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ORIGINAL RESEARCH

Resource Utilization and Costs Associated With Cardiogenic Shock Complicating Myocardial Infarction

A Population-Based Cohort Study

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ABSTRACT

BACKGROUND Cardiogenic shock due to acute myocardial infarction (AMI-CS) is associated with significant short- and long-term morbidity and mortality. Despite this, little is known about associated cost.

OBJECTIVES The purpose of this study was to evaluate the health care costs and resource use associated with AMI-CS using administrative data from the province of Ontario, Canada.

METHODS This was a retrospective cohort study of adult patients with AMI-CS from April 2009 to March 2019. One-year costs following index admission were reported at an individual level. We used generalized linear models to identify factors associated with increased cost. We stratified patients by revascularization strategy to compare cost in each group and examined total cost at a patient level per individual fiscal year.

RESULTS We included 9,789 consecutive patients with AMI-CS across 135 centers in Ontario (mean age 70.5 years; 67.7% male). Mortality in-hospital was 30.2%, and mortality at 2 years was 45.9%. The median inpatient cost per patient was $23,912 (IQR: $12,234-$41,833) with a median total 1-year cost of $37,913 (IQR: $20,113-$66,582). The median 1-year cost was $17,730 (IQR: $9,323-$38,379) for those who died in hospital, and $45,713 (IQR: $29,688-$77,683) for those surviving to discharge, with $12,719 (IQR: $4,262-$35,275) occurring after discharge. Patients who received coronary artery bypass grafting incurred the highest cost among revascularization groups. No significant differences were observed in cost per fiscal year from 2009 to 2019.

CONCLUSIONS AMI-CS is associated with significant health care costs, both during the index hospitalization and following discharge. To optimize cost-effectiveness, future therapies should aim to reduce disability in addition to improving mortality. (JACC Adv 2024;3:101047) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

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ABBREVIATIONS AND ACRONYMS

AMI = acute myocardial infarction

AMI-CS = acute myocardial infarction complicated by cardiogenic shock

CABG = coronary artery bypass grafting

CR = cost ratio

CS = cardiogenic shock

ECMO = extracorporeal membrane oxygenation

IABP = intra-aortic balloon pump

ICU = intensive care unit

MCS = mechanical circulatory support

PCI = percutaneous coronary intervention

RRT = renal replacement therapy

Cardiogenic shock (CS) is a clinical syndrome resulting in end-organ hypoperfusion due to cardiac dysfunction.[1,2] Among the most common etiologies of CS is acute myocardial infarction (AMI-CS),[3] which is associated with higher rates of adverse outcomes when compared to other causes.[4] Despite recent advancements in therapeutic technologies, short-term mortality in AMI-CS ranges from 40 to 52% and is associated with significant morbidity.[5] Furthermore, long-term mortality and morbidity is substantial, with 41 to 57% of patients deceased by 1 year and 42.0% of survivors requiring an increased level of care following discharge,[6,7] which can be associated with significant cost and health care resource utilization.

While therapeutic strategies and outcomes in AMI-CS have been reported extensively,[7-10] health care costs associated with its management in contemporary cardiac centers remain poorly defined. The American Heart Association recently identified cost and resource use associated with CS to be a major priority.[2] Despite this, little data exist. Given the prolonged intensive care unit (ICU) stay that is often necessary for these patients,[7,11,12] and the increase of mechanical circulatory support (MCS) device utilization[13-15] despite a lack of robust efficacy and safety data,[8,10,16,17] a thorough understanding of the costs associated with AMI-CS, as well as the patient factors associated with increased costs, is necessary to optimize care delivery. We therefore used administrative data from the province of Ontario, Canada, to investigate the short- and long-term resource utilization and health care costs associated with AMI-CS.

METHODS

Studies conducted at ICES using administrative data fall under section 45 of the Personal Health Information Protection Act of Ontario, and do not require approval by a research ethics board. Therefore, data are collected without the need for individual patient consent.

DATA SOURCES AND SETTING. We conducted a population-level cohort study using health administrative databases from the province of Ontario in Canada, which has a population of over 14.5 million. As Ontario uses a single-payer health care system, all medically necessary health care services and patient demographic information are included in these databases, which are housed at ICES: an independent, nonprofit custodian of health data (Supplemental Tables 1 and 2). ICES is funded by an annual grant from the Ontario Ministry of Health.

