ORIGINAL RESEARCH

Fifteen-Year Trends in Incidence of Cardiogenic Shock Hospitalization and In-Hospital Mortality in the United States

Mohammed Osman, MD; Moinuddin Syed, MD; Saikrishna Patibandla, MD; Samian Sulaiman, MD; Babikir Kheiri, MD, MSc; Mahek K. Shah (ID), MD; Christopher Bianco, DO; Sudarshan Balla (ID), MD; Brijesh Patel (ID), DO

BACKGROUND: There is a lack of contemporary data on cardiogenic shock (CS) in-hospital mortality trends.

METHODS AND RESULTS: Patients with CS admitted January 1, 2004 to December 31, 2018, were identified from the US National Inpatient Sample. We reported the crude and adjusted trends of in-hospital mortality among the overall population and selected subgroups. Among a total of 563 949 644 hospitalizations during the period from January 1, 2004, to December 30, 2018, 1 254 358 (0.2%) were attributed to CS. There has been a steady increase in hospitalizations attributed to CS from 122 per 100 000 hospitalizations in 2004 to 408 per 100 000 hospitalizations in 2018 (P_{trend}<0.001). This was associated with a steady decline in the adjusted trends of in-hospital mortality during the study period in the overall population (from 49% in 2004 to 37% in 2018; P_{trend}<0.001), among patients with acute myocardial infarction CS (from 43% in 2004 to 34% in 2018; P_{trend}<0.001), and among patients with non–acute myocardial infarction CS (from 52% in 2004 to 37% in 2018; P_{trend}<0.001). Consistent trends of reduced mortality were seen among women, men, different racial/ethnic groups, different US regions, and different hospital sizes, regardless of the hospital teaching status.

CONCLUSIONS: Hospitalizations attributed to CS have tripled in the period from January 2004 to December 2018. However, there has been a slow decline in CS in-hospital mortality during the studied period. Further studies are necessary to determine if the recent adoption of treatment algorithms in treating patients with CS will further impact in-hospital mortality.

Key Words: cardiogenic shock ■ in-hospital mortality ■ national trends

Cardiogenic shock (CS) is a highly fatal condition and is a significant cause of morbidity and mortality.[1] With the expansion in mechanical circulatory support (MCS) strategies, timely revascularization, and advances in intensive care, there has been a reduction in mortality among patients with CS.[2–5] Previous studies on mortality in patients with CS have been limited to multicenter registries from participating hospitals or single-center studies, which may not represent national outcomes.[2,4,6] Few studies used national databases to report in-hospital mortality rates, but they used old data that may not represent the most recent trends.[7,8] This study's primary objective was to report the contemporary temporal trends in in-hospital mortality among patients with CS. In addition, we explored the mortality trends based on demographic variables such as sex, race/ethnicity, etiology of CS, and regional variations in the trends of CS in-hospital mortality.

METHODS

Study Data

The study was derived from National Inpatient Sample (NIS) data from January 1, 2004, to December 31, 2018. The NIS database is part of the Healthcare Cost and

CLINICAL PERSPECTIVE

What Is New?

- Hospitalizations attributed to cardiogenic shock (CS) tripled in the period from January 2004 to December 2018.
- There has been a steady decline in CS in-hospital mortality in the United States during the study period from 1 in 2 in 2004 to about 1 in 3 in 2018.

What Are the Clinical Implications?

- A slow decline in CS mortality has been observed during the study period.
- Despite the currently available treatment strategies for CS, mortality among patients with CS continues to be substantial and warrants further research to improve CS outcomes.

Nonstandard Abbreviations and Acronyms

CS	cardiogenic shock
MCS	mechanical circulatory support
NCSI	National Cardiogenic Shock Initiative
NIS	National Inpatient Sample

Utilization Project databases and is sponsored by the Agency for Healthcare Research and Quality.[9] The NIS is the largest publicly available all-payer administrative claims-based database and contains patient discharges from 1000 hospitals in 45 states. It has clinical and resource use information on >7 million discharges annually. Weighted, it represents >35 million hospitalizations nationally on an annual basis. These data are stratified to represent 20% of US inpatient hospitalizations across different hospital and geographic regions (random sample).[9] National databases have been used extensively to study national trends, disparities, and outcomes of different cardiac procedures.[7,10–15] Because of the NIS database's deidentified nature and public availability, institutional review board approval and informed consent were not required for this study. Because of the sensitive nature of the data collected for this study, requests to access the data set from qualified researchers trained in human subject confidentiality protocols may be sent to the Healthcare Cost and Utilization Project at https://www.hcup-us.ahrq.gov/tech_assist/centdist.jsp.

Study Population

Adult patients (≥18 years) admitted with CS from January 1, 2004 to December 31, 2018 were identified in the NIS using the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) and *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM) codes 78551 and R570, respectively. The *ICD-9-CM* and *ICD-10-CM* codes for CS used in the current study have been previously validated.[16,17] We excluded the following patients: (1) patients with missing mortality, age, or sex data, (2) patients aged <18 years, (3) patients who were admitted electively to the hospital, and (4) patients who were transferred out from the receiving hospital.

We have reported the trends of in-hospital mortality in the following populations: (1) among all patients who received the diagnosis of CS during their hospitalization, (2) among patients with acute myocardial infarction (AMI) CS (AMI-CS), and (3) among patients with non–AMI-CS. The AMI-CS cohort was identified by selecting patients with the principal diagnosis of AMI (ST-segment–elevation myocardial infarction or non–ST-segment–elevation myocardial infarction) and then identifying patients with a secondary code of CS. For the non–AMI-CS cohort, we identified patients with CS who lacked a concomitant code for acute coronary syndrome as a primary or secondary diagnosis.

In addition, as previous studies suggested regional variations and disparity based on sex and race in the management and outcomes of CS, we reported in-hospital mortality trends among patients with CS stratified by sex, race/ethnicity, US regions, hospital bed size, and hospital teaching status.[11,18,19] Furthermore, we reported the trend of mortality among patients who were treated with MCS (intra-aortic balloon pump, percutaneous left ventricular assist devices, and extracorporeal membrane oxygenation) and among the patients with AMI-CS who received revascularization (percutaneous coronary intervention or coronary artery bypass grafting).

In addition, and to study the difference in the treatment strategies for patients with AMI-CS and non–AMI-CS, the study period was divided into the following 3 different eras: (1) pre–percutaneous left ventricular assist device approval era (2004–2007); (2) percutaneous left ventricular assist device era (2008–2014), which corresponded to the US Food and Drug Administration approval of Impella (AbioMed, Danvers, MA) and the wide adoption of robust MCS in the management of CS; and (3) shock team era (2015–2018), during which an algorithmic approach for the management of CS was implemented and used by multiple institutions across the United States.[2,4,20–22] We reported the treatment strategies for patients with AMI-CS and non–AMI-CS across the different eras.

Study End Points

The current study's primary end point was the trend of in-hospital mortality during the study period.

Furthermore, we studied the differences in the care of patients with AMI-CS and non–AMI-CS by reporting the percentage of patients treated with MCS, durable left ventricular support devices, mechanical ventilation, and renal replacement therapy across the different eras. The list of the *ICD-9-CM* and *ICD-10-CM* codes used in the current analysis is shown in Table S1.

