

## Supplemental Online Content

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

**eTable 1.** Administrative coding used to identify procedures, outcomes, and diagnoses

IABP	
CPT	33967
ICD-9	37.61
ICD-10	5A02110, 5A02210
Intravascular LVAD	
CPT	33990, 33991
ICD-9	37.68
ICD-10	02HA3RJ, 02HA3RS, 02HA3RZ, 02HL3DZ, 5A0211D, 5A0221D
AMI	
ICD-9	410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91
ICD-10	I21.01, I21.02, I21.09, I21.11, I21.19, I21.21, I21.29, I21.3, I21.4, I21.9, I21.A1, I21.A9, I22.0, I22.1, I22.2, I22.8, I22.9
PCI	
CPT/HCPCS	92920, 92921, 92924, 92925, 92928, 92929, 92933, 92934, 92937, 92938, 92941, 92943, 92944, 92980, 92981, 92982, 92984, 92995, 92996, C9600, C9601, C9602, C9603, C9604, C9605, C9606, C9607, C9608, G0290, G0291
ICD-9	00.66, 17.55, 36.01, 36.02, 36.05, 36.06, 36.07, 36.09
ICD-10	0270046, 027004Z, 02700D6, 02700DZ, 02700T6, 02700TZ, 02700Z6, 02700ZZ, 0270346, 027034Z, 02703D6, 02703DZ, 02703T6, 02703TZ, 02703Z6, 02703ZZ, 0270446, 027044Z, 02704D6, 02704DZ, 02704T6, 02704TZ, 02704Z6, 02704ZZ, 0271046, 027104Z, 02710D6, 02710DZ, 02710T6, 02710TZ, 02710Z6, 02710ZZ, 0271346, 027134Z, 02713D6, 02713DZ, 02713T6, 02713TZ, 02713Z6, 02713ZZ, 0271446, 027144Z, 02714D6, 02714DZ, 02714T6, 02714TZ, 02714Z6, 02714ZZ, 0272046, 027204Z, 02720D6, 02720DZ, 02720T6, 02720TZ, 02720Z6, 02720ZZ, 0272346, 027234Z, 02723D6, 02723DZ, 02723T6, 02723TZ, 02723Z6, 02723ZZ, 0272446, 027244Z, 02724D6, 02724DZ, 02724T6, 02724TZ, 02724Z6, 02724ZZ, 0273046, 027304Z, 02730D6, 02730DZ, 02730T6, 02730TZ, 02730Z6, 02730ZZ, 0273346, 027334Z, 02733D6, 02733DZ, 02733T6, 02733TZ, 02733Z6, 02733ZZ, 0273446, 027344Z, 02734D6, 02734DZ, 02734T6, 02734TZ, 02734Z6, 02734ZZ, 02C03ZZ, 02C04ZZ, 02C13ZZ, 02C14ZZ, 02C23ZZ, 02C24ZZ, 02C33ZZ, 02C34ZZ, X2C0361, X2C1361
ECMO	
CPT	33947, 33948, 33949, 36822, 33960, 33961
ICD-9	39.65
ICD-10	5A1522F, 5A1522G, 5A1522H
Cardiogenic shock	
ICD-9	785.51
ICD-10	R57.0
Blood transfusion	

