Readmissions in ST-Elevation Myocardial Infarction and Cardiogenic Shock (from Nationwide Readmission Database)

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Management of ST-elevation myocardial infarction complicated by cardiogenic shock (STEMI-CS) has evolved in the last decade. There is paucity of data on readmissions in this study population. We aimed to assess the burden, major etiologies, and resource utilization for 30-day readmissions among patients with STEMI and CS. The Nationwide Readmission Database was queried from 2010 to 2014. All adult patients with an index admission for STEMI-CS were identified using International Classification of Diseases, ninth edition codes. Patient with mortality on index admission and transfers to other hospitals were excluded. A total of 18,659 admissions were identified with primary diagnosis of STEMI-CS for the study duration. Percutaneous coronary interventions was performed in 78.1% and mechanical circulatory devices were utilized in 53.9% with a mean length of stay of 10.6 (±0.2) days and mean cost of hospitalization of $47,744 (±327). Among these, 2,404 (12.9%) patients were readmitted within 30 days. Major etiologies for readmission include congestive heart failure (25.7%), acute myocardial infarction (9.4%), arrhythmias (4.5%), and sepsis (4.2%). The mean length of stay and cost of hospitalization for 30-day readmission were 5.9 (±0.3) days and $17,043 (±590), respectively. Older age, female gender, lower socioeconomic status, and discharge to home health care were significant predictors for readmission. In conclusion, there is a significant burden of 30-day readmission among patients with STEMI-CS. Percutaneous coronary interventions and mechanical circulatory devices were utilized in a majority of index admissions. Congestive heart failure was the single most common reason for 30-day readmission. Patients discharged to skilled nursing facility, patients with private insurance and higher socioeconomic status were less likely to be readmitted. Moreover, readmissions among STEMI-CS patients contribute to significant resource utilization. **(Am J Cardiol 2019;124:1841−1850)**

Hospital readmissions have been identified as a major source of healthcare burden and have been associated with increased risk of adverse outcomes. Readmissions have become an important performance metric for hospitals and are target of reimbursement-based improvement incentives. Acute myocardial infarction (AMI) is 1 of the 6 readmission measures utilized as a healthcare quality metric. Over the past 2 decades, both in-hospital and 1-year mortality for all AMI have decreased to 5% to 6% and 7% to 18%, respectively.[1−6] Cardiogenic shock (CS) complicates approximately 5% to 8% of ST-elevation myocardial infarction (STEMI) and 2.5% of non-STEMI with a gradual decrease in the incidence over the past 2 decades.[7] In the setting of STEMI, CS occurs due to large left ventricular infarct or by a mechanical complication such as papillary muscle rupture.[8] All cause in-hospital and short-term mortality in CS complicating STEMI has decreased over the past 2 decades from 60%-70% to 47%-51% and to around 30% in recent years which in part is attributed to the increased rate of revascularization.[9−11] Data on 30-day all-cause readmission in STEMI in particular complicated by CS are limited. Hence, we conducted a retrospective study to investigate the prevalence, predictors, cost, and reasons for all-cause 30-day readmission among patients with STEMI-CS based on the National Readmission (NRD) "real-life" database.

Methods

Data were obtained from the NRD between years 2010 and 2014. The NRD is part of the all-payer databases developed by the Agency for Healthcare Research and quality for the Healthcare Cost and Utilization Project. The NRD is derived from the state inpatient databases (SID) and represents ~50% of all US hospitalizations. It is an annual database based on 1 year of discharge data from SIDs with verified patient linkage numbers used to track patients

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across hospitals within a state during a given year. The NRD provides up to 25 diagnoses and 15 procedures for each hospitalization record for years 2010 to 2013. The number of diagnoses coded in the database was expanded to 30 for the year 2014. All these have been coded using the standard International Classification of Diseases, ninth edition, Clinical Modification (ICD-9 CM) codes. All adult hospitalizations (>18 years) with a diagnosis code corresponding to STEMI were included in our study. The list of diagnosis codes used to identify patients with STEMI is shown in Supplementary Table 1. The first diagnosis in the database is referred to as the "principal diagnosis" and is considered the primary reason for admission to the hospital. Further, patients with CS were identified among this study population. The ICD-9 codes for surgical and endovascular procedures performed during the hospitalization are shown in Supplementary Table 2. We used the Charlson co-morbidity score to quantify the co-morbidity of each admitted patient based on 17 categories of diagnoses.[12] In addition, the NRD provides 29 Elixhauser co-morbidities on each hospital admission, based on standard ICD-9 codes.[13] These were used to derive the prevalence of hypertension, diabetes, obesity, and chronic kidney disease in our population. Patients were excluded if (1) age <18 years; (2) mortality on index admission; (3) discharges for the month of December; and (4) transfer to another acute care hospital, to get an accurate estimate of 30-day readmissions.

