS indicates prolonged length-of-stay; RA-90, 90-day readmission; readmits, readmissions.

**Figure 4. Adverse Outcome Rate of Hospitals by Decile of Case Volumes[a]**




RAAO indicates risk-adjusted adverse outcome.
[a]The error bars indicate the interquartile range.

clinical outcomes. To meet this challenge, hospitals must first institute effective methods for measuring their postdischarge adverse outcome rates. They then must devise and implement methods to link these results to specific processes of care for redesign of overall management when and where it is indicated.

Using risk-adjusted readmission rates as a measure of the quality of inpatient care is controversial because analytic methods have not been standardized and many readmissions have been judged to be clinically unavoidable or unrelated to the index hospitalization.[14] The most common follow-up period for unscheduled postdischarge readmissions is 30 days, with reported rates after PCI ranging from 9% to12%.[15,16] Wasfy et al reported that 30-day post-PCI readmissions are due mainly to chest pain and anxiety,[17] are seldom due to complications of the PCI,[18] and, in nearly half of cases, could be prevented with improved decision making.[19] They also noted a modest improvement in predictions of 30-day readmissions when postprocedural risk factors, such as bleeding and prolonged LOS, were included in predictive models.[20] On the other hand, Moretti et al[21] extended the follow-up period for readmissions after PCI to 60 days based on their belief that 8 weeks were required to recover from the effects of myocardial damage. These investigators found overall readmission rates of 4.4% for 30 days and 8.4% for 60 days of postdischarge follow-up. They also found that readmission within 60 days of discharge was associated with increased mortality during 2 years after discharge. Similarly, Kharvaja et al found that 30-day readmissions after PCI were associated with an increased 1-year death rate.[16] The only studies to examine 90-day readmissions following PCI were in clinical trials examining anticoagulation[22] and hemodynamic support strategies.[23] Both of these studies were performed on very restricted populations of patients.

The choice of a 90-day follow-up period for readmissions in this study is supported by the fact that of all readmissions that satisfied criteria for inclusion, 55% occurred 31 to 90 days after discharge. Cardiac-related events were the most common causes for readmission throughout the follow-up interval. Furthermore, Medicare's bundled payment program is including 90 days of postdischarge care in its initial implementation,[24] and PCI and coronary artery bypass surgery are expected to be included in the next set of scheduled episodes.[25] Providers of inpatient PCI will likely have cost accountability for 90 days following discharge of the patient. The follow-up period of accountability for readmissions for 90 days will likely remain controversial.

Analysts have found risk-adjusted predictive models for readmission difficult to design.[26] It has been difficult to obtain data about nonmedical factors that may have an even greater influence on readmission rates than conventional medical risk factors identified at the beginning of an index hospitalization. We have consistently found that prolonged risk-adjusted LOS during the index hospitalization is a powerful predictor of 90-day readmissions.[27] In the current study, we also found that when hospitals are grouped by decile of performance, risk-adjusted prolonged LOS are highly correlated with readmission rates. Thus, it appears that hospitals with low risk-adjusted rates of severe inpatient complications have correspondingly low rates of risk-adjusted adverse outcomes following discharge.

In the current study, there was no significant difference in RAAO rates between low-volume and high-volume centers. In interpreting this finding, it is important to note that only inpatient, nonemergent PCIs were performed on Medicare patients older than 64 years who qualified for inclusion in the study, and hospitals with fewer than 50 such cases were excluded from comparative analyses. Therefore, almost all truly low-volume centers were probably excluded from this analysis.

### Limitations

This study has several important limitations. Its reliance on administrative data raises concerns about the accuracy and completeness of the diagnostic information used to construct and apply risk factors. Complete abstraction of clinical records would yield better predictive models, and previous studies have shown that even modest enhancements of administrative data with numerical laboratory results that were obtained at the time of admission improve predictions of inpatient medical and surgical mortality[27,28] and adverse outcomes,[29] but not predictions of readmissions.[30]

Other studies have found that a patient's ejection fraction and preprocedure serum creatinine are important independent variables in predictive models for mortality and complications in CABG[31] and PCI.[32] In its favor, administrative data has the distinct advantage of consistently capturing postdischarge AEs, such as readmissions, that often are not consistently documented in clinical registries. For example, 20% to 40% of postsurgical readmissions occur at hospitals other than the hospital at which the initial operation was performed, which probably is also the case for readmissions after PCI.[33] Continuing evolution of the electronic health record (EHR) may result in the creation of new hybrid databases that combine the advantages of administrative and detailed clinical data. The use of EHRs as a source of laboratory results and other clinical data acquired at the time of discharge, rather than at admission, may further enhance the predictive power of readmission models derived from hybrid databases. EHRs have the promise of improving the accuracy of administrative data.

