ASSOCIATIONS BETWEEN HOSPITAL LENGTH OF STAY, 30-DAY READMISSION, AND COSTS IN ST-SEGMENT–ELEVATION MYOCARDIAL INFARCTION AFTER PRIMARY PERCUTANEOUS CORONARY INTERVENTION: A NATIONWIDE READMISSIONS DATABASE ANALYSIS

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BACKGROUND: Readmission after ST-segment–elevation myocardial infarction (STEMI) poses an enormous economic burden to the US healthcare system. There are limited data on the association between length of hospital stay (LOS), readmission rate, and overall costs in patients who underwent primary percutaneous coronary intervention for STEMI.

METHODS AND RESULTS: All STEMI hospitalizations were selected in the Nationwide Readmissions Database from 2010 to 2014. From the patients who underwent primary percutaneous coronary intervention, we examined the 30-day outcomes including readmission, mortality, reinfarction, repeat revascularization, and hospital charges/costs according to LOS (1–2, 3, 4, 5, and >5 days) stratified by infarct locations. The 30-day readmission rate after percutaneous coronary intervention for STEMI was 12.0% in the anterior wall (AW) STEMI group and 9.9% in the non-AW STEMI group. Patients with a very short LOS (1–2 days) were readmitted less frequently than those with a longer LOS regardless of infarct locations. However, patients with a very short LOS had significantly increased 30-day readmission mortality versus an LOS of 3 days (hazard ratio, 1.91; CI, 1.16–3.16 [P=0.01]) only in the AW STEMI group. Total costs (index admission+readmission) were the lowest in the very short LOS cohort in both the AW STEMI group (P<0.001) and the non-AW STEMI group (P<0.001).

CONCLUSIONS: For patients who underwent primary percutaneous coronary intervention for STEMI, a very short LOS was associated with significantly lower 30-day readmission and lower cumulative cost. However, a very short LOS was associated with higher 30-day mortality compared with at least a 3-day stay in the AW STEMI cohort.

Key Words: costs ■ length of hospital stay ■ PCI ■ readmission ■ STEMI

Recent advances in the treatment of ST-segment–elevation myocardial infarction (STEMI) have resulted in improved outcomes.1–3 However, STEMI remains a significant cause of morbidity and mortality in the United States. It is estimated that nearly $12.1 billion US dollars were spent in 2013 for hospital care of STEMI.4,5 Early discharge after primary percutaneous coronary intervention (PCI) for STEMI has been shown...
Length of Stay, Readmission, and Costs in STEMI

CLINICAL PERSPECTIVE

What Is New?
• In this large, nationwide cohort of patients hospitalized for ST-segment–elevation myocardial infarction (STEMI) undergoing primary percutaneous coronary intervention, we demonstrated that very early discharge strategy is associated with reduced readmissions and decreased overall cost in low-risk patients.
• Very short discharge (length of stay 1–2 days) after primary percutaneous coronary intervention for STEMI was associated with increased 30-day mortality compared with 3-daylength of stay in the anterior wall (AW) STEMI group but not in the non-AW STEMI group.
• Longer length of stay and readmissions were strong independent predictors of higher total costs in both patients with AW and those with non-AW STEMI.

What Are the Clinical Implications?
• Hospital length of stay appeared to be a marker of subsequent outcomes and total healthcare costs in patients hospitalized for STEMI undergoing primary percutaneous coronary intervention.
• Very early discharge after primary percutaneous coronary intervention for STEMI may represent potential strategies to decrease readmissions and to lower healthcare costs.
• Patients with AW STEMI need attention for very early discharge strategy considering potential increase in 30-day mortality.

Methods

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Data Source

Data were obtained from the Agency for Healthcare Research and Quality, which administers the Healthcare Cost and Utilization Project (HCUP). We used NRD from 2010 to 2014. The NRD is a large administrative database constructed using discharge data from the HCUP State Inpatient Databases, with verified patient linkage numbers used to track the patients across hospitals within a state during a given year. The NRD is designed to support national readmission analyses and is a publicly available national representative healthcare database. From 2010 to 2014, the NRD contained deidentified information for total 70,501,787 index hospitalizations from 1715 to 2048 hospitals in 18 to 22 states, representing a national estimate of 181,545,077 discharges. Each patient record in the NRD contains information on the patient’s diagnoses and procedures performed during the hospitalization based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes and Clinical Classification Software (CCS) codes that groups multiple ICD-9-CM codes for facilitated to be feasible in multiple studies. However, the impact of shortening hospital length of stay (LOS) on readmission remains an important question, especially since readmission after STEMI is still an enormous economic burden to the US healthcare system.

As an effort to reduce readmissions and to improve quality of care, which can lead to significant cost reduction, the Centers for Medicare & Medicaid Services implemented the Hospital Readmission Reduction Program (HRRP) in several key diseases including acute myocardial infarction. Recent studies demonstrated that about 20% of patients are readmitted within 30 days of hospitalization after STEMI, and significant efforts have been spent on identifying factors associated with 30-day readmissions. Our group recently demonstrated that 30-day readmission after STEMI was associated with an ≈50% increase in cumulative hospital costs. Considering the recent trend of declining hospital LOS after STEMI, the association between LOS, readmissions, and costs needs to be further defined. Using the Nationwide Readmissions Database (NRD), we aimed to investigate the impact of LOS on the 30-day readmission rates and hospital costs after PCI in patients with STEMI stratified by the location of infarct.

Nonstandard Abbreviations and Acronyms

AMA against medical advice
AW anterior wall
CABG coronary artery bypass grafting
HCUP Healthcare Cost and Utilization Project
HMO health maintenance organization
HR hazard ratio
HRRP hospital readmission reduction program
IABP intra-aortic balloon pump
ICD-9-CM International Classification of Diseases, Ninth Revision, Clinical Modification
LOS length of stay
MACE major adverse cardiac events
NCDR National Cardiovascular Data Registry
NRD Nationwide Readmissions Database
PCI percutaneous coronary intervention
PLVAD percutaneous left ventricular assist device
SE standard error
STEMI ST-segment–elevation myocardial infarction
Statistical analyses. We identified our study population, comorbidities, causes of readmissions, inhospital outcomes using a combination of ICD-9-CM codes, and Clinical Classification Software codes. Institutional review board approval and informed consent were not required for current study because all data collection was derived from a publicly open and deidentified administrative database.

**Study Population and Variables**

All hospitalizations for STEMI with subsequent underwritten PCI during index hospitalization were selected by finding ICD-9-CM codes for initial STEMI (410.x1) and PCI (00.66, 36.01, 36.02, 36.05, 36.06, and 36.07) (total unweighted N=228 953; weighted N=539 517). Subendocardial infarction (410.7x) was excluded from the analysis. In addition, patients who died during the index hospitalization were excluded in this cohort. To evaluate the effect of LOS and eliminate outliers, we included patients with a LOS from 1 day up to 14 days. LOS was calculated by subtracting the admission date from the discharge date. The LOS was categorized as follows: short LOS (LOS 1–3 days), medium LOS (LOS 4–5 days), and long LOS (LOS >5 days). We also examined the very short LOS (LOS 1–2 days) cohort versus those with a longer LOS after subdividing patients into 5 LOS cohorts (LOS 1–2, 3, 4, 5, and >5).

Patients with a concomitant diagnosis of cardiogenic shock and cardiac arrest were identified using ICM-9-CM codes 785.51 and 427.5, respectively. Concurrent use of intra-aortic balloon pump and percutaneous left ventricular assist devices were identified with ICD-9-CM procedure codes 37.61 and 37.68, respectively. Since NRD prohibits linking patients across years, patients discharged from January through November were included in the study to allow for completeness of data on 30 days of follow-up after discharge. Furthermore, patients with missing data on LOS were excluded to properly capture interval until readmission. Patient- and hospital-level variables were included as baseline characteristics. NRD variables were used to identify age, sex, median household income quartiles, primary payer, hospital teaching status, location, and bed size. ICD-9-CM codes for selected concurrent clinical diagnoses and procedures are listed in Table S1.

**Study Outcomes**

The primary outcome of this study was 30-day readmission. The secondary outcomes within 30 days included rates of all-cause mortality, reinfarction (ICD-9-CM codes of 410.x1 except 410.7x), repeat revascularization, and major adverse cardiac events (MACE), defined as a composite of mortality, reinfarction, and repeat revascularization. Furthermore, cumulative hospital charges and costs for index hospitalizations and readmissions were examined according to LOS.

**Statistical Analyses**

All statistical analyses were performed using SAS software version 9.4 (SAS Institute Inc) and R statistical software version 3.5.1 (www.R-project.org) with its package “survey.” Discharge weight and stratum provided by NRD were used for all analyses and thus all reported numbers are weighted national estimates. Domain analysis was used for accurate variance calculations for subgroup analyses. All analyses accounted for NRD sampling design by including hospital-year fixed effects based on hospital identification number. We compared baseline patient- and hospital-level characteristics with STEMI and PCI stratified by the occurrence of 30-day readmission, LOS, and location of the infarct. Categorical variables are presented as frequencies and analyzed by Rao-Scott chi-square test. Continuous variables are shown as mean or median and were tested by either Mann–Whitney–Wilcoxon test or survey-specific linear regression test. To evaluate the predictive value of LOS and other covariates for primary and secondary outcomes, survey-specific univariate and multivariable Cox proportional hazards models were applied. Variables with \( P < 0.1 \) were included as initial covariates. Final parsimonious models were created by manual removal of each covariate based on Akaike information criterion while ensuring each removal did not result in >10% change in the measure of association for the primary predictor variable. Adjusted risks are presented as hazard ratios (HRs) together with 95% CIs and \( P \) values. For the cost analysis, the estimated cost for each hospitalization was calculated by the validated method of using cost-to-charge ratio provided by HCUP. NRD data was merged with cost-to-charge ratio files provided by HCUP and then multiplied by the charge for each hospitalization with the respective cost-to-charge ratio. Cumulative total cost was defined as the cost of readmission plus the cost of the index admission. Afterward, we examined the predictors of cumulative cost by performing survey-specific multivariable linear regression test and log-transforming costs to achieve a normal distribution. All tests were 2-sided with \( P < 0.05 \) considered statistically significant.
RESULTS

Baseline Characteristics by LOS

During the study period, 539,517 patients underwent primary PCI after STEMI at 3682 sites. Overall, 187,557 patients (34.8%) presented with anterior wall (AW) STEMI, while 351,960 patients (65.2%) presented with non-AW (NAW) STEMI. The mean age was 60.8 years (standard error, 0.1) in the AW STEMI group and 61.2 years (standard error, 0.1) in the NAW STEMI group. The distribution of LOS in the overall patients, AW STEMI group, and NAW STEMI group is shown in Figure 1. Patients with AW STEMI were more likely to stay longer in the hospital than those with NAW STEMI (LOS mean±standard error: 3.7±0.1 versus 3.3±0.1; P<0.001). The proportion of patients in each LOS cohort was 69.7% (n=375,996) for short LOS, 17.6% (n=94,936) for medium LOS, and 12.7% (n=68,583) for long LOS. Among those who presented with AW STEMI, the proportion of each LOS cohort was 62.6% (n=117,332) for short LOS, 21.4% (n=40,232) for medium LOS, and 16.0% (n=29,993) for long LOS. In the NAW STEMI group, the proportion was 73.5% (n=258,663) for short LOS, 15.5% (n=54,706) for medium LOS, and 11.0% (n=38,591) for long LOS.

Tables 1 and 2 compare the baseline patient- and hospital-level characteristics according to LOS groups stratified by 30-day readmission. Patients in the medium or long LOS cohort were older and more likely to be women and have hypertension, diabetes mellitus, previous myocardial infarction, previous coronary artery bypass graft surgery, family history of coronary artery disease, congestive heart failure, peripheral vascular disorders, chronic pulmonary disease, chronic kidney disease, liver disease, anemia, atrial fibrillation, coagulopathy, cerebrovascular disease, fluid and electrolyte disorders, obesity, and other neurological disorders compared with the short LOS cohort in both AW and NAW STEMI groups (Table S2). In addition, patients in the medium or long LOS cohort were more likely to have concomitant cardiogenic shock or cardiac arrest and require support from intraaortic balloon pump or percutaneous left ventricular assist device in both the AW and NAW STEMI groups.

