Supplementary Online Content

This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods - *Sensitivity Analyses*

In addition to our primary analysis, we performed several sensitivity analyses. First, we excluded patients with ≤ 2 days length of stay in the hospital in effort to avoid immortal time bias, as done previously.[1] This eliminated patients who may not have had lived long enough to undergo an echo and increased the likelihood that echo was performed before any patient deaths. This also excluded patients well enough for discharge after only 1 night in the hospital and helps avoid immortal time bias. Second, we excluded any patient with a transfer in or out of the hospital. We did not initially exclude these patients because we were primarily interested in hospital-level practice patterns in echo use, but eliminating this group assured that all echo tests and outcomes occurred at the same hospital. Third, given that the ICD-9 code of 410.x does not reliably distinguish between ST-segment elevation and non-ST-segment elevation myocardial infarction,[2] we examined the population by cardiac catheterization and revascularization sub-groups; procedures which are reliably recorded in Premier. This included 1) cardiac catheterization with subsequent revascularization with either percutaneous coronary intervention or coronary artery bypass graft surgery, 2) patients who underwent cardiac catheterization without revascularization, and 3) patients that had neither cardiac catheterization nor underwent revascularization. For these sub-group analyses, multiple hospitals were excluded, so we divided hospitals into tertiles instead of quartiles.

1.   Hernandez AF, Velazquez EJ, Solomon SD, et al. Left ventricular assessment in myocardial infarction: the VALIANT registry. *Arch Intern Med.* Oct 10 2005;165(18):2162-2169.

2.   Steinberg BA, French WJ, Peterson E, Frederick PD, Cannon CP, National Registry of Myocardial Infarction I. Is coding for myocardial infarction more accurate now that coding descriptions have been clarified to distinguish ST-elevation myocardial infarction from non-ST elevation myocardial infarction? *Am J Cardiol.* Sep 1 2008;102(5):513-517.

eResults - *Sensitivity Results*

Of all deaths in the cohort, 36% occurred on the first day of the hospitalization when echo use among those with mortality was lowest (39.7%). (eTable 3) However, by hospital day 3, the majority of deaths had now had an echo (80.4%), which indicates that many of the patients who died likely did not live long enough to undergo an echo. Given this finding, we then performed a sensitivity analysis excluding patients with length of stay ≤ 2 days .This exclusion also removed more than 30,000 patients who were low acuity and were discharged quickly. (eTable 4.) After excluding these patients, the median hospital echo use rate rose to 81.7% Compared to patients without an echo, patients who underwent an echo continued to have significantly higher comorbidity burden and great utilization of critical care therapies. (eTable 5) However, unlike the full cohort, unadjusted mortality rates now shifted directions, such that the performance of an echo was associated with an unadjusted higher mortality rate (4.4 vs 2.6% in echo vs. no echo respectively, p <0.001, eTable 5). Outcomes remained essentially unchanged, and after risk standardization and adjustment for residual imbalance in patient and hospital factors, we observed no difference between hospitals in mortality or 3-month readmission but costs remained higher among high RSecho hospitals. (eTable 6).

In other sensitivity analyses, the exclusion of hospital transfers removed 25,805 (27.0%) patients, but showed essentially unchanged echo rates, unadjusted mortality rates, and similar outcomes pattern as the original cohort. (eTable7.) When stratified by use of cardiac catheterization and revascularization, we noted significant differences in outcomes between these three populations. Patients without cardiac catheterization were approximately 3 times more likely to die, twice as likely to be readmitted, but had costs that were half those observed among patients who underwent revascularization with either CABG or PCI. (eTable 4 and 8.) However,

in all three subgroups, we continued to observe no differences in adjusted mortality rates when examined across RSecho rate tertiles, while costs and length of stay continued to be higher in hospitals with high RS echo use rates. (eTable 8.) Rates of 3-month readmission were not different among tertiles of RSecho among patients with cardiac catheterization and/or revascularization, but among patients who did not undergo a cardiac catheterization, we observed marginally lower odds of 3-month readmission, [OR (95% CI): 0.89 (0.80 – 0.99), p = 0.04 for tertile 3 vs. tertile 1].

eTable. 1. Patient Characteristics and Unadjusted Outcomes by Use of Echocardiography at Hospitals with At Least 25 Admissions for Acute Myocardial Infarction