STUDY DESIGN. We included adult patients (age ≥18 years of age) admitted to a hospital in the province of Ontario between April 1, 2009, and March 31, 2019, with a diagnosis of AMI-CS. Our methods used to capture and identify AMI-CS patients have been previously described.[7] Briefly, patients with a primary discharge diagnosis of acute myocardial infarction (AMI) were identified using a previously

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TABLE 1 Baseline Characteristics of Patients With Acute Myocardial Infarction Complicated by Cardiogenic Shock in Ontario (2009-2019, N = 9,789)

Sex	
Female	3,162 (32.3)
Male	6,627 (67.7)
Age, y	70.54 ± 12.25
Income quintile	
Lowest	2,343 (23.9)
Low	2,122 (21.7)
Middle	1,905 (19.5)
High	1,847 (18.9)
Highest	1,527 (15.6)
Unknown	45 (0.5)
Rurality	
Urban	8,403 (85.8)
Rural	1,366 (14.0)
Comorbidities	
Hypertension	4,929 (50.4)
Dyslipidemia	1,143 (11.7)
Diabetes	4,130 (42.2)
Prior AMI	679 (6.9)
Prior PCI	136 (1.4)
Prior CABG	47 (0.5)
Prior CHF	1,660 (17)
Atrial fibrillation/flutter	615 (6.3)
Stroke	330 (3.4)
Renal failure	1,883 (19.2)
Cirrhosis	101 (1.0)
Cancer	2,014 (20.6)
COPD	940 (9.6)
Charlson index	
≤2	8,672 (88.6)
≥3	1,117 (11.4)
STEMI	4,347 (44.4)
Place of residence	
Home (without homecare)	8,066 (82.4)
Home (with homecare)	1,489 (15.2)
LTC/Nursing home	203 (2.1)
Long-term hospital/rehab	31 (0.3)

Values are n (%) or mean ± SD.
AMI = acute myocardial infarction; CABG = coronary artery bypass grafting; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; LTC = long-term care; PCI = percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.

TABLE 2 Short- and Long-Term Outcomes in Patients With Acute Myocardial Infarction Complicated by Cardiogenic Shock in Ontario (2009-2019, N = 9,789)

Total cohort	
Death in hospital	2,961 (30.2)
Mortality	
30 d	2,846 (29.1)
1 y	4,004 (40.9)
2 y	4,491 (45.9)
Revascularization strategy	
Coronary angiogram during admission	6,894 (70.4)
Coronary angiogram in first 24 h	3,020 (30.9)
PCI	4,338 (44.3)
CABG	2,058 (21.0)
Length of stay, d	
ICU	5 (3-10)
Total	12 (6-20)
MODS at ICU admission	4 (3-6)
ICU days on vasoactive meds, d	2 (1-4)
ICU interventions	
Invasive mechanical ventilation	5,422 (55.4)
Renal replacement therapy	1,425 (14.6)
Any mechanical circulatory support	1,484 (15.2)
IABP	1,464 (15.0)
Impella	30 (0.3)
ECMO	30 (0.3)
Survivors only (n = 6,828)	
Mortality	
30 d	149 (2.2)
1 y	1,047 (15.3%)
2 y	1,531 (22.4%)
Discharge disposition	
Home (without homecare)	3,327 (48.7%)
Home (with homecare)	2,491 (36.5%)
LTC/Nursing home	140 (2.1%)
Long-term hospital/rehab	870 (12.7%)
Change from baseline disposition at discharge	2,870 (42.0%)
Hospital readmission	
30 d	1,314 (19.2%)
1 y	3,244 (47.5%)
Days spent at home postdischarge	
30 d	26.99 ± 6.75
1 y	307.87 ± 109.59
Days spent at home postdischarge	
30 d	30 (28-30)
1 y	361 (334-365)

Values are n (%), median (IQR), or mean ± SD.
ECMO = extracorporeal membrane oxygenation; IABP = intra-aortic balloon pump; ICU = intensive care unit; MODS = Multiorgan Dysfunction Score; other Abbreviations as in Table 1.

validated algorithm derived from International Classification of Diseases-10th revision (ICD-10) codes (Supplemental Table 3).[18] We captured the presence of CS using the following criteria: 1) admission to an ICU, identified using validated algorithms;[19] 2) treatment with vasoactive medications during hospitalization, as identified in the Critical Care Information Services database and in keeping with guideline-directed management of CS,[20] as performed previously;[21] and 3) evidence of multiple organ dysfunction, defined as a Multiorgan Dysfunction Score ≥ 2.[22]

We excluded patients with out-of-hospital cardiac arrest, as identified using validated algorithms.[23] Using previously described methods,[24] we identified relevant comorbidities through hospitalization and physician billing codes occurring prior to the date of index admission. These datasets were linked using unique encoded identifiers and analyzed at ICES.