Statistical Analysis

All variables are expressed as weighted national estimates. This was done following the survey analysis method by incorporating the HOSP_NIS as a clustering variable and accounting for the different strata in the NIS design using the NIS_STRATUM as recommended in the Agency for Healthcare Research and Quality methods series. For trend analysis, and because of the NIS design change following the year 2011, we followed the Agency for Healthcare Research and Quality methods to adjust for that by incorporating the correct sample weight.[9] For trend analysis, we used the Mantel-Haenszel χ^2 test of linear association.

We used multilevel generalized structural equation modeling to adjust for selected covariates to report the adjusted mortality trends. Following that, we applied marginal standardization using the Stata postestimation margins command to estimate the predicted probability (adjusted rates) of in-hospital mortality per year while accounting for the selected covariates. We used marginal standardization because it has been shown to be an appropriate method when making an inference to the overall population.[23] Variables included in the regression models included demographics (age, sex, race/ethnicity), all Elixhauser comorbidities,[24] and hospital characteristics (hospital region and bed size). We removed the corresponding covariate from the regression model when it was the subgroup of interest (eg, when conducting analysis stratified by sex, we removed sex from the covariate list). A P value of <0.05 was considered statistically significant. All statistical analyses were performed using Stata Statistical Software version 15.1 and SPSS version 26 (IBM Corp).

RESULTS

Among a total of 563 949 644 hospitalizations during the period from January 1, 2004, to December 30, 2018, 1 254 358 (0.2%) were attributed to CS. There has been a steady increase in hospitalizations attributed to CS from 122 per 100 000 hospitalizations in 2004 to 408 per 100 000 hospitalizations in 2018 (P_{trend}<0.001). This increase was observed among AMI-CS (from 44 per 100 000 hospitalizations in 2004 to 103 per 100 000 hospitalizations in 2018) and non–AMI-CS (from 68 per 100 000 hospitalizations in 2004 to 258 per 100 000 hospitalizations in

2018) (Figure 1). This was accompanied by a decline in in-hospital mortality during the study periods from 49% in 2004 to 37% in 2018 (P_{trend}<0.001). The reduction in in-hospital mortality was seen among both patients with AMI-CS (from 44% in 2004 to 35% in 2018; P_{trend}<0.001) and non–AMI-CS (from 53% in 2004 to 36% in 2018; P_{trend}<0.001). The results remained significant even after the adjustment for covariates with the overall in-hospital mortality improving from 49% in 2004 to 37% in 2018 (P_{trend}<0.001), AMI-CS improving from 43% in 2004 to 34% in 2018 (P_{trend}<0.001), and non–AMI-CS improving from 52% in 2004 to 37% in 2018 (P_{trend}<0.001) (Figure 2).

In the unadjusted analysis, a consistent reduction of in-hospital mortality was seen among men (from 47% in 2004 to 35% in 2018; P_{trend}<0.001) and women (from 51% in 2004 to 40% in 2018; P_{trend}<0.001) (Figure 3). Furthermore, the trends showed a consistent reduction in in-hospital mortality among White patients (from 50% in 2004 to 37% in 2018; P_{trend}<0.001), Black patients (from 49% in 2004 to 36% in 2018; P_{trend}<0.001), Hispanic patients (from 49% in 2004 to 35% in 2018; P_{trend}<0.001), and Asian or Pacific Islander patients (from 54% in 2004 to 39% in 2018; P_{trend}<0.001) (Figure 4). In addition, there has been a consistent drop in the in-hospital mortality among patients with CS in different regions of the United States: Northeast from 53% in 2004 to 39% in 2018, Midwest from 46% in 2004 to 36% in 2018, South from 47% in 2004 to 37% in 2018, and West from 50% for 2004 to 37% for 2018 (P_{trend}<0.001 for all) (Figure 5). Furthermore, a consistent trend of reduction in mortality was seen among hospitals of different sizes and regardless of the hospital teaching status, MCS use, or revascularization (Figures S1 through S4).

The results remained significant after adjusting for covariates, with a reduction of in-hospital mortality among men (from 48% in 2004 to 35% in 2018, P_{trend}<0.001), women (from 50% in 2004 to 40% in 2018, P_{trend}<0.001), White patients (from 49% in 2004 to 37% in 2018; P_{trend}<0.001), Black patients (from 48% in 2004 to 36% in 2018; P_{trend}<0.001), Hispanic patients (from 48% in 2004 to 36% in 2018; P_{trend}<0.001), and Asian or Pacific Islander patients (from 53% in 2004 to 39% in 2018; P_{trend}<0.001) (Figures 3 and 4). In addition, a consistent reduction in in-hospital mortality was seen among different regions of the United States during the study period: Northeast from 54% in 2004 to 39% in 2018 (P_{trend}<0.001), Midwest from 46% in 2004 to 36% in 2018 (P_{trend}<0.001), South from 46% in 2004 to 37% in 2018 (P_{trend}<0.001), and West from 52% in 2004 to 37% in 2018 (P_{trend}<0.001) (Figure 5). Furthermore, a consistent trend of reduction in mortality was seen among hospitals of different sizes and regardless of the hospital teaching status, MCS use, or revascularization (Figures S1 through S4). Trends
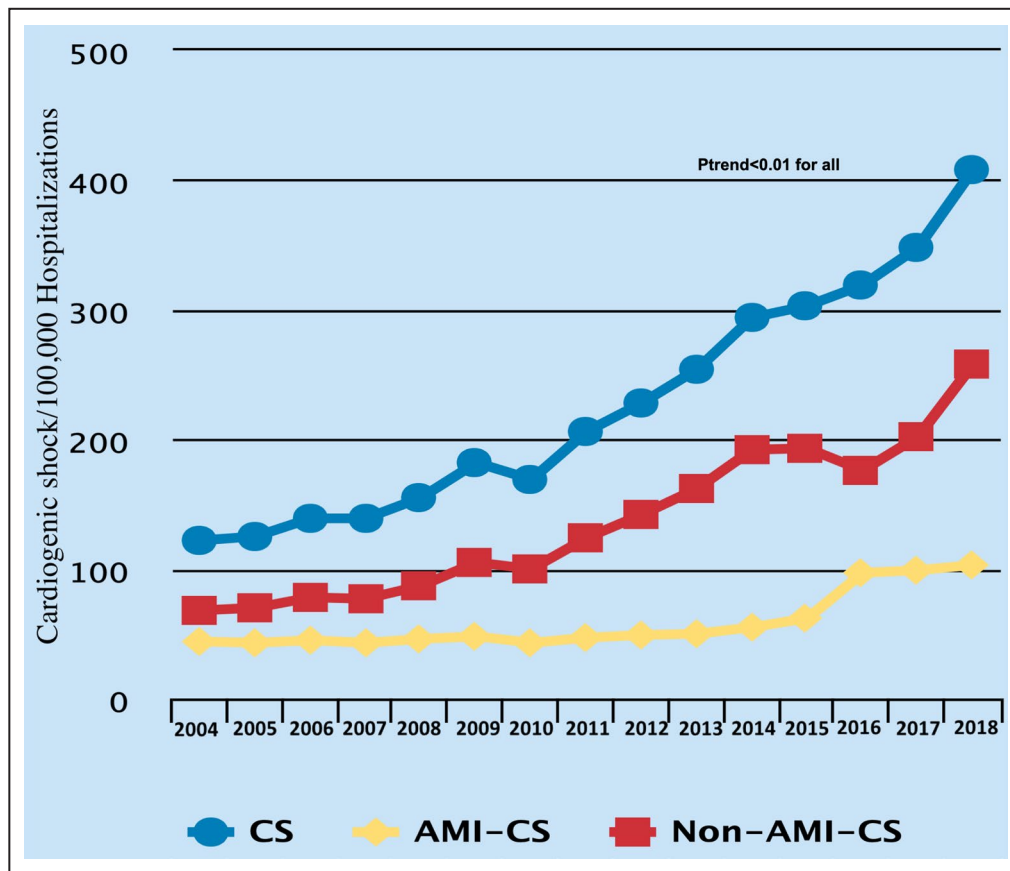
Figure 1.   Prevalence of CS among hospitalizations during the study period.
AMI-CS indicates acute myocardial infarction cardiogenic shock; CS, cardiogenic shock; and non–AMI-CS, non–acute myocardial infarction cardiogenic shock.

in using different treatment strategies in the AMI-CS and non–AMI-CS cohorts during the study period are shown in Table S2.