Incidence of 30-day readmission among patients admitted with primary diagnosis of STEMI and associated CS was calculated. Readmissions were categorized based on elective versus unplanned. Readmission rate was calculated according to the methods recommended by Healthcare Cost and Utilization Project. For any records with more than single readmission within 30 days of discharge, only the first readmission was included. The primary diagnosis for each readmission was identified using the principal diagnosis on readmission. These were further categorized into system-based etiologies. The median length of stay (LOS) and median hospital costs were also calculated to estimate resource utilization. The NRD database provides the total charges associated with each hospital stay that were claimed by the respective hospital. The total charges of each hospital stay were converted to cost estimates using the group average all-payer in-hospital cost and charge information from the detailed reports by hospitals to the Centers of Medicare and Medicaid Services. All costs and charges were then converted to projected estimates for the year 2014, after accounting for annual inflation rates based on consumer price index data available from the Bureau of Labor Statistics.

The incidence of readmission was calculated at 30 days among all eligible primary STEMI admissions with CS. In addition, readmission was quantified using median time to readmission in days. Survey statistics traditionally used to analyze complex semirandom survey designs were employed to analyze these data.[14,15] NRD recommends the use of "strata" for constructing analysis clusters, which include hospital ownership, teaching status, urban/rural location, and bed size. In the NRD database, each hospital admission is linked to a "discharge weight" that can be utilized to calculate projected national estimates for all hospital related outcomes, after accounting for the hierarchical structure of the dataset.[15] Multivariable hierarchical logistic regression analysis with exchangeable matrix (clustered by unique patients) was utilized to determine independent predictors of 30-day unplanned readmissions among patients admitted primarily for STEMI and CS that subsequently survived to hospital discharge. Covariates included age, gender, revascularization during hospitalization, co-morbidity score, hospital characteristics (location and teaching affiliation), socioeconomic status quartile (assessed using median income of the residential zip code), insurance type, disposition, and LOS. In addition, we evaluated the possibility of statistical interactions between the covariates in a systematic fashion. All statistical analyses were performed using the statistical software Stata v 13.1 (Stata Corp, College Station, Texas).

Results

A total of 874,243 nationwide estimated admissions for STEMI were identified for the years 2010 to 2014. Among these a total of 94,998 hospital admissions were identified with associated CS. After excluding patients less than 18 years, mortality on index admission, discharges in the month of December, and transfer to other acute facilities, a total of 43,205 admissions were included in the final study population (Figure 1). Table 1 demonstrates the baseline characteristics of all primary STEMI-CS admissions stratified by patients readmitted within 30 days of discharge and those without readmission. Notably, the study population constitutes a majority of patients between age of 55 and 75 years with high prevalence of hypertension, diabetes, and smoking. Moreover, only 0.7% patients had ICD in place before index admission. Table 1 also demonstrates the differences in baseline socioeconomic status, hospital characteristics, and insurance status of all STEMI-CS admissions. Notably, more patients among the 30-day readmission group belonged to a lower socioeconomic status and were insured with Medicare.

Table 2 demonstrates in-hospital outcomes among the study population comparing those with or without 30 day readmissions. Acute respiratory failure, acute renal failure, atrial fibrillation, and pneumonia were the most prevalent in-hospital complications for the index admissions. Percutaneous coronary interventions (PCI) and coronary artery bypass grafting were performed in 78.2% and 16.7% of all index admissions. Further, mechanical ventilation and mechanical circulatory support were required in a significant proportion of index admissions. The need for skilled nursing facility (SNF) and home health care was observed in 20.7% and 17.8% of hospital admissions in the primary STEMI-CS cohort. Among patients readmitted within 30 days, more were discharged to home health care after index admission as compared to those without any 30-day readmission.

Among all STEMI-CS patients about 2.1% had an encounter for palliative care. Among all patients eligible for palliative care, 45% did not undergo any revascularization and about 52% initially underwent PCI. Further, among all patients with encounter for palliative care, about 61% were dispositioned to SNF and another 22% to home services. These accounted for about 6.2% and 2.6% of all