TABLE 3 1-Year Costs After Admission With Acute Myocardial Infarction Complicated by Cardiogenic Shock in Ontario (2009-2019, N = 9,789)

Total costs	
Entire cohort	37,913 (20,113-66,582)
Patients deceased in hospital	17,730 (9,323-38,379)
Survivors to discharge	45,713 (29,688-77,683)
Readmitted patients[d]	63,539 (41,608-107,020)
Total costs after discharge (survivors to discharge)	12,719 (4,262-35,275)
Acute care sectors (entire cohort)	
Inpatient	23,912 (12,324-41,833)
ED	608 (416-1,126)
Continuing care sectors (survivors to discharge)	
Complex continuing care	0 (0-0)
Long-term care	0 (0-0)
Rehabilitation	0 (0-0)
Home care	0 (0-1,124)
Continuing care sectors[a]	
Complex continuing care (n = 460, 6.7%)	15,170 (5,604-36,706)
Long-term care (n = 360, 4.5%)	11,779 (4,404-24,408)
Rehabilitation (n = 765, 11.2%)	12,324 (7,775-16,860)
Home care (n = 3,172, 46.5%)	1,368 (458-4,076)
Outpatient care (survivors to discharge)	
Outpatient clinics	923 (320-1,830)
Laboratory (OHIP[b])	125 (39-256)
Drugs[b]	1,163 (132-2,380)
Outpatient care[a]	
Outpatient clinics (n = 5,984, 87.6%)	1,062 (565-1,961)
Laboratory (OHIP, n = 5,579, 81.7%)	161 (86-299)
Drugs[b] (n = 5,886, 86.2%)	1,445 (545-2,660)
Physician billings[c]	6,720 (3,550-10,635)
Total costs by home time quartile	
Lowest	77,643 (45,730-130,076)
Second	54,703 (38,828-85,175)
Third	36,431 (25,604-55,025)
Highest	33,416 (20,575-48,273)

Values are median (IQR) and in U.S. dollars. [a]Includes only patients using this service; [b]includes only patients 65 years or older; [c]includes both inpatient and outpatient physician billings; [d]includes only patients readmitted to hospital within 1 year of index admission for acute myocardial infarction (n = 3,244).

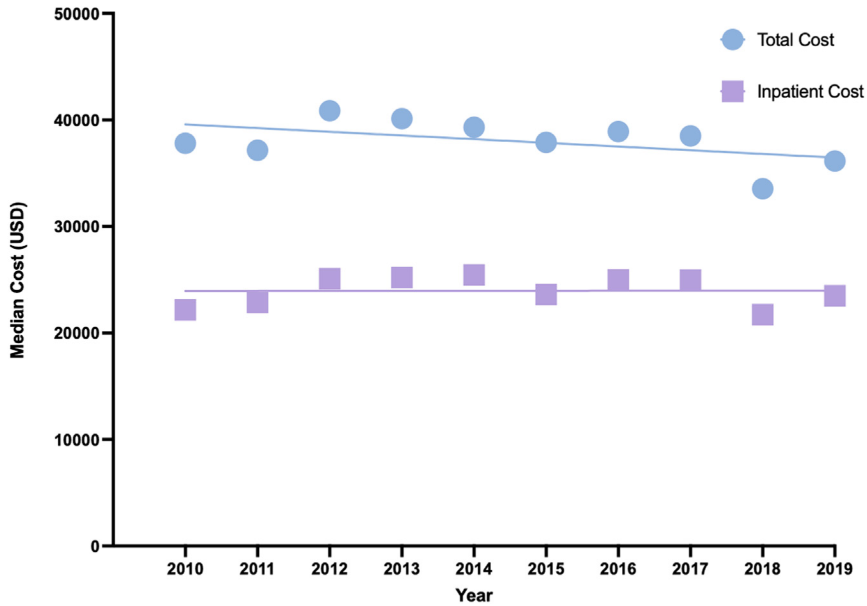
ED = emergency department; OHIP = Ontario Health Insurance Plan; other Abbreviation as in Table 1.

OUTCOMES. We report costs in the 1-year period following the index admission for AMI-CS at an individual patient level. Costs are divided by sector based on previously defined methods.[25,26] Acute care sectors include inpatient care and emergency departments. Continuing care sectors include complex-continuing care, long-term care, inpatient rehabilitation, and home care. Outpatient care sectors include outpatient clinics and laboratory investigations. Data on outpatient prescription medications are available for patients ≥65 years of age through the Ontario Drug Benefit program. Case mix methodology was used to determine cost data associated with sectors that use global budgets and directly estimate cost data associated with sectors that use direct fee payments. We report costs incurred through outpatient sectors following discharge from hospital separately for patients surviving to discharge, and for patients surviving to discharge and using these resources.