Description	Total	No ECHO	ECHO	Absolute standardized differences
	n (%)	n (%)	n (%)	%
Patients, n, (%)	**98999 (100)**	**29347 (29.6)**	**69652 (70.4)**	
Age, Mean (SD), years	66.5 (13.6)	65.9 (13.4)	66.7 (13.7)	6.3
Median (IQR), years	66 (57 - 77)	66 (56 - 76)	67 (57 - 78)	
Female sex	37851 (38.2)	11157 (38)	26694 (38.3)	0.63
Race/Ethnicity				4.77
White	69566 (70.3)	20877 (71.1)	48689 (69.9)	
Black	10267 (10.4)	3060 (10.4)	7207 (10.3)	
Hispanic	6378 (6.4)	1943 (6.6)	4435 (6.4)	
Other	12788 (12.9)	3467 (11.8)	9321 (13.4)	
Marital status				5.35
Married	45136 (45.6)	13788 (47)	31348 (45)	
Single	40774 (41.2)	12009 (40.9)	28765 (41.3)	
Other	13089 (13.2)	3550 (12.1)	9539 (13.7)	
Insurance payor				5.37
Medicare	56990 (57.6)	16655 (56.8)	40335 (57.9)	
Medicaid	8594 (8.7)	2463 (8.4)	6131 (8.8)	
Managed care	19063 (19.2)	6020 (20.5)	13043 (18.7)	
Commercial-Indemnity	5303 (5.3)	1497 (5.1)	3806 (5.5)	
Self pay	5179 (5.2)	1625 (5.5)	3554 (5.1)	
Other	3870 (3.9)	1087 (3.7)	2783 (4)	
Gagne combined comorbidity score				
Mean (SD)	2.03 (2.7)	1.6 (2.6)	2.2 (2.7)	22.11
Median (IQR)	1 (0 - 4)	1 (0 - 3)	2 (0 - 4)	
Comorbidities				
Hypertension	78590 (79.4)	23427 (79.8)	55163 (79.2)	1.56
Hypothyroidism	12039 (12.2)	3457 (11.8)	8582 (12.3)	0.26
Congestive heart failure	31501 (31.8)	7287 (24.8)	24214 (34.8)	21.85
Chronic pulmonary disease	22633 (22.9)	6606 (22.5)	16027 (23)	1.19
Renal failure	21038 (21.2)	5542 (18.9)	15496 (22.2)	8.33
Obesity	18466 (18.6)	5301 (18.1)	13165 (18.9)	2.16
Deficiency Anemias	17709 (17.9)	4508 (15.4)	13201 (19)	9.54
Valvular disease	15243 (15.4)	3168 (10.8)	12075 (17.3)	18.9
Diabetes	39825 (40.2)	11779 (40.1)	28046 (40.3)	1.66
Peripheral vascular disease	12859 (13.0)	3657 (12.5)	9202 (13.2)	2.24
Depression	9084 (9.2)	2772 (9.4)	6312 (9.1)	1.32