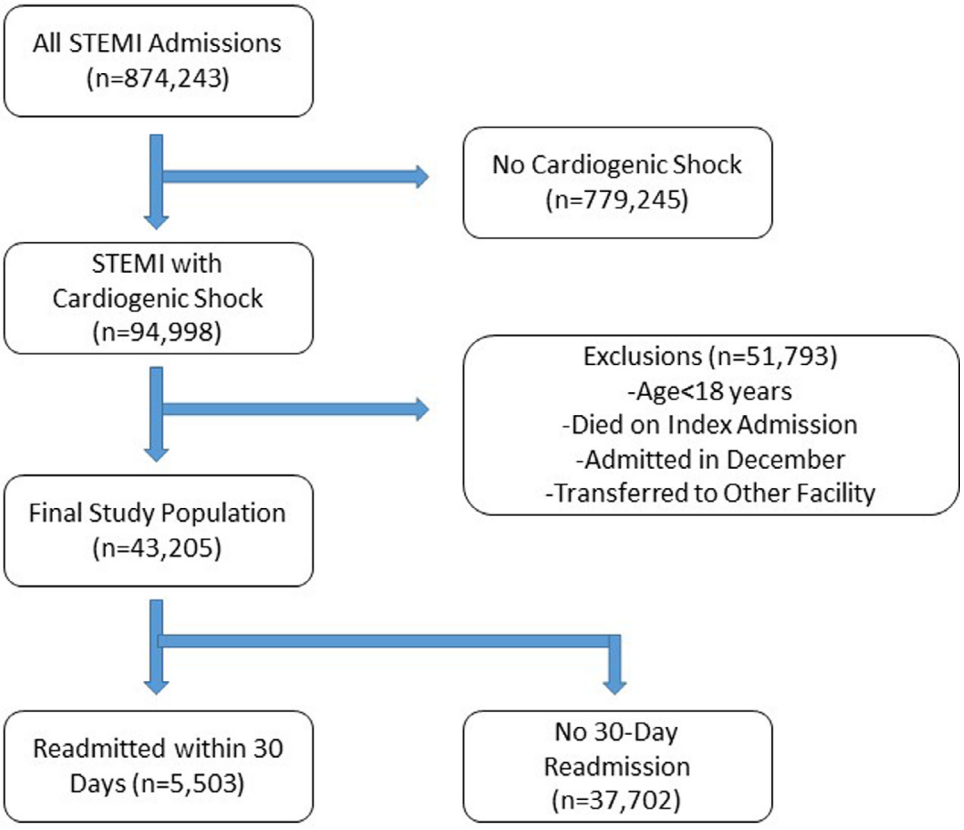

Figure 1. The figure demonstrates the flow diagram depicting study methodology and inclusion criteria.

discharges to SNF and home health care, respectively among this study population.

Total 30-day readmission rate for all primary STEMI-CS admissions was 12.8%. Among these 94% were unplanned readmissions (Table 3). The median time to readmission (interquartile range) was 16 days (interquartile range 11 to 23; Figure 2). Figure 3 shows the overall rate of 30-day readmission per year over the study duration. Overall, there is a trend toward lower readmission rate from 13.2% in 2010 to 11.3% in 2014 (p value <0.05)

Figure 4 demonstrates the common reasons for readmission within 30 days. Except for miscellaneous causes for readmission, heart failure, ischemic heart disease, arrhythmias, chest pain and sepsis were most common causes for repeat admissions. Heart failure was the single most common reason for readmission, accounting for almost a quarter of all 30-day readmissions. Among arrhythmias, 1.8% had paroxysmal ventricular tachycardia, 1.5% had atrial fibrillation or flutter, 0.4% had ventricular fibrillation and the remaining were coded as unspecified arrhythmias. Gastrointestinal bleeding accounted for 2.6% of 30-day readmissions. Further, intracranial hemorrhage was the principal reason for 30-day readmission in about 0.1% of all readmissions. Figure 4 shows system-based etiologies for readmissions. As shown, cardiovascular causes were the most common reason for readmission.

Table 3 demonstrates the major in-hospital outcomes for all 30-day readmissions stratified on the basis of elective versus unplanned readmission. A quarter of all readmissions were admitted over the weekend and as noted there were a significantly more number of weekend admissions among the unplanned 30-day readmissions group. The overall in-hospital mortality for 30-day readmissions was 6.6%. Major in-hospital complications were acute renal failure, atrial fibrillation, acute respiratory failure, pneumonia, and CS. Notably, the rate of pneumonia among unplanned readmissions was significantly higher as compared with elective readmissions. Major in-hospital procedures for all readmissions were PCI and mechanical ventilation. Further, a significant proportion of elective readmissions underwent revascularization with PCI or coronary artery bypass grafting. The requirement of mechanical ventilation among unplanned readmissions was higher as compared with elective readmissions, although this was not statistically significant. A majority of patients after readmission were discharged to home. Moreover, 20.2% and 17.9% patients required home health care and SNF, respectively.