This study was also limited by the absence of a refined set of criteria for excluding all readmissions that were unrelated to the index procedure, by the exclusion of emergency and outpatient PCIs, and PCIs performed on patients younger than 65 years. Additional research is needed to determine whether current findings extend to these populations. The availability of all-payer claims databases with encrypted patient identifiers should facilitate expanded studies that provide accurate information about important postdischarge AEs in all patients undergoing PCIs.

## CONCLUSIONS

This study of elective PCIs in Medicare beneficiaries revealed marked differences in hospital-level risk-adjusted adverse outcomes. These findings provide a realistic estimate of benefits that could be achieved by properly focused care redesign based on accurate knowledge of comparative hospital performance and successful linking of clinical outcomes to specific clinical judgments and technical proficiencies. Improved outcomes in both inpatient and postdischarge care will be very important for providers to meet the challenge of bundled payment initiatives.

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***Source of Funding:*** This study was internally funded by MPA Healthcare Solutions, Chicago, IL.

***Author Disclosures*:** Dr Fry is on the research advisory board of IrriMax Corp, and has received grants from the company for surgical site infection studies; he has also received lecture fees for speaking at CareFusion. The remaining authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

***Authorship Information:*** Concept and design (MP, DEF, SMN, DGL, AMR, GP); acquisition of data (MP, DEF, SMN, DGL, AMR); analysis and interpretation of data (MP, DEF, SMN, DGL, AMR, GP); drafting of the manuscript (DEF); critical revision of the manuscript for important intellectual content (MP, DEF, SMN, DGL, AMR; GP); statistical analysis (MP, DEF, SMN, DGL, AMR, GP); provision of study materials or patients (GP); administrative, technical, or logistic support (MP, GP); and supervision (MP, DEF, GP).

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**eAppendix Table 1.** The significant risk factors (P<0.001) and odds ratios in predictive models following percutaneous coronary intervention

| Significant Risk Factors | Risk Model Odds Ratios | | | |
|---|---|---|---|---|
| | IpD[a] | PrLOS[b] | PD-90[c] | RA-90[d] |
| Female | - | 1.49 | - | 1.18 |
| Age 75-84 years | 2.21 | 1.18 | 1.59 | 1.18 |
| Age ≥ 85 years | 4.72 | 1.58 | 3.01 | 1.50 |
| Ischemic Heart Failure | 2.15 | 2.74 | - | - |
| Systolic/Diastolic Heart Failure | - | 3.01 | - | - |
| Unspecified Congestive Heart Failure | - | 1.65 | 2.26 | 1.46 |
| Rheumatic Heart Disease | 4.65 | - | - | - |
| Myocarditis | - | 1.15 | - | - |
| Heart Valve Disease | - | 1.13 | - | 1.15 |
| Complications of Cardiovascular Device | - | 3.23 | - | - |
| Ventricular Fibrillation/Flutter | 58.09 | 3.98 | - | - |
| Conduction Disturbance | - | 2.00 | - | - |
| Other Cardiac Arrhythmias | - | 1.59 | 1.51 | 1.33 |
| Miscellaneous Cardiac Conditions | - | 2.22 | - | - |
| Pacemaker Status | - | - | - | 1.11 |
| Deep venous thrombosis | - | 9.93 | - | - |
| Superficial venous phlebitis | - | 1.52 | - | - |
| History of venous thromboembolism | - | - | - | 1.19 |
| No Systemic Hypertension | 2.99 | 1.38 | - | - |
| Intestinal Malignant Neoplasm | 5.12 | - | - | 3.03 |
| Injury present-on-admission | 2.29 | 3.12 | - | - |
| Severe Malnutrition | 5.50 | 3.84 | 8.48 | - |
| Mild/Moderate Malnutrition | - | 1.90 | - | 1.71 |
| Overweight | - | 1.59 | - | - |
| Pituitary Disease | - | 2.78 | - | - |
| Long term Steroid Use | - | - | - | 1.34 |
| Gastric Ulcer / Gastritis | - | 1.61 | - | 1.25 |
| Gastrointestinal Bleeding | - | 4.44 | - | - |
| Vomiting/Gastroparesis | - | 1.93 | - | - |
| Disorders of Gut Motility | - | - | - | 4.97 |
| Chronic Renal Failure | 3.21 | 1.76 | - | 2.06 |
| Hematuria | - | 2.85 | - | - |
| Renal Dialysis Status | - | - | 4.32 | 1.45 |
| Miscellaneous Renal Disorders | - | - | - | 1.27 |
| Urinary Tract Obstruction | - | 2.19 | - | - |
| Urinary Tract Infection / Inflammation | - | 2.01 | - | 1.27 |
| Vitamin Deficiency Anemias | - | 1.46 | 1.85 | 1.29 |
| Iron Deficiency Anemia | - | 1.96 | - | - |
| Hypercoagulable Disorders | - | 2.24 | - | - |
| Platelet disorders | - | 1.47 | - | - |
| Diabetic Extremity Ulcers | - | 5.84 | 3.96 | 2.03 |
| Atherosclerotic Ulceration | - | 2.00 | - | 6.50 |
| Hemiplegia/Hemiparesis | - | 6.74 | - | - |
| **Significant Risk Factors** | **Risk Model Odds Ratios** | | | |