CPT/HCPCS	P9010, P9011, P9039, P9021, P9057, P9038, P9058, P9040, P9022, P9051, P9054, P9056
ICD-9	99.03,99.04
ICD-10	30233H1, 30233N1, 30243H1, 30243N1
Major bleeding	
ICD-9	430,431,432,578, 280.0, 285.1, 363.6, 423.0, 432.X, 455.2, 455.5, 455.8, 456.0, 459.0, 530.7, 531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.2, 533.4, 533.6, 534.0, 534.2, 534.4, 534.6, 569.3, 578.0, 578.1, 578.9, 599.7, 784.7, 784.8, 786.3, 852.0, 852.2, 852.4, 853.0, 372.72, 456.20, 530.21, 530.82, 531.0, 531.2, 531.4, 531.6, 532.0, 532.2, 532.4, 532.6, 533.0, 533.2, 533.4, 533.6, 534.0, 534.2, 534.4, 534.6, 535.x1, 537.83, 537.84, 562.02, 562.03, 562.12, 562.13, 568.81, 569.85, 569.86, 719.1x, 852.0x, 852.2x, 852.4x, 853.0x
ICD-10	D50.0, D62, H11.33, I31.2, I60.%, I61.%, I62.%, I69.0%, I69.1%, I69.2%, I84.1%, I85.01, I85.11, K22.11, K22.6, K25.0, K25.2, K25.4, K25.6, K25.7, K26.0, K26.2, K26.4, K26.6, K27.0, K27.2, K27.4, K27.6, K28.0, K28.2, K28.4, K28.6, K29.%1, K31.811, K31.82, K55.21, K57.%1, K57.%3, K62.5, K66.1, K92.0, K92.1, K92.2, M25.00, M25.0%9, M25.073, M25.076, M25.08, R04.0, R04.1, R58, S06.34%, S06.35%, S06.36%, S06.4%A, S06.5%A, S06.6%A
RRT	
CPT/HCPCS	G8714, G8715, G8713, G8717, G8718, G8720, G8956, S9335, 90937, 90935, 4054F, 4052F, 4053F, 99512
ICD-9	39.95
ICD-10	5A1D00Z, 5A1D60Z, 5A1D70Z, 5A1D80Z, 5A1D90Z
Stroke	
ICD-9	433.x1, 434.x1, 433.x0, 434.x0, 435.x
ICD-10	I63%, G45.%
Hypertension	
ICD-9	401.xx, 402.xx, 403.xx, 404.xx
ICD-10	I10.%, I11.%, I12.%, I13.%, H35.03%, I67.4
Dyslipidemia	
ICD-9	272.xx
ICD-10	E78.%
Diabetes mellitus	
ICD-9	250.x1, 250.x3, 250.x0, 250.x2
ICD-10	E10.%, E11.%
Tobacco use	
CPT/HCPCS	99406, 99407, 1034F, 4004F,4001F, G0436, G0437, G9016, S9075, S9453, S4995, G9276, G9458
ICD-9	V15.82, 305.1
ICD-10	F17.%, Z87.891, Z72.0
Obesity	
ICD-9	278.0x

ICD-10	E66.%
Heart failure	
ICD-9	398.91, 402.01, 402.11, 402.91, 404.01, 404.03, 404.11, 404.13, 404.91, 404.93, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9
ICD-10	I09.81, I11.0, I13.0, I13.2, I50.1, I50.20, I50.21, I50.22, I50.23, I50.30, I50.31, I50.32, I50.33, I50.40, I50.41, I50.42, I50.43, I50.810, I50.811, I50.812, I50.813, I50.814, I50.82, I50.83, I50.84, I50.89, I50.9
Atrial fibrillation	
ICD-9	427.41, 427.42, 427.5
ICD-10	I48.%
CVD	
ICD-9	430.xx-438.xx
ICD-10	G45.%, G46.%, I60.%-I67.%, I69.%
PVD	
ICD-9	093.0, 437.3, 440.xx, 441.xx, 443.xx, 447.1, 557.1, 557.9, V43.4
ICD-10	I70.%, I71.%, I73.%, I77.1, I79.0, K55.%, Z95.8%, Z95.9
Chronic lung disease	
ICD-9	490.xx, 491.xx, 492.xx, 493.xx, 494.0, 494.1, 495.xx, 496
ICD-10	J41.1, J41.8, J42.%, J43.%, J60.%, J61.%, J62.%, J63.%, J64.%, J65.%, J66.%, J70.1, J70.3, J84.%
Cancer	
ICD-9	141.xx-165.xx, 170.xx-172.xx, 174.xx-176.xx, 179.xx-195.xx, 200.xx-208.xx
ICD-10	C00.%-C26.%, C30.%-C34.%, C37.%-C41.%, C43, C45.%-C58.%, C60.%-C76.%, C7A.%, C7B.%, C81.%-C85.%, C88.%, C90.%-C97.%
CKD	
ICD-9	403.xx, 404.00, 404.01, 404.02, 404.03, 404.10, 404.11, 585.x
ICD-10	D63.1, E08.22, E09.22, E10.22, E11.22, E13.22, I12.0, I12.9, I13.0, I131, I13.11, I13.2, N18.%, Z99.2

IABP = Intra-aortic balloon pump; CPT = Current procedural terminology; ICD = International classification of diseases; LVAD = Left ventricular assist device; AMI = Acute myocardial infarction; PCI = Percutaneous coronary intervention; HCPCS = Healthcare common procedure coding system; ECMO = Extracorporeal membrane oxygenation; RRT = Renal replacement therapy; CVD = Cerebrovascular disease; PVD = Peripheral vascular disease; CKD = Chronic kidney disease

**eTable 2.** Baseline characteristics of the overall population of patients undergoing percutaneous coronary intervention for acute myocardial infarction complicated by cardiogenic shock receiving an intra-aortic balloon pump or intravascular left ventricular assist device