Other neurological disorders	6487 (6.5)	1749 (6)	4738 (6.8)	3.45
Pulmonary circulation disease	6026 (6.1)	1197 (4.1)	4829 (6.9)	12.54
Critical care therapies				
Intensive/Intermediate care unit	53966 (54.5)	12859 (43.8)	41107 (59)	30.77
Vasodilators	37739 (38.1)	10447 (35.6)	27292 (39.2)	7.41
Noninvasive ventilation	8105 (8.2)	1487 (5.1)	6618 (9.5)	17.13
Invasive mechanical ventilation	15483 (15.6)	3384 (11.5)	12099 (17.4)	16.67
Vasopressors	19591 (19.8)	4368 (14.9)	15223 (21.9)	18.08
Arterial line	4109 (4.1)	1015 (3.5)	3094 (4.4)	5.05
Intraaortic balloon pump	4399 (4.4)	830 (2.8)	3569 (5.1)	11.77
Inotropes	10445 (10.5)	2050 (7)	8395 (12.1)	17.33
Other cardiac tests/therapies				
Nuclear imaging	4743 (4.8)	874 (3.0)	3869 (5.5)	12.8
Ventriculography	1687 (1.7)	273 (0.9)	1414 (2.0)	9.1
Cardiac magnetic resonance imaging	295 (0.3)	57 (0.2)	238 (0.3)	2.8
Procedures				
Coronary artery bypass surgery	9402 (9.5)	2295 (7.8)	7107 (10.2)	8.33
Percutaneous coronary intervention	46824 (47.3)	13962 (47.6)	32862 (47.2)	0.79
Cardiac catheterization	74112 (74.9)	21405 (72.9)	52707 (75.7)	6.3
Acute Organ failure				
Respiratory	10378 (10.5)	1957 (6.7)	8421 (12.1)	18.7
Cardiac	13244 (13.4)	2781 (9.5)	10463 (15.0)	17
Renal	17145 (17.3)	3397 (11.6)	13748 (19.7)	22.6
Neurological	5048 (5.1)	1045 (3.6)	4003 (5.7)	10.4
Hematological	5770 (5.8)	1258 (4.3)	4512 (6.5)	9.7
Hepatic	1501 (1.5)	226 (0.8)	1275 (1.8)	9.4
Acidosis	4835 (4.9)	951 (3.2)	3884 (5.6)	11.4
Outcomes				p-value*
Length of stay†, mean (SD), days	4.6 (4.2)	3.3 (3.1)	5.1 (4.5)	<0.001
Total cost‡, mean (SD)	17813 (16287)	13455 (11507)	19646 (17602)	<0.001
In-hospital mortality	4613 (4.8)	1524 (5.4)	3089 (4.5)	<0.001
3 month readmission among survivors	17396 (18.4)	5266 (18.9)	12130 (18.2)	0.01

LOS = Length of stay; echo = echocardiography;
*Generalized estimating (GEE) models accounting for patient clustering within hospitals
†Winsorized at 99th percentile
‡Winsorized at 1st and 99th pctl

eTable 2. Risk Standardized Model

Patient characteristic	Odds ratio	95% Confidence Limits	
		Upper Limit	Lower Limit
Age (for every 5 years)	0.99	0.98	1.00
Insurance payor			
Medicare	Referent		
Medicaid	1.04	0.98	1.11
Managed care	1.06	1.01	1.11
Commercial-Indemnity	1.09	1.02	1.18
Self pay	1.11	1.03	1.19
Other	1.18	1.08	1.28
Gagne Combined Comorbidity score (for every 5 units)	1.69	1.56	1.83
Comorbidities			
Hypertension	1.05	1.01	1.09
Congestive heart failure	1.12	1.06	1.18
Chronic pulmonary disease	0.84	0.80	0.87
Renal failure	0.66	0.62	0.70
Obesity	1.09	1.04	1.13
Deficiency anemias	0.97	0.92	1.01
Valvular disease	1.58	1.50	1.66
Diabetes	0.90	0.87	0.93
Peripheral vascular disease	0.88	0.84	0.92
Depression	0.93	0.89	0.98
Other neurological disease	1.05	0.99	1.12
Pulmonary circulation disease	1.21	1.12	1.31
Liver disease	0.92	0.82	1.04
Metastatic cancer	0.53	0.44	0.64
Blood loss	1.33	1.10	1.61
Psychoses	0.90	0.82	1.00
Acute organ failure			
Respiratory	1.41	1.32	1.50
Cardiac	1.33	1.27	1.40
Renal	1.58	1.50	1.66
Neurologic	1.13	1.04	1.23
Hematological	1.14	1.06	1.23

eTable 3. Death and Echo Rates by Patient Hospital Length of Stay

Hospital Length of Stay	Patients (N)	Echo Rate among patients with this designated LOS (%)	Deaths (N)	Echo Rate among deaths (%)
1	13949	47.2	1669	39.7
2	23843	65.7	598	69.4
3	17508	73.9	429	80.4
4	9721	77.6	311	81.0
5	6432	78.8	271	86.0
6	4823	78.4	250	87.2
7	3807	79.2	172	86.0

