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Thirty-Day R and Costs aft Myocardial Ir National Rea 2014

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Abstract

Background

Readmission after ST-segment–elevation myocardial infarction (STEMI) poses an enormous economic burden to the US healthcare system. Efforts to prevent readmissions should be based on understanding the timing and causes of these readmissions. This study aimed to investigate contemporary causes, timing, and cost of 30-day readmissions after STEMI.

Methods and Results

All STEMI hospitalizations were selected in the Nationwide Readmissions Database (NRD) from 2010 to 2014. The 30-day readmission rate as well as the primary cause and cost of readmission were examined. Multivariate regression analysis was performed to identify the predictors of 30-day readmission and increased cumulative cost. From 2010 to 2014, the 30-day readmission rate after STEMI was 12.3%. Within 7 days of discharge, 43.9% were readmitted, and 67.3% were readmitted within 14 days. The annual rate of 30-day readmission decreased by 19% from 2010 to 2014 ($P<0.001$). Female sex, AIDS, anemia, chronic kidney disease, collagen vascular disease, diabetes mellitus, hypertension, pulmonary hypertension, congestive heart failure, atrial fibrillation, and increased length of stay were independent predictors of 30-day readmission. A large proportion of patients (41.6%) were readmitted for noncardiac reasons. After multivariate adjustment, 30-day readmission was associated with a 47.9% increase in cumulative cost ($P<0.001$).

Conclusions

Two thirds of patients were readmitted within the first 14 days after STEMI, and a large proportion of patients were readmitted for noncardiac reasons. Thirty-day readmission was associated with an ≈50% increase in cumulative hospitalization costs. These findings highlight the importance of closer surveillance of both cardiac and general medical conditions in the first several weeks after STEMI discharge

Clinical Perspective

What is New?

- Thirty-day readmission rates after ST-segment–elevation myocardial infarction have declined in recent years.
- Nearly two thirds of patients were readmitted early, within the first 14 days after discharge.
- A large proportion of pati asons, particularly after coronar
- Thirty-day readmission w italization cost.

What Are the Clinical Im

- These data suggest that and attention to both cardiac and gene period.
- Further research is warra fter ST-segment–elevation myoc ions after ST-segment–elevation myoc erformance and better outcomes.

Introduction

Recent advances in the trea STEMI) have resulted in improved outcom a significant cause of morbidity and mort 2.1 billion US dollars were spent in 2013 for hospital care of STEMI.[4] Despite efforts to provide prompt revascularization and optimal medical therapy for those presenting with STEMI, ≈20% of patients were readmitted within 30 days of hospitalization in earlier studies.[5] Not surprisingly, 30-day readmission is an enormous economic burden to the US healthcare system and impacts patient quality of life. Significant efforts have been spent on identifying factors associated with 30-day readmissions.[6]

The Medicare Payment Advisory Commission has identified acute myocardial infarction as one of the 7 conditions that frequently result in costly readmission, and the Centers for Medicare & Medicaid Services have tried to address this issue through the Hospital Readmission Reduction Program.[7] In July 2009, the Centers for Medicare & Medicaid Services began reporting 30-day readmission for 3 common medical conditions, one of which was acute myocardial infarction.[8] These measures have become part of a federal strategy to provide incentives to improve quality of care by reducing preventable readmissions.[9] However, to achieve this goal, further understanding of the timing, underlying causes and cost of readmission is needed. Although value-based medical care is becoming of greater emphasis and a measure of hospital performance, modifiable causes of readmissions remain elusive for the majority of these conditions. Identifying common and preventable etiologies of 30-day all-cause readmissions would allow institutions to focus already limited resources and prevent unnecessary readmissions. Using the National Readmission Database (NRD), we aimed to investigate contemporary causes, timing, and cost of 30-day readmissions after STEMI from 2010 to 2014. The impact of percutaneous coronary intervention (PCI), coronary artery bypass grafting (CABG), or medical therapy (no revascularization) during the index STEMI admission on 30-day readmissions was also examined.

Methods

Data Source and Study Population

The authors declare that all supporting data are available within the article and its online supplementary files. Data were obtained from the Agency for Healthcare Research and Quality, which administers the Healthcare Cost and Utilization Project. We used the NRD from 2010 to

year.[10] The NRD is designed to support national readmission analyses and is a publicly available nationally representative healthcare database. In the year 2014, the NRD contained deidentified information for 14 894 613 discharges from 2048 hospitals in 22 states, representing 35 306 427 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 as well as Clinical Classification Software (CCS) codes that ç :al analyses. We identified study population, outcomes using a combination of *ICD-9-CM* tutional Review Board approval and informe all data collection was derived from

Study Population and Varia

From 2010 to 2014, all hospi *CD-9-CM* codes for initial STEMI 410.x1 (n=3 s with *ICD-9* codes 410.7x (subendocardi ure codes were used to identify patients wh 1, 36.02, 36.05, 36.06, and 36.07) or CABG (ogenic shock and cardiac arrest were ider tively. Concurrent use of intra-aort port devices were identified with *ICD-9-C* ents discharged from January thr r completeness of data on 30 days of follow rtality rates stratified by revascularizatic ndex hospitalization. Furthermore, patients with missing data on length of hospital stay were excluded to properly capture interval until readmission. Patients discharged between October and December were additionally excluded during the analysis of 90-day 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; and hospital teaching status, location, and bed size. The overall severity of comorbidities was defined by using the Elixhauser comorbidity score.[11] Length of hospital stay was stratified to ≤3 days, 4 to 5 days, and ≥6 days.