	Overall Cohort N=3,077
<b>Demographics</b>	
Median age (IQR), years	64 (18.0)
Female, n (%)	890 (29%)
Ratio of Race/ethnicity at zip code level, mean (SD)	
Black	0.09 (0.2)
Hispanic	0.12 (0.2)
White	0.79 (0.2)
Health plan type, n (%)	
HMO	546 (18%)
PPO	2,218 (72%)
Other	318 (10%)
Geographic region, n (%)	
Northeast	468 (15%)
Midwest	890 (29%)
South	905 (29%)
West	716 (23%)
Mean socioeconomic status index, (%)*	54.3 (5.8)
Year of index admission, n (%)	
2015	505 (16%)
2016	593 (19%)
2017	625 (20%)
2018	540 (18%)
2019	629 (20%)
2020 (up to 4/30)	185 (6%)
Cardiac arrest, n (%)**	986 (32%)
<b>Comorbidities</b>	
Charlson comorbidity index score, (median, IQR)	1 (2.0)
Hypertension	1642 (53%)
Dyslipidemia	1290 (42%)
Diabetes mellitus	887 (29%)
Tobacco use	434 (14%)
Obesity	257 (8%)
Previous PCI	65 (2%)
Previous CABG	10 (0%)
Heart failure	427 (14%)
Atrial fibrillation	242 (8%)
Cerebrovascular disease	272 (9%)
Peripheral vascular disease	381 (12%)
Chronic lung disease	338 (11%)
Cancer	255 (8%)

Chronic kidney disease	425 (14%)
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\*Based on zip code

\*\*Upon first medical contact to the day of device implantation

IABP = Intra-aortic balloon pump; LVAD = left ventricular assist device; IQR = Interquartile range; SD = Standard deviation; PCI = Percutaneous coronary intervention; CABG = Coronary artery bypass grafting

Groups with less than 10 patients are shown as “<10” to preserve patient confidentiality

**eTable 3.** Healthcare utilization preceding index hospitalization for acute myocardial infraction complicated by cardiogenic shock

				Propensity-Matched Cohort		
	IABP N=2,234	Intravascular LVAD N=867	<i>P</i> Value	IABP N=820	Intravascular LVAD N=820	Standardized Mean Difference
<b>Healthcare utilization, mean (SD)</b>						
Number of inpatient visits	0.19 (0.6)	0.25 (0.7)	0.02	0.23 (0.7)	0.24 (0.7)	0.01
Number of ER visits	0.19 (0.5)	0.23 (0.9)	0.25	0.19 (0.6)	0.19 (0.5)	0
Number of office visits	3.9 (4.5)	4.3 (4.6)	0.02	4.1 (4.5)	4.2 (4.5)	0.03
Mean total healthcare costs	\$9,158	\$14,260	0.02	\$9,921	\$12,746	0.04

IABP = Intra-aortic balloon pump; LVAD = left ventricular assist device; SD = Standard deviation; ER = Emergency Room

**eTable 4.** Clinical outcomes at 30-days and 1-year in the propensity matched cohort

	IABP	Intravascular LVAD	Odds Ratio/ Hazard Ratio 95% CI	<i>P</i> value
<b>Up to 30-days</b>	N=773	N=771		
Severe bleeding	112	147	1.35 (1.04-1.76)	0.027
RRT	54	94	1.88 (1.30-2.73)	0.001
Stroke	44	52	1.14 (0.76-1.73)	0.53
Repeat revascularization	12	<10	0.58 (0.23-1.48)	0.26
Death	219	309	1.71 (1.37-2.13)	<0.001
<b>Up to 1-year</b>	N=551	N=579		
Severe bleeding	134	172	1.36 (1.05-1.75)	0.018
RRT	60	105	1.95 (1.35-2.83)	0.001
Stroke	56	60	1.21 (0.81-1.81)	0.36
Repeat revascularization	57	44	0.86 (0.51-1.47)	0.59
Death	248	341	1.44 (1.21-1.71)	0.001

IABP = Intra-aortic balloon pump; LVAD = left ventricular assist device; CI = Confidence interval; RRT = Renal replacement therapy



**eTable 5.** Mean total medical costs for patients undergoing percutaneous coronary intervention for acute myocardial infarction complicated by cardiogenic shock in the propensity-matched cohort

Mean Total Medical Costs	IABP N=817	Intravascular LVAD N=817	Mean Difference (95% CI)	<i>P</i> value
In-Hospital	\$100,750	\$161,029	\$60,279 (\$43,245-\$79,328)	<0.001
30-Day	\$91,861	\$143,541	\$51,680 (\$31,488, \$75,178)	<0.001
30-Day Amongst Survivors Only	\$104,416	\$162,605	\$58,189 (\$31,349, \$90,335)	<0.001
1-Year	\$115,029	\$161,638	\$46,609 (\$22,126, \$75,461)	0.004
1-Year Amongst Survivors Only	\$142,426	\$217,475	\$75,049 (\$37,553, \$120,357)	<0.001