LOS = Length of stay; echo = echocardiography;

eTable 4. Sensitivity Analysis Cohorts

Analysis	Hospitals	Observed Echo Rate, median (IQR)	Risk Standardized Echo Rate, median (IQR)	Patients in Mortality Analysis (N) ^	In-hospital mortality, n (%)
Original Cohort	397	72.4 (62.6 to 79.1)	73.9 (62.8 to 81.1)	95967	4613 (4.8)
Exclude Hospital LOS ≤ 2 days	335	81.7 (74.2 to 88.1)	79.1 (72.0 to 84.3)	58175	2346 (4.0)
Exclude Transfers	348	76.3 (65.8 to 82.4)	73.0 (64.1 to 78.6)	70162	3633 (5.2)
Revascularization Subgroups					
Cardiac catheterization with revascularization (CABG/PCI)	287	75.8 (63.6 to 84.4)	72.0 (61.4 to 80.6)	52086	1462 (2.8)
Cardiac catheterization without revascularization	255	72.6 (62.5 to 81.3)	70.0 (61.1 to 78.0)	19710	810 (4.1)
No cardiac catheterization	324	70.4 (62.1 to 78.1)	68.7 (62.8 to 76.1)	23044	2235 (9.7)

LOS = Length of stay, IQR = Interquartile range, CABG = Coronary artery bypass graft, PCI = Percutaneous coronary intervention
^ Randomly selected 1 admission

eTable 5. Patient Characteristics and Unadjusted Outcomes By Use of Echocardiography When Excluding Length of Stay ≤ 2 Days

Description	Total	No ECHO	ECHO	Absolute standardized differences
	n (%)	n (%)	n (%)	%
Patients, n, (%)	**60175 (100)**	**13200 (21.9)**	**46975 (78.1)**	
Age, Mean (SD), years	68.2 (13.4)	67.9 (13.1)	68.3 (13.5)	3.5
Median (IQR), years	68 (59 - 79)	68 (58 - 78)	69 (59 - 79)	
Female sex	24354 (40.5)	5457 (41.3)	18897 (40.2)	2.3
Race/Ethnicity				7.2
White	41558 (69.1)	9229 (69.9)	32329 (68.8)	
Black	6694 (11.1)	1533 (11.6)	5161 (11)	
Hispanic	3889 (6.5)	911 (6.9)	2978 (6.3)	
Other	8034 (13.4)	1527 (11.6)	6507 (13.9)	
Marital status				5.7
Married	26175 (43.5)	5869 (44.5)	20306 (43.2)	
Single	26124 (43.4)	5798 (43.9)	20326 (43.3)	
Other	7876 (13.1)	1533 (11.6)	6343 (13.5)	
Insurance payor				3.6
Medicare	37881 (63)	8401 (63.6)	29480 (62.8)	
Medicaid	5152 (8.6)	1083 (8.2)	4069 (8.7)	
Managed care	9601 (16)	2152 (16.3)	7449 (15.9)	
Commercial-Indemnity	2717 (4.5)	559 (4.2)	2158 (4.6)	
Self pay	2583 (4.3)	558 (4.2)	2025 (4.3)	
Other	2241 (3.7)	447 (3.4)	1794 (3.8)	
Gagne combined comorbidity score				
Mean (SD)	2.7 (2.8)	2.4 (2.8)	2.8 (2.8)	13
Median (IQR)	2 (0 - 5)	2 (0 - 4)	2 (0 - 5)	
Comorbidities				
Hypertension	49133 (81.7)	10973 (83.1)	38160 (81.2)	4.9
Hypothyroidism	7953 (13.2)	1748 (13.2)	6205 (13.2)	0.1
Congestive heart failure	25043 (41.6)	4627 (35.1)	20416 (43.5)	17.3
Chronic pulmonary disease	15913 (26.4)	3652 (27.7)	12261 (26.1)	3.5
Renal failure	16255 (27)	3511 (26.6)	12744 (27.1)	1.2
Obesity	11798 (19.6)	2617 (19.8)	9181 (19.5)	0.7
Deficiency Anemias	14415 (24)	3147 (23.8)	11268 (24)	0.3
Valvular disease	11485 (19.1)	1936 (14.7)	9549 (20.3)	14.9
Diabetes	26814 (44.6)	6098 (46.2)	20716 (44.1)	4.2