Table 4 demonstrates the predictors of 30-day unplanned readmissions in the study cohort. There was a significant interaction noted between the age and type of insurance. Compared with Medicare-insured patients, those with private insurance had significantly lower 30-day readmission rates among the age group of less than 60 years. However, among patients aged >75 years, private insurance had significantly higher 30-day readmission as compared Medicare-insured patients. Besides this, female gender, initial LOS >5 days, higher Charlson co-morbidity score, patients who underwent PCI, discharge to home health care and patients who left against medical advice were at higher risk of readmission. Notably, obese patients, patients with a palliative care encounter, discharge to SNF, and higher socio-

Table 1
Baseline characteristics of study population

Variable	Overall (n = 18,659)	Thirty-day readmissions		p Value
		No (n = 16,255)	Yes (n = 2,404)	
Weighted	43,205	37,702	5,503	
Age (mean ± standard deviation)	64.3 (64.1-64.5)	64 (63.8-64.2)	66.3 (65.7-66.7)	<0.01
Age by category (years)				
18-34	0.6%	0.7%	0.5%	<0.01
35-54	22.2%	22.7%	19.2%	<0.01
55-74	54.7%	55.0%	52.4%	<0.01
≥75	22.4%	21.6%	27.9%	<0.01
Women	30.9%	30.1%	35.9%	<0.01
Weekend admission	27.5%	27.6%	27.3%	0.76
Prior myocardial infarction	7.1%	7.0%	7.4%	0.53
Prior coronary artery bypass graft	2.0%	2.0%	1.8%	0.40
Prior Stroke	3.4%	3.3%	4.1%	0.04
Peripheral vascular disease	9.9%	9.5%	12.4%	<0.01
Smoking	39.9%	40.0%	39.7%	0.79
Hypertension	56.9%	56.2%	61.5%	<0.01
Diabetes mellitus	30.3%	29.5%	35.1%	<0.01
Congestive heart failure	49.8%	49.0%	55.2%	<0.01
Obesity	12.6%	12.9%	11.2%	0.02
Renal failure	13.0%	12.6%	16.4%	<0.01
Prior coronary artery bypass graft	2.0%	2.0%	1.8%	0.41
Socioeconomic status (quartile)				
1st	27.2%	26.8%	30.3%	<0.01
2nd	25.7%	25.6%	26.1%	<0.01
3rd	25.4%	25.6%	24.3%	<0.01
4th	21.7%	22.0%	19.4%	<0.01
Insurance				
Medicare	47.8%	46.7%	55.1%	<0.01
Medicaid	9.3%	9.2%	9.7%	<0.01
Private	29.8%	30.8%	23.5%	<0.01
Self	7.8%	7.9%	6.9%	<0.01
Others	5.3%	5.4%	4.8%	<0.01
Hospital type				
Metropolitan nonteaching	42.2%	42.0%	43.3%	0.45
Metropolitan teaching	54.0%	54.3%	52.9%	0.45
Non metropolitan	3.8%	3.7%	3.8%	0.45
Hospital bed size				
Small	5.1%	5.0%	5.3%	0.60
Medium	20.6%	20.6%	21.3%	0.60
Large	74.3%	74.4%	73.4%	0.60

economic status were at a lower risk of readmission within the first 30 days.

Figure 5 shows the mean LOS and mean cost of hospitalization over the study duration. The mean LOS decreased from 11.5 days in 2010 to 9.4 days in 2014 (p trend <0.05). The mean cost of index hospitalization has gradually increased from $46,502 in the year 2010 to $51,825 in 2014 (p trend <0.05) for this study cohort. Further, the mean LOS for all 30-day readmissions was 5.9 days over the study duration with no significant trend over years. Similarly, the mean cost of hospitalization for all 30-day readmissions was $17,896 for the 5-year study duration (Figure 5).

Discussion

The current study has evaluated the incidence and predictors of readmission at 30 days among patients admitted with STEMI and CS, using a large administrative database. Our study is the first national database study to assess 30-day readmission rate among patients with STEMI and CS over a period of 5 years. There are several important findings. First, there is a high rate of 30-day readmission among this study population. The most common reasons for readmission were congestive heart failure, AMI, and arrhythmias. Second, 30-day readmissions among this study population contribute to a significant resource utilization. Third, the major independent predictors for 30-day readmission include female gender, higher initial LOS, higher number of co-morbidities, lower socioeconomic status, and discharge to home health care. On the contrary, encounter for palliative care and discharge to SNF were associated with less likelihood of 30-day readmission. Fourth, the major in-hospital outcomes for STEMI-CS patients include acute respiratory failure, acute renal failure, and

Table 2
In-hospital outcomes for all index hospitalizations with STEMI and cardiogenic shock