DISCUSSION

In this contemporary observational study using a nationally representative sample of the US population, we report several significant findings. First, CS hospitalizations have almost tripled during the study period. Second, we report a decreasing trend in in-hospital mortality among patients admitted with CS. Third, the decreasing trends of in-hospital mortality were consistent across all subgroups analyzed, including men and women, AMI-CS and non-AMI CS, and across different racial/ethnic groups. Fourth, there was a decreasing temporal trend in CS in-hospital mortality across all US regions and regardless of hospital size or teaching status.

This is the most extensive study using a nationally representative sample of the US population to analyze the temporal trends in CS hospitalization incidence and in-hospital mortality. Prior investigations of temporal trends in CS morality were limited to registry data contributed by few select hospitals and do not necessarily reflect the national trends in incidence of outcomes of CS.[25,26] Our findings corroborate and expand on the results from prior single-center studies, multicenter studies, and registries.[25,26] In a large registry spanning >20 years from Switzerland, the authors reported an increase in CS admission among patients with AMI-CS in the period from 1997 to 2017 by more than double from 2.5% to 4.6%.[27] Similarly, in a recent retrospective report from the Mayo Clinic cardiac intensive care unit, which included >12 000 patients, the authors reported an increase in CS incidence by almost 4-fold from 5.7% in 2007 to 2009 to 19.4% in 2016 to 2018.[25] We postulate that the observed rise in CS hospitalizations is attributed to several factors. There has been an increasing awareness about the importance of the appropriate and timely diagnosis of CS and the inception of shock teams and shock algorithms; these may have collectively led to the recognition of more patients with CS compared with the early years.[2,6] Moreover, studies have suggested a shift in the epidemiological risk factors of cardiovascular disease with a higher burden
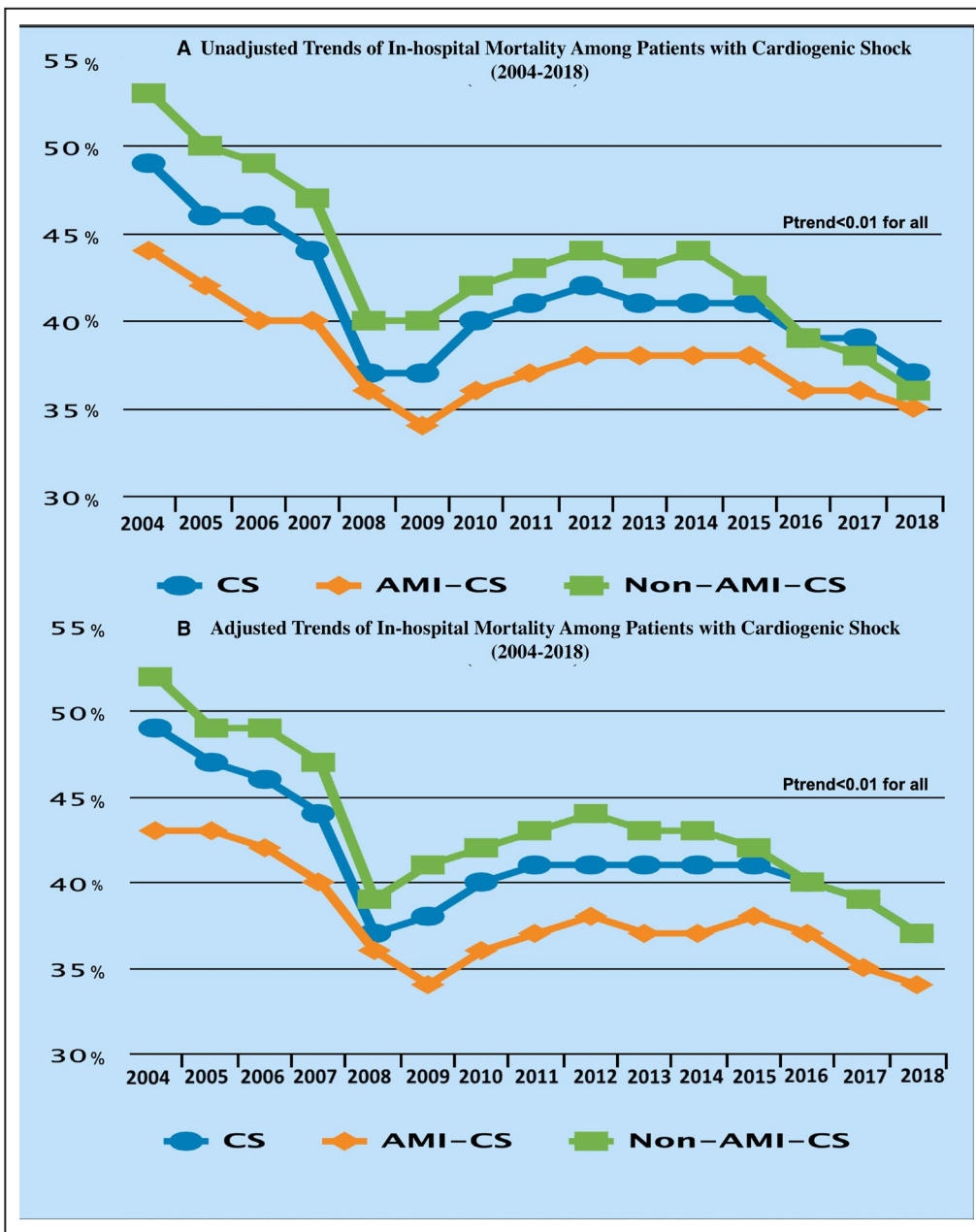
Figure 2.   Trends in in-hospital mortality among patients with CS during the study period.
A, Unadjusted trends. **B**, Adjusted trends. AMI-CS indicates acute myocardial infarction cardiogenic shock; CS, cardiogenic shock; and non–AMI-CS, non–acute myocardial infarction cardiogenic shock.

of classical risk factors such as obesity, diabetes mellitus, and hypertension; all are also linked to coronary artery disease and heart failure, which are the major etiologies of CS.[26]