We report death in hospital, as well as at 30 days, 1 year, and 2 years after index admission. In-hospital interventions, including revascularization strategy used during the index hospitalization, use of invasive mechanical ventilation, use of renal replacement therapy (RRT), and use of MCS, were identified using procedure codes from the Discharge Abstract Database or physician billings from the Ontario Health Insurance Plan. We use a hierarchal approach to report discharge disposition for survivors to discharge (Supplemental Table 4).[27] We also use home time, defined as number of days in a private residence, as a surrogate for functional outcomes, given its strong correlation with objective function scales,[28] and the fact that it is a measure strongly valued by patients.[29] We divided survivors to discharge into quartiles on the basis of mean home time, comparing costs between groups. We also stratified patients by revascularization strategy, including no revascularization, percutaneous coronary intervention (PCI), and coronary artery bypass grafting (CABG), comparing individual costs in each group. Lastly, we evaluated total costs individually by fiscal year. All costs were expressed in 2023 United States Dollars.

STATISTICAL ANALYSIS. We express data as mean ± SD or median (IQR) as appropriate. The Student's *t*-test, Mann-Whitney test, and chi-squared test were performed to estimate between-group differences for parametric, nonparametric, and categorical variables, respectively. We modeled total costs per person as a continuous response variable using a generalized linear model with a log-link and gamma distribution, as recommended.[30] Log-gamma models handle the skew and heteroscedasticity of cost data better than a regular linear model with no link and a Gaussian distribution. We exponentiated the resulting beta coefficients to obtain cost ratios (CRs) and 95% CIs. Assumptions of linearity and homoscedasticity are present just as they are with a linear model. Factors included in the model were determined a priori, based on existing evidence or postulated associations with health care costs. Given reported costs are related directly to interventions received in hospital, we included only preadmission variables in our models. We created separate models for patients who died in hospital and survivors to discharge, and models were clustered by center. We conducted all

FIGURE 1 Inpatient and Total 1-Year Costs Among Patients With AMI-CS per Fiscal Year



Cost is presented in 2023 U.S. dollars.

analyses using SAS Enterprise Guide 7.1 (SAS Institute Inc). A *P* value of <0.05 was taken to represent statistical significance.

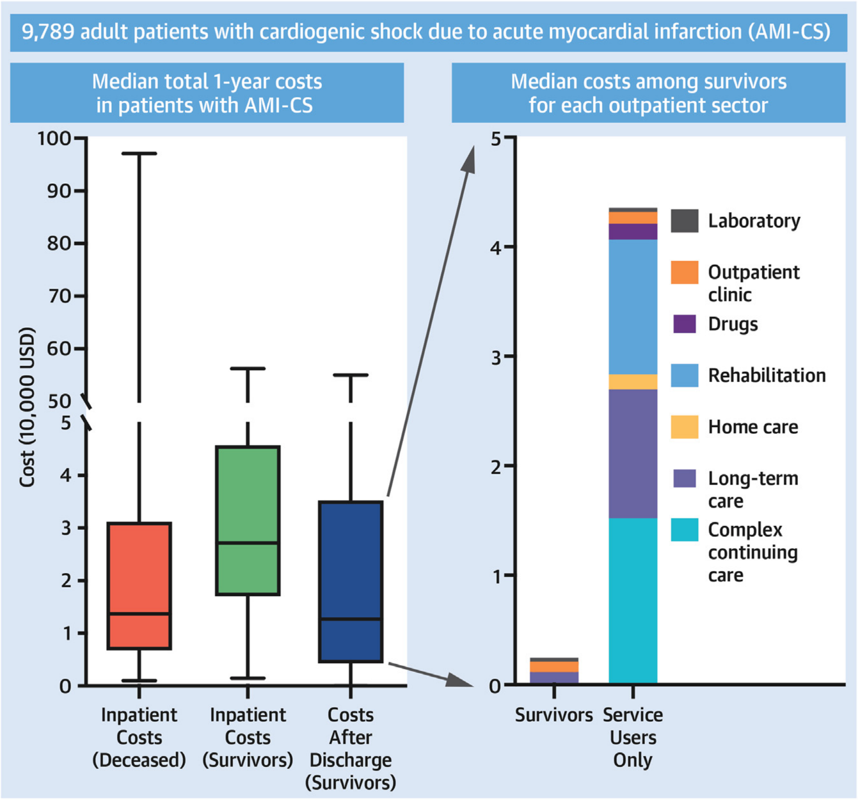
RESULTS

PATIENT DEMOGRAPHICS AND OUTCOMES. We included 9,789 consecutive patients who were admitted to an ICU with AMI-CS during the study period, at 135 centers in Ontario. Baseline characteristics for the cohort are outlined in **Table 1**. The mean age was 70.5 ± 12.3 years, and 67.7% of patients were male. Short- and long-term patient outcomes are displayed in **Table 2**. A total of 2,961 (30.2%) patients died in hospital, and 4,491 (45.9%) died within the 2-year period following index admission. The median (IQR) length of stay in ICU and hospital was 5 (3-10) and 12 (6-20) days, respectively. MCS was used in 1,484 (15.2%) patients, and 1,425 (14.6%) patients received RRT. In total, 3,327 (40.0%) patients were discharged home independently, and 1,010 (10.3%) patients were discharged to long-term hospital rehabilitation centers or to long-term care.