Study End Points

The primary outcome of interest was 30-day all-cause readmission rate according to the methodology described by the Healthcare Cost and Utilization Project.[12] Time to readmission was computed as the number of days from discharge date of index admission to readmission date. Only the first readmission within 30 days after discharge was included, and transfer to another hospital was not counted as a readmission. The primary cause of 30-day readmission was identified based on Clinical Classification Software code in the first diagnosis field of each readmission record and dichotomized into noncardiac and cardiac causes.[12] Noncardiac causes included respiratory, infectious, gastrointestinal, neuropsychiatric/substance, stroke/transient ischemic attack, endocrine/metabolic, genitourinary, hematologic/oncologic, peripheral vascular disease, trauma, complication of medical procedure, and other noncardiac causes. Cardiac causes included angina and chronic ischemic heart disease, heart failure, acute myocardial infarction, nonspecific chest pain, arrhythmia, and other cardiac causes. Furthermore, we identified most common diagnoses of 30-day readmission using *ICD-9-CM* codes in the primary diagnosis field.[13] Exploratory analysis was performed to identify the causes of 90-day readmissions.

Statistical Analysis

All analyses were performed using SAS software, version 9.4 (SAS Institute, Cary, NC). Discharge weight provided by NRD was used for all analyses to obtain national estimates.[10] Domain analysis was used for accurate variance calculations for subgroup analyses. All analyses accounted for hospital-level clustering of patients and complex survey sampling design. For descriptive

Rao-Scott χ^2 test was used for categorical variables and either the Mann-Whitney-Wilcoxon nonparametric test or survey-specific linear regression was used for continuous variables. To identify predictors of 30-day readmission following discharge with STEMI, we created a multivariate Cox proportional hazards regression model for the outcome of 30-day readmission by including covariates that had univariate significance with the outcome (P<0.1). For the cost analysis, the estimated cost for each hospitalization was calculated by merging NRD data with cost-to-charge ratio files pro nd then multiplying the charge for ea ratio. Cumulative cost was define admission. Cumulative cost for patients heir cost of the index admission. Afterward, forming survey-specific multivariate e a normal distribution, as previously de ng statistical significance.

Results

Study Population and Trend

For each year from 2010 to 2 hospitals in 2010 to 2048 hospitals in 20 2010 to 2014, 709 548 patients presented 95% confidence interval [CI], 8.6–8.8), 4.6% (5% CI, 24.9–25.3) for overall cohort, PCI , respectively (P<0.001). Among those wh e readmitted within 30 days of discharge (Table 1). Specifically, 30-day readmission rates were 11.1% (95% CI, 11.0–11.1), 14.9% (95% CI, 14.5–15.3) and 17.6% (95% CI, 17.4–17.9) for PCI cohort, CABG cohort, and no revascularization cohort, respectively. Of the total cohort, 17.8% of patients were readmitted more than once during the 30-day period. During index hospitalizations for STEMI, 78.5% and 4.8% of patients underwent PCI and CABG, respectively, while 16.0% patients were medically treated (without revascularization). The median length of stay during the index hospitalization was 2.5 days (interquartile range [IQR], 1.6–4.4 days), 2.3 days (IQR, 1.5–3.6), 8.7 days (IQR, 6.2–13.1) and 3.0 days (IQR, 1.6–5.5) for the overall cohort, PCI cohort, CABG cohort, and no revascularization cohort, respectively (P<0.001).

Table 1 Baseline Individual- and Hospital-Level Characteristics for Patients Discharged Alive After Index Hospitalization With STEMI, 2010 to 2014

		30-Day Readmission[a]		
Characteristics	**Overall**	**No**	**Yes**	**Value[b]**
Number of admissions	709 548	622 134 (87.7)	87 415 (12.3)	
Patient characteristics				
Age, mean (SE), y	62.9 (0.1)	62.4 (0.1)	66.5 (0.1)	<0.001[c]
Age group, y				
<50	116 388 (16.4)	105 717 (17.0)	10 671 (12.2)	<0.001

EXPAND TABLE

AMA indicates against medical advice; CABG, coronary artery bypass graft; CHF, congestive heart failure; HMO, health maintenance organization; IABP, intra-aortic balloon pump; IQR, interquartile range; PCI, percutaneous coronary intervention; PLVAD, percutaneous left ventricular assist device; SE, standard error; STEMI, ST-segment–elevation myocardial infarction.

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

d Mann-Whitney-Wilcoxon test was used.

e Facility includes skilled nursing facility, intermediate care facility, and inpatient rehabilitation facility.

The annual rate of 30-day readmission (Figure 1) decreased by 19% from 135 449 readmissions per million adults per year (1[illegible]s per year (10.9%) in 2014 (*P*<0.001). T[illegible] readmission in the unrevascularized cohort[illegible]10 to 159 194 per million adults per year (1[illegible]dmission rate decreased by 20% for patie[illegible]illion adults per year (12.3%) in 2010 to 97 8[illegible]. In contrast, the 30-day readmission rate[illegible]ABG after presenting with STEMI. The[illegible] days (IQR, 1.1–5.2), with in-hospital mortali[illegible] median length of stay was 2.3 days (IQR, 1.[illegible].2) for PCI cohort, CABG cohort, and n[illegible]thermore, in-hospital mortality during the[illegible]l, 3.3–4.4) and 8.8% (95% CI, 8.4–9.2) for P[illegible]ort, respectively (*P*<0.001).