Variable	Overall	Thirty-day readmissions		p Value
		No	Yes	
In-hospital complications				
Acute renal failure	30.5%	30.4%	30.9%	0.60
Pneumonia	14.3%	14.4%	13.1%	0.07
Sepsis	6.8%	7.2%	4.7%	<0.01
Atrial fibrillation	21.4%	21.1%	23.4%	<0.01
Major bleeding	3.9%	3.9%	3.9%	0.92
Pulmonary embolism	0.6%	0.7%	0.2%	<0.01
Pressors	6.9%	6.8%	7.3%	0.39
Acute respiratory failure	44.7%	45.2%	41.4%	<0.01
Cardiac arrest	18.7%	19.4%	13.8%	<0.01
Encounter for palliative	2.1%	2.3%	0.8%	<0.01
In-hospital Procedures				
Percutaneous coronary intervention	78.2%	77.9%	79.8%	0.04
Mechanical circulatory support	53.9%	53.7%	55.6%	0.07
Pacemaker insertion	1.4%	1.4%	1.6%	0.42
Mechanical ventilation	36.2%	36.7%	32.6%	<0.01
Thrombolysis	3.4%	3.4%	3.3%	0.78
Temporary pacing	8.0%	8.1%	7.5%	0.31
Implantable cardioverter-defibrillator	2.1%	2.2%	1.3%	<0.01
Coronary artery bypass graft	16.7%	16.8%	15.6%	0.12
Disposition				
Home	56.6%	57.2%	52.5%	<0.01
Short term Hospital	4.3%	4.2%	4.4%	<0.01
Skilled nursing facility	20.7%	20.8%	19.8%	<0.01
Home health care	17.8%	17.2%	22.0%	<0.01
Left against medical advice	0.5%	0.4%	1.2%	<0.01

pneumonia. Fifth, a majority of patients were discharged to home, and more than 1 of every 3 patients required either a SNF or home health care.

Unplanned hospital readmissions contribute to a staggering amount of annual healthcare expenditure.[16–18] It is not surprising that unplanned hospital readmission rates are being used as a quality of care metric for hospitals with financial implications for excessive rates of readmission. Multiple studies have shown a steady gradual decrease in case fatality rate among AMI patients complicated by CS.[5,19] These findings are reflective of the overall impact of quality improvement initiatives in last few decades, the changes in reperfusion strategies, and increased utilization of mechanical circulatory support.[20] This study demonstrates that even though the overall 30-day readmission rate for STEMI-CS patients is trending down, there is still a significant burden of readmission. Further, we have established that heart failure is the single most important reason for 30-day readmission accounting for almost 1 of 4 readmissions. This is consistent with the findings of Shah et al who demonstrated a high rate of heart failure readmission among all AMI patients with CS.[21] It is important to note that even though cardiovascular etiologies contribute to a majority of readmissions, there is a significant proportion of patients who were readmitted for other non-cardiac causes and complications. This suggests that these patients require comprehensive discharge planning keeping in mind the multiorgan systemic involvement and possible complications from the hospitalization.

Our study shows that greater number of co-morbidities are associated with more number of readmissions at 30-day for this study population. Walraven et al have demonstrated a direct impact of rising Charlson co-morbidity index on the rate of readmission.[22] Other predictive factors for readmissions include female gender and longer initial LOS. Factors underlying the gender differences in outcomes are poorly understood. Previous studies have shown that women are more likely to have worse post AMI outcomes including in-hospital mortality and LOS.[23] Similarly, patients with lower socioeconomic status have higher risk of readmission. Income-related discrepancies in outcomes have also been previously reported and established particularly among elderly Medicare beneficiaries.[24,25] LOS is associated with age and other co-morbidities along with several immeasurable variables like patient frailty, social support, education status as well as patient's ability to deal with a new problem along with physician's interpretation of the patient's outpatient needs. As several of these variables are highly subjective, LOS might serve as an important determinant of this "immeasurable co-morbidity."

Patients discharged to home health services were more likely to be readmitted. On the contrary, those discharged to SNF were less likely to readmitted. Although our data do not allow us to determine with certainty the exact causes for the observed differences, there are few possible explanations. Patients are usually referred for home health services if there are concerns regarding functional status and health literacy but there is insufficient basis for discharge to a facility.[26] Moreover, Kelly et al have previously studied and shown that physicians commonly overestimate patients' literacy level and this may be a source of disparity

Table 3
In-hospital outcomes of 30-day readmissions

Variable	Overall	Elective readmission	Unplanned readmission	p Value
Number of readmissions	n = 2,404	n = 147	n = 2,257	
Weighted	n = 5,503	n = 341	n = 5162	
Weekend admission	24.8%	12.2	25.6	<0.01
In-hospital complications				
Acute renal failure	21.5%	16.3%	21.9%	0.11
Pneumonia	10.5%	4.8%	10.8%	0.02
Sepsis	6.7%	4.8%	6.8%	0.33
Atrial fibrillation	19.9%	15.7%	20.3%	0.17
Major bleeding	3.8%	3.4%	3.8%	0.82
Pulmonary embolism	3.1%	2.0%	3.2%	0.43
Pressors	1.5%	2.0%	1.4%	0.54
Acute respiratory failure	16.1%	11.6%	16.4%	0.12
Cardiac arrest	2.9%	1.4%	3.0%	0.25
Cardiogenic shock	9.6%	7.5%	9.8%	0.37
Encounter for palliative	3.5%	2.0%	3.6%	0.32
In-hospital procedures				
Percutaneous coronary intervention	11.3%	27.9%	10.2%	<0.01
Mechanical circulatory support	3.4%	4.1%	3.3%	0.62
Pacemaker insertion	0.6%	0.0%	0.6%	0.34
Mechanical ventilation	10.4%	6.8%	10.4%	0.14
Thrombolysis	1.3%	2.7%	1.2%	0.11
Temporary pacing	0.42%	0.0%	0.4%	0.42
Implantable cardioverter-defibrillator	2.4%	1.4%	2.4%	0.41
Coronary artery bypass graft	3.5%	25.2%	2.1%	<0.01
Disposition				
Home	53.1%	55.8%	52.9%	0.93
Short term hospital	1.3%	1.4%	1.3%	0.93
Skilled nursing facility	17.9%	15.7%	18.2%	0.93
Home health care	20.2%	21.8%	20.1%	0.93
Left against medical advice	0.7%	0.7%	0.7%	0.93
Mortality	6.6%	4.8%	6.7%	0.35