Consistent with previous studies, we report a decline in CS in-hospital mortality during the study period.[2,26,28,29] A reduction in in-hospital mortality was seen in the early years of the study (2004–2008) and among the AMI-CS and non–AMI-CS cohorts. It is important to note that there have been no changes in

the administrative coding algorithms used to identify patients with CS during this period. The adoption of early revascularization and the proliferation of cardiac catheterization laboratories contributed to the early drop in mortality among the AMI-CS cohort.[30] For the non-AMI cohort, the reduction in in-hospital mortality during the early years can be explained by the increased awareness about the importance of early diagnosis of CS, advances in critical care management, and the proliferation of cardiac intensive care
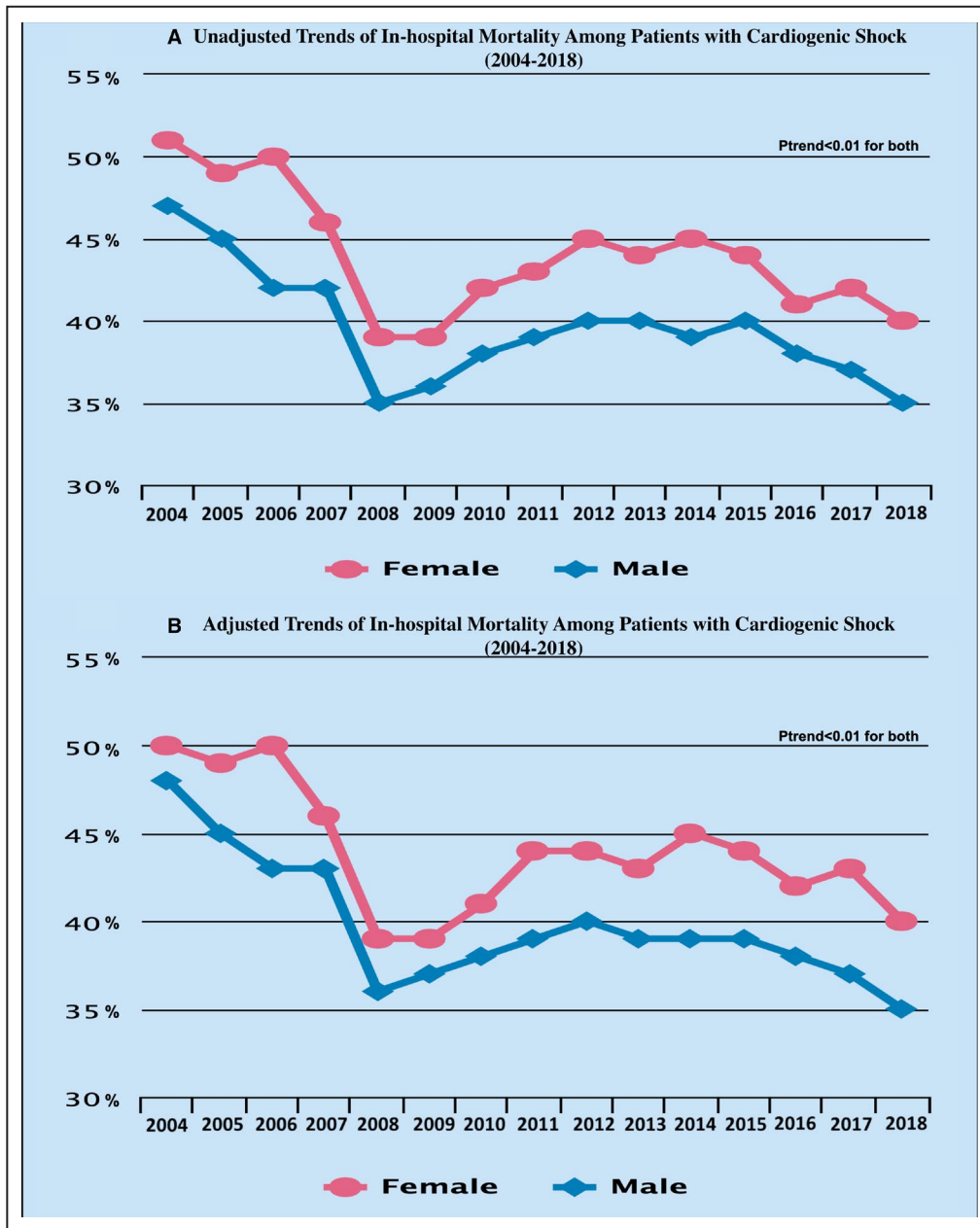
Figure 3. **Trends in in-hospital mortality among patients with cardiogenic shock during the study period stratified by sex.**
A, Unadjusted trends. B, Adjusted trends.

units.[30–34] In addition, more robust contemporary percutaneous MCS platforms were introduced into the US market between 2006 and 2008, which coincides with a major drop in CS-related mortality among the AMI and non-AMI cohorts (Figure 2). Although these devices have not been shown to improve survival in randomized clinical trials independently, there has been increasing evidence supporting the implementation of CS treatment algorithms that promote early diagnosis, early revascularization when appropriate, use of invasive hemodynamic data, and early deployment of MCS.[3,21,35,36] Further refinements in CS treatment strategies, including shock teams and care algorithms, and collaborative efforts such as the NCSI (National Cardiogenic Shock Initiative) may be responsible for more recent reductions in CS mortality.[2,6,15,21]

Our findings contrast to the conclusions of the study by Wayangankar et al, who reported an increasing trend of in-hospital mortality among patients with CS during the period from 2005 to 2013.[37] However, significant
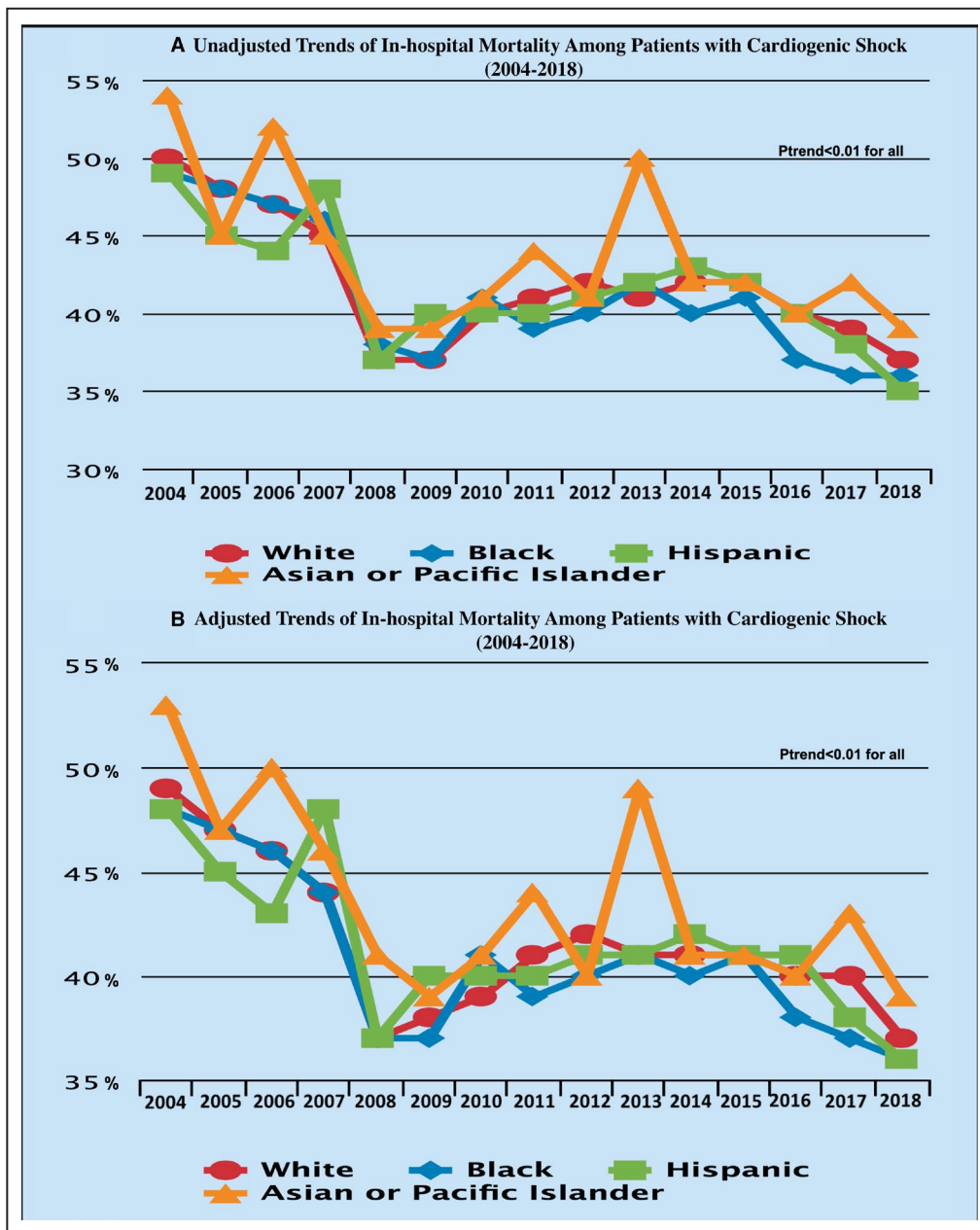
Figure 4.   Trends in in-hospital mortality among patients with cardiogenic shock during the study period stratified by race/ethnicity.
A, Unadjusted trends. **B**, Adjusted trends.