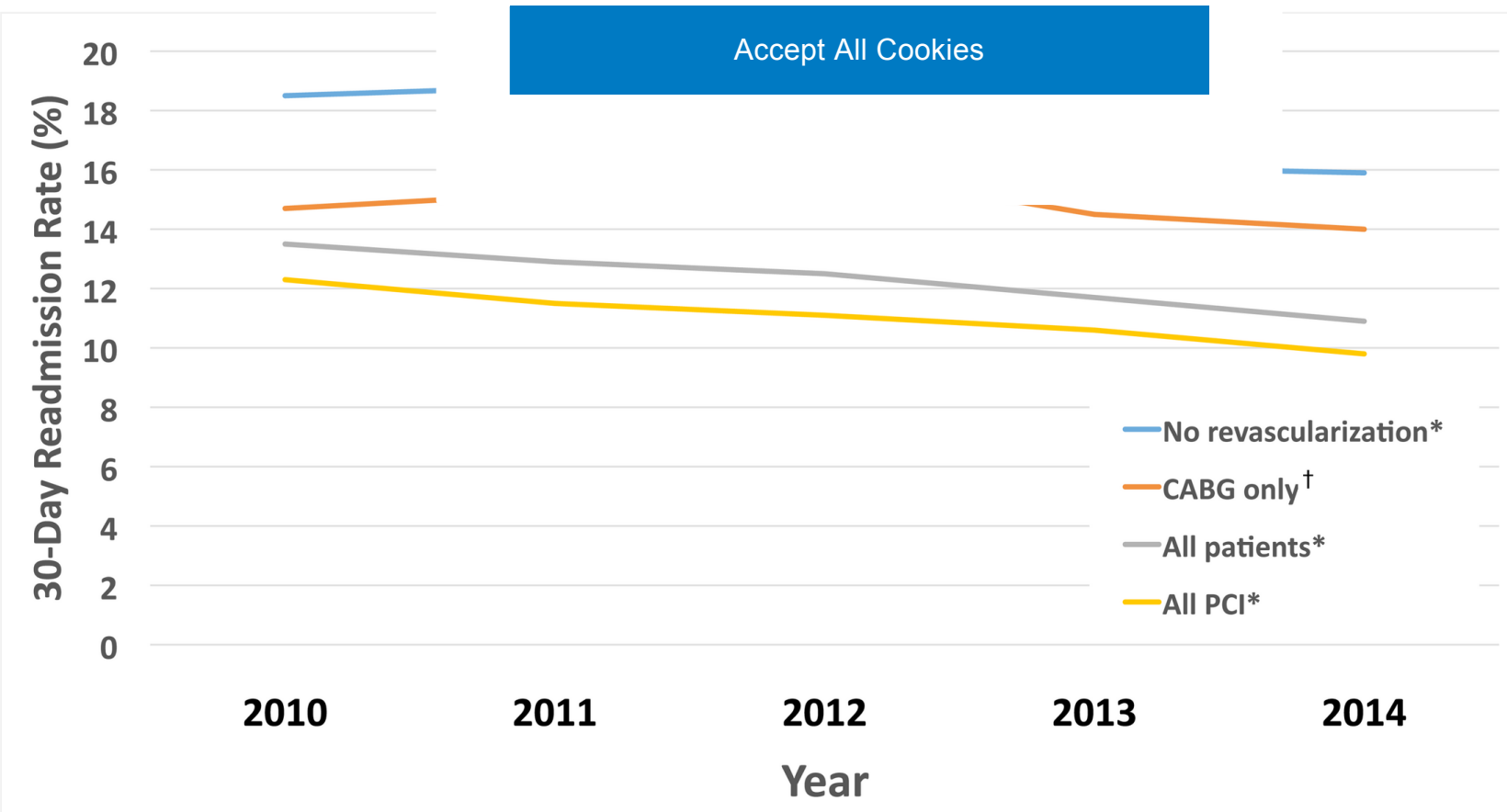

Figure 1 Temporal trends of 30-day readmission rates after index admission for STEMI (ST-segment–elevation myocardial infarction). **P* for trend <0.001. †*P* for trend=0.472. CABG indicates coronary artery bypass graft; PCI, percutaneous coronary intervention.

Table 1 compares baseline characteristics for overall cohort as well as groups stratified by 30-day readmission. Patients readmitted within the 30 days were older and more likely to be female and have hypertension, diabetes mellitus, previous myocardial infarction, previous coronary revascularization, congestive heart failure, peripheral vascular disease, chronic obstructive pulmonary disease, pulmonary hypertension, and chronic kidney disease. In addition, 34.8% of readmitted patients had an Elixhauser comorbidity score >4 versus 18.4% in the nonreadmitted cohort. Patients who presented with either cardiogenic shock or cardiac arrest or those who were not revascularized during the initial admission with STEMI were more likely to be readmitted within 30 days. Furthermore, 30-day readmission was more frequent with >3 days of hospital stay during the index hospitalization, and particularly if the index length of stay was >6 days.