Thirty-Day Readmission by LOS

Overall incidence of 30-day readmission was higher in patients with AW STEMI than those with NAW STEMI (12.3% versus 9.9%, P<0.001). The rates of 30-day readmission in patients with AW STEMI were 8.7% in the short LOS cohort, 14.9% in the medium LOS cohort, and 21.1% in the long LOS cohort (P<0.001). The rate of 30-day readmission in patients with NAW STEMI were 7.7% in the short LOS cohort, 13.4% in the medium LOS cohort, and 19.5% in the long LOS cohort (P<0.001). In the AW STEMI group, the 30-day readmission rates were 7.8% in the very short LOS (1–2 days) cohort, 9.8% in the 3-day LOS cohort, 13.8% in the 4-day LOS cohort, 16.9% in the 5-day LOS cohort, and 21.1% in the >5-day LOS cohort (P<0.001) (Figure 2A). In the NAW STEMI group, the 30-day readmission rates were 7.1% in the very short LOS cohort, 8.8% in the 3-day LOS cohort, 12.0% in
Table 1. Baseline Characteristics for Patients Discharged Alive After Index Hospitalization With STEMI in AW

| Characteristics                        | Overall | LOS 1 to 3 d | LOS 4 to 5 d | LOS >5 d | P | No | Yes | P Value | No | Yes | P Value | No | Yes | P Value | No | Yes | P Value |
|----------------------------------------|---------|--------------|--------------|----------|----|----|-----|---------|----|-----|---------|----|-----|---------|----|-----|---------|
| Patients, No.                           | 165,024 | 82,699 (50.0) | 67,688 (41.0) | 4,637 (2.8) | <0.001 | Yes | No | <0.001 | Yes | No | <0.001 | Yes | No | <0.001 | Yes | No | <0.001 |
| Patient characteristics                |         |              |              |          |    |    |     |         |    |    |         |    |    |         |    |    |         |
| Age, mean (SE), y                      | 60.3 (0.1) | 63.6 (0.2) | 58.6 (0.2) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Smoking history                        | 77,606 (47.0) | 9,691 (44.8) | 52,876 (49.4) | 0.320 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Hypertension                           | 100,897 (61.1) | 15,186 (67.4) | 64,681 (60.4) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Diabetes mellitus                      | 94,442 (57.2) | 12,791 (56.8) | 62,864 (58.7) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Known coronary artery disease          | 22,629 (13.6) | 2,446 (11.0) | 17,141 (15.6) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Previous myocardial infarction          | 17,322 (10.6) | 2,246 (11.2) | 14,576 (16.9) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Previous PCI                           | 1,664 (10.0) | 184 (1.2) | 1,480 (1.7) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Previous CABG                          | 17,966 (10.8) | 2,326 (12.6) | 15,640 (14.3) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Chronic lung disease                   | 20,720 (12.5) | 2,741 (14.1) | 17,979 (16.5) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Chronic kidney disease                 | 9,696 (5.8) | 1,122 (6.2) | 8,574 (8.8) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Chronic respiratory disease            | 17,714 (10.8) | 2,224 (12.1) | 15,490 (15.6) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Ischemic heart disease                 | 23,962 (14.6) | 2,541 (12.8) | 21,421 (19.6) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Collagen vascular disease              | 12,573 (7.6) | 1,563 (7.7) | 10,971 (10.9) | 0.018 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Drug abuse                             | 4,019 (2.4) | 824 (4.3) | 3,195 (3.6) | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Fluid/electrolyte disorders            | 20,752 (12.6) | 4,205 (21.2) | 16,547 (18.2) | 0.821 | 0.016 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |

(Continued)
| Characteristics                  | Overall | LOS 1 to 3 d | LOS 4 to 5 d | LOS >5 d |
|---------------------------------|---------|--------------|--------------|----------|
|                                 | No      | Yes          | No           | Yes      | P Value | No           | Yes          | P Value | No           | Yes          | P Value |
| Obesity                         | 22,433  | 2902 (12.9)  | 14,366 (13.4)| 1259 (12.3)| 0.129   | 4628 (13.5)| 772 (12.9)  | 0.463   | 34,399 (14.5)| 870 (13.7)  | 0.374   |
| Other neurological disorders    | 4791    | 1037 (4.6)   | 2223 (2.1)  | 331 (3.2)  | <0.001  | 1185 (3.5) | 278 (4.6)  | 0.014   | 1384 (5.9)  | 429 (6.8)   | 0.122   |
| Median household income         |         |              |              |           | <0.001  |              |              |         |              |              | 0.557   |
| First quartile                  | 45,601  | 6801 (30.7)  | 28,807 (27.4)| 2989 (29.7)|         | 9777 (29.1)| 1834 (31.2)|         | 7027 (30.3)| 1978 (31.9)|         |
| Second quartile                 | 42,951  | 6003 (27.1)  | 27,946 (26.6)| 2756 (27.4)|         | 8888 (26.4)| 1639 (27.9)|         | 6117 (26.4)| 1608 (25.9)|         |
| Third quartile                  | 39,131  | 5113 (23.1)  | 25,613 (24.4)| 2317 (23.1)|         | 8090 (24.0)| 1403 (23.8)|         | 5427 (23.4)| 1390 (22.5)|         |
| Fourth quartile                 | 34,165  | 4222 (19.1)  | 22,659 (21.6)| 1989 (19.8)|         | 6884 (20.5)| 1009 (17.1)|         | 4621 (19.9)| 1225 (19.7)|         |
| Primary payer                   | <0.001  |              |              |           | <0.001  |              |              | <0.001  |              |              | <0.001  |
| Medicare                        | 59,249  | 11,581 (51.4)| 33,937 (31.7)| 4618 (45.2)|         | 13,858 (40.5)| 3113 (52.1)|         | 11,453 (48.4)| 3849 (60.7)|         |
| Medicaid                        | 12,619  | 2225 (9.9)   | 7639 (7.1)  | 975 (9.6)  |         | 2881 (8.4) | 623 (10.4) |         | 2099 (8.9)  | 627 (9.9)   |         |
| Private including HMO           | 65,646  | 5970 (26.5)  | 46,446 (43.4)| 3235 (31.7)|         | 12,291 (35.9)| 1507 (25.2)|         | 6910 (29.2)| 1228 (19.4)|         |
| Self-pay/no charge/other        | 27,510  | 2757 (12.2)  | 19,101 (17.8)| 1381 (13.5)|         | 5220 (15.2)| 737 (12.3) |         | 3189 (13.5)| 639 (10.1)  |         |
| Weekend admission               | 48,189  | 6272 (27.8)  | 31,794 (29.7)| 2875 (28.2)| 0.083   | 10,326 (30.1)| 1811 (30.3)|         | 6070 (25.7) | 1567 (25.0)| 0.548   |
| Cardiogenic shock               | 11,189  | 2532 (11.2)  | 1847 (1.7)  | 247 (2.4)  | <0.001  | 2611 (76.6)| 546 (9.1)  | 0.023   | 6723 (28.4)| 1738 (27.4)| 0.387   |
| Cardiac arrest                  | 6675    | 1030 (4.6)   | 1987 (1.9)  | 213 (2.1)  | 0.058   | 1672 (4.9) | 274 (4.6)  | 0.624   | 3017 (12.8)| 543 (8.6)   | <0.001  |
| IABP                            | 13,261  | 2818 (12.5)  | 2193 (2.0)  | 306 (3.0)  | <0.001  | 4167 (12.2)| 770 (12.9) | 0.398   | 6901 (29.2)| 1742 (27.5)| 0.121   |
| PLVAD                           | 565     | 114 (0.5)    | 86 (0.1)    | 12 (0.1)   | 0.041   | 100 (0.3) | 15 (0.3)   | 0.750   | 380 (16.0) | 87 (1.4)   | 0.451   |
| Hospital characteristics        | 0.210   |              | 0.011        |            | 0.055   |              |              |         |              |              | 0.661   |
| Teaching                        | 88,606  | 11,905 (52.8)| 55,994 (52.3)| 5083 (49.8)|         | 19,335 (56.5)| 3228 (54.0)|         | 13,277 (66.1)| 3593 (56.7)|         |
| Nonteaching                     | 76,418  | 10,627 (47.2)| 51,129 (47.7)| 5126 (50.2)|         | 14,915 (43.5)| 2753 (46.0)|         | 10,374 (43.9)| 2747 (43.3)|         |
| Rural                           | 85,571  | 11,146 (49.5)| 56,907 (53.1)| 5233 (51.8)|         | 17,207 (50.2)| 2945 (49.2)|         | 11,456 (48.4)| 2907 (45.8)|         |
| Urban                           | 79,453  | 11,387 (50.5)| 50,216 (46.9)| 4916 (48.2)|         | 17,044 (49.8)| 3036 (50.8)|         | 12,192 (51.6)| 3434 (54.2)|         |
| Hospital bed size               | 0.019   |              | 0.399        |            | 0.536   |              |              |         |              |              | 0.222   |
| Small                           | 11,889  | 13,990 (6.2)| 8081 (7.5)  | 702 (6.8)  |         | 2302 (6.7) | 363 (6.1)  |         | 1506 (6.4) | 334 (5.3)   |         |
| Medium                          | 36,686  | 4920 (21.8)  | 24,707 (23.1)| 2426 (23.8)|         | 7356 (21.5)| 1239 (20.7)|         | 4623 (19.5)| 1254 (19.8)|         |
| Large                           | 116,449 | 16,213 (72.0)| 74,335 (69.4)| 7081 (69.4)|         | 24,593 (71.8)| 4379 (73.2)|         | 17,521 (74.1)| 4753 (75.0)|         |
the 4-day LOS cohort, 16.3% in the 5-day LOS cohort, and 19.5% in the >5-day LOS cohort (P<0.001) (Figure 2B). Very short LOS was associated with reduced risk of adjusted 30-day readmission in both the AW STEMI group (adjusted HR, 0.84; 95% CI, 0.78–0.91) and the NAW STEMI group (adjusted HR, 0.87; 95% CI, 0.83–0.92) compared with 3-day LOS. Patients with LOS of 4 days, 5 days, and >5 days showed incrementally higher risk of adjusted 30-day readmission in both the AW STEMI group (adjusted HR, 1.26 [95% CI, 1.17–1.36]; 1.42 [95% CI, 1.30–1.55]; and 1.50 [95% CI, 1.39–1.63], respectively) and the NAW STEMI group (adjusted HR, 1.19 [95% CI, 1.11–1.27]; 1.47 [95% CI, 1.34–1.60]; and 1.46 [95% CI, 1.37–1.57], respectively) (Figure 3, Tables S3 through S8).

Thirty-Day Readmission Mortality, Reinfarction, and Repeat Revascularization by LOS

The 30-day mortality rates during readmission were 0.2% in the short LOS cohort, 0.4% in the medium LOS cohort, and 1.3% in the long LOS cohort among the AW STEMI group (P<0.001), and 0.1% in the short LOS cohort, 0.4% in the medium LOS cohort, and 0.9% in the long LOS cohort among the NAW STEMI group (P<0.001). The 30-day mortality rates for both the AW STEMI group and the NAW STEMI group stratified by more detailed LOS cohorts are shown in Figure 2C and 2D. In the AW STEMI group, the rate of 30-day mortality was the lowest in the 3-day LOS cohort, showing a U-shaped risk distribution (Figure 3 and 4). Very short LOS after AW STEMI was associated with significantly higher risk of adjusted 30-day mortality compared with 3-day LOS (adjusted HR, 1.92; 95% CI, 1.16–3.16). However, the risk of adjusted 30-day mortality increased progressively with increasing LOS (adjusted HR: 4-day LOS [versus 3-day LOS], 1.80 [95% CI, 1.06–3.04]; 5-day LOS, 2.32 [95% CI, 1.44–3.73]; and >5-day LOS, 3.45 [95% CI, 2.22–5.36]) in the AW STEMI group. In the NAW STEMI group, the risk of adjusted 30-day mortality was not significantly different in the very short LOS cohort (adjusted HR, 0.71; 95% CI, 0.48–1.06) versus the 3-day LOS cohort, but the risk of adjusted 30-day mortality sequentially increased with longer LOS (adjusted HR: 4-day LOS [versus 3 day LOS], 1.52 [95% CI, 1.00–2.30]; 5-day LOS, 1.76 [95% CI, 1.06–2.93]; and >5-day LOS, 2.30 [95% CI, 1.45–3.65]).