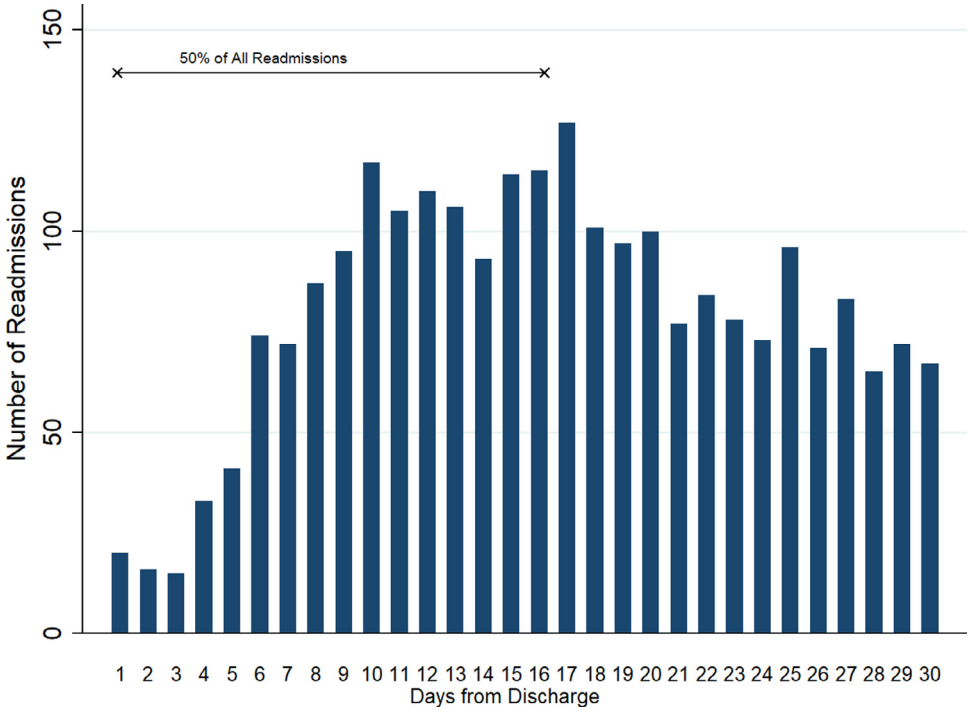

Figure 2. The figure demonstrates the distribution of readmissions within 30 days from the day of discharge.

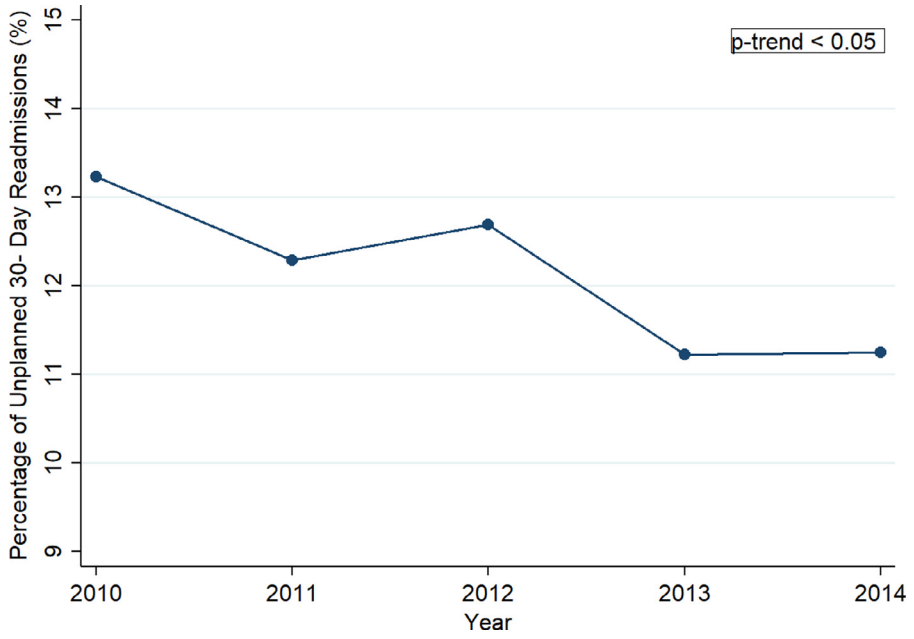

Figure 3. The figure demonstrates the trend of 30-day unplanned readmission rate for all patients with an index admission for STEMI-CS over the years 2010 to 2014.