differences between the 2 studies need to be noted. First, Wayangankar et al used the NCDR (National Cardiovascular Data Registry CathPCI Registry), in contrast to the NIS used in the current study. Second, Wayangankar et al only included patients with AMI-CS who were treated with percutaneous coronary intervention. Third, Wayangankar et al excluded patients who had symptoms for >24 hours (n=17 791).[37]

It is important to note that the only randomized trial to date that has shown a reduction in mortality among patients with CS is the SHOCK (Should We Emergently Revascularize Occluded Coronaries for Cardiogenic Shock) trial, which showed that compared with medical stabilization alone, emergency revascularization was associated with a significant reduction in mortality.[30] On the other hand, although randomized clinical trials on MCS did not show a mortality benefit, these trials had several limitations and enrolled the patients who were sickest in whom shock had progressed from a reversible hemodynamic phase to an irreversible
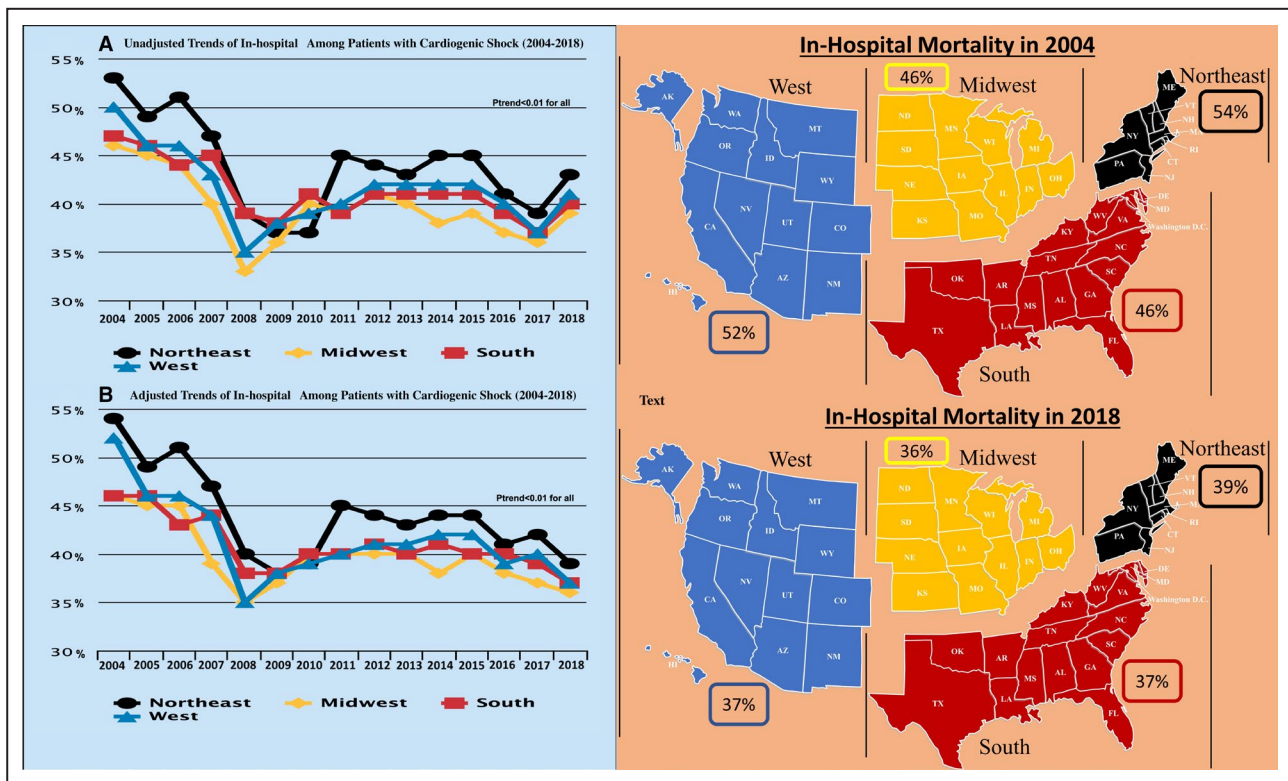
Figure 5. **Trends in in-hospital mortality among patients with cardiogenic shock during the study period stratified region.** **A**, Unadjusted trends. **B**, Adjusted trends.

hemometabolic phase.[36,38] Recognition of this fact led multiple investigators to develop a CS treatment algorithm aimed at early recognition of CS, early revascularization, early use of invasive hemodynamic monitoring, and early deployment of MCS.[2,4] After the encouraging results of incorporating the CS treatment algorithm in the Detroit Cardiogenic Shock Initiative in which the investigators could reduce in-hospital mortality to 24%, a similar treatment algorithm has been adopted at the national level under the currently active NCSI. Early reports from the NCSI indicate a reduction in mortality to 28% in patients with AMI-CS.[2] The mortality benefit of implementing a bundled approach with shock teams, early invasive hemodynamic monitoring, and early MCS need confirmation in randomized controlled trials. Despite the strategies mentioned previously, mortality among patients with CS continues to be substantial, thereby prompting further research to improve CS outcomes.

Study Limitations

Several limitations of the current analysis need to be acknowledged. First, as the present study uses billing codes, a reasonable concern would be that the increase in the prevalence may be attributed to more generous application of billing codes.