The 30-day reinfarction rates were 4.6% in the short LOS cohort, 7.8% in the medium LOS cohort, and 10.0% in the long LOS cohort among the AW STEMI group (P<0.001), and 3.8% in the short LOS cohort, 6.1% in the medium LOS cohort, and 8.0% in the long LOS cohort among the NAW STEMI group (P<0.001).
Table 2. Baseline Characteristics for Patients Discharged Alive After Index Hospitalization with STEMI in Nonanterior Wall

| Characteristics | Overall | LOS 1 to 3 d | LOS 4 to 5 d | LOS >5 d |
|-----------------|---------|-------------|-------------|---------|
|                 | No  | Yes | P Value | No  | Yes | P Value | No  | Yes | P Value | No  | Yes | P Value |
| Patients, No.   | 317,076* (90.1) | 34,883 (9.9) | 238,624 (92.3) | 20,040 (7.7) | 47,395 (86.6) | 7310 (13.4) | 31,058 (80.5) | 7533 (19.5) |
| Patient characteristics |
| Age, mean (SE), y | 60.9 (0.1) | 64.4 (0.1) | <0.001† | 59.7 (0.1) | 62.2 (0.2) | <0.001† | 63.6 (0.1) | 66.3 (0.3) | <0.001† | 65.9 (0.1) | 68.3 (0.3) | <0.001† |
| Age group, y | <0.001‡ | <0.001 | <0.001 | <0.001 | |
| <50 | 56,533 (17.8) | 48,611 (13.9) | 46,821 (19.6) | 34,912 (17.4) | 66,214 (14.0) | 833 (11.4) | 80,855 (9.9) | 538 (7.1) |
| 50 to 64 | 144,000 (45.4) | 12,817 (36.7) | 113,218 (47.4) | 80,289 (40.1) | 19,283 (40.7) | 2420 (33.1) | 11,500 (37.0) | 2368 (31.4) |
| ≥65 | 116,544 (36.8) | 17,205 (49.3) | 78,585 (32.9) | 85,289 (42.5) | 21,486 (45.3) | 4058 (55.5) | 16,473 (0.53) | 4627 (61.4) |
| Women | 87,055 (27.5) | 12,980 (37.2) | 59,996 (25.1) | 55,21 (33.1) | 16,024 (33.8) | 3065 (41.9) | 11,034 (35.5) | 3282 (43.6) |
| Smoking history | 165,955 (52.3) | 16,289 (46.7) | 130,523 (54.7) | 10,113 (50.5) | 22,398 (47.3) | 3192 (43.7) | 13,034 (42.0) | 2985 (39.6) |
| Hypertension | 204,951 (64.6) | 24,543 (70.4) | 151,781 (63.6) | 13,912 (69.4) | 31,918 (67.3) | 5274 (72.1) | 13,034 (42.0) | 2985 (39.6) |
| Diabetes mellitus | 74,376 (23.5) | 10,130 (29.0) | 52,890 (22.2) | 5449 (27.2) | 12,590 (26.6) | 2279 (31.2) | 11,034 (35.5) | 3282 (43.6) |
| Dyslipidemia | 189,949 (59.9) | 20,014 (57.4) | 145,164 (60.8) | 11,911 (59.4) | 27,933 (58.9) | 4183 (57.2) | 16,852 (54.2) | 3920 (52.0) |
| Known coronary artery disease | 274,434 (86.6) | 30,088 (86.3) | 20,014 (57.4) | 11,911 (59.4) | 27,933 (58.9) | 4183 (57.2) | 16,852 (54.2) | 3920 (52.0) |
| Previous myocardial infarction | 26,016 (8.2) | 3,117 (8.9) | 19,196 (8.0) | 16,922 (8.4) | 41,178 (8.7) | 714 (5.1) | 7203 (8.7) | 712 (9.5) |
| Previous PCI | 41,118 (13.0) | 4,885 (14.0) | 30,853 (12.9) | 10,275 (14.0) | 41,178 (8.5) | 714 (5.1) | 7203 (8.7) | 712 (9.5) |
| Previous CABG | 9875 (3.1) | 1,338 (3.8) | 6,941 (2.9) | 679 (3.4) | 1,721 (3.6) | 282 (3.9) | 1,193 (3.8) | 377 (5.0) |
| Family history of coronary artery disease | 42,565 (13.4) | 3,669 (10.5) | 34,591 (14.5) | 2,531 (12.6) | 5,200 (11.0) | 634 (8.7) | 5,055 (8.7) | 506 (7.1) |
| Congestive heart failure | 24,943 (7.9) | 5,985 (16.9) | 9,634 (4.0) | 1,503 (7.5) | 5,200 (11.0) | 634 (8.7) | 5,055 (8.7) | 506 (7.1) |
| Peripheral vascular disease | 20,194 (6.4) | 3,605 (10.3) | 12,438 (5.2) | 1,536 (7.7) | 4,047 (8.5) | 931 (12.7) | 3,709 (11.5) | 1,138 (15.1) |
| Chronic pulmonary disease | 40,035 (12.6) | 6,846 (19.6) | 25,818 (10.8) | 3,304 (16.5) | 7,466 (15.8) | 1,572 (21.5) | 6,750 (19.6) | 1,969 (26.1) |
| Chronic kidney disease | 18,086 (5.9) | 4,513 (12.9) | 9,624 (4.0) | 1,647 (8.2) | 4,159 (8.8) | 1,099 (15.0) | 5,025 (16.2) | 1,767 (23.5) |
| Liver disease | 2883 (0.9) | 478 (1.4) | 1,803 (8.0) | 235 (1.2) | 562 (1.2) | 100 (1.4) | 518 (1.7) | 143 (1.9) |
| Anemia | 20,972 (6.6) | 4,780 (13.7) | 8,928 (3.7) | 1,486 (7.4) | 5,100 (10.8) | 1,240 (17.0) | 6,944 (22.4) | 2,053 (27.3) |
| Atrial fibrillation | 25,715 (8.1) | 5,038 (14.4) | 12,901 (5.4) | 1,665 (8.5) | 5,933 (12.5) | 1,362 (18.6) | 6,981 (22.5) | 1,981 (26.3) |
| Coagulopathy | 7,280 (2.3) | 1,204 (3.5) | 2,899 (1.2) | 294 (1.5) | 1,488 (3.1) | 268 (3.7) | 2,893 (9.3) | 642 (8.5) |
| Collagen vascular disease | 5857 (1.8) | 915 (2.6) | 3,965 (1.7) | 422 (2.1) | 1,186 (2.5) | 254 (3.5) | 705 (2.3) | 240 (3.2) |
| Drug abuse | 8306 (2.6) | 991 (2.8) | 6181 (2.6) | 663 (3.3) | <0.001 | 1304 (2.8) | 204 (2.8) | 933 (2.6) | 124 (1.6) |

(Continued)
### Table 2. Continued

| Characteristics                          | Overall | LOS 1 to 3 d | LOS 4 to 5 d | LOS >5 d | 30-d Readmission |
|-----------------------------------------|---------|--------------|--------------|----------|------------------|
| Fluid/electrolyte disorders             | 33,047 (10.4) | 5801 (16.6) | <0.001 | 16,251 (6.8) | 17,308 (13.7) | <0.001 |
| Obesity                                 | 44,435 (14.0) | 4886 (14.0) | 0.982 | 32,872 (13.8) | 26,935 (13.4) | 0.483 |
| Other neurological disorders            | 8686 (2.7) | 1597 (4.8) | <0.001 | 5182 (2.2) | 714 (3.6) | <0.001 |
| Median household income                 | <0.001 | <0.001 | 0.109 | <0.001 | 0.235 |
| First quartile                          | 91,316 (29.3) | 10,926 (31.9) | 67,466 (28.6) | 6,162 (31.3) | 14,503 (31.2) | 23,866 (33.2) | 93,320 (30.6) | 23,792 (32.1) |
| Second quartile                         | 83,375 (26.8) | 9,046 (28.4) | 63,116 (26.9) | 5,199 (26.4) | 12,159 (26.1) | 18,233 (25.4) | 81,002 (26.6) | 20,241 (27.3) |
| Third quartile                          | 76,278 (24.5) | 8,163 (23.8) | 57,915 (24.7) | 4,702 (23.9) | 10,977 (23.6) | 17,299 (24.1) | 73,863 (24.2) | 17,323 (23.4) |
| Fourth quartile                         | 60,361 (19.4) | 6,150 (17.9) | 45,089 (19.6) | 3,634 (18.4) | 8,878 (19.1) | 12,413 (17.3) | 56,731 (18.6) | 12,754 (17.2) |
| Primary payer                           | <0.001 | <0.001 | <0.001 | <0.001 | <0.001 |
| Medicare                                | 121,138 (38.2) | 18,413 (52.8) | 82,427 (34.5) | 9,219 (46.0) | 22,094 (46.6) | 43,639 (59.7) | 16,618 (53.5) | 43,781 (64.1) |
| Medicaid                                | 21,603 (6.8) | 2,926 (8.4) | 15,700 (6.6) | 1,651 (8.2) | 3,564 (7.3) | 603 (8.2) | 2,447 (7.9) | 671 (8.9) |
| Private including HMO                   | 122,511 (38.6) | 9,046 (28.4) | 63,116 (26.9) | 5,199 (26.4) | 12,159 (26.1) | 18,233 (25.4) | 81,002 (26.6) | 20,241 (27.3) |
| Self-pay/no charge/other                | 51,824 (16.3) | 4,015 (11.5) | 40,977 (17.2) | 2,706 (13.5) | 7,164 (15.1) | 725 (10.9) | 3,688 (11.9) | 583 (7.7) |
| Index STEMI presentation/treatment      |         |             |             |             |             |             |             |             |
| Weekend admission                       | 90,651 (28.6) | 97,702 (28.0) | 69,034 (28.9) | 56,655 (28.3) | 13,662 (28.8) | 23,000 (31.5) | 7,955 (25.6) | 18,042 (23.9) | 0.118 |
| Cardiogenic shock                       | 15,204 (4.8) | 3,033 (8.7) | 15,700 (6.6) | 1,651 (8.2) | 3,564 (7.3) | 603 (8.2) | 2,447 (7.9) | 671 (8.9) | 0.213 |
| Cardiac arrest                          | 9,423 (3.0) | 1,343 (3.8) | 3,015 (14.1) | 308 (1.5) | 1,918 (4.6) | 317 (4.3) | 3,820 (12.3) | 717 (9.5) | <0.001 |
| IABP                                    | 11,373 (3.6) | 2,346 (6.7) | 2,077 (6.9) | 307 (1.5) | 3,377 (7.1) | 590 (8.1) | 6,282 (20.2) | 1,450 (19.2) | 0.348 |
| PLVAD                                    | 301 (0.1) | 74 (0.2) | 41 (0.0) | 8 (0.0) | 62 (0.1) | 5 (0.1) | 198 (0.6) | 60 (0.8) | 0.398 |
| Hospital characteristics                |         |             |             |             |             |             |             |             |             |
| Hospital teaching status                | 0.312 | 0.133 | 0.784 | 0.234 |
| Teaching                                | 166,974 (52.7) | 18,158 (52.1) | 124,444 (52.2) | 10,217 (51.0) | 25,442 (53.7) | 39,013 (53.4) | 17,089 (55.0) | 40,409 (53.6) |
| Nonteaching                             | 150,102 (47.3) | 16,725 (47.9) | 114,179 (47.8) | 9,822 (49.0) | 21,964 (46.3) | 34,310 (46.6) | 13,969 (45.0) | 34,493 (46.4) |
| Hospital location                       | <0.001 | <0.001 | 0.698 | 0.019 |
| Rural                                   | 167,549 (52.8) | 17,352 (49.7) | 128,909 (54.0) | 10,295 (51.4) | 23,502 (49.6) | 35,919 (49.1) | 15,138 (48.7) | 34,662 (46.0) |
| Urban                                   | 149,527 (47.2) | 17,532 (50.3) | 109,714 (46.0) | 9,744 (48.6) | 23,890 (50.4) | 37,195 (50.9) | 15,920 (51.3) | 40,686 (54.0) |
| Hospital bed size                       | 0.973 | 0.775 | 0.052 | 0.729 |
| Small                                   | 22,403 (7.1) | 2,458 (7.0) | 17,761 (7.4) | 1,446 (7.2) | 2,806 (5.9) | 530 (7.2) | 1,836 (5.9) | 482 (6.4) |
| Medium                                  | 69,610 (22.0) | 7,699 (22.1) | 53,459 (22.4) | 4,572 (22.8) | 10,140 (21.4) | 16,759 (22.9) | 6,017 (19.4) | 14,527 (19.3) |

(Continued)
The 30-day reinfarction rates for both the AW and the NAW STEMI groups stratified by the detailed LOS cohorts are shown in Figure 2E and 2F. The risk of adjusted 30-day reinfarction increased progressively with increasing LOS in both the AW and the NAW STEMI groups (Figure 3).