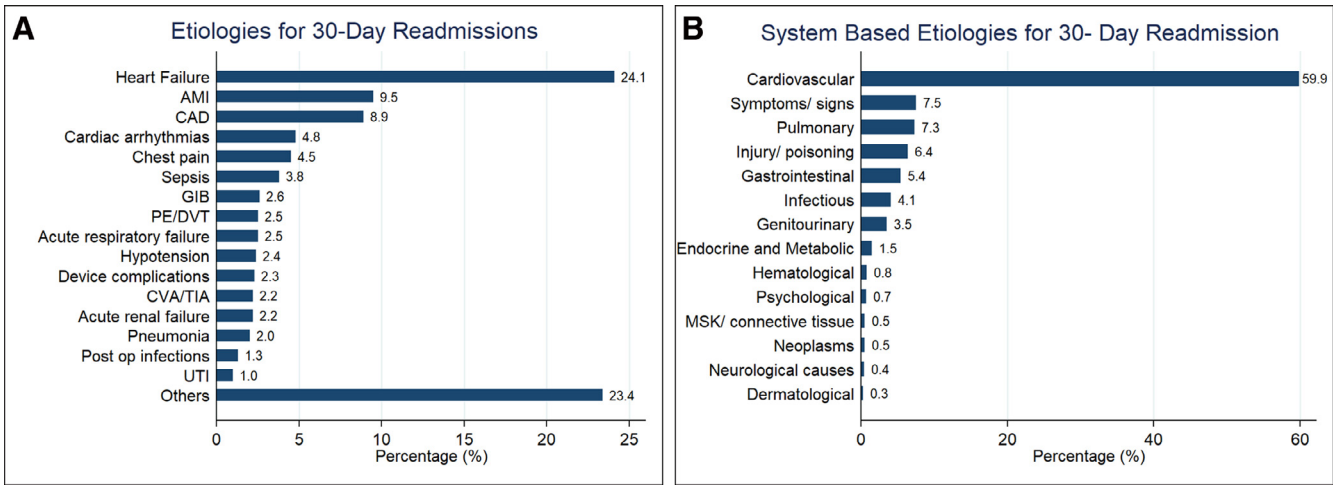

Figure 4. The figure demonstrates the primary reason for 30-day readmission among patients with STEMI-CS during index hospitalization. Panel A demonstrates the ICD-9 code-based principal diagnosis for readmission and panel B demonstrates the system-based etiologies for readmission within 30 days of discharge from the index hospitalization. Numbers besides individual bars denote the percentage of patients presenting with the corresponding diagnosis.

in health care.[27] Further, among patients eligible for palliative care, a majority were discharged to SNF and in-hospital encounters for palliative were associated with lower readmission rates. This may to some extent account for the less likelihood of readmission with discharge to SNF.[28,29] Although 30-day readmissions have traditionally been utilized as a quality metric by Centers of Medicare and Medicaid Services on which reimbursement is based for PCI, adoption of similar policy for patients with co-existing CS requires some deliberation and caution. This is because a significant proportion of readmissions are not for procedural complications, and there is still a significant proportion of readmissions for noncardiovascular reasons. Our study along with several others reinstates the need for rational clinical pathways where the focus should be on treating underlying medical co-morbidities, improving access to medical care along with intensifying outpatient management and close follow up of these patients.

Our study has several important limitations that are inherent to large administrative databases. First, there may be errors in coding of diseases or procedures. Second, this is an observational study, which is subject to traditional biases of observational studies such as selection bias. Third, NRD does not provide details about anatomic characteristics and echocardiographic data. It was also not possible to determine the home/discharge medications and compliance to guideline-directed therapies from the database. Although the comparison of outcomes was adjusted for Charlson co-morbidity