Peripheral vascular disease	9321 (15.5)	2102 (15.9)	7219 (15.4)	1.5
Depression	6042 (10)	1422 (10.8)	4620 (9.8)	3.1
Other neurological disorders	4724 (7.9)	978 (7.4)	3746 (8)	2.1
Pulmonary circulation disease	4925 (8.2)	824 (6.2)	4101 (8.7)	9.5
Critical care therapies				
Intensive/Intermediate care unit	37234 (61.9)	7013 (53.1)	30221 (64.3)	22.9
Vasodilators	24186 (40.2)	5164 (39.1)	19022 (40.5)	2.8
Noninvasive ventilation	6951 (11.6)	1067 (8.1)	5884 (12.5)	14.6
Invasive mechanical ventilation	13857 (23)	2671 (20.2)	11186 (23.8)	8.6
Vasopressors	16249 (27)	3051 (23.1)	13198 (28.1)	11.4
Arterial line	3537 (5.9)	783 (5.9)	2754 (5.9)	0.3
Intraaortic balloon pump	3654 (6.1)	494 (3.7)	3160 (6.7)	13.4
Inotropes	8940 (14.9)	1447 (11)	7493 (16)	14.7
Other cardiac tests/therapies				
Nuclear imaging	3691 (6.1)	557 (4.2)	3134 (6.7)	10.8
Ventriculography	1161 (1.9)	143 (1.1)	1018 (2.2)	8.6
Cardiac magnetic resonance imaging	265 (0.4)	51 (0.4)	214 (0.5)	1.1
Procedures				
Coronary artery bypass surgery	9344 (15.5)	2269 (17.2)	7075 (15.1)	5.8
Percutaneous coronary intervention	25048 (41.6)	5306 (40.2)	19742 (42)	3.7
Cardiac catheterization	44022 (73.2)	9284 (70.3)	34738 (73.9)	8.1
Acute Organ failure				
Respiratory	8425 (14.0)	1105 (8.4)	7320 (15.6)	22.3
Cardiac	10242 (17.0)	1568 (11.9)	8674 (18.5)	18.4
Renal	14280 (23.7)	2347 (17.8)	11933 (25.4)	18.6
Neurological	4290 (7.1)	692 (5.2)	3598 (7.7)	9.8
Hematological	4861 (8.1)	886 (6.7)	3975 (8.5)	6.6
Hepatic	1228 (2.0)	134 (1.0)	1094 (2.3)	10.3
Acidosis	3834 (6.4)	539 (4.1)	3295 (7.0)	12.8
Outcomes				**p-value***
Length of stay†, mean (SD), days	6.5 (4.8)	5.6 (3.7)	6.8 (5.0)	<0.001
Total cost‡, mean (SD)	23006 (19437)	18746 (14200)	24201 (20511)	<0.001
In-hospital mortality^	2346 (4.0)	334 (2.7)	2012 (4.4)	<0.001
3 month readmission among survivors	12902 (22.3)	3194 (24.8)	9708 (21.6)	<0.001

LOS = Length of stay; echo = echocardiography;

*Generalized estimating (GEE) models accounting for patient clustering within hospitals

†Winsorized at 99th percentile

‡Winsorized at 1st and 99th pctl

^Randomly selected 1 admission

eTable 6: Sensitivity Analysis Excluding Patients with Hospital Length of Stay of ≤2 days

Unadjusted Outcomes (Quartile range %)	Quartile 1 (4.2%-71.8%)	Quartile 2 (71.9% - 79%)	Quartile 3 (79% - 84%)	Quartile 4 (84.2% - 94.6%)	p-value (Q4 vs. Q1)	
Number of Hospitals	83	84	84	84		
Length of stay*, Mean (SD), days,	6.5 (4.7)	6.5 (4.8)	6.6 (4.9)	6.5 (4.9)	0.40	
Total cost†, Mean (SD), $ USD	21930 (17940)	21486 (18334)	24773 (20882)	24650 (20689)	0.005	
In-hospital mortality^	620 (4.1)	667 (4.4)	522 (3.8)	550 (3.6)	0.11	
3 month readmission among survivors	3169 (21.8)	3257 (22.3)	3120 (23.8)	3113 (21.4)	0.62	
Fully Adjusted‡ Outcome Effect Sizes	**Estimate/OR (95% CI)**	**Estimate/OR (95% CI)**	**Estimate/OR (95% CI)**	**Estimate/OR (95% CI)**	**p-value (Q4 vs. Q1)**	**Overall p-value**
Length of stay*, Mean (SD), days,	Referent	-0.08 (-0.31, 0.15)	-0.12 (-0.36, 0.11)	0.08 (-0.15, 0.32)	0.31	0.49
Total cost†, Mean (SD), $ USD	Referent	935 (-908, 2778)	3380 (1526, 5235)	4550 (2690, 6409)	<0.001	<0.001
In-hospital mortality^	Referent	1.09 (0.91 - 1.30)	0.92 (0.77 - 1.11)	0.90 (0.75 - 1.08)	0.17	0.26
3 month all cause readmission among survivors	Referent	1.05 (0.96 - 1.15)	1.10 (1.00 - 1.21)	0.99 (0.90 - 1.08)	0.08	0.78