The 30-day revascularization rates were 2.5% in the short LOS cohort, 3.0% in the medium LOS cohort, and 2.6% in the long LOS cohort among the AW STEMI group (P=0.021), and 2.7% in the short LOS cohort, 3.3% in the medium LOS cohort, and 2.7% in the long LOS cohort among the NAW STEMI group (P<0.001). The 30-day repeat revascularization rates from more detailed stratification of LOS are shown in Figure 2G and 2H. There was no significant difference in the risk for adjusted 30-day repeat revascularization among different LOS cohorts versus the 3-day LOS cohort in both the AW STEMI and the NAW STEMI groups.

The 30-day MACE rates were 5.8% in the short LOS cohort, 9.5% in the medium LOS cohort, and 11.9% in the long LOS cohort among the AW STEMI group (P<0.001), and 5.0% in the short LOS cohort, 7.8% in the medium LOS cohort, and 9.9% in the long LOS cohort among the NAW STEMI group (P<0.001).

The 30-day MACE rates for both the AW and the NAW STEMI groups stratified by the detailed LOS cohorts are shown in Figure 2I and 2J. The risk of adjusted 30-day MACE increased progressively with increasing LOS in both the AW and the NAW STEMI groups (Figure 3).

### Total Costs by LOS and Predictors of Total Cost

Hospital costs over 30 days after index hospitalization after primary PCI for STEMI according to the LOS are shown in Table 3. The median cumulative costs from index hospitalization for PCI and 30-day readmission were $20 050 (interquartile range, $15 494–$27 463) in patients with AW STEMI and $18 995 (interquartile range, $14 790–$25 787) in patients with NAW STEMI (P<0.001). The cumulative costs were also increased in the longer LOS groups compared with the very short LOS group regardless of the location of infarct (P<0.001 and P<0.001, respectively).

From the multivariable hierarchical regression analysis, very short LOS was found to be associated with a 4.3% decrease in 30-day total cost in the AW STEMI group and a 5.0% decrease in the NAW STEMI group versus 3-day LOS. Among patients with AW STEMI, 4-day LOS, 5-day LOS, and >5-day LOS were all found to be associated with increased total costs (4.7%, 8.6%, and 19.0% increase, respectively; P<0.001 for all) versus 3-day
Figure 2. Cumulative rates of 30-day readmission, 30-day mortality, 30-day reinfarction, 30-day repeat revascularization, and 30-day major adverse cardiac events (MACE) according to hospital length of stay (LOS) and infarct location. Data show unadjusted 30-day readmission in anterior wall (AW) ST-segment-elevation myocardial infarction (STEMI) (A) and non-AW STEMI (B), 30-day readmission mortality in AW STEMI (C) and non-AW STEMI (D), 30-day reinfarction in AW STEMI (E) and non-AW STEMI (F), 30-day repeat revascularization in AW STEMI (G) and non-AW STEMI (H), and 30-day MACE in AW STEMI (I) and non-AW STEMI (J).
LOS (Table 4). Similarly, 4-day LOS, 5-day LOS, and >5-day LOS were associated with increased total costs (5.8%, 10.7%, and 22.3% increase, respectively; $P<0.001$ for all) compared with 3-day LOS in the NAW STEMI cohort. The 30-day readmission was a significant predictor of increased total costs in both the AW STEMI group (17.5% increase, $P<0.001$) and the NAW STEMI group (18.7% increase, $P<0.001$).

**DISCUSSION**

In this large, contemporary, all-payer observational analysis of the NRD, we have presented several noteworthy findings for patients with STEMI who underwent primary PCI. First, very short LOS after primary PCI for STEMI was associated with significantly less 30-day readmission with reduced overall costs compared with more traditional, longer LOS in all STEMI
Second, very short LOS appeared to be associated with higher 30-day readmission mortality rate compared with an LOS of at least 3 days in patients with AW STEMI, while very short LOS was associated with similar 30-day readmission mortality to 3-day LOS in patients with NAW STEMI. Third, rates of 30-day reinfarction, repeat revascularization rate, and MACE were the lowest in the very short LOS cohort.

Reducing hospital LOS has become a top priority in the past decade for our healthcare systems in the United States.\textsuperscript{21,22} Hospitalization with an average LOS of 4.5 days is estimated to cost the healthcare industry $377.5 billion annually, and longer LOS has contributed greatly to these rising healthcare costs.\textsuperscript{23} Optimizing and reducing LOS improves financial, operational, and clinical outcomes by preventing unnecessary hospital stays and decreasing the costs of care for a patient in various conditions.\textsuperscript{24,25} With recent advances in medical therapy and various therapeutic modalities, outcomes after STEMI have steadily improved over the past several years.\textsuperscript{1,26} With improving outcomes, there has been a growing interest in shortening LOS and assessing feasibility of early discharge after primary PCI for STEMI.\textsuperscript{27,28} We previously reported that short LOS (1–3 days) resulted in similar 30-day outcomes compared with medium LOS (4–5 days) after primary PCI for STEMI in the Medicare population using the NCDR (National Cardiovascular Data Registry) from 2004 to 2009.\textsuperscript{9} However, very short LOS (1–2 days) was associated with worse 30-day mortality and 30-day MACE in this elderly population. In the current study, analyzing all comers, including younger population with more contemporary data from 2010 to 2014, we demonstrated that very short hospital stay is associated with significantly less 30-day readmission as well as 30-day MACE including reinfarction and repeat revascularization. Shorter LOS and lower readmission rates were associated with 4.3% to 5.0% reduction in overall costs compared with more traditional ≥3 day LOS. However, very short LOS in AW STEMI was associated with an ≈2-fold increase in 30-day mortality, while very short LOS was not associated with any increase in adverse outcomes in the NAW STEMI group. In fact, very short LOS was associated with 13% reduction in readmission rates and an ≈5.0% reduction in overall costs in comparison to 3-day LOS in the NAW STEMI cohort. Our data emphasize that a very early discharge strategy for low-risk patients can be safe and feasible, especially in those with NAW STEMI. However, more careful assessment is necessary for patients with AW STEMI before opting for very early discharge. Once patients with AW STEMI are readmitted after a very short LOS during the index hospitalization, they may need closer attention with their medical care as our study demonstrates a higher 30-day mortality rate once they are readmitted. Our finding is not surprising given the increased likelihood of developing heart failure, left ventricular thrombus, and other complications including ventricular septal wall defect and free wall rupture, with AW STEMI because of larger territory involved.\textsuperscript{29,30} This group of patients may require more time to optimize the medications, especially for potentially newly developed heart failure with reduced ejection fraction.

Despite recent studies demonstrating the safety of very early discharge after PCI\textsuperscript{6–9,31} a significant portion of patients stay in the hospital ≥3 days in the real world as demonstrated in our study (56.2%). Studies performed before modernization of pharmacotherapy and interventional therapy have demonstrated risks of potential subacute complications up to 72 hours after

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure4.png}
\caption{Plot of 30-day mortality according to hospital length of stay (LOS). \textbf{A}, Thirty-day readmission mortality rate in patients with anterior wall (AW) ST-segment–elevation myocardial infarction (STEMI) (red points). \textbf{B}, Thirty-day readmission mortality rate in patients with non-AW STEMI (red points). Box plot shows total number of patients in each LOS group.}
\end{figure}
### Table 3. Costs and Charges Over 30-d Postindex Hospitalization After STEMI Stratified by the Location of Infarct

| Outcomes                        | Overall | LOS 1 to 2 d | LOS 3 d | LOS 4 d | LOS 5 d | LOS >5 d | P Value* |
|---------------------------------|---------|--------------|---------|---------|---------|----------|----------|
| **AWMI**                        |         |              |         |         |         |          |          |
| Patients, No.                   | 187,556 | 64,098       | 53,234  | 26,284  | 13,947  | 29,993   | <0.001   |
| Charge (index PCI), $           | 66,879  | 56,799       | 61,581  | 69,536  | 79,591  | 110,719  | <0.001   |
| (48,942–96,268)†                | (42,817–77,204) | (46,908–83,214) | (52,388–97,494) | (59,316–112,784) | (78,640–159,337) |
| Cumulative charges (index PCI+30-d readmission), $ | 69,617  | 58,425       | 64,619  | 72,866  | 84,665  | 118,599  | <0.001   |
| (50,272–102,446)                | (43,741–80,277) | (47,942–87,767) | (54,208–103,595) | (61,701–120,650) | (83,336–172,750) |
| Cost (index PCI), $             | 19,307  | 16,501       | 18,166  | 20,313  | 22,821  | 31,425   | <0.001   |
| (15,150–25,711)                 | (13,377–20,710) | (14,782–22,651) | (16,329–26,019) | (18,146–29,422) | (23,511–42,431) |
| Cumulative costs (index PCI+30-d readmission), $ | 20,050  | 16,899       | 18,689  | 21,224  | 24,210  | 33,581   | <0.001   |
| (15,494–27,463)                 | (13,609–21,627) | (16,890–27,804) | (19,049–31,868) | (24,883–46,152) |
| **Non-AWMI**                    |         |              |         |         |         |          |          |
| No. of patients                 | 351,961 | 161,332      | 97,331  | 36,760  | 17,947  | 38,591   | <0.001   |
| Charge (index PCI), $           | 64,020  | 55,873       | 61,566  | 73,157  | 84,796  | 119,856  | <0.001   |
| (47,024–91,562)                 | (42,255–75,033) | (46,898–83,430) | (54,312–102,146) | (63,283–118,509) | (84,845–171,422) |
| Cumulative charges (index PCI+30-d readmission), $ | 66,174  | 57,370       | 63,462  | 76,762  | 90,277  | 126,772  | <0.001   |
| (48,057–96,916)                 | (43,023–78,032) | (47,671–87,824) | (55,959–109,101) | (66,026–127,599) | (89,184–184,904) |
| Cost (index PCI), $             | 18,413  | 16,288       | 18,049  | 20,749  | 23,668  | 33,339   | <0.001   |
| (14,506–24,358)                 | (13,201–20,329) | (14,630–22,707) | (16,520–26,712) | (18,782–30,667) | (24,581–45,087) |
| Cumulative costs (index PCI+30-d readmission), $ | 18,995  | 16,676       | 18,576  | 21,661  | 25,055  | 35,390   | <0.001   |
| (14,790–25,787)                 | (13,411–21,068) | (14,914–23,869) | (16,962–28,570) | (19,562–33,109) | (25,985–48,214) |

AWMI indicates anterior wall myocardial infarction; LOS, length of stay; PCI, percutaneous coronary intervention; and STEMI, ST-segment–elevation myocardial infarction.

*Mann–Whitney–Wilcoxon test was used in all comparisons.

†All values are shown as a median (interquartile range).
STEMI, which has become a foundation of our clinical practice for many years. However, recent studies including the current one demonstrate the safety of early discharge in certain low-risk cohorts. A recent increase in the adoption of radial access certainly has contributed to a significant decrease in access