Predictors of 30-Day Readmission After STEMI

Table 2 lists univariate and multivariate predictors of 30-day readmission after initial hospitalization with STEMI. After adjusting for clinical and hospital characteristics, AIDS, anemia

increased risk of 30-day readmission. Although age was not associated with increased risk of readmission, female sex was a strong predictor of 30-day readmission. More importantly, increased length of stay (LOS) during the index hospitalization was highly predictive of 30-day readmission (62% increase in the group with LOS ≥6 days and 40% increase in the group with LOS 4 to 5 days versus the LOS ≤3 days group). In addition, private-payer insurance and self-pay status compared with Medicare were associated with fewer 30-day readmissions. Unadjusted readmission rates were high adjustment, CABG was found to be pred

Table 2 Independent Predictors o

Predictors	egressionb 95%	*P* Value
Female sex		<0.001
Hypertension		<0.001
Diabetes mellitus		<0.001
Dyslipidemia	)	<0.001
Family history of coronary arte	)	0.030

AMA indicates against medical ac re; CI, confidence interval; HMO, health maintenanc tion; PLVAD, percutaneous left ventricular assist device; STEMI, ST-segment-elevation myocardial infarction.

a 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 $P<0.1$ are listed.

b Multivariate Cox proportional hazards regression model was created with an outcome of 30-day readmission including all predictors with $P<0.1$ in the univariate analysis.

c Facility includes skilled nursing facility, intermediate care facility, and inpatient rehabilitation facility.

Independent predictors of 30-day readmission were identified for subgroups of patients who underwent PCI, CABG, or no revascularization at the time of index admission with STEMI (Tables S1 through S3). Chronic kidney disease, chronic obstructive pulmonary disease, diabetes mellitus, congestive heart failure, and increased LOS during the index hospitalization (LOS >4 days) were associated with increased 30-day readmission regardless of revascularization status. Female sex was associated with a greater likelihood of readmission in the revascularized cohort only (adjusted hazard ratio, 1.23; 95% CI, 1.19–1.27 in PCI cohort; adjusted hazard ratio, 1.39; 95% CI, 1.24–1.55 in CABG cohort).

Timing and Causes of 30-Day Readmission After STEMI

Figure 2 and Figure S1 demonstrate the timing of readmission for the overall cohort as well as for subgroups stratified by revascularization status during the index admission for STEMI. Importantly, 43.9% were readmitted within 7 days of discharge, and 67.3% were readmitted within 14 days in the overall cohort, with median time to readmission being 9 days (IQR, 3–17 days). The revascularization status did not impact the timing of readmissions. In the overall cohort, 41.6% of readmissions were attributable to noncardiac causes (Figure 3); this was also seen in PCI and no-revascularization subgroups (Figure S2). In patients who underwent CABG, noncardiac causes accounted for a majority (65.1%) of 30-day readmissions (Figure S2B). In the overall cohort, 24% of 30-day readmissions were secondary to chest pain, angina, or ischemia. In addition, 11.3% of readmissions were attributable to recurrent myocardial infarction, while 13.9% and 4.2% were attributable to heart failure and arrhythmic causes, respectively. Among noncardiac causes,

causes of 30-day readmission, particularly within the first 2 weeks after discharge. In fact, Figure S4 demonstrates that readmissions due to recurrent myocardial infarction (13.3% versus 7.2, *P*<0.001) or heart failure (14.7% versus 12.1%, *P*<0.001) are more common in the first 2 weeks after discharge compared with 15 to 30 days after discharge from index admission. By 90 days, 42.5% of patients were still readmitted for noncardiac causes in the overall cohort, 39.7% in the PCI cohort, 62.7% in the CABG cohort, and 46.7% in the nonrevascularized cohort (Figure S5).