Although this may have amplified any real change in the disease prevalence, we believe that there was an increase in the true prevalence of CS based on the reports from other studies of similar trends and the increased number of patients receiving MCS, heart transplantations, and durable left ventricular support devices over time.[7,8,39] Moreover, the codes used to identify CS in the current analysis have been validated in previous studies. Furthermore, we used a hard clinical end point for the outcomes (death), which is less prone to coding errors.[16,17] Second, because of the data set's inherent limitation, we do not have hemodynamic, metabolic, or clinical data, which are vital in diagnosing and staging CS. Similarly, data on hospitals' adoption of shock teams and the algorithmic approach for the management of CS are lacking. Third, the database does not have (present on admission) indicators, so for some comorbidities, it is difficult to differentiate between chronic conditions and new complications attributed to the CS admission. Fourth, given the large sample size, small non–clinically significant changes could meet the statistical significance criteria. However, we report a statistically and clinically significant drop in in-hospital mortality during the study period.

CONCLUSIONS

Hospitalizations attributed to CS have tripled in the period from January 2004 to December 2018. However, there has been a steady decline in CS in-hospital mortality in the United States during the study period from 1 in 2 in 2004 to about 1 in 3 in 2018.

ARTICLE INFORMATION

Affiliations

Division of Cardiology, West Virginia University School of Medicine, Morgantown, WV (M.O., M.S., S.P., S.S., C.B., S.B., B.P.); Knight Cardiovascular Institute, Oregon Health and Science University, Portland, OR (M.O., B.K.); and Division of Cardiology, Thomas Jefferson University, Philadelphia, PA (M.K.S.).

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Disclosures

None.

Supplementary Material

Tables S1–S2
Figures S1–S4

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Supplemental Material

Table S1. International classification of disease codes used in the current analysis.

Disease/Treatment	ICD-9 codes	ICD-10 codes
Acute myocardial infarction	410.00, 410.01, 410.10, 410.11, 410.20, 410.21, 410.30, 410.31, 410.40, 410.41, 410.50, 410.51, 410.60, 410.61, 410.80, 410.81, 410.90, 410.91, 410.70, 410.71, 411.1	I21.01, I21.02, I21.09, I21.11 I21.19, I21.21, I21.29, I21.3, I22.0, I22.1, I22.2, I22.8, I22.9, I21.4, I22.2
Percutaneous coronary intervention	00.66, 36.01, 36.02, 36.05, 36.06, 36.07, 17.55	0270346, 027034Z, 02703D6, 02703DZ, 02703Z6, 02703ZZ, 0270446, 027044Z, 02704D6, 02704DZ
Coronary artery bypass grafting	3610, 3611, 3612, 3613, 3614, 3615, 3616, 3617, 3619	02130KW, 02130Z3, 02130Z8, 02130Z9, 02130ZC, 02130ZF, 02130K8, 02130K9, 02130KC, 02130KF, 02130A9, 02130AC, 02130AF,02130AW 02130J3, 02130J8 02130J9, 02130JC 02130JF, 02130JW 02130K3, 02120Z8, 02120Z9, 02120ZC, 02120ZF, 0213093, 0213098, 0213099, 021309C, 021309F, 021309W, 02130A3, 02130A8, 02120AW, 02120J3, 02120J8, 02120J9, 02120JC, 02120JF, 02120JW, 02120K3, 02120K8 02120K9, 02120KC 02120KF, 02120KW, 02120Z3, 02110Z9, 02110ZC, 02110ZF 0212093, 0212098, 0212099, 021209C, 021209F, 021209W, 02120A3, 02120A8, 02120A9, 02120AC 02120AF, 02110J3, 02110J8, 02110J9, 02110JC, 02110JF, 02110JW, 02110K3, 02110K8, 02110K9, 02110KC, 02110KF, 02110KW, 02110Z3, 02110Z8, 02100ZC 02100ZF 0211093 0211098, 0211099, 021109C, 021109F, 021109W, 02110A3, 02110A8, 02110A9, 02110AC, 02110AF, 02110AW, 02100J3, 02100K9, 02100KC, 02100KF, 02100KW, 02100Z3,02100Z8, 02100Z9,0210093, 0210099, 021009C, 021009F, 021009W, 02100A3, 02100A8, 02100A9, 02100AC, 02100AF, 02100AW
Percutaneous left ventricular assist devices	3768	5A0221D5A0211D,02HA3RJ,02HA4RJ,5A0211 6,5A02216,02HA3QZ,02HA3RS,02HA3RZ,02H A4QZ,02HA4RJ,02HA4RS,02HA4RZ
Extracorporeal membrane oxygenation	3965	5A1522F,5A1522G,5A15A2F,5A15A2G,5A152 23
Intra-aortic balloon pump	3761	5A02210
Durable left ventricular assist devices	3766 & 3752	02HA0QZ
Renal replacement therapy	3995	5A1D70Z,5A1D80Z, 5A1D90Z, 5A1D60Z,5A1D00Z
Mechanical ventilation	9762	5A1935Z,5A1945Z, 5A1955Z

Table S2. Treatment strategies across the different eras.

Treatment	Pre-PLVAD era (2004-2007)	PLVAD era (2008-2014)	Shock team era (2015-2018)	P value
AMI-CS				
Revascularization	64%	75%	69%	<0.01
Mechanical Circulatory Support				
IABP	49%	50%	33%	<0.01
PLVAD	0.1%	3%	10%	<0.01
ECMO	0.15	1%	2%	<0.01
LVAD	0.5%	0.6%	0.4%	<0.01
Mechanical Ventilation	14%	16%	42%	<0.01
Renal Replacement Therapy	3%	4%	7%	<0.01
Non-AMI-CS				
Mechanical Circulatory Support				
IABP	19%	15%	6%	<0.01
PLVAD	0.1%	1%	2%	<0.01
ECMO	0.2%	1%	2%	<0.01
LVAD	0.9%	1.9%	2.4%	<0.01
Mechanical Ventilation	19%	20%	42%	<0.01
Renal Replacement Therapy	9%	12%	13%	<0.01

IABP; Intra-aortic balloon pump, PLVAD; Percutaneous left ventricular support devices [Tandem heart & Impella heart pump], ECMO; Extracorporeal membrane oxygenation, LVAD; Durable left ventricular support devices.