### Table 4. Multivariate Regression Analysis to Assess the Association of LOS on Total Cost in Patients With STEMI Stratified by the Location of Infarct

| Variable                                | AW STEMI | Non-AW STEMI |
|-----------------------------------------|----------|--------------|
|                                         | Beta*    | 95% CI       | P Value | Beta*    | 95% CI       | P Value |
| LOS (reference: 3 d)                    |          |              |         |          |              |         |
| 1 to 2 d                                | −0.043   | −0.049 to −0.037 | <0.001 | −0.050   | −0.055 to −0.046 | <0.001 |
| 4 d                                     | 0.047    | 0.043–0.052   | <0.001 | 0.058    | 0.055–0.062   | <0.001 |
| 5 d                                     | 0.086    | 0.080–0.091   | <0.001 | 0.107    | 0.102–0.112   | <0.001 |
| >5 d                                    | 0.190    | 0.185–0.196   | <0.001 | 0.223    | 0.218–0.228   | <0.001 |
| 30-d readmission                        | 0.175    | 0.170–0.180   | <0.001 | 0.187    | 0.183–0.191   | <0.001 |
| Age (reference: <50), y                 |          |              |         |          |              |         |
| 50 to 64                                | 0.006    | 0.003–0.010   | 0.001  | 0.007    | 0.004–0.010   | <0.001 |
| >64                                     | 0.007    | 0.002–0.013   | 0.006  | 0.010    | 0.006–0.014   | <0.001 |
| Women (reference: men)                  | −0.018   | −0.021 to −0.015 | <0.001 | −0.019   | −0.022 to −0.017 | <0.001 |
| Diabetes mellitus                       | 0.004    | 0.001–0.007   | 0.012  | 0.005    | 0.002–0.007   | <0.001 |
| Dyslipidemia n/s                        | 0.004    | 0.001–0.007   | 0.004  | 0.004    | 0.001–0.007   | 0.014  |
| Previous MI n/s                         | 0.009    | 0.004–0.015   | 0.001  | n/s      | n/s           |        |
| Known coronary artery disease           | 0.008    | 0.002–0.013   | 0.005  | 0.008    | 0.003–0.012   | 0.001  |
| Peripheral vascular disease             | 0.010    | 0.004–0.016   | 0.002  | 0.005    | 0.001–0.009   | 0.017  |
| Chronic kidney disease n/s              | n/s      | n/s           |        | n/s      | n/s           |        |
| Anemia n/s                              | 0.006    | 0.001–0.012   | 0.030  | n/s      | n/s           |        |
| Coagulopathy n/s                        | 0.031    | 0.023–0.040   | <0.001 | 0.029    | 0.022–0.036   | <0.001 |
| Drug abuse n/s                          | 0.012    | 0.003–0.020   | 0.006  | n/s      | n/s           |        |
| Fluid/electrolyte disorders             | 0.012    | 0.007–0.017   | <0.001 | 0.011    | 0.007–0.016   | <0.001 |
| Obesity n/s                             | 0.013    | 0.008–0.018   | <0.001 | 0.010    | 0.006–0.013   | <0.001 |
| Cardiogenic shock                       | 0.029    | 0.022–0.036   | <0.001 | 0.029    | 0.024–0.035   | <0.001 |
| Cardiac arrest                          | 0.050    | 0.042–0.057   | <0.001 | 0.037    | 0.031–0.043   | <0.001 |
| IABP n/s                                | 0.077    | 0.071–0.084   | <0.001 | 0.080    | 0.073 to 0.087 | <0.001 |
| PLVAD n/s                               | 0.288    | 0.262–0.314   | <0.001 | 0.291    | 0.267–0.314   | <0.001 |
| Weekend admission n/s                   | n/s      | n/s           |        | n/s      | n/s           |        |
| Median household income (reference: first quartile) | 0.021    | 0.014–0.025   | <0.001 | 0.021    | 0.014–0.025   | <0.001 |
| Second quartile                         | 0.038    | 0.030–0.045   | <0.001 | 0.035    | 0.028–0.041   | <0.001 |
| Third quartile                          | 0.064    | 0.055–0.074   | <0.001 | 0.064    | 0.055–0.073   | <0.001 |
| Fourth quartile                         |          |              |         |          |              |         |
| Primary payer (reference: Medicare)     |          |              |         |          |              |         |
| Medicaid n/s                            | 0.018    | 0.010–0.025   | <0.001 | 0.011    | 0.005–0.017   | <0.001 |
| Private n/s                             | 0.015    | 0.010–0.020   | <0.001 | 0.014    | 0.010–0.017   | <0.001 |
| Self-pay/no charge/others               | 0.002    | −0.004 to 0.008 | 0.568 | −0.002   | −0.007 to 0.003 | 0.534 |
| Hospital bed size (reference: small)    |          |              |         |          |              |         |
| Medium n/s                              | −0.023   | −0.050 to 0.003 | 0.078 | −0.018   | −0.043 to 0.007 | 0.156 |
| Large n/s                               | −0.033   | −0.059 to −0.008 | 0.011 | −0.031   | −0.056 to −0.007 | 0.013 |
| Disposition (reference: home)           |          |              |         |          |              |         |
| Facility n/s                            | 0.017    | 0.011–0.022   | <0.001 | 0.010    | 0.006–0.015   | <0.001 |
| AMA/unknown n/s                         | −0.010   | −0.029 to 0.008 | 0.261 | −0.009   | −0.021 to −0.003 | 0.140 |
| Year (per y)                            | 0.008    | 0.003–0.014   | 0.004  | 0.008    | 0.003–0.013   | 0.004  |

AMA indicates against medical advice; AW, anterior wall; IABP, intra-aortic balloon pump; LOS, length of stay; MI, myocardial infarction; PLVAD, percutaneous left ventricular assist device; and STEMI, ST-segment-elevation myocardial infarction.

Survey-specific multivariate linear regression model was created with an outcome of log-transformed cumulative cost including all predictors with \( P \leq 0.1 \) in the univariate analysis. Hospital ID was also included as a covariable for consideration of hospital fixed-year effect (insignificant contribution, not shown).
site complications and bleeding risk,33 which, in turn, may contribute to improving in-hospital outcomes with shorter LOS.33–36 With a recent study showing a significant increase of transradial PCI from 2010 to 2012 in the United States,37,38 reduced readmission in the very short LOS cohort in our study may partially reflect more contemporary data in the current era of transradial PCI.

Since the implementation of the HRRP, there have been some controversies on the association of reduction in readmission rates and its impact on overall mortality.39,40 A study comprising Medicare beneficiaries with heart failure demonstrated that the implementation of the HRRP was associated with an 0.5% increase in 30-day mortality.41,42 Some studies have shown that 30-day readmission rate has a poor or even an inverse relationship with 30-day mortality.13,44 Pandey et al45 demonstrated that the 30-day risk-adjusted readmission rates after acute myocardial infarction were not associated with 1-year mortality. In addition, Dharmarajan et al46 reported that the reduction in 30-day readmission rate did not correlate with higher 30-day mortality rate in Medicare beneficiaries hospitalized for acute myocardial infarction. The inverse relationship of 30-day readmission and 30-day mortality in the AW STEMI group with very short LOS in our study demonstrates that 30-day readmission rate may not be the best metric for quality of care, especially for AW STEMI. More detailed studies are necessary to tease out the features that may predispose certain patients with STEMI who would be at risk of worse outcomes with very early discharge. Last, our study demonstrated that the total cumulative costs are the lowest in the very short LOS group in both the patients with AW and NAW STEMI, mostly as a result of significantly less index hospitalization cost with similar or fewer readmissions. Identifying proper cohorts with less likelihood of readmission despite shortening the LOS remains an important goal for future studies.

STUDY LIMITATIONS

The present study has the limitations inherent to nonrandomized observational studies. First, the data from the NRD include the sample designed to approximate the national distribution of representative hospital characteristics. Our study cohort was derived from approximately half sample of US hospitals, and as a result the study cohort can be either underrepresented or overrepresented by the sample. Our results cannot be considered completely generalizable among all states in the United States since the NRD includes only 22 states in the United States. However, there have been numerous publications utilizing the NRD that validate the sampling design.15,47,48 Second, the study cohort from a large administrative data set can be subject to coding bias or possibly missing events or variables. Nevertheless, many studies have proven the validity of using administrative databases for risk-adjusted outcome evaluation.47,49,50 Third, some of the clinical parameters including vital signs (eg, blood pressure and heart rate), echocardiographic parameters (eg, ejection fraction), laboratory findings (eg, troponin-I and brain natriuretic peptide), or medications (eg, antiplatelets and heart failure medications) are not available for analysis in the NRD. Our study is intended to generate a hypothesis, and future studies are necessary to confirm our findings with more detailed information. Fourth, although we performed an appropriate statistical approach using validated risk models, there is no way to eliminate bias from the influence of unmeasured confounders given that the NRD is based on ICD-9-CM codes. Fifth, our study did not differentiate between STEMI with emergent PCI versus STEMI with delayed PCI during hospitalization. In addition, some of the readmissions may be attributable to staged PCI procedures, but the limitation of the database does not allow identification of these admissions. Sixth, our cost analyses did not consider the effects of differential mortality among different LOS cohorts. Finally, our 30-day mortality rate does not account for out-of-hospital deaths, which may underestimate the overall mortality rate.

CONCLUSIONS

This study examined short-term clinical outcomes and total costs according to LOS after STEMI stratified by the location of infarct. Our data show that very early discharge after primary PCI is safe and less costly in low-risk patients, especially those with NAW STEMI. For those with AW STEMI, care needs to be taken before opting for very early discharge given the potential increase in 30-day mortality. Very short LOS is associated with fewer readmissions, but if patients are readmitted, 30-day mortality is higher in those with AW STEMI. Further studies to better identify proper cohorts of patients with STEMI who are suitable for a very early discharge strategy are warranted. These efforts will hopefully lead to reduction in overall cost and improvement in overall quality and efficiency of care for patients with STEMI.

ARTICLE INFORMATION

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Disclosures
None.

Supplementary Materials
Tables S1–S8

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SUPPLEMENTAL MATERIAL
Table S1. International Classification of Diseases, Ninth Revision-Clinical Modification (ICD-9-CM) codes and Clinical Classification Software (CCS) codes for selected variables.

| Condition                                      | Code(s)                  |
|------------------------------------------------|--------------------------|
| Percutaneous coronary intervention             | 0066, 3601, 3602, 3605, 3606, 3607 |
| Smoking                                        | 305.1, V15.82            |
| Dyslipidemia                                   | 272.4                    |
| Previous myocardial infarction                 | 412                      |
| Previous percutaneous coronary intervention    | V45.82                   |
| Previous coronary artery bypass graft          | V45.81                   |
| Family history of coronary artery disease      | V17.3                    |
| Congestive heart failure                       | 428.0                    |
| Known coronary artery disease                  | 414.01                   |
| Pulmonary hypertension                         | 416.0                    |
| Atrial fibrillation                            | 427.31                   |
| Collagen vascular disease                      | 357.1                    |
| Cardiogenic shock                              | 785.51                   |
| Cardiac arrest                                 | 427.5                    |
| Intra-aortic balloon pump (IABP)               | 37.61                    |
| Percutaneous left ventricle assist device (PLVAD) | 37.68                   |
Table S2. Baseline Characteristics for Patients Discharged Alive After Index Hospitalization for STEMI Stratified by Length of Stay.