LOS = Length of stay; echo = echocardiography; Q1 = quartile 1; Q4 = quartile 4

*Winsorized at 99th percentile

†Winsorized at 1st and 99th pctl

^ Randomly selected 1 admission

‡ Hierarchical generalized linear model models accounted for patient clustering within hospitals and adjusted for patient demographics, comorbidities, acute organ failures, hospital characteristics, and hospital interventional capabilities

eTable 7. Sensitivity Analysis Excluding Hospital Transfers

Unadjusted Outcomes	Quartile 1 (2.8%-64.0%)	Quartile 2 (64.1% - 73.0%)	Quartile 3 (73.1% - 78.5%)	Quartile 4 (78.6% - 93.7%)	p-value (Q4 vs. Q1)*	
Number of Hospitals	87	87	87	87		
Risk-standardized echo rate, Median (%)	56.3	68.8	76.1	83.2		
Length of stay*, mean (SD), days	4.4 (4.0)	4.7 (4.3)	4.6 (4.2)	4.7 (4.3)	0.51	
Total cost, † mean, (SD), $USD	16294 (14039)	16673 (14915)	18723 (16316)	19419 (16616)	<0.001	
In-hospital mortality^	998 (4.9)	938 (5.7)	863 (5.3)	834 (4.8)	0.48	
3 month all cause readmission among survivors	3690 (18.7)	3176 (19.7)	3414 (21.6)	3258 (19.3)	0.95	
Fully Adjusted‡ Outcome Effect Sizes	Estimate/OR (95% CI)	Estimate/OR (95% CI)	Estimate/OR (95% CI)	Estimate/OR (95% CI)	p-value (Q4 vs. Q1)	p-value (overall)
Length of stay*, mean (SD), days	Referent	0.12 (-0.07, 0.31)	0.20 (0.01, 0.39)	0.22 (0.03, 0.41)	0.02	0.09
Total cost, † mean, (SD) † $USD	Referent	485 (-881, 1851)	2541 (1187, 3897)	3090 (1736, 4444)	<0.001	<0.0001
In-hospital mortality^	Referent	1.12 (0.95 - 1.31)	1.05 (0.89 - 1.24)	0.94 (0.80 - 1.24)	0.44	0.21
3 month all cause readmission among survivors	Referent	1.06 (0.97 - 1.16)	1.19 (1.08 - 1.30)	1.01 (0.92 - 1.10)	0.89	0.001

LOS = Length of stay; echo = echocardiography; Q1 = quartile 1; Q4 = quartile 4, USD = United States Dollars

*Winsorized at 99th percentile

†Winsorized at 1st and 99th pctl

^ Randomly selected 1 admission

‡ Hierarchical generalized linear model models accounted for patient clustering within hospitals and adjusted for patient demographics, comorbidities, acute organ failures, hospital characteristics, and hospital interventional capabilities

eTable 8: Sensitivity Analysis by Catheterization and Revascularization Subgroups