Table 4
Predictors for 30-day unplanned readmissions

Variable	OR (95% CI)		
	Age <60 years	Age 60 to 75 years	Age >75 years
Primary payor			
Medicare	Reference	0.89 (0.69-1.17)	1.12 (0.85-1.46)
Medicaid	0.84 (0.61-1.15)	1.50 (0.96-2.33)	0.67 (0.25-1.81)
Private insurance	0.64 (0.49-0.85)	1.28 (0.90-1.80)	2.18 (1.32-3.60)
Others	0.76 (0.52-1.11)	0.89 (0.58-1.37)	1.06 (0.44-2.56)
Women		1.24 (1.10-1.37)	
Length of stay ≥5 days		1.23 (1.07-1.41)	
Charlson co-morbidity index			
1		Reference	
2		1.18 (1.02-1.37)	
3		1.39 (1.19-1.64)	
4		1.49 (1.23-1.81)	
≥5		1.88 (1.56-2.27)	
Obesity		0.81 (0.69-0.96)	
Prior stroke		1.15 (0.39-3.4)	
Encounter for palliative care		0.29 (0.16-0.50)	
Mechanical circulatory support		1.08 (0.97-1.20)	
Revascularization			
No revascularization		Reference	
Percutaneous coronary intervention		1.21 (1.03-1.42)	
Coronary artery bypass graft		0.99 (0.80-1.22)	
Disposition			
Home		Reference	
Transfer to short term facility		1.08 (0.82-1.41)	
Skilled nursing facility		0.83 (0.71-0.96)	
Home health care		1.26 (1.10-1.45)	
Left against medical advice		3.37(2.01-5.67)	
Socioeconomic status (quartile)			
1st		Reference	
2nd		0.91 (0.79-1.04)	
3rd		0.84 (0.73-0.96)	
4th		0.78 (0.67-0.91)	
Hospital teaching status			
Metropolitan nonteaching		Reference	
Metropolitan teaching		0.92 (0.83-1.02)	
Nonmetropolitan		0.79 (0.59-1.05)	

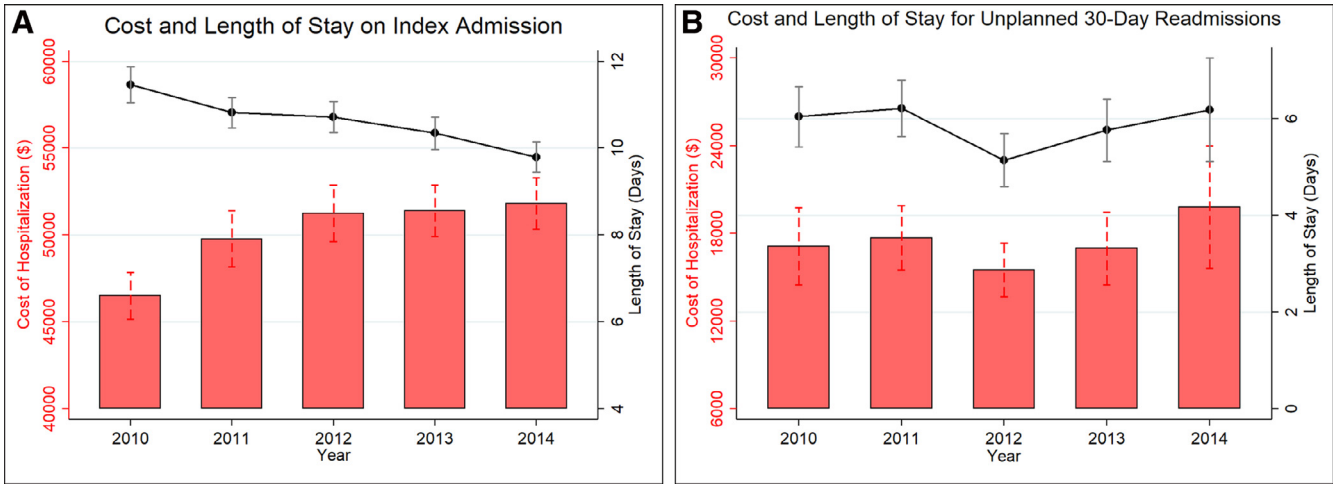

Figure 5. The figure demonstrates the trend of length of stay (black line) and cost of hospitalization (red bars) over the years 2010 to 2014 for STEMI-CS patients on index hospitalization *(Panel A)* and the trend for all 30-day readmissions after index hospitalization for STEMI-CS *(Panel B)*. (Color version of figure is available online.)

score, it is possible that differences might arise due to residual confounding. Fourth, NRD reports discharge information from 22 states across United States and represents a sizeable national population. However, these results should not be completely generalized. Lastly, the readmissions cannot be tracked across calendar years or different states. This may possibly represent an underestimation of actual outcomes.

In conclusion, readmission rate at 30 days is high among STEMI patients who survive CS. More than half of the readmissions are of cardiovascular etiology and heart failure is the single most common etiology of readmission within 30 days of discharge. Female gender, longer initial LOS, lower socioeconomic status, higher number of baseline co-morbidities, and discharge to home health services are important predictors for readmission. Readmissions among STEMI-CS patients contribute to significant resource utilization.

Disclosures

The authors have no conflicts of interest to disclose.

Supplementary materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.amjcard.2019.08.048.

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