| Characteristics                        | AW STEMI                      | NAW STEMI                     |
|----------------------------------------|-------------------------------|-------------------------------|
|                                        | Overall (N = 187,557) | LOS<=3 days 117,332 (62.6) | LOS 4-5 days 40,232 (21.4) | LOS>5 days 29,993 (16.0) | P Value Overall 351,960 | LOS<=3 days 258,663 (73.5) | LOS 4-5 days 54,706 (15.5) | LOS>5 days 38,591 (11.0) | P Value |
| Number of admissions                    | 187,557                       | 117,332                       | 40,232                       | 29,993                       | <0.001 †               | 61.2 (0.1)                   | 60.0 (0.1)                   | 64.0 (0.1)                   | 66.3 (0.1)                   | <0.001 †               |
| Patient characteristics                |                               |                               |                              |                              |                        |                              |                              |                              |                        |
| Age, mean (SE), y                      | 60.8 (0.1)                    | 59.3 (0.1)                    | 62.2 (0.2)                   | 65.0 (0.2)                   | <0.001 †               | 61.2 (0.1)                   | 60.0 (0.1)                   | 64.0 (0.1)                   | 66.3 (0.1)                   | <0.001 †               |
| Age group, y                           |                               |                               |                              |                              |                        |                              |                              |                              |                        |
| <50                                    | 36,759 (19.6)                 | 25,384 (21.6)                 | 73.13 (18.2)                 | 4,062 (13.5)                 | 61,394 (17.4)          | 50,312 (19.5)               | 7,459 (13.6)                 | 3,623 (9.4)                  | <0.001               |
| 50-64                                  | 81,776 (43.6)                 | 54,771 (46.7)                 | 16,284 (40.5)                | 10,721 (35.7)                | 156,816 (44.6)         | 121,246 (46.9)              | 21,703 (39.7)                | 13,867 (35.9)                | <0.001               |
| ≥65                                    | 69,022 (36.8)                 | 37,177 (31.7)                 | 16,635 (41.3)                | 15,210 (50.7)                | 133,750 (38.0)         | 87,105 (33.7)               | 25,544 (46.7)                | 21,101 (54.7)                | 13,867 (35.9)                | <0.001               |
| Female                                 | 49,028 (26.1)                 | 26,346 (22.5)                 | 12,247 (30.4)                | 10,435 (34.8)                | 100,035 (28.4)         | 66,629 (25.8)               | 19,090 (34.9)                | 14,316 (37.1)                | <0.001               |
| Smoking history                        | 87,696 (46.8)                 | 57,820 (49.3)                 | 18,129 (45.1)                | 11,747 (39.2)                | 182,245 (51.8)         | 140,636 (54.4)              | 25,590 (46.8)                | 16,019 (41.5)                | <0.001               |
| Hypertension                           | 116,083 (61.9)                | 71,383 (60.8)                 | 25,379 (63.1)                | 19,321 (64.4)                | 229,495 (65.2)         | 165,692 (64.1)              | 37,193 (68.0)                | 26,610 (69.0)                | <0.001               |
| Diabetes mellitus                      | 44,515 (23.7)                 | 25,958 (22.1)                 | 10,425 (25.9)                | 8,132 (27.1)                 | 84,506 (24.0)          | 58,339 (22.6)               | 14,868 (27.2)                | 11,299 (29.3)                | <0.001               |
| Dyslipidemia                           | 107,233 (57.2)                | 68,849 (58.7)                 | 22,769 (56.6)                | 15615 (52.1)                 | 209,963 (59.7)         | 157,075 (60.7)              | 32,115 (58.7)                | 20,773 (53.8)                | <0.001               |
| Known coronary artery disease          | 163,919 (87.4)                | 102,541 (87.4)                | 35,336 (87.8)                | 26,043 (86.8)                | 304,522 (86.5)         | 223,759 (86.5)              | 47,708 (87.2)                | 33,055 (85.7)                | 0.003               |
| Previous myocardial infarction         | 12,807 (6.8)                  | 7,925 (6.8)                   | 2,639 (6.6)                  | 2,243 (7.5)                  | 29,134 (8.3)           | 20,888 (8.1)                | 4,831 (8.8)                  | 3,414 (8.8)                  | <0.001               |
| Previous PCI                           | 20,267 (10.8)                 | 12,489 (10.6)                 | 4,275 (10.6)                 | 3,503 (11.7)                 | 46,013 (13.1)          | 33,607 (13.0)               | 7,103 (13.0)                 | 5,303 (13.7)                 | 0.105               |
| Previous CABG                          | 2,048 (1.1)                   | 1,126 (1.0)                   | 452 (1.1)                    | 469 (1.1)                    | 11,212 (3.2)           | 7,639 (3.0)                  | 2,003 (3.7)                  | 1,570 (4.1)                  | <0.001               |
| Family history of coronary artery disease | 24,785 (13.2)               | 17,183 (14.6)                 | 4,979 (12.4)                 | 2,622 (8.7)                  | 46,234 (13.1)         | 37,122 (14.4)               | 5,834 (10.7)                 | 3,278 (8.5)                  | <0.001               |
| Condition                        | Count(%)   | Count(%)   | Count(%)   | Count(%)   | Significance |
|---------------------------------|------------|------------|------------|------------|--------------|
| **Congestive heart failure**    | 34,515 (18.4) | 10,566 (9.0) | 9,885 (24.6) | 14,064 (46.9) | <0.001        |
| **Peripheral vascular disease** | 9,925 (5.3)  | 4,560 (3.9)  | 2,521 (6.3)  | 2,844 (9.5)   | <0.001        |
| **Chronic pulmonary disease**   | 21,699 (11.6)| 10,868 (9.3) | 5,201 (12.9) | 5,630 (18.8)  | <0.001        |
| **Chronic kidney disease**      | 12,324 (6.6) | 4,650 (4.0)  | 3,107 (7.7)  | 4,567 (15.2)  | <0.001        |
| **Liver disease**               | 1,702 (0.9)  | 919 (0.8)   | 365 (0.9)   | 418 (1.4)     | <0.001        |
| **Anemia**                      | 13,338 (7.1) | 3,871 (3.3)  | 3,509 (8.7)  | 5,958 (19.9)  | <0.001        |
| **Atrial fibrillation**         | 16,357 (8.7) | 5,152 (4.4)  | 4,589 (11.4) | 6,616 (22.1)  | <0.001        |
| **Coagulopathy**                | 5,141 (2.7)  | 1,514 (1.3)  | 1,149 (2.9)  | 2,478 (8.3)   | <0.001        |
| **Collagen vascular disease**   | 3,499 (1.9)  | 1,859 (1.6)  | 835 (2.1)   | 805 (2.7)     | <0.001        |
| **Drug abuse**                  | 5,621 (3.0)  | 3,441 (2.9)  | 1,249 (3.1)  | 931 (3.1)     | 0.456         |
| **Fluid/electrolyte disorders** | 24,803 (13.2)| 9,234 (7.9)  | 6,098 (15.2) | 9,471 (31.6)  | <0.001        |
| **Obesity**                     | 25,336 (13.5)| 15,625 (13.3)| 5,401 (13.4)| 4,310 (14.4)  | 0.031         |
| **Other neurological disorders**| 5,827 (3.1)  | 2,553 (2.2)  | 1,462 (3.6)  | 1,812 (6.0)   | <0.001        |
| **Median household income**     | <0.001      | <0.001      | <0.001      | <0.001       | <0.001        |
| **First quartile**              | 52,402 (28.5)| 31,796 (27.6)| 11,611 (29.4)| 8,995 (30.6)  |              |
| **Second quartile**             | 48,955 (26.6)| 30,702 (26.7)| 10,528 (26.6)| 7,725 (26.3)  |              |
| **Third quartile**              | 44,243 (24.0)| 27,930 (24.3)| 9,493 (24.0) | 6,820 (23.2)  |              |
| **Fourth quartile**             | 38,387 (20.9)| 24,648 (21.4)| 7,893 (20.0) | 5,846 (19.9)  |              |
| **Primary payer**               | <0.001      | <0.001      | <0.001      | <0.001       | <0.001        |
| Medicare          | 70,830 (37.8) | 38,556 (32.9) | 16,972 (42.2) | 15,302 (51.0) | 139,552 (39.6) | 91,646 (35.4) | 26,457 (48.4) | 21,449 (55.6) |
|-------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Medicaid          | 14,844 (7.9)  | 8,615 (7.3)   | 3,504 (8.7)   | 2,725 (9.1)   | 24,529 (7.0)  | 17,351 (6.7)  | 4,060 (7.4)   | 3,118 (8.1)   |
| Private including HMO | 71,617 (38.2) | 49,681 (42.3) | 13,798 (34.3) | 8,138 (27.1)  | 132,040 (37.5)| 105,983 (41.0)| 16,300 (29.8)| 9,757 (25.3)  |
| Self-pay/no charge/other | 30,266 (16.1) | 20,481 (17.5) | 5,958 (14.8)  | 3,827 (12.8)  | 55,839 (15.9) | 43,683 (16.9) | 7,890 (14.4) | 4,266 (11.1)  |

**Index STEMI presentation/treatment**

| Weekend admission | 54,462 (29.0) | 34,668 (29.5) | 12,137 (30.2) | 7,657 (25.5)  | <0.001         | 100,421 (28.5)| 74,700 (28.9)| 15,962 (29.2)| 9,759 (25.3)| <0.001 |
| Cardiogenic shock  | 13,711 (7.3)  | 2,093 (1.8)   | 3,157 (7.8)   | 8,461 (28.2)  | <0.001         | 18,241 (5.2)  | 5,079 (2.0)  | 4,344 (7.9)  | 8,818 (22.8)| <0.001 |
| Cardiac arrest     | 7,705 (4.1)   | 2,200 (1.9)   | 1,945 (4.8)   | 3,560 (11.9)  | <0.001         | 10,766 (3.1)  | 3,723 (1.4)  | 2,506 (4.6)  | 4,537 (11.8)| <0.001 |
| IABP               | 16,078 (8.6)  | 2,499 (2.1)   | 4,937 (12.3)  | 8,642 (28.8)  | <0.001         | 14,082 (4.0)  | 2,383 (0.9)  | 3,967 (7.3)  | 7,732 (20.0)| <0.001 |
| PLVAD              | 680 (0.4)     | 98 (0.1)      | 115 (0.3)     | 467 (1.6)     | <0.001         | 375 (0.1)     | 49 (0.0)     | 67 (0.1)     | 259 (0.7)   | <0.001 |

**Hospital characteristics**

| Hospital teaching status | <0.001 | <0.001 |
| Teaching                 | 100,512 (53.6) | 61,078 (52.1)| 22,563 (56.1)| 16,871 (56.3)| 185,133 (52.6)| 134,662 (52.1)| 29,342 (53.6)| 21,129 (54.8)| 680 (0.4) | 98 (0.1) | 115 (0.3) | 467 (1.6) | <0.001 | <0.001 |
| Nonteaching             | 87,045 (46.4) | 56,255 (47.9)| 17,669 (43.9)| 13,121 (43.7)| 166,827 (47.4)| 124,001 (47.9)| 25,364 (46.4)| 17,462 (45.2)| 680 (0.4) | 98 (0.1) | 115 (0.3) | 467 (1.6) | <0.001 | <0.001 |

| Hospital location       | <0.001 | <0.001 |
| Rural                   | 96,717 (51.6) | 62,199 (53.0)| 20,152 (50.1)| 14,366 (47.9)| 184,901 (52.5)| 139,204 (53.8)| 27,093 (49.5)| 18,604 (48.2)| 680 (0.4) | 98 (0.1) | 115 (0.3) | 467 (1.6) | <0.001 | <0.001 |
| Urban                   | 90,840 (48.4) | 55,133 (47.0)| 20,080 (49.9)| 15,627 (52.1)| 167,059 (47.5)| 119,459 (46.2)| 27,613 (50.5)| 19,987 (51.8)| 680 (0.4) | 98 (0.1) | 115 (0.3) | 467 (1.6) | <0.001 | <0.001 |

| Hospital bed size       | <0.001 | <0.001 |
| Small                   | 13,289 (7.1)  | 8,783 (7.5)   | 2,665 (6.6)   | 1,841 (6.1)   | 24,861 (7.1)  | 19,207 (7.4)  | 3,336 (6.1)   | 2,318 (6.0)  |
| Medium                  | 41,605 (22.2) | 27,133 (23.1) | 8,595 (21.4)  | 5,877 (19.6)  | 77,308 (22.0)| 58,030 (22.4)| 11,814 (21.6)| 7,464 (19.3) |
| Large     | 132,663 (70.7) | 81,417 (69.4) | 28,971 (72.0) | 22,275 (74.3) | 249,791 (71.0) | 181,426 (70.1) | 39,556 (72.3) | 28,809 (74.7) |
|-----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| **Disposition** |                |                |                | <0.001         |                |                |                | <0.001         |
| **Home**  | 164,476 (87.7) | 111,587 (95.1) | 34,468 (85.7)  | 18,421 (61.4)  | 316,308 (89.9) | 247,080 (95.5) | 46,789 (85.5)  | 22,439 (58.1)  |
| **Facility|| 21,858 (11.7)  | 4,773 (4.1)    | 5,617 (14.0)   | 11,468 (38.2)  | 33,350 (9.5)   | 9,639 (3.7)     | 7,710 (14.1)   | 16,001 (41.5)  |
| **AMA/unknown** | 1,223 (0.7)   | 974 (0.8)      | 146 (0.4)      | 103 (0.3)      | 2,302 (0.7)    | 1,944 (0.8)    | 207 (0.4)      | 151 (0.4)      |

AW STEMI, anterior wall ST-segment elevation myocardial infarction; NAW STEMI, non-anterior wall ST-segment elevation myocardial infarction; LOS, length of stay; SE, standard error; PCI, percutaneous coronary intervention; CABG, coronary artery bypass grafting; HMO, health maintenance organization; IABP, intra-aortic balloon pump; PLVAD, percutaneous left ventricular assist device; AMA, against medical advice.

*Values are presented as number (percentage) of patients unless otherwise indicated.

†Survey-specific linear regression was performed.