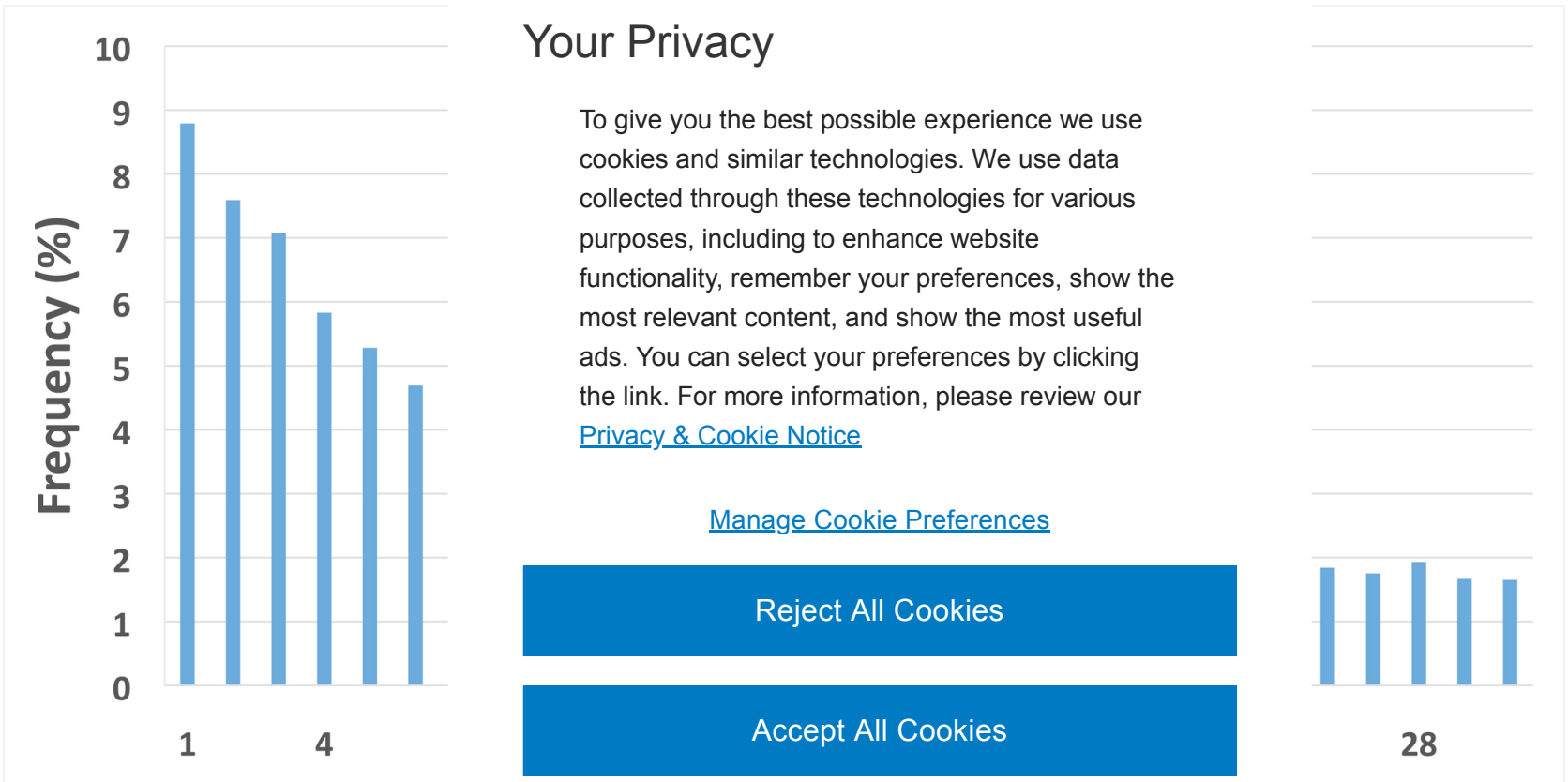

Figure 2 Timing of 30-day readmission by postdischarge day in all patients after index admission for STEMI (ST-segment–elevation myocardial infarction). *43.9% and 55.0% readmitted within 7 and 10 days, respectively. †Median time to readmission (IQR): 9 (3–17) days: 51.6% admitted within 9 days of discharge.

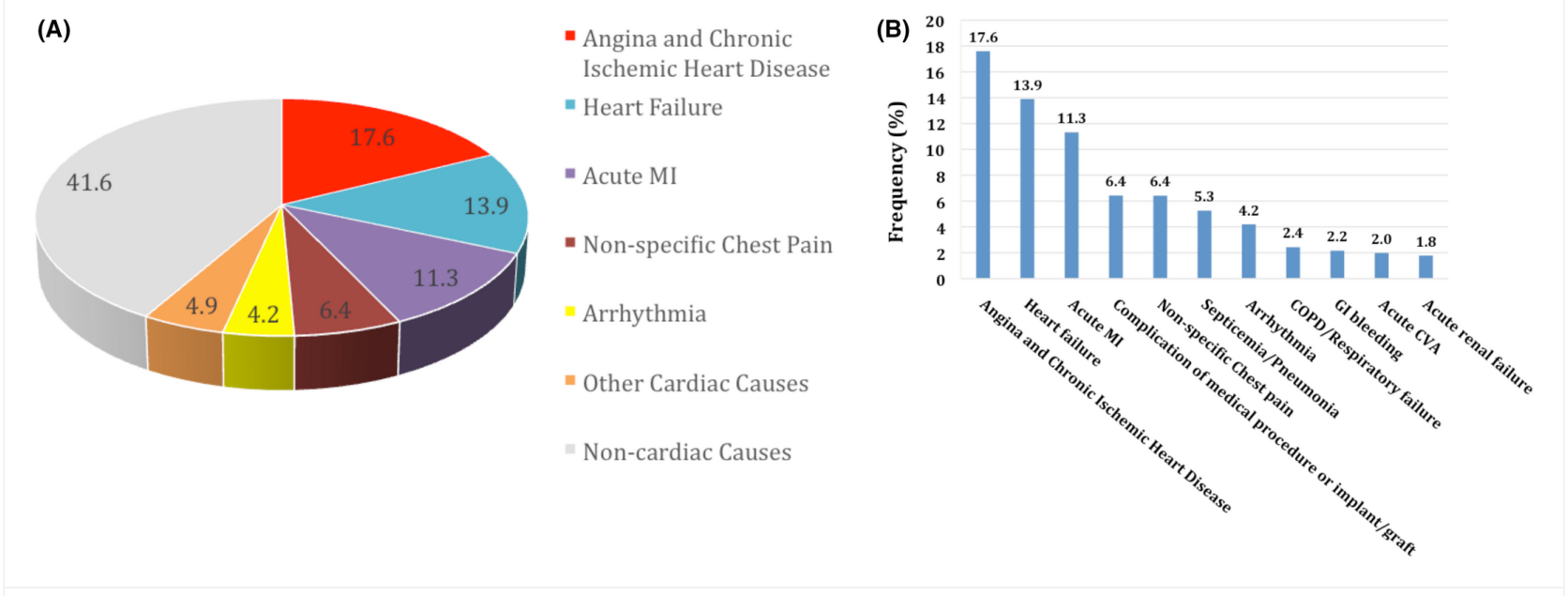

Figure 3 Common causes of 30-day readmission in patients after index admission with STEMI. COPD indicates chronic obstructive pulmonary disease ; CVA, stroke; GI, gastro intestinal; MI, myocardial infarction; STEMI, ST-segment-elevation myocardial infarction.