IABP = Intra-aortic balloon pump; LVAD = left ventricular assist device; CI = Confidence interval

**eTable 6.** Sensitivity analyses including our propensity score as a covariate, including patients also receiving extracorporeal membrane oxygenation, and exclusion of patients who had cardiac arrest

	PS as covariate N=3,077			Sensitivity (including ECMO) N=893 each group			Exclude cardiac arrest N=512 each group		
<b>Index hospitalization</b>	Odds ratio	95% CI	<i>P</i> value	Odds ratio	95% CI	<i>P</i> value	Odds ratio	95% CI	<i>P</i> value
Severe bleeding	1.31	(1.05, 1.63)	0.0149	1.39	(1.11, 1.75)	0.005	1.16	(0.85, 1.57)	0.35
Death	2.01	(1.66, 2.43)	<0.001	1.76	(1.43, 2.16)	<0.001	2.00	(1.49, 2.69)	<0.001
<b>Up to 30-days</b>	Odds ratio	95% CI	<i>P</i> value	Odds ratio	95% CI	<i>P</i> value	Odds ratio	95% CI	<i>P</i> value
Severe bleeding	1.21	(0.97, 1.52)	0.095	1.32	(1.02, .69)	0.03	1.15	(0.83, 1.60)	0.4
RRT	1.89	(1.40,2.55)	<0.001	1.68	(1.21, 3.34)	0.0018	2.00	(1.24, 3.23)	0.0047
Death	2.09	(1.72, 2.54)	<0.001	1.69	(1.37, 2.09)	<0.001	2.28	(1.67, 3.10)	<0.001
<b>Up to 1-year</b>	Hazard ratio	95% CI	<i>P</i> value	Hazard ratio	95% CI	<i>P</i> value	Hazard ratio	95% CI	<i>P</i> value
Severe bleeding	1.26	(1.04, 1.51)	0.016	1.31	(1.05, 1.64)	0.019	1.13	(0.84, 1.52)	0.41
RRT	1.97	(1.51,2.56)	<0.001	1.86	(1.35, 2.56)	0.0001	2.20	(1.37, 3.53)	0.001
Death	1.62	(1.41, 1.86)	<0.001	1.50	(1.27, 1.77)	<0.001	1.81	(1.42, 2.30)	<0.001

CI = Confidence interval; ECMO = Extracorporeal membrane oxygenation; RRT = Renal replacement therapy

**eTable 7.** Landmark analysis for patients who survived their index admission up to 1-year in the propensity matched cohort

	IABP N=481	Intravascular LVAD N=481	Hazard Ratio 95% CI	<i>P</i> value
Severe bleeding	95 (19.8%)	126 (26.2%)	1.37 (1.03-1.82)	0.032
Stroke	38 (7.9%)	48 (10.0%)	1.27 (0.81-1.98)	0.31
Repeat revascularization	50 (10.4%)	41 (8.5%)	0.89 (0.55-1.44)	0.62
Incident RRT	27 (5.6%)	56 (11.6%)	2.20 (1.37-3.53)	0.001
Death	27 (5.6%)	42 (8.7%)	1.81 (1.06-3.08)	0.029

IABP = Intra-aortic balloon pump; LVAD = left ventricular assist device; CI = Confidence interval; RRT = Renal replacement therapy

**eTable 8.** Falsification endpoints among propensity-matched patients receiving an intravascular left ventricular assist device versus intra-aortic balloon pump

Falsification endpoint, n (%)	IABP N=817	Intravascular LVAD N=817	OR (95% CI)	<i>P</i> value
Pneumonia	113 (14%)	119 (15%)	1.06 (0.81-1.40)	0.67
Composite	58 (7%)	66 (8%)	1.15 (0.80-1.65)	0.46
Diarrhea	17 (2%)	24 (3%)	1.41 (0.76-2.63)	0.28
Cellulitis	18 (2%)	17 (2%)	0.94 (0.49-1.83)	0.87
Deep vein thrombosis	<10 (0%)	<10 (0%)	0.50 (0.05-5.51)	0.57
Intestinal obstruction	24 (3%)	267 (3%)	1.13 (0.65-1.95)	0.67
Osteomyelitis	<10 (0%)	<10 (0%)	0.75 (0.17-3.35)	0.71

IABP = Intra-aortic balloon pump; LVAD = left ventricular assist device; OR = Odds ratio; CI = Confidence interval

Groups with less than 10 patients are shown as “<10” to preserve patient confidentiality.

**eFigure.** Kaplan-Meier curves for 1-year bleeding (A), renal replacement therapy (B), stroke (C) and repeat revascularization (D) among propensity-matched patients receiving an intravascular left ventricular assist device versus intra-aortic balloon pump