‡Rao-Scott $\chi^2$ test was used for all statistical tests unless stated otherwise.

||Facility includes skilled nursing facility, intermediate care facility, and inpatient rehabilitation facility.
Table S3. Thirty-day Outcomes According to Length of Stay Stratified by Location of Infarct.

| Outcome                  | LOS (Ref: 3 days) | AW STEMI | NAW STEMI | P value | AW STEMI | NAW STEMI | P value | P for interaction |
|--------------------------|-------------------|----------|-----------|---------|----------|-----------|---------|-------------------|
|                          |                   | Unadjusted HR | Adjusted HR (95% CI) | P value | Unadjusted HR | Adjusted HR (95% CI) | P value |                   |
| Readmission              | 1-2 days          | 0.79 (0.73-0.85) | 0.84 (0.78-0.91) | <0.01   | 0.80 (0.76-0.84) | 0.01 | <0.01   | 0.08 (0.83-0.92) | <0.01 |
|                          | 4 days            | 1.44 (1.33-1.55) | 1.26 (1.17-1.36) | <0.01   | 1.38 (1.29-1.47) | <0.01 | 1.19 (1.11-1.27) | <0.01 |
|                          | 5 days            | 1.78 (1.65-1.95) | 1.42 (1.30-1.55) | <0.01   | 1.92 (1.77-2.09) | <0.01 | 1.47 (1.34-1.60) | <0.01 |
|                          | >5 days           | 2.30 (2.15-2.46) | 1.50 (1.39-1.63) | <0.01   | 2.36 (2.23-2.50) | <0.01 | 1.46 (1.37-1.57) | <0.01 |
| Mortality                | 1-2 days          | 1.65 (1.01-2.68) | 1.92 (1.16-3.16) | 0.01    | 0.62 (0.42-0.92) | 0.02 | 0.71 (0.48-1.06) | 0.09  |
|                          | 4 days            | 2.79 (1.65-4.71) | 1.80 (1.06-3.04) | <0.01   | 2.06 (1.37-3.07) | <0.01 | 1.52 (1.00-2.30) | 0.05  |
|                          | 5 days            | 4.35 (2.73-6.92) | 2.32 (1.44-3.73) | <0.01   | 3.06 (1.87-5.02) | <0.01 | 1.76 (1.06-2.93) | 0.03  |
|                          | >5 days           | 10.29 (6.94-15.27) | 3.45 (2.22-5.36) | <0.01   | 6.02 (4.23-8.57) | <0.01 | 2.30 (1.45-3.65) | <0.01 |
| Reinfarction             | 1-2 days          | 0.74 (0.67-0.82) | 0.78 (0.70-0.86) | <0.01   | 0.78 (0.72-0.85) | <0.01 | 0.84 (0.77-0.91) | <0.01 |
|                          | 4 days            | 1.38 (1.24-1.55) | 1.26 (1.13-1.40) | <0.01   | 1.32 (1.20-1.46) | <0.01 | 1.18 (1.07-1.30) | <0.01 |
|                          | 5 days            | 1.67 (1.49-1.88) | 1.41 (1.25-1.59) | <0.01   | 1.66 (1.49-1.85) | <0.01 | 1.35 (1.21-1.51) | <0.01 |
|                          | >5 days           | 1.97 (1.80-2.16) | 1.46 (1.32-1.62) | <0.01   | 1.95 (1.79-2.13) | <0.01 | 1.36 (1.23-1.50) | <0.01 |
| Repeat Revascularization | 1-2 days          | 0.88 (0.77-1.02) | 0.90 (0.78-1.03) | 0.12    | 0.88 (0.80-0.97) | 0.01 | 0.91 (0.82-1.00) | 0.06  |
|                          | 4 days            | 1.17 (0.98-1.40) | 1.13 (0.95-1.36) | 0.17    | 1.16 (1.03-1.31) | 0.01 | 1.11 (0.98-1.25) | 0.09  |
|                          | 5 days            | 1.14 (0.93-1.38) | 1.09 (0.89-1.33) | 0.41    | 1.20 (1.03-1.41) | 0.02 | 1.14 (0.97-1.34) | 0.10  |
|                          | >5 days           | 1.07 (0.90-1.26) | 1.01 (0.84-1.22) | 0.91    | 1.01 (0.87-1.17) | 0.93 | 0.96 (0.81-1.14) | 0.62  |
| MACE                     | 1-2 days          | 0.79 (0.72-0.86) | 0.83 (0.76-0.91) | <0.01   | 0.80 (0.75-0.86) | <0.01 | 0.86 (0.81-0.92) | <0.01 |
|                          | 4 days            | 1.40 (1.26-1.54) | 1.25 (1.14-1.39) | <0.01   | 1.30 (1.20-1.42) | <0.01 | 1.15 (1.06-1.25) | <0.01 |
|                          | 5 days            | 1.65 (1.48-1.83) | 1.36 (1.22-1.51) | <0.01   | 1.62 (1.47-1.78) | <0.01 | 1.29 (1.17-1.43) | <0.01 |
|                          | >5 days           | 1.93 (1.77-2.10) | 1.37 (1.24-1.51) | <0.01   | 1.84 (1.70-1.99) | <0.01 | 1.24 (1.13-1.36) | <0.01 |

AW STEMI, anterior wall ST-segment elevation myocardial infarction; NAW STEMI, non-anterior wall ST-segment elevation myocardial infarction; LOS, length of stay; HR, hazard ratio; CI, confidence interval.

*Univariate Cox proportional hazards regression model was created with an outcome of 30-day readmission for each covariate from Table 1 and the covariates with p values < 0.1 are listed.

†Multivariate Cox proportional hazards regression model was created with an outcome of 30-day readmission including all predictors with p values < 0.1 in the univariate analysis.
Table S4. Independent Predictors of 30-day Readmission After Index PCI with STEMI.

| Variables                                      | AW STEMI | NAW STEMI |
|------------------------------------------------|----------|-----------|
|                                                | Adjusted HR  | 95% CI (lower) | 95% CI (higher) | P value | Adjusted HR  | 95% CI (lower) | 95% CI (higher) | P value |
| Length of Stay (Ref: 3 days)                   |           |            |                |         |           |            |                |         |
| 1-2 days                                       | 0.84      | 0.78       | 0.91           | <0.01   | 0.87      | 0.83       | 0.92           | <0.01   |
| 4 days                                         | 1.26      | 1.17       | 1.36           | <0.01   | 1.19      | 1.11       | 1.27           | <0.01   |
| 5 days                                         | 1.42      | 1.30       | 1.55           | <0.01   | 1.47      | 1.34       | 1.60           | <0.01   |
| >5 days                                        | 1.50      | 1.39       | 1.63           | <0.01   | 1.46      | 1.37       | 1.57           | <0.01   |
| Female                                         | 1.25      | 1.18       | 1.31           | <0.01   | 1.22      | 1.17       | 1.28           | <0.01   |
| Hypertension                                   | 1.10      | 1.04       | 1.16           | <0.01   | 1.09      | 1.04       | 1.14           | <0.01   |
| Diabetes mellitus                              | 1.14      | 1.08       | 1.21           | <0.01   | 1.16      | 1.11       | 1.21           | <0.01   |
| Congestive heart failure                       | 1.17      | 1.11       | 1.24           | <0.01   | 1.31      | 1.23       | 1.38           | <0.01   |
| Peripheral vascular disease                    | 1.18      | 1.08       | 1.29           | <0.01   | 1.17      | 1.09       | 1.25           | <0.01   |
| Chronic lung disease                           | 1.26      | 1.18       | 1.35           | <0.01   | 1.27      | 1.20       | 1.33           | <0.01   |
| Renal failure                                  | 1.38      | 1.28       | 1.49           | <0.01   | 1.37      | 1.27       | 1.45           | <0.01   |
| Anemia                                         | 1.14      | 1.05       | 1.23           | <0.01   | 1.21      | 1.14       | 1.29           | <0.01   |
| Atrial fibrillation                            | 1.33      | 1.24       | 1.43           | <0.01   | 1.26      | 1.18       | 1.32           | <0.01   |
| Drug abuse                                     | 1.30      | 1.15       | 1.48           | <0.01   | 1.14      | 1.00       | 1.28           | 0.03    |
| Other neuropathy                               | 1.12      | 1.00       | 1.25           | 0.05    | 1.18      | 1.07       | 1.30           | <0.01   |
| Fluid/Electrolyte disorders                    | n/s       |            |                |         | 1.09      | 1.02       | 1.14           | <0.01   |
| Intra-aortic balloon pump                      | 1.09      | 1.01       | 1.18           | 0.02    | 1.19      | 1.01       | 1.21           | 0.03    |
| Hospital location, rural (Ref: urban)          | 0.94      | 0.89       | 0.99           | 0.03    | 0.93      | 0.88       | 0.97           | <0.01   |
| Disposition (Ref: home)                        |           |            |                |         |           |            |                |         |
| Facility                                       | 1.22      | 1.13       | 1.31           | <0.01   | 1.29      | 1.21       | 1.37           | <0.01   |
| AMA/others                                     | 1.80      | 1.45       | 2.24           | <0.01   | 1.87      | 1.57       | 2.23           | <0.01   |
| Primary payer (Ref: Medicare)                  |           |            |                |         |           |            |                |         |
| Medicaid                                       | 1.10      | 0.99       | 1.23           | 0.09    | 1.03      | 0.94       | 1.12           | 0.50    |
| Private                                        | 0.72      | 0.66       | 0.78           | <0.01   | 0.74      | 0.69       | 0.79           | <0.01   |
| Others                                         | 0.76      | 0.69       | 0.84           | <0.01   | 0.70      | 0.65       | 0.76           | <0.01   |
| Median household income (Ref: 1st quartile)    |           |            |                |         |           |            |                |         |
| 2nd quartile                                   | 0.98      | 0.92       | 1.05           | 0.65    | 0.94      | 0.89       | 0.98           | 0.03    |
| 3rd quartile                                   | 0.92      | 0.86       | 0.99           | 0.02    | 0.94      | 0.88       | 0.98           | 0.02    |
| 4th quartile                                   | 0.89      | 0.82       | 0.97           | <0.01   | 0.89      | 0.83       | 0.94           | <0.01   |
| Age group, y (Ref: <50)                        |           |            |                |         |           |            |                |         |
| 50 to 64                                       | 0.99      | 0.92       | 1.07           | 0.85    | 0.95      | 0.88       | 1.00           | 0.09    |
|          | ≥65  | 0.98 | 1.20 | 0.11 | 0.97 | 0.89 | 1.05 | 0.46 |
|----------|------|------|------|------|------|------|------|------|
| Hospital year (per year group) | 0.98 | 0.95 | 1.00 | 0.08 | 0.93 | 0.91 | 0.95 | <0.01 |

AW STEMI, anterior wall ST-segment elevation myocardial infarction; NAW STEMI, non-anterior wall ST-segment elevation myocardial infarction; LOS, length of stay; HR, hazard ratio; CI, confidence interval.

*Multivariate Cox proportional hazards regression model was created with an outcome of 30-day readmission including all predictors with p values < 0.1 and in the univariate analysis eliminating backward for p values ≥0.05 (except age group, hospital year, and hospital id number).
Table S5. Independent Predictors of 30-day Mortality After Index PCI with STEMI.

| Variables                        | AW STEMI                     | NAW STEMI                    |
|----------------------------------|------------------------------|------------------------------|
|                                  | Adjusted HR | 95% CI (lower) | 95% CI (higher) | P value | Adjusted HR | 95% CI (lower) | 95% CI (higher) | P value |
| LOS (Ref: 3 days)                |               |                 |                 |         |             |                 |                 |         |
| 1-2 days                         | 1.92          | 1.16            | 3.16            | 0.01    | 0.71        | 0.48            | 1.06            | 0.09    |
| 4 days                           | 1.80          | 1.06            | 3.04            | 0.03    | 1.52        | 1.00            | 2.30            | 0.05    |
| 5 days                           | 2.32          | 1.44            | 3.73            | <0.01   | 1.76        | 1.06            | 2.93            | 0.03    |
| >5 days                          | 3.45          | 2.22            | 5.36            | <0.01   | 2.30        | 1.45            | 3.65            | <0.01   |
| Female                           | 1.35          | 1.04            | 1.75            | 0.03    | n/s         |                 |                 |         |
| Diabetes mellitus                | 1.35          | 1.02            | 1.79            | 0.03    | 1.34        | 1.03            | 1.73            | 0.03    |
| Dyslipidemia                     | 0.74          | 0.57            | 0.96            | 0.02    |             |                 |                 |         |
| Congestive heart failure         | 1.86          | 1.37            | 2.52            | <0.01   | 2.01        | 1.45            | 2.78            | <0.01   |
| Peripheral vascular disease      | 1.62          | 1.15            | 2.29            | <0.01   | n/s         |                 |                 |         |
| Renal failure                    | 1.53          | 1.10            | 2.14            | 0.01    | 1.73        | 1.28            | 2.33            | <0.01   |
| Anemia                           | 1.59          | 1.13            | 2.22            | <0.01   | 1.47        | 1.06            | 2.03            | 0.02    |
| Atrial fibrillation              | 1.63          | 1.21            | 2.19            | <0.01   | 1.50        | 1.11            | 2.01            | <0.01   |
| Disposition (Ref: home)          |               |                 |                 |         |             |                 |                 |         |
| Facility                         | 1.77          | 1.29            | 2.42            | <0.01   | 1.80        | 1.24            | 2.60            | <0.01   |
| AMA/others                       | 3.64          | 1.26            | 10.54           | 0.02    | 5.64        | 2.17            | 14.65           | <0.01   |
| Median household income (Ref: 1st quartile) |               |                 |                 |         |             |                 |                 |         |
| 2nd quartile                     | 0.79          | 0.56            | 1.12            | 0.19    | n/s         |                 |                 |         |
| 3rd quartile                     | 0.76          | 0.54            | 1.06            | 0.10    | n/s         |                 |                 |         |
| 4th quartile                     | 0.59          | 0.39            | 0.90            | 0.01    | n/s         |                 |                 |         |
| Age group, y (Ref: <50)          |               |                 |                 |         |             |                 |                 |         |
| 50 to 64                         | 1.64          | 0.94            | 2.86            | 0.08    | 1.74        | 1.00            | 3.01            | 0.05    |
| ≥65                              | 4.58          | 2.66            | 7.86            | <0.01   | 4.27        | 2.52            | 7.24            | <0.01   |
| Hospital year (per year group)   | 1.00          | 0.87            | 1.15            | 0.97    | 0.93        | 0.81            | 1.06            | 0.28    |

AW STEMI, anterior wall ST-segment elevation myocardial infarction; NAW STEMI, non-anterior wall ST-segment elevation myocardial infarction; LOS, length of stay; HR, hazard ratio; CI, confidence interval.