TOTAL COSTS. Median total cost per patient over the 1-year period after the date of admission was $37,913 (IQR: $20,113-$66,582), and median inpatient cost per patient during the index admission was $23,912 (IQR: $12,234-$41,833) (**Table 3**). Among AMI-CS patients who died in hospital, the median total cost was $17,730 (IQR: $9,323-$38,379), and for survivors to discharge it was $45,713 (IQR: $29,688-$77,683), of which $12,719 (IQR: $4,262-$35,275) encompassed postdischarge costs. Following discharge, 3,244 (33.1%) patients were readmitted to hospital within 1 year, and the median total 1-year cost among these patients was $63,539 (IQR: $41,608-$107,020). **Figure 1** and Supplemental Table 5 display total cost per fiscal year from 2009 to 2019. There were no significant trends toward either lower or higher cost per year across this time period.

Median costs for outpatient complex continuing care, long-term care, rehabilitation, and home care were $15,170 (IQR: $5,604-$36,706), $11,779 (IQR: $4,404-$24,408), $12,324 (IQR: $7,775-$16,860), and $1,368 (IQR: $458-$4,076), respectively, among patients using these services. Median costs for outpatient clinics, laboratory testing, and drugs were $1,062 (IQR: $565 -$1,961), $161 (IQR: $86-$299), and $1,445 (IQR: $565-$2,660), respectively, among patients using these services (**Central Illustration**). Median physician billing cost was $6,720 (IQR:

CENTRAL ILLUSTRATION Costs and Resource Utilization Associated With Cardiogenic Shock Complicating Myocardial Infarction



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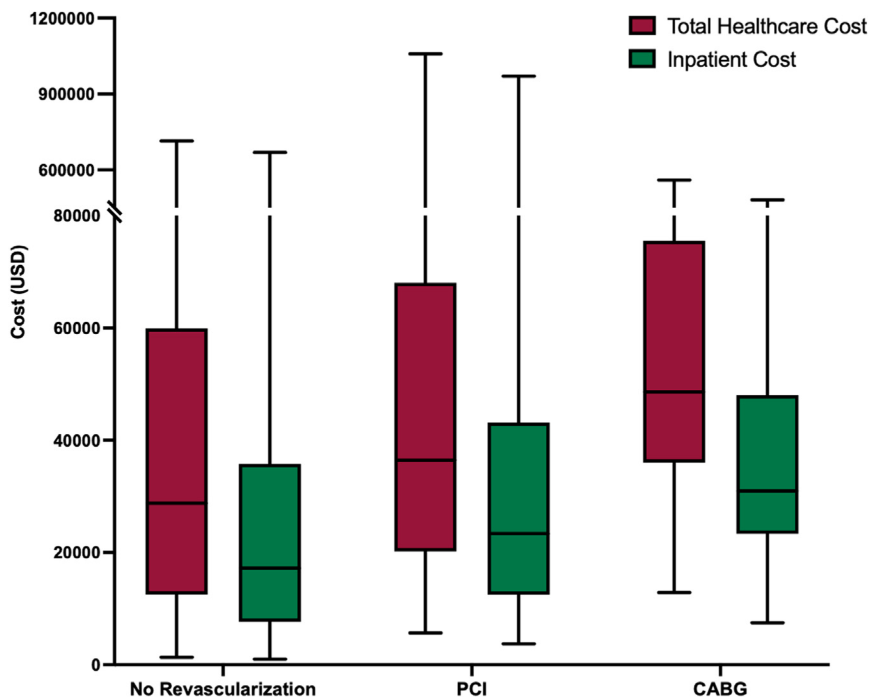
Median total 1-year costs among patients with AMI-CS in ontario stratified by those that died in hospital and those that survived to discharge. Among those that survived to discharge, median individual costs for each outpatient sector following discharge are shown, both across all survivors to discharge, and across only patients that used the service.

$3,550-$10,635). Among patients in the lowest home time quartile, median total costs were $77,643 (IQR: $45,730-$130,076) and this decreased with increasing quartiles, with median costs in the highest quartile of $33,416 (IQR: $20,575-$48,273).

COSTS BY REVASCULARIZATION. In total, 3,749 (38.3%) patients were treated medically without revascularization, 3,982 (40.7%) received PCI, and 2,058 (21.0%) underwent CABG. Revascularization strategy was associated with total 1-year cost (Figure 2, Supplemental Table 6). Median inpatient costs were $17,204 (IQR: $7,664-$35,771) in the group that did not receive revascularization, $23,366 (IQR: $12,495-$43,141) in group that received PCI, and $30,959 (IQR: $23,334-$48,047) in the group that received CABG ($P < 0.001$). Median total 1-year costs were $28,791 (IQR: $12,517-$59,916), $36,434 (IQR: $20,213-$68,044), and $48,604 (IQR: $35,995-$75,525) in these groups, respectively ($P < 0.001$).