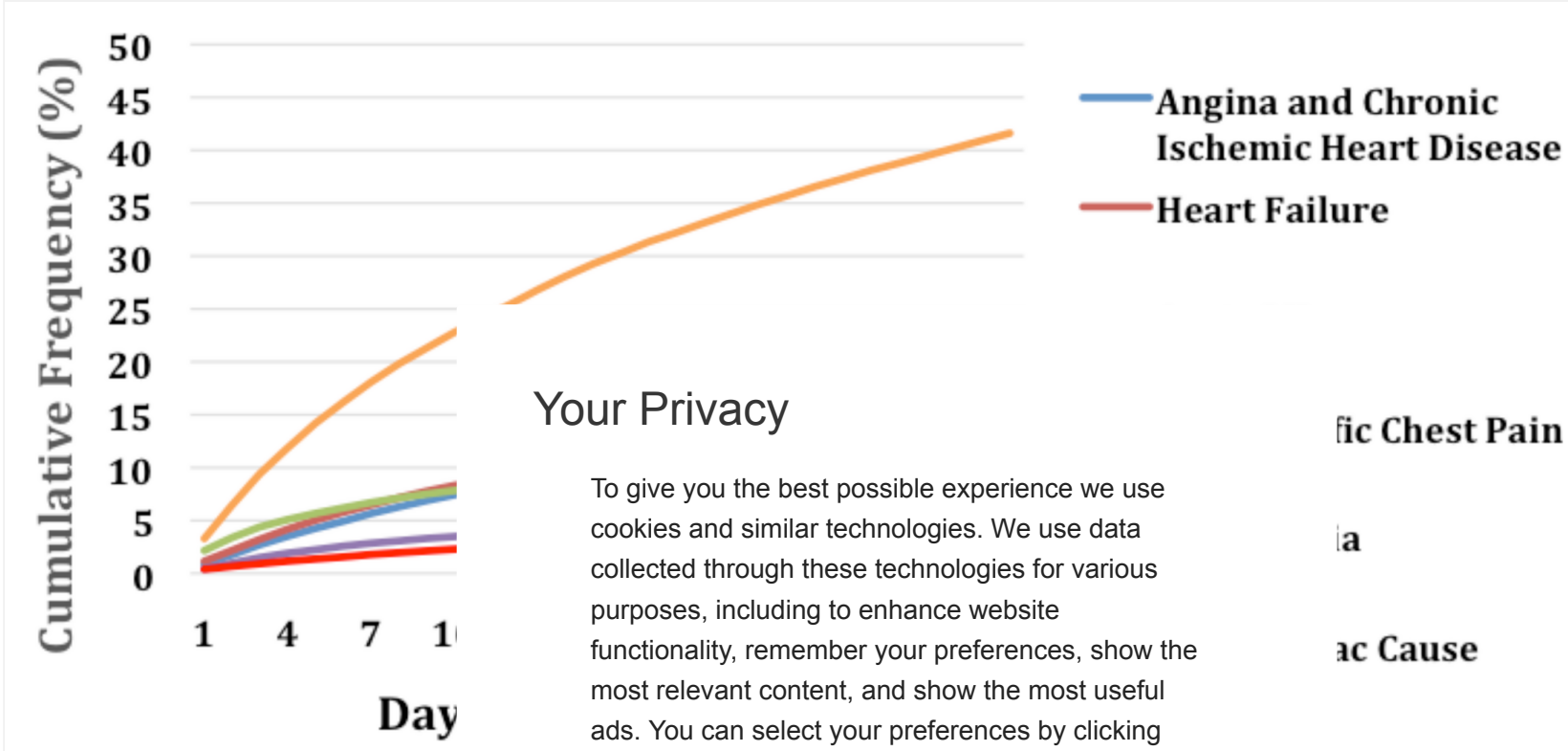

Figure 4 Cumulative frequency of … I (ST-segment-elevation myocardial infarction) p…

Cost of Hospitalization and …

The median cumulative (ind… …ed within 30 days was $31 072 (IQR, $… …ents without 30-day readmission was $18… …relative cost difference was particularly p… …edian cumulative cost for those readmitted within 30 days was $20 959 (IQR, $13 421–34 723), whereas the cumulative cost for patients without 30-day readmission was $9273 (IQR, $6042–14 596), *P*<0.001. Table 3 demonstrates the association of 30-day readmission and cumulative hospitalization cost. After multivariate adjustment, 30-day readmission was associated with 47.9% increase in cumulative cost (95% CI, 0.47–0.49; *P*<0.001). Concomitant comorbidities including congestive heart failure, anemia, previously known coronary artery disease, obesity, peripheral vascular disease, valvular disease, and pulmonary circulation disorders also were independently associated with increased cumulative cost. In addition, cardiogenic shock (16% increase), cardiac arrest (18% increase), and the use of an intra-aortic balloon pump (17% increase) or a percutaneous left ventricular assist device (66% increase) were associated with an increased cumulative cost. As expected, increased LOS (>4 days) was associated with higher cumulative cost, whereas lack of revascularization was associated with lower cumulative hospitalization cost.