Cardiac Catheterization with Coronary Artery Bypass and/or Percutaneous Coronary Intervention					
Tertile of Risk-standardized ECHO rate (range %)	Tertile 1 (3.5%-66.4%)	Tertile 2 (66.5% - 77.5%)	Tertile 3 (77.6% - 94.3%)	p-value (T3 vs. T1)*	p-value (overall)
Hospitals (n)	95	96	96		
Risk-standardized echo rate, Median (%)	54.9	71.9	83.6		
Unadjusted Outcomes					
Length of stay*, Mean (SD), days,	4.6 (4.5)	4.8 (4.7)	4.8 (4.6)	0.94	
Total cost†, Mean (SD), $ USD	20934 (16152)	23629 (18857)	24042 (18440)	<0.001	
In-hospital mortality^	510 (2.8)	531 (3.0)	421 (2.6)	0.58	
3 month all cause readmission among survivors	2464 (13.6)	2568 (14.9)	2232 (14.2)	0.45	
Fully Adjusted‡ Outcome Effect Sizes	Estimate/OR (95% CI)	Estimate/OR (95% CI)	Estimate/OR (95% CI)		
Length of stay*, Mean (SD), days,	Referent	-0.03 (-0.25, 0.16)	0.04 (-0.18, 0.26)	0.76	0.84
Total cost†, Mean (SD), $ USD	Referent	854 (-892, 2600)	2402 (665, 4139)	0.007	0.02
In-hospital mortality^	Referent	1.04 (0.87 - 1.26)	0.89 (0.74 - 1.08)	0.25	0.26
3 month all cause readmission among survivors	Referent	1.12 (1.01 - 1.23)	1.06 (0.96 - 1.17)	0.24	0.09
Cardiac Catheterization without Revascularization					
Tertile of Risk-standardized ECHO rate (range %)	Tertile 1 (9.3%-64.8%)	Tertile 2 (64.8% - 75.6%)	Tertile 3 (75.6% - 90.1%)		
Hospitals	85	85	85		
Risk-standardized echo rate, Median (%)	58.2	70	79.4		
Unadjusted Outcomes					
Length of stay*, Mean (SD), days,	3.9 (3.5)	4.2 (3.7)	4.1 (3.5)	0.04	
Total cost†, Mean (SD), $ USD	11483 (10309)	12663 (11329)	12803 (11280)	0.001	
In-hospital mortality^	286 (4.2)	286 (4.3)	238 (3.7)	0.27	
3 month all cause readmission among survivors	1278 (19.6)	1317 (20.8)	1288 (20.8)	0.18	

Fully Adjusted‡ Outcome Effect Sizes	Estimate/OR (95% CI)	Estimate/OR (95% CI)	Estimate/OR (95% CI)		
Length of stay*, Mean (SD), days,	Referent	0.22 (0.03, 0.41)	0.33 (0.14, 0.52)	0.001	0.002
Total cost†, Mean (SD), $ USD	Referent	546 (-473, 520)	1471 (461, 2481)	0.02	0.004
In-hospital mortality^	Referent	1.11 (0.88 - 1.39)	1.01 (0.80 - 1.28)	0.94	0.64
3 month all cause readmission among survivors	Referent	1.10 (0.98 - 1.23)	1.09 (0.98 - 1.22)	0.12	0.19
No Cardiac Catheterization					
Tertile of Risk-standardized ECHO rate (range %)	Tertile 1 (6.8%-64.6%)	Tertile 2 (64.6% - 73.7%)	Tertile 3 (74.0% - 90.7%)		
Hospitals	108	108	108		
Risk-standardized echo rate, Median (%)	58.4	68.7	78		
Unadjusted Outcomes					
Length of stay*, Mean (SD), days,	4.6 (4.0)	4.7 (4.0)	4.8 (4.3)	0.35	
Total cost†, Mean (SD), $ USD	11011 (12434)	12007 (12958)	12902 (14388)	0.02	
In-hospital mortality^	660 (8.9)	849 (10.7)	726 (9.4)	0.53	
3 month all cause readmission among survivors	1982 (28.3)	1913 (26.2)	1839 (25.5)	0.006	
Fully Adjusted‡ Outcome Effect Sizes	Estimate/OR (95% CI)	Estimate/OR (95% CI)	Estimate/OR (95% CI)		
Length of stay*, Mean (SD), days,	Referent	-0.05 (-0.30, 0.20)	0.16 (-0.09, 0.41)	0.21	0.22
Total cost†, Mean (SD), $ USD	Referent	317 (-770, 1404)	922 (-168, 2012)	0.10	0.24
In-hospital mortality^	Referent	1.12 (0.94 - 1.34)	1.02 (0.85 - 1.22)	0.84	0.37
3 month all cause readmission among survivors	Referent	0.90 (0.81 - 1.01)	0.89 (0.80 - 0.99)	0.04	0.08

LOS = Length of stay; echo = echocardiography; Q1 = quartile 1; Q4 = quartile 4

*Winsorized at 99th percentile

†Winsorized at 1st and 99th pctl

^ Randomly selected 1 admission

‡ Hierarchical generalized linear model models accounted for patient clustering within hospitals and adjusted for patient demographics, comorbidities, acute organ failures, hospital characteristics, and hospital interventional capabilities