| | | | | |
|---|---|---|---|---|
| Paraplegia | - | 1.76 | - | 1.46 |
| Chronic Pain Syndrome | - | - | - | 1.25 |
| Chronic Neurological Disease | - | - | - | 1.41 |
| Depression/ Bipolar Disorder | - | 4.26 | - | 1.16 |
| Drug Abuse / Dependence | - | 7.28 | - | - |
| Alcohol Abuse | - | 1.71 | - | - |
| Alzheimers / Dementia | - | 4.14 | - | - |
| Anxiety and Miscellaneous Emotional Disorders | - | - | - | 1.18 |
| Chronic Bronchitis/Emphysema | - | 1.20 | 1.91 | 1.45 |
| Drug Toxicity/Reaction | - | 4.09 | - | - |
| Psychosocial Problems | - | 12.79 | - | - |
| Systemic Hypotension Present-on-admission | - | 1.97 | - | - |
| Aortic Aneurysm | - | 1.37 | - | 1.48 |
| Occlusive Arterial Disease | - | 1.25 | - | 1.46 |
| Other Peripheral Arterial Disease | - | - | - | 1.24 |
| Complications of Diabetes | - | 1.49 | - | - |
| Diabetes | - | - | - | 1.18 |
| Immune Deficiency | - | 1.35 | - | - |
| Reflux Esophagitis | - | 1.73 | - | - |
| Constipation | - | 2.05 | - | - |
| Nausea and Vomiting | - | 1.49 | - | 1.29 |
| Acute Cholecystitis | - | 9.01 | - | - |
| Gallstone Disease | - | 1.74 | - | - |
| Chronic Infectious Disease | - | 1.56 | - | 1.47 |
| Osteomyelitis | - | 3.32 | - | - |
| Recent Skeletal Fracture | - | 5.31 | - | - |
| Cerebrovascular Disease | - | 1.24 | - | 1.27 |
| Sleep Disorders | - | 1.33 | - | - |
| Schizophrenic Disorders | - | 1.60 | - | - |
| Intellectual Disability | - | 5.40 | - | - |
| Ventilator Dependence | - | 13.56 | - | - |
| Supplemental Oxygen | - | - | - | 1.21 |
| Interstitial Lung Disease | - | 2.41 | 2.89 | 1.45 |
| Acute Lung Conditions | - | 2.06 | - | - |
| Head/Neck Cancer | - | 1.47 | - | - |
| Metastatic Cancer | - | - | 23.36 | 1.87 |
| Benign Neoplasm | - | 2.72 | - | - |
| Hematopoietic Malignancy | - | - | 3.56 | 1.37 |
| Ascites | - | - | - | 2.18 |
| Liver Cirrhosis | - | - | - | 1.69 |
| Seizure Disorder | - | - | - | 1.32 |
| Procedure in Year 2010 | - | - | - | 1.45 |
| Procedures in Year 2011 | - | - | - | 1.28 |
| Procedure in Year 2012 | - | 1.09 | - | - |
| Prolonged Risk-Adjusted Length of Stay | - | - | 3.99 | 1.62 |

[a]Inpatient deaths
[b]Prolonged Length-of-Stay
[c]90-day post-discharge deaths without readmission
[d]90-day post-discharge readmissions