*Multivariate Cox proportional hazards regression model was created with an outcome of 30-day readmission including all predictors with p values < 0.1 and in the univariate analysis eliminating backward for p values ≥0.05 (except hospital year and hospital id).
Table S6. Independent Predictors of 30-day Reinfarction After Index PCI with STEMI.

| Variables                        | AW STEMI | NAW STEMI |
|----------------------------------|----------|-----------|
|                                  | Adjusted HR | 95% CI (lower) | 95% CI (higher) | P value | Adjusted HR | 95% CI (lower) | 95% CI (higher) | P value |
| LOS (Ref: 3 days)                | 1-2 days  | 0.78 | 0.70 | 0.86 | <0.01 | 0.84 | 0.77 | 0.81 | <0.01 |
|                                  | 4 days    | 1.26 | 1.13 | 1.40 | <0.01 | 1.18 | 1.07 | 1.30 | <0.01 |
|                                  | >5 days   | 1.46 | 1.32 | 1.62 | <0.01 | 1.36 | 1.21 | 1.51 | <0.01 |
| Female                           |          | 1.22 | 1.14 | 1.31 | <0.01 | 1.26 | 1.18 | 1.35 | <0.01 |
| Smoking                          |          | 1.12 | 1.04 | 1.21 | <0.01 | n/s  |        |        |        |
| Congestive heart failure         |          | 1.23 | 1.13 | 1.33 | <0.01 | 1.36 | 1.25 | 1.48 | <0.01 |
| Chronic lung disease             |          | 1.16 | 1.05 | 1.27 | <0.01 | 1.23 | 1.13 | 1.33 | <0.01 |
| Renal failure                    |          | 1.38 | 1.24 | 1.53 | <0.01 | 1.43 | 1.30 | 1.57 | <0.01 |
| Atrial fibrillation              |          | 1.32 | 1.19 | 1.46 | <0.01 | 1.22 | 1.11 | 1.33 | <0.01 |
| Disposition (Ref: home)          |          | 1.09 | 0.98 | 1.21 | 0.13  | 1.24 | 1.13 | 1.36 | <0.01 |
| Facility                         |          | 2.05 | 1.53 | 2.73 | <0.01 | 1.80 | 1.38 | 2.35 | <0.01 |
| Primary payer (Ref: Medicare)    |          | 1.06 | 0.90 | 1.25 | 0.47  | 1.01 | 0.88 | 1.15 | 0.93 |
| Medicaid                         |          | 0.75 | 0.67 | 0.85 | <0.01 | 0.81 | 0.74 | 0.90 | <0.01 |
| Private                          |          | 0.74 | 0.64 | 0.85 | <0.01 | 0.72 | 0.64 | 0.81 | <0.01 |
| Others                           |          | 0.97 | 0.88 | 1.07 | 0.59  | 0.945| 0.87 | 1.04 | 0.28 |
| Age group, y (Ref: <50)          |          | 1.15 | 0.99 | 1.34 | 0.06  | 1.04 | 0.92 | 1.17 | 0.53 |
| Hospital year (per year group)   |          | 0.98 | 0.94 | 1.02 | 0.35  | 0.90 | 0.87 | 0.93 | <0.01 |

AW STEMI, anterior wall ST-segment elevation myocardial infarction; NAW STEMI, non-anterior wall ST-segment elevation myocardial infarction; LOS, length of stay; HR, hazard ratio; CI, confidence interval.

*Multivariate Cox proportional hazards regression model was created with an outcome of 30-day readmission including all predictors with p values < 0.1 and in the univariate analysis eliminating backward for p values ≥0.05 (except age group, hospital year and hospital id).
Table S7. Independent Predictors of 30-day Repeat Revascularization After Index PCI with STEMI.

| Variables                                | AW STEMI |                        | NAW STEMI |                        |
|------------------------------------------|----------|------------------------|-----------|------------------------|
|                                          | Adjusted HR | 95% CI (lower) | 95% CI (higher) | P value | Adjusted HR | 95% CI (lower) | 95% CI (higher) | P value |
| LOS (Ref: 3 days)                         | 1-2 days | 0.90 | 0.76 | 1.01 | 0.07 | 0.91 | 0.82 | 1.00 | 0.06 |
|                                          | 4 days    | 1.13 | 0.95 | 1.37 | 0.15 | 1.11 | 0.98 | 1.25 | 0.09 |
|                                          | 5 days    | 1.09 | 0.90 | 1.34 | 0.38 | 1.14 | 0.97 | 1.34 | 0.10 |
|                                          | ≥5 days   | 1.01 | 0.85 | 1.24 | 0.81 | 0.96 | 0.81 | 1.14 | 0.62 |
| Smoking                                  | 1.20 | 1.08 | 1.33 | <0.01 | 0.87 | 0.80 | 0.95 | <0.01 |
| Diabetes mellitus                        | 1.24 | 1.09 | 1.38 | <0.01 | 1.22 | 1.12 | 1.33 | <0.01 |
| Coagulopathy                             | 0.70 | 0.51 | 0.96 | 0.03 | n/s | 1.24 | 1.02 | 1.47 | 0.03 |
| Intra-aortic balloon pump                 | 1.24 | 1.02 | 1.47 | 0.03 | 1.36 | 1.13 | 1.64 | <0.01 |
| Disposition (Ref: home)                   | Facility | 0.79 | 0.64 | 0.96 | 0.02 | 0.77 | 0.67 | 0.90 | <0.01 |
|                                          | AMA/others | 2.45 | 1.67 | 3.66 | <0.01 | 1.93 | 1.43 | 2.60 | <0.01 |
| Median household income (Ref: 1st quartile) | 2nd quartile | 0.93 | 0.79 | 1.06 | 0.21 | 0.92 | 0.83 | 1.02 | 0.12 |
|                                          | 3rd quartile | 0.83 | 0.70 | 0.95 | <0.01 | 0.89 | 0.79 | 0.99 | 0.03 |
|                                          | 4th quartile | 0.84 | 0.71 | 0.97 | 0.02 | 0.83 | 0.74 | 0.93 | <0.01 |
| Age group, y (Ref: <50)                   | 50 to 64 | 1.23 | 1.05 | 1.41 | <0.01 | 1.15 | 1.03 | 1.28 | 0.02 |
|                                          | ≥65       | 1.63 | 1.35 | 1.88 | <0.01 | 1.34 | 1.19 | 1.51 | <0.01 |
| Hospital year (per year group)            | 0.90 | 0.85 | 0.96 | <0.01 | 0.88 | 0.83 | 0.92 | <0.01 |

AW STEMI, anterior wall ST-segment elevation myocardial infarction; NAW STEMI, non-anterior wall ST-segment elevation myocardial infarction; LOS, length of stay; HR, hazard ratio; CI, confidence interval.

*Multivariate Cox proportional hazards regression model was created with an outcome of 30-day readmission including all predictors with p values < 0.1 and in the univariate analysis eliminating backward for p values ≥0.05 (except hospital year and hospital id).
Table S8. Independent Predictors of 30-day Major Adverse Cardiac Event (MACE) After Index PCI with STEMI.

| Variables                        | AW STEMI | NAW STEMI |
|----------------------------------|----------|-----------|
|                                  | Adjusted HR | 95% CI (lower) | 95% CI (higher) | P value | Adjusted HR | 95% CI (lower) | 95% CI (higher) | P value |
| ---------------------------------|-----------|-------------|----------------|---------|-----------|-------------|----------------|---------|
| LOS (Ref: 3 days)                | 1-2 days  | 0.83 0.76 0.91 | <0.01        | 0.86 0.81 0.92 | <0.01 |
|                                  | 4 days    | 1.25 1.13 1.39 | <0.01        | 1.15 1.06 1.25 | <0.01 |
|                                  | 5 days    | 1.36 1.22 1.51 | <0.01        | 1.29 1.17 1.43 | <0.01 |
|                                  | >5 days   | 1.37 1.24 1.51 | <0.01        | 1.24 1.13 1.36 | <0.01 |
| Female                           | n/s       | 1.19 1.11 1.27 | <0.01        | 1.16 1.10 1.23 | <0.01 |
| Hypertension                     | n/s       | 1.09 1.03 1.16 | <0.01        | 1.15 1.08 1.22 | <0.01 |
| Diabetes mellitus                | n/s       | 1.09 1.02 1.17 | 0.02       | 1.15 1.08 1.22 | <0.01 |
| Congestive heart failure         | n/s       | 1.20 1.11 1.30 | <0.01        | 1.32 1.22 1.42 | <0.01 |
| Peripheral vascular disease      | n/s       | 1.18 1.04 1.33 | <0.01        | 1.13 1.03 1.24 | 0.01 |
| Chronic lung disease             | n/s       | 1.20 1.09 1.31 | <0.01        | 1.20 1.12 1.29 | <0.01 |
| Renal failure                    | n/s       | 1.39 1.26 1.53 | <0.01        | 1.29 1.18 1.41 | <0.01 |
| Anemia                           | n/s       | 1.26 1.15 1.38 | <0.01        | 1.17 1.08 1.27 | <0.01 |
| Drug abuse                       | n/s       | 1.23 1.04 1.45 | 0.01       | n/s     | n/s |
| Other neuropathy                 | n/s       | 1.28 1.12 1.46 | <0.01        | 1.28 1.12 1.46 | <0.01 |
| Fluid/Electrolyte disorders      | n/s       | 1.12 1.04 1.20 | <0.01        | 1.12 1.04 1.20 | <0.01 |
| Intra-aortic balloon pump        | n/s       | 1.12 1.02 1.24 | 0.02       | 1.16 1.04 1.30 | <0.01 |
|Disposition (Ref: home)           | n/s       | 1.08 0.97 1.19 | 0.12       | 1.14 1.05 1.24 | <0.01 |
| Facility                         | n/s       | 2.10 1.63 2.71 | <0.01        | 1.82 1.45 2.27 | <0.01 |
| AMA/others                       | n/s       | 1.10 0.96 1.26 | 0.17       | 1.02 0.91 1.14 | 0.72 |
| Primary payer (Ref: Medicare)    | n/s       | 0.76 0.68 0.85 | <0.01        | 0.81 0.74 0.88 | <0.01 |
| Medicaid                         | n/s       | 0.78 0.68 0.88 | <0.01        | 0.74 0.67 0.81 | <0.01 |
| Median household income (Ref: 1st quartile) | n/s |       |                               | 0.43 |
| 2nd quartile                     | n/s       | 0.97 0.89 1.05 | 0.43       | n/s |
| 3rd quartile                     | n/s       | 0.91 0.83 0.99 | 0.04       | n/s |
| 4th quartile                     | n/s       | 0.90 0.82 1.00 | 0.04       | n/s |
| Age group, y (Ref: <50)          | n/s       | 1.00 0.91 1.09 | 0.95       | 1.00 0.92 1.07 | 0.97 |
| ≥65                              | n/s       | 1.18 1.03 1.34 | 0.01       | 1.05 0.95 1.16 | 0.30 |
| Hospital year (per year group) | 0.97 | 0.94 | 1.01 | 0.10 | 0.90 | 0.87 | 0.93 | <0.01 |

AW STEMI, anterior wall ST-segment elevation myocardial infarction; NAW STEMI, non-anterior wall ST-segment elevation myocardial infarction; LOS, length of stay; HR, hazard ratio; CI, confidence interval.

*Multivariate Cox proportional hazards regression model was created with an outcome of 30-day readmission including all predictors with p values < 0.1 and in the univariate analysis eliminating backward for p values ≥0.05 (except age group, hospital year and hospital id).