Table 3 Independent Predictors of Higher 30-Day Total Cost of Hospitalization in Patients Treated After STEMI

	Univariate Regressiona		Multivariate Regressionb	
Predictors	**β (95% CI)**	***P* Value**	**β (95% CI)**	***P* Value**
30-day readmission	0.556 (0.547–0.564)	<0.001	0.479 (0.472–0.486)	<0.001
Age group, y				
<50	1 (reference)		1 (reference)	
50–64	0.078 (0.071–0.085)	<0.001	0.019 (0.014–0.025)	<0.001
≥65	0.034 (0.025–0.043)	<0.001	0.004 (−0.005 to 0.012)	0.381

EXPAND TABLE

AMA indicates against medical advice; CABG, coronary artery bypass graft; CHF, congestive heart failure; CI, confidence interval; HMO, health maintenance organization; IABP, intra-aortic balloon pump; PCI, percutaneous coronary intervention; PVAD, percutaneous ventricular assist device; STEMI, ST-segment-elevation myocardial infarction.

b Survey-specific multivariate linear regression model was created with an outcome of log-transformed cumulative cost including all predictors with $P<0.1$ in the univariate analysis.

c Facility includes skilled nursing facility, intermediate care facility, and inpatient rehabilitation facility.

Discussion

There are several important
study of the National Readm
of >700 000 STEMI patients
reported rate of ≈20%.[8] The
median length of readmissic
8.7% and readmission in-hos
readmission rates after STEI
medically treated patients. T
the first 14 days after discha
within 30 or 90 days for non
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associated with a 47.9% inci
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ine in 30-day
readmissions after STEMI has been also seen in the fee-for-service Medicare and Veterans Health Administration beneficiaries between 2009 and 2012.[15] The decline in readmissions following STEMI may be due to widespread use of primary PCI (≈80% in our study), adherence to improved antiplatelet and medical therapy, and greater national focus by the Centers for Medicare & Medicaid Services on reducing 30-day readmissions. Angina and ischemic heart disease have been identified as the primary reason for cardiac readmissions in our study. A minority of these readmissions are due to planned PCI, given that a proportion of patients in the United States are readmitted within 30 days after STEMI for planned elective PCI or, less commonly, CABG.[16]

Similar to previous work, we have demonstrated that a large proportion of patients are readmitted early after STEMI, with 67.3% of patients being readmitted within 14 days. The median time to readmission of 9 days in our cohort was similar to the published data in the Medicare population, where median time to readmission was 10 days after STEMI.[5] Given that one third of 30-day readmissions occur during days 15 through 30 after hospitalization, meticulous attention should be paid to the period beyond the initial follow-up visit within 1 to 2 weeks of hospitalization. This may partly explain why outpatient interventions have been ineffective in reducing 30-day readmissions when close outpatient follow-up was lacking.[17] The timing of 30-day readmissions highlights the importance of both early outpatient care and longitudinal surveillance strategies within 30 to 90 days following hospitalization.[18] Measures focusing on supportive discharge interventions have been shown to enhance patient capacity for self-care and have helped to avoid readmissions.[19] Comprehensive programs that focus on both inpatient and outpatient interventions and utilize tools that facilitate cross-site communication can lead to a decrease in early readmissions.[20] Programs focusing on reducing 30-day readmissions should take into account that over one third of all readmissions occur for noncardiac reasons, with two thirds of post-CABG patients being readmitted for medical conditions within 30 days. Therefore, continuity of care with primary care providers from the inpatient setting to strategic follow-up after discharge should be of great importance. This is particularly important in the post-CABG population, where many patients may benefit from earlier and closer medical surveillance (especially in the setting of the global surgical fee). Furthermore, institutions with poorer patient safety performance have been associated with greater unplanned readmissions.[22] Additional follow-up measures, including provider-initiated telephone or videophone communication, the use

Thirty-day hospital readmissions are common and costly, particularly in the elderly and high-risk patients with STEMI.[23] Similar to our data, prior studies have also indicated that the risk of readmission was higher in women compared with men, particularly in younger patients.[24] The analysis of the 2013 National Readmissions Database confirmed an unequal burden of readmissions on women, particularly in younger women.[25] This may be partly explained by the fact that women have atypical presentation symptoms and receive suboptimal care because of fusion in women is often delayed, wh re rehospitalizations.[26] Women nplications after PCI, with lower adoption of Importantly, age was not found to be an studies have indicated that patients >65 ssion.[24] However, despite conflicting with advanced age, the burden of readmiss Thus, it is important to continue monit dherence to process measures based on .

Our study further confirms t he LOS after STEMI has dramatically decl ury.[28] The median LOS for the index ac ites has one of the lowest lengths of stay c ven by financial factors within a healthcare s een raised that very early discharge (<48 h ss, this analysis suggests that early nissions compared with longer LOS c with a prolonged index hospitalization of ≥6 days because of complexity of the clinical presentation and adverse in-hospital post–myocardial infarction events, are much more likely to be readmitted within 30 days. Our findings indicate that hospitals and clinicians (both cardiologists and primary care providers) should intensify their focus and postdischarge surveillance of patients with prolonged LOS given the high risk of subsequent events.