FACTORS ASSOCIATED WITH TOTAL COSTS. Figures 3 and 4 display generalized linear model results, demonstrating variables associated with total 1-year cost. In patients surviving to discharge, factors associated with increased cost include a history of diabetes (CR: 1.20 [95% CI: 1.15-1.25]), stroke (CR: 1.23 [95% CI: 1.10-1.38]), or chronic obstructive pulmonary disease (CR: 1.17 [95% CI: 1.09-1.26]), baseline residence in long-term care (CR: 2.08 [95% CI: 1.76-2.44]), or long-term rehabilitation (CR: 2.27 [95% CI: 1.53-3.37]), need for invasive mechanical ventilation (CR: 1.09 [95% CI: 1.04-1.14]), and need for RRT (CR: 1.61 [95% CI: 1.50-1.73]), among others. Factors associated with lower cost include income quintile (highest income quintile CR: 0.89 [95% CI: 0.84-0.95]), rural

FIGURE 2 **Inpatient and Total 1-Year Costs in Patients With AMI-CS Stratified by Revascularization Strategy**



Cost is presented in 2023 U.S. dollars. CABG = coronary artery bypass grafting; PCI = percutaneous coronary intervention.

location of residence (CR: 0.93 [95% CI: 0.88-0.98]), and history of dyslipidemia (CR: 0.86 [95% CI: 0.81-0.91]), among others. Similar trends were seen among patients who died in hospital.

DISCUSSION

We examined health care costs in patients with AMI-CS over a 10-year period in Ontario, Canada, and observed that AMI-CS is associated with high cost and resource utilization, as well as high rates of short-term mortality and readmission to hospital. While inpatient costs were high in our cohort, survivors of AMI-CS hospitalization also had substantial resource use following discharge.

The highest individual cost sector observed in this population was inpatient care. Patients in the current cohort experienced high-intensity care, including long ICU stays and high rates of mechanical ventilation, RRT, and MCS. The average individual cost of inpatient care for AMI-CS was more than triple that observed for both AMI hospitalizations[31,32] and heart failure hospitalizations in Canada,[33] highlighting the need for specialized care of AMI-CS patients. Invasive mechanical ventilation, an important indicator of care complexity and predictor of individual cost,[34] was used in over 55% of patients in our cohort.

Furthermore, MCS (including intra-aortic balloon pump [IABP], Impella, and venoarterial extracorporeal membrane oxygenation [ECMO]) were collectively used in 15.2% of patients; however, the majority of these were IABP, as only 60 (0.6%) patients received more resource-intensive devices such as Impella or ECMO. This is in stark contrast to what is observed in the United States, with a prevalence of non-IABP MCS device use in AMI-CS as high as 7.2%.[35] Importantly, minimal randomized evidence exists suggesting benefit of these devices in patients with AMI-CS.[8,10,36,37] Collectively, the current body of literature demonstrates an increase in total cost with the use of Impella versus IABP in AMI-CS, without a meaningful improvement in outcomes.[38-42] Therefore, there is an important need to identify which patients with AMI-CS might benefit from MCS, in order to maximize cost-effectiveness.

Survivors to discharge also encountered high outpatient costs. Specifically, complex continuing care, long-term care, and rehabilitation contributed significantly to the overall cost burden among patients using these services. Among survivors, 42%