Figure S1. Trend in in-hospital mortality during the study period stratified by hospital bed size.
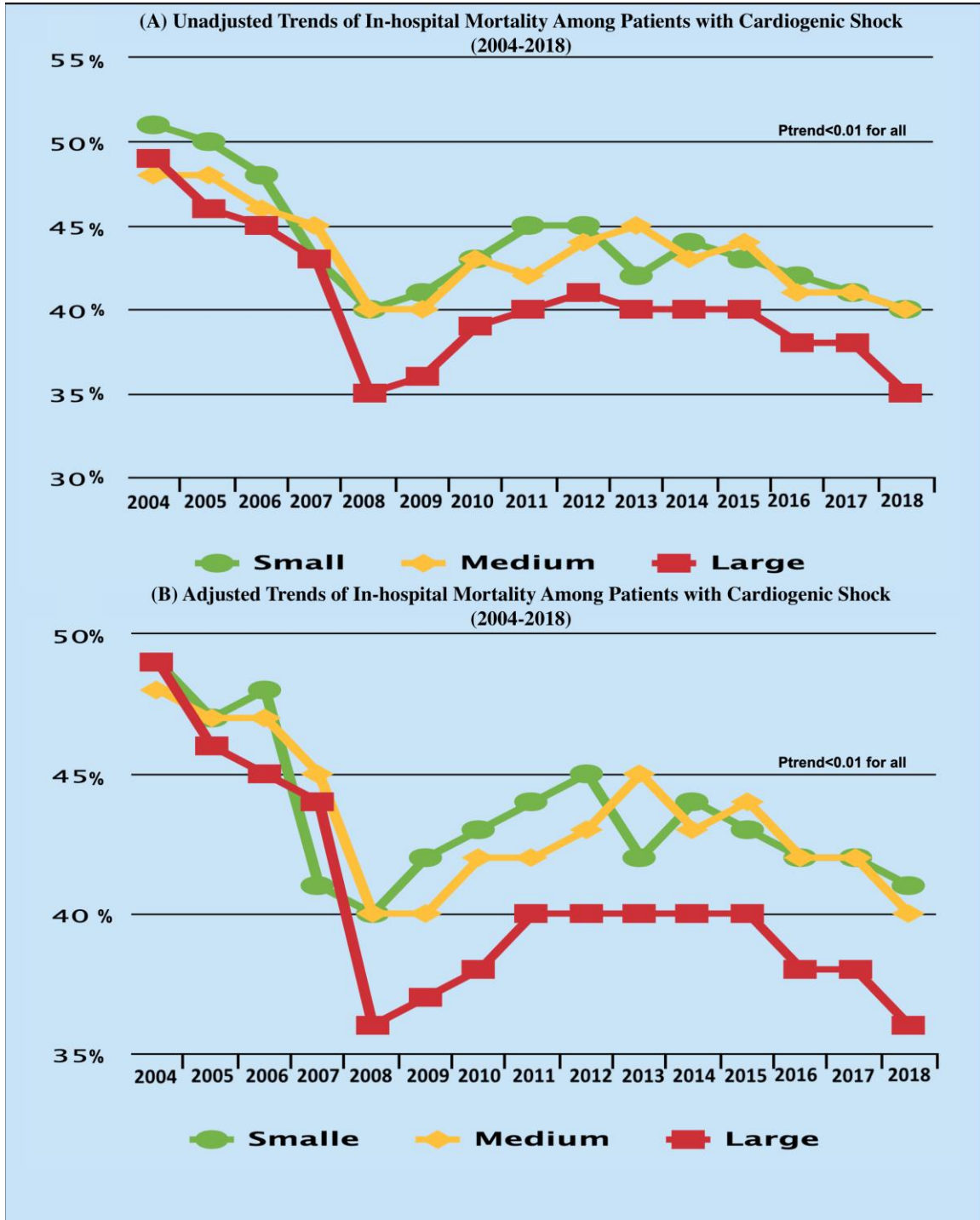
Figure S2. Trend in in-hospital mortality during the study period stratified by hospital teaching status.

(A) Unadjusted Trends of In-hospital Mortality Among Patients with Cardiogenic Shock (2004-2018)

Ptrend<0.01 for all

Rural Non-teaching
Urban Non-teaching
Urban Teaching

(B) Adjusted Trends of In-hospital Mortality Among Patients with Cardiogenic Shock (2004-2018)