There is a growing interest in examining costs associated with post-STEMI readmissions.[4] Recent data on post-PCI readmissions in 2013 indicate that the mean cumulative costs are higher for those with readmissions ($39 634 versus $22 058; *P*<0.001), with multivariable analysis showing that readmission accounted for a 45% increase in cumulative costs.[14] Our cost analysis data extend these findings to the STEMI population ($31 072 versus $18 169; *P*<0.001). After the multivariable adjustment, the 30-day readmission after STEMI substantially increased the cumulative costs by nearly 50%. This is of particular importance, given the Medicare Access and CHIP Reauthorization Act of 2015, which penalizes hospitals with higher risk-adjusted 30-day readmission rates regardless of the cause for readmission.[33] Such reimbursement policies are designed to encourage hospitals to develop better strategies to prevent expensive 30-day readmissions. Currently, voluntary payment bundles for STEMI care (that extend to 90 days) are being introduced. However, hospitals may be discouraged to participate in such bundles given that ≈40% of 90-day readmissions occur for noncardiac reasons, and thus the hospitals would be forced to absorb the high cost of noncardiac readmissions. Several important questions remain: whether the bundled payment structure will result in better post-STEMI outcomes and whether hospitals should be penalized for noncardiac readmissions after STEMI. Furthermore, policymakers need to ensure that 30-day readmission rates after STEMI is a good-quality metric that leads to better outcomes, which recently has been questioned in the heart failure literature.[34] Further research is needed to examine the preventability of 30-day readmissions after STEMI and to explore whether short-term readmissions after STEMI should serve as a reliable quality metric of hospital performance and better clinical outcomes.

The results of this study should be interpreted in the context of several limitations. First, this is a retrospective study based on data from the NRD, with the sample designed to approximate the national distribution of key hospital characteristics. Our estimates were derived from a 50%

numerous publications.[14] Second, miscoded and missing data can occur in large administrative data sets; however, Healthcare Cost and Utilization Project quality control procedures are routinely performed to confirm that NRD data values are valid, consistent, and reliable.[35] Third, the NRD does not include detailed information about patient clinical characteristics, such as coronary anatomy, heart failure class, left ventricular function, or admission/discharge medications. Data on discharge medications or long-term compliance with medications were not available. Fourth, we have re ough not the main focus of our analysis), spital mortality in patients discharged after could be lower than the actual 30-day post- dmissions because of planned staged eadmission is important for estimation of t efining clinical scenarios and procedures, v auses of readmission may have been the revascularization strategy (e al access, acute renal failure from cont , infection from central line placement, or st ation from 22 states across the United Sta r results cannot be considered completely g

Conclusions

This study examined post-S iation of readmissions on overall 30-(ter STEMI have declined, particularly in those undergoing PCI and in medically treated patients. Nearly two thirds of patients were readmitted early, within the first 14 days after discharge. A large proportion of patients were readmitted within 30 or 90 days for noncardiac reasons, particularly after CABG. Thirty-day readmission was associated with an ≈50% increase in the cumulative hospitalization cost. These data suggest that early readmissions could be prevented by closer surveillance and attention to both cardiac and general medical conditions before and within the early discharge period. Further research is warranted to examine strategies to prevent 30-day readmissions after STEMI and to examine whether short-term readmissions after STEMI should serve as a quality metric of hospital performance and better outcomes.

Sources of Funding

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Disclosures

None.

Supplemental Material

File (jah33447-sup-0001-supinfo.pdf)
Table S1. Independent Predictors of 30-Day Readmission after Index Hospitalization With STEMI in Patients Treated With PCI
Table S2. Independent Predictors of 30-Day Readmission After Index Hospitalization With STEMI in Patients Treated With CABG
Table S3. Independent Predictors of 30-Day Readmission After Index Hospitalization With STEMI in Medically Treated (Nonrevascularized) Patients
Table S4. Cumulative 30-Day Charges and Costs
Figure S1. A, Timing of 30-day readmission by postdischarge day in patients treated with PCI during index

within 7 days, 50.6% within 9 days and 54.0% within 10 days of discharge. †Median time to readmission (IQR): 9 (4–17) days. C, Timing of 30-day readmission by post-discharge day in patients without revascularization during index admission for STEMI. *44.5% and 55.7% admitted within 7 and 10 days, respectively. †Median time to readmission (IQR): 8 (3–17) days: 48.5% and 52.1% admitted within 8 and 9 days, respectively.

Figure S2. Common causes of 30-day readmission after index admission with STEMI in the **(A)** PCI cohort, **(B)** CABG cohort, and **(C)** nonrevascularization cohort.

Figure S3. Cumulative frequency of 30-day readmission for **(A)** cardiac versus noncardiac causes in post-PCI patients, **(B)** cardiac versus nor s noncardiac causes in patients without reva:

Figure S4. Common causes of : sus 15 to 30 days of discharge after index admiss for *<0.001, *P* value for nonspecific chest pair auses=0.32.

Figure S5. Cumulative frequenc es in the overall cohort, **(B)** cardiac and noncarc causes in post-CABG patients, and **(D)** cardiac ed) patients.

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