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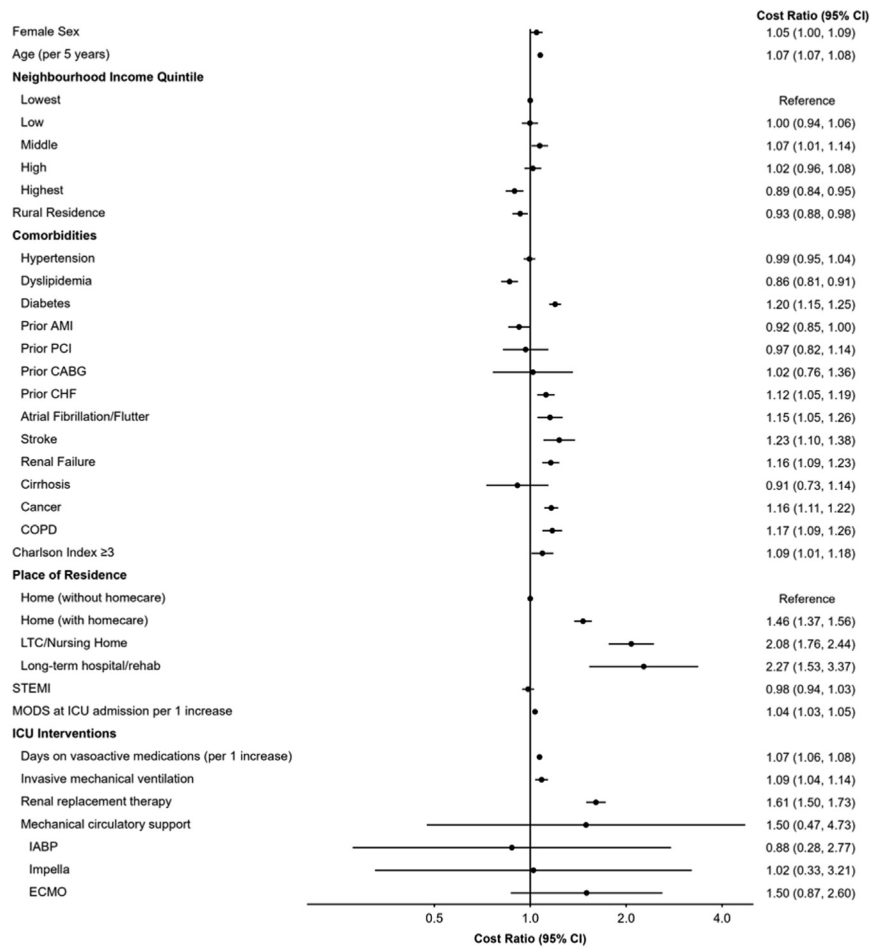
FIGURE 3 Generalized Linear Model to Identify Factors Associated With 1-Year Costs Among Patients With AMI-CS Surviving to Discharge (2009-2019, N = 6,803)

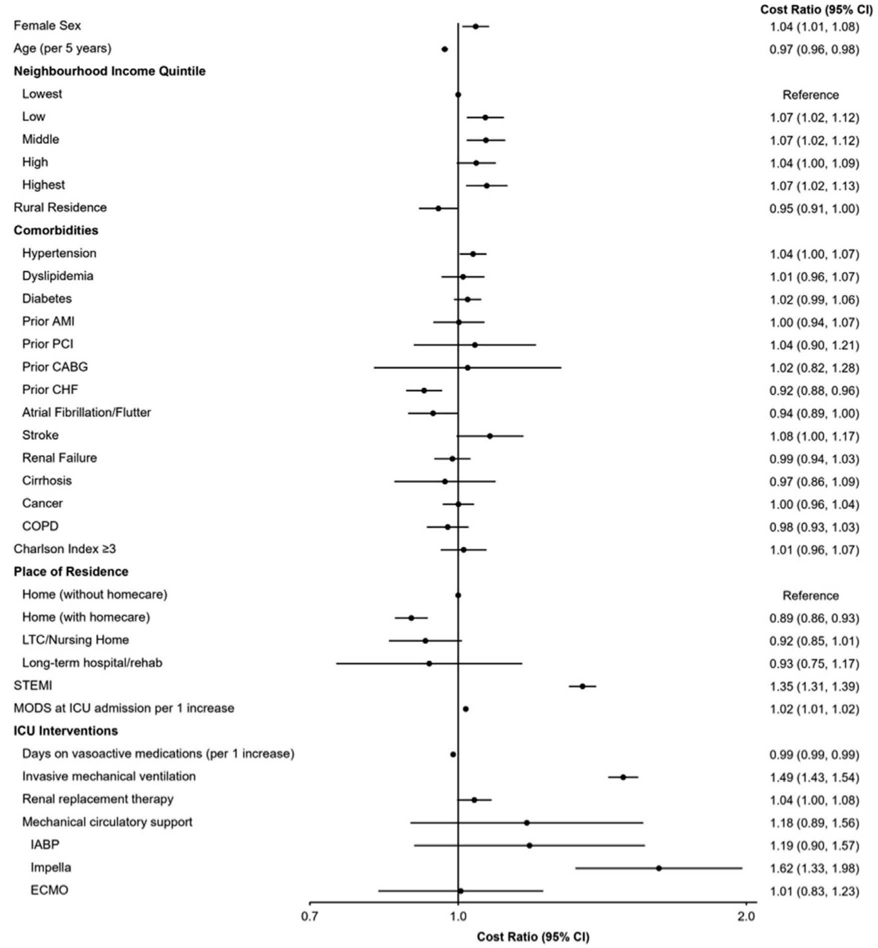


AMI = acute myocardial infarction; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; ECMO = extracorporeal membrane oxygenation; IABP = intra-aortic balloon pump; LTC = long-term care; MODS = Multiorgan Dysfunction Score; STEMI = ST-segment elevation myocardial infarction.

experienced a change from baseline residence following discharge, and <50% were discharged home independently. Patients readmitted to hospital following discharge incurred significantly higher costs when compared to the median cost among all survivors, and patients in the lowest home time quartile experienced more than double the health care costs observed in both the third highest and highest quartile groups. To reduce this significant cost and resource burden, health care systems must provide the infrastructure and targeted resources necessary to meet the needs of this high-risk population postdischarge. Furthermore, these data would suggest that the most effective treatments should not only reduce short-term mortality but also long-term resource expenditure and cost, and this is an important outcome to consider in future trials examining therapies for AMI-CS.