Ptrend<0.01 for all

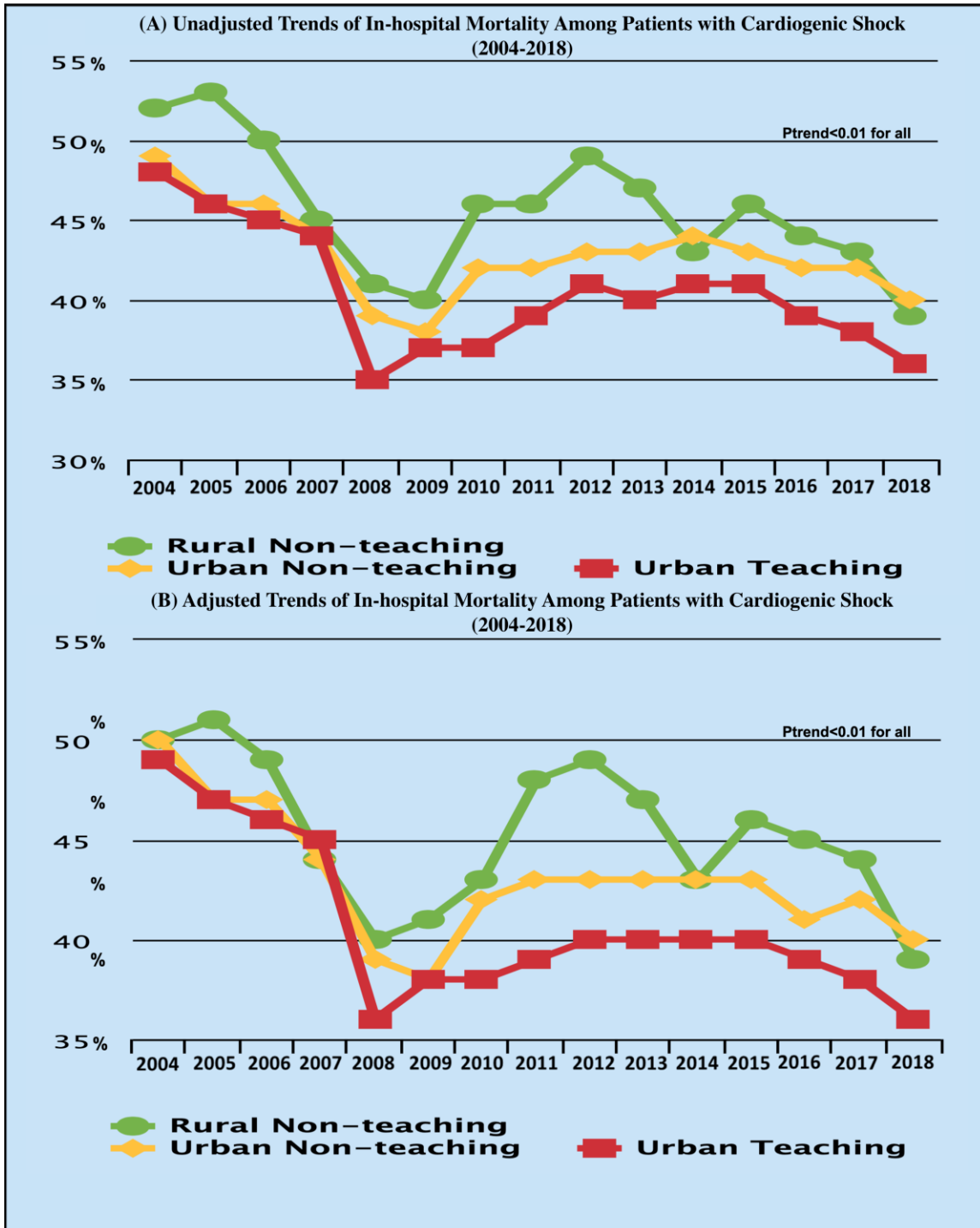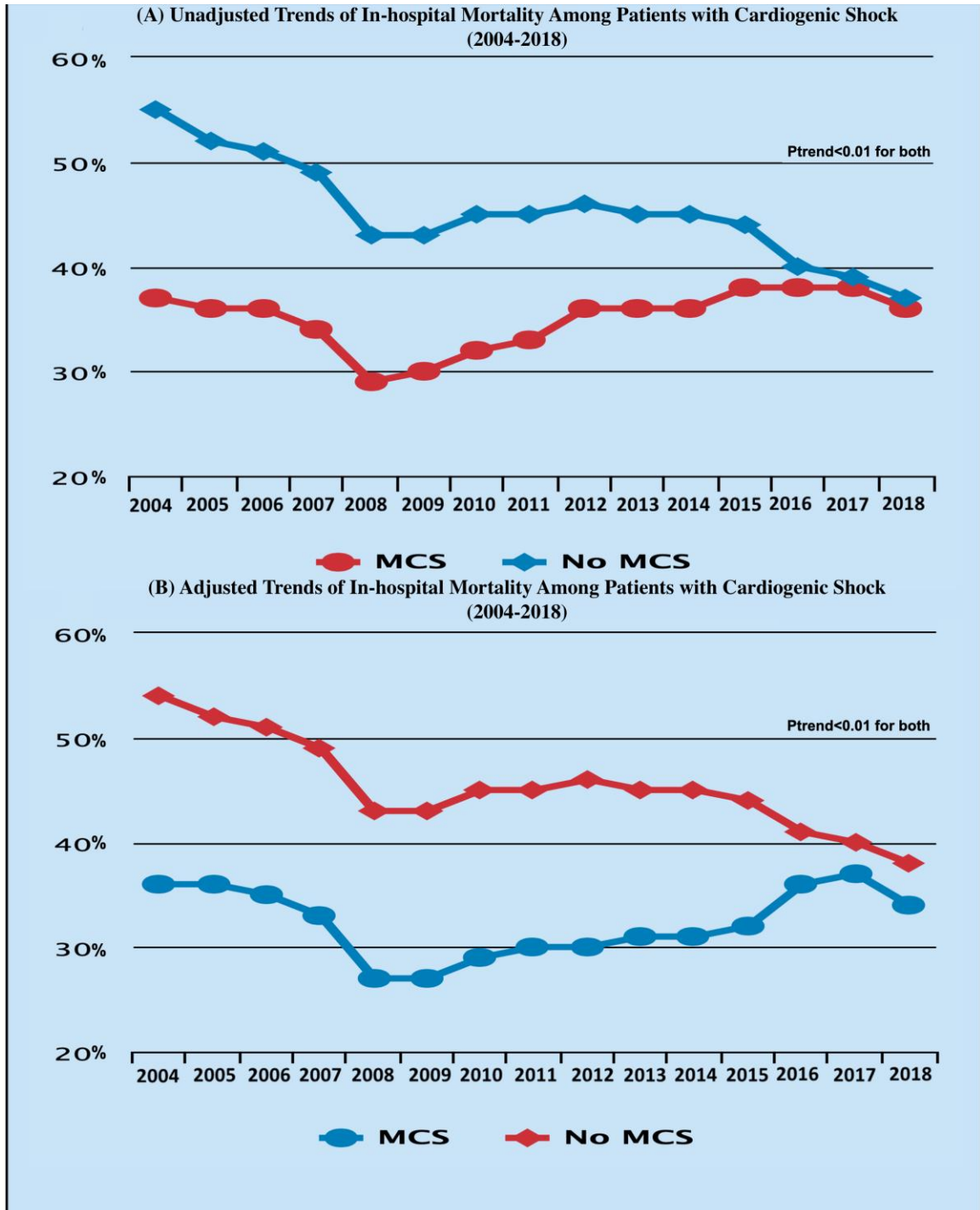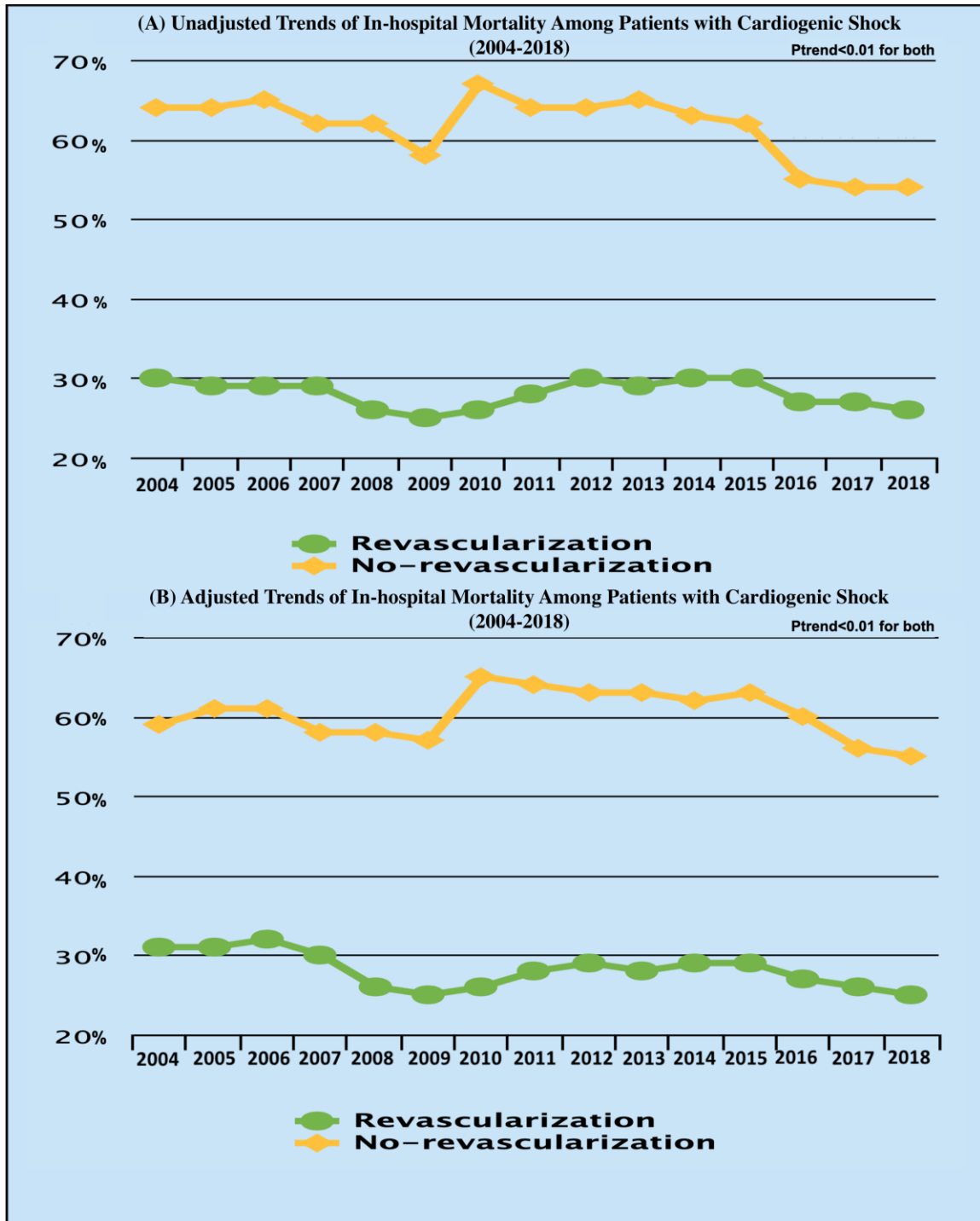Rural Non-teaching
Urban Non-teaching
Urban Teaching

Figure S3. Trend in in-hospital mortality during the study period stratified by utilization of mechanical circulatory support.

MCS; Mechanic circulatory support devices

Figure S4. Trend in in-hospital mortality during the study period among patients with AMI-CS stratified by revascularization status.

AMI-CS; Acute myocardial infarction related cardiogenic shock