We also evaluated factors associated with total 1-year cost. Among survivors, burden of comorbidity was associated with increased cost, as were complex inpatient interventions such as use of mechanical ventilation and RRT. MCS use was not associated with increased cost, however IABPs, which are the least expensive form of MCS, were the most commonly used device in our cohort, with less than 1% of patients receiving other forms of MCS such as Impella or ECMO.[7,43] Furthermore, patients who are deemed candidates for advanced MCS are typically more robust at baseline, and thus less likely to incur

FIGURE 4 Generalized Linear Model to Identify Factors Associated With 1-Year Costs Among Patients With AMI-CS Who Died in Hospital (2009-2019, N = 2,945)



AMI = acute myocardial infarction; CHF = congestive heart failure; COPD = chronic obstructive pulmonary disease; ECMO = extracorporeal membrane oxygenation; IABP = intra-aortic balloon pump; LTC = long-term care; MODS = Multiorgan Dysfunction Score; STEMI = ST-segment elevation myocardial infarction.

significant downstream costs following discharge.[14,27] Overall, these data suggest that patients with multiple pre-existing comorbid conditions have increased care needs and more complex hospitalizations, resulting in higher costs incurred both during index hospitalization and following discharge. Targeting modifiable comorbidities in high-risk patients, including optimizing control of diabetes and renal function, is an important step toward effective resource utilization, and therefore may reduce downstream cost. This target for resource investment may be most effectively focused in the primary care setting. Furthermore, higher baseline income quartile was associated with lower cost, suggesting better preadmission health status and a greater ability to afford private postdischarge care in this group. Lastly, revascularization with CABG was associated with higher total 1-year and acute inpatient costs when compared to PCI and to no revascularization. The high costs in the CABG group were primarily due to costs incurred during the index hospitalization; a trend observed consistently in previously published cost-effectiveness models comparing revascularization strategies.[44,45] This may reflect greater care needs and longer hospital stays resulting from surgery performed in this vulnerable population.[46] The lower median cost seen in patients that did not receive revascularization is likely in part due to a significantly higher in-hospital mortality rate.[7]

This study used robust data from a complete population to evaluate costs and health care resource utilization associated with AMI-CS, as well as patient factors associated with increased cost. However, this work also has important limitations. First, we identified patients using ICD-10 codes, which can result in misclassification. However, we further utilized evidence of vasoactive medication use and organ dysfunction to identify patients with AMI-CS, and our outcomes were similar to those seen in randomized trials in this population.[10] In addition, we were limited with regard to the granularity of available data, including detailed information on how inpatient costs were divided, data on patients admitted to hospice or palliative settings, and incidence and timing of withdrawal of life-sustaining therapy. As such, the cost data we have presented likely do not fully account for the financial burden of AMI-CS. We were also unable to formally capture quality of life metrics, and this is an important area of investigation for future cost-effectiveness studies. Furthermore, our data were limited to health resources paid for by the Ministry of Health. For this reason, we did not account for costs paid out of pocket by patients or their families for care postdischarge and were unable to obtain data on outpatient prescription medication use. Lastly, we used data from only one province in Canada: a country in which the majority of health care is funded by the government. As such, these data may not be generalizable to health care systems that exist in other countries.

CONCLUSIONS

The current study provides data on the financial burden of AMI-CS in Ontario, Canada, at a population level. In-hospital costs in this population were high, however significant costs were also observed following discharge, especially among patients readmitted to hospital or discharged to a nonhome setting. To maximize cost-effectiveness, health care resource utilization as well as novel therapies for AMI-CS should focus not only on improving mortality but also reducing disability.

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PERSPECTIVES

COMPETENCY IN MEDICAL KNOWLEDGE: These data demonstrate that CS due to AMI is associated with high cost and resource utilization, both during the index hospitalization and following discharge.

TRANSLATIONAL OUTLOOK: In this population, significant cost is incurred following discharge, especially among patients readmitted to hospital or discharged to a nonhome setting. Therefore, future research in this field should focus on a reduction in long-term disability in addition to an improvement in mortality.

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KEY WORDS acute myocardial infarction, cardiogenic shock, critical care, health care cost, resource utilization

APPENDIX For supplemental tables, please see the online version of this paper.