

SUPPLEMENTAL MATERIAL

Table S1. International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes and Clinical Classification Software (CCS) codes for identification of Comorbidities in the Nationwide Inpatient Sample.

Comorbid Conditions/Procedures	Code
Left ventricular assist device	ICD-9-CM 37.66
Heart transplantation	ICD-9-CM 33.6, 37.51
Acute myocardial infarction	ICD-9-CM 410.01, 410.11, 410.21, 410.31, 410.41, 410.51, 410.61, 410.71, 410.81, 410.91
Cardiogenic shock	ICD-9-CM 785.51
Percutaneous coronary intervention	ICD-9-CM 00.66, 36.06, 36.07
Coronary artery bypass surgery	ICD-9-CM 36.10, 36.11, 36.12, 36.13, 36.14, 36.15, 36.16, 36.17, 36.19
Extracorporeal membrane oxygenation	ICD-9-CM 39.65
Percutaneous mechanical support	ICD-9-CM 37.68
Intra-aortic balloon pump	ICD-9-CM 37.61
Pulmonary artery catheter placement	ICD-9-CM 89.63, 89.64, 89.66, 89.67, 89.68
Mechanical ventilation	ICD-9-CM 96.70, 96.71, 96.72
Coronary artery disease	ICD-9-CM 414.00, 414.01, 414.02, 414.03, 414.04, 414.05, 414.06, 414.07
Prior myocardial infarction	ICD-9-CM 412
Prior percutaneous coronary intervention	ICD-9-CM V45.82
Prior coronary artery bypass surgery	ICD-9-CM V45.81
Family history of coronary artery disease	ICD-9-CM V17.3
Cardiac arrest	ICD-9-CM 99.60, 99.62, 99.63

Table S2. Additional baseline characteristics.

	Overall (n = 272,075)	LVAD Hospital (n = 70,685)	Non-LVAD Hospital (n = 201,390)	P value	Std Diff (%)
≥75 years	34.9	26.3	38.0	<0.001	25.3
Race				<0.001	
White	66.0	59.8	68.2		17.4
Black	13.0	17.1	11.5		15.9
Hispanic	7.7	5.3	8.6		13.0
Asian or Pacific Islander	2.9	2.2	3.2		5.8
Native American	0.6	0.5	0.6		0.8
Other	3.5	5.3	2.9		12.0
Unknown/missing	6.3	9.8	5.0		18.1
Primary/expected payer				<0.001	
Medicare	63.4	57.8	65.4		15.7
Medicaid	9.7	11.2	9.1		7.0
Private insurance	18.7	23.3	17.1		15.6
Self-pay	5.0	4.2	5.3		5.3
No charge	0.4	0.4	0.4		0.1
Other	2.7	2.9	2.6		1.8
Unknown/missing	0.2	0.3	0.2		1.6
Median household income				<0.072	
0-25th percentile	29.5	29.0	29.6		1.2
26th-50th percentile	25.9	24.4	26.5		4.7
51st-75th percentile	22.8	22.9	22.7		0.3
76th-100th percentile	19.6	21.4	18.9		6.2
Unknown/missing	2.3	2.3	2.3		
Elixhauser co-morbidities					
AIDS	0.2	0.2	0.1	0.034	2.0
Alcohol abuse	5.5	5.1	5.6	0.023	2.5
Collagen vascular disease	2.6	2.7	2.6	0.724	0.4
Chronic blood loss anemia	1.2	1.2	1.1	0.807	0.3
Depression	7.0	7.1	7.0	0.571	0.7
Drug abuse	3.8	3.9	3.7	0.449	0.9
Hypothyroidism	11.8	11.2	11.9	0.076	2.2
Lymphoma	1.1	1.4	1.0	0.001	3.3
Metastatic cancer	2.0	2.0	2.0	0.836	0.2
Other neurological disorders	9.5	8.4	9.9	<0.001	5.1
Paralysis	3.1	3.0	3.2	0.168	1.4
Peptic ulcer disease (non-bleeding)	<0.1	<0.1	<0.1	0.213	1.1
Psychoses	3.4	3.3	3.4	0.790	0.3
Solid tumor without metastasis	2.2	2.2	2.2	0.748	0.3

Data are listed as percentages. AIDS = acquired immunodeficiency syndrome.

Table S3. Baseline characteristics in acute myocardial infarction subgroup.

	Overall (n = 129,330)	LVAD Hospital (n = 26,650)	Non-LVAD Hospital (n = 102,680)	P value	Std Diff (%)
Age	69.0 ± 13.3	66.9 ± 13.2	69.5 ± 13.2	<0.001	8.9
≥ 75 yrs	37.2	30.5	39.0	<0.001	17.8
Female	38.4	36.4	38.9	0.001	5.2
Race				<0.001	
White	69.6	64.6	70.8		13.3
Black	9.0	11.5	8.3		10.7
Hispanic	7.6	5.4	8.2		11.2
Asian or Pacific Islander	3.2	2.6	3.3		4.2
Native American	0.5	0.6	0.5		1.0
Other	3.8	5.7	3.3		11.8
Unknown/missing	6.4	9.6	5.6		15.3
Primary/expected payer				<0.001	
Medicare	63.5	59.3	64.6		10.9
Medicaid	8.0	9.1	7.8		4.7
Private insurance	19.7	22.8	18.8		9.9
Self-pay	5.5	4.9	5.7		3.4
No charge	0.4	0.4	0.4		0.3
Other	2.7	3.2	2.5		3.7
Unknown/missing	0.2	0.3	0.2		2.3
Median household income				0.019	
0-25th percentile	28.8	28.4	28.9		1.3
26th-50th percentile	26.4	24.1	26.9		6.5
51st-75th percentile	22.9	22.7	23.0		0.6
76th-100th percentile	19.5	22.4	18.8		9.0
Unknown/missing	2.4	2.4	2.4		0.4
Weekend admission	26.8	24.9	27.2	0.001	5.3
Hospital characteristics					
Bed size				<0.001	
Small	9.3	1.0	11.4		44.2
Medium	24.9	8.7	29.0		53.8
Large	65.9	90.3	59.6		75.8
Urban Location	94.7	99.9	93.4	<0.001	36.7
Teaching Hospital	63.2	97.1	54.4	<0.001	114.9
Region				<0.001	
Northeast	17.8	25.3	15.8		23.8
Midwest	21.5	21.5	21.5		0.1
South	40.0	39.9	40.0		0.2
West	20.8	13.2	22.7		25
Cardiac Comorbidities					
Known coronary artery disease	69.9	71.9	69.4	0.010	5.6
Family history of coronary artery disease	4.6	4.5	4.6	0.793	0.5
Prior myocardial infarction	9.4	9.3	9.5	0.779	0.5

Prior percutaneous coronary intervention	10.2	11.9	9.8	<0.001	6.8
Prior coronary artery bypass surgery	6.1	6.7	6.0	0.088	2.8
Elixhauser Comorbidities					
AIDS	0.1	0.1	0.1	0.782	0.4
Alcohol abuse	4.5	4.5	4.4	0.764	0.5
Collagen vascular disease	2.3	2.0	2.4	0.084	2.9
Congestive heart failure	15.4	16.5	15.1	0.031	3.8
Chronic blood loss anemia	1.2	1.1	1.2	0.669	0.8
Chronic pulmonary disease	23.4	20.4	24.2	<0.001	9.3
Coagulopathy	18.3	22.3	17.2	<0.001	12.8
Deficiency anemias	22.6	20.2	23.2	0.001	7.4
Depression	6.0	5.6	6.1	0.254	1.9
Diabetes (uncomplicated)	29.2	29.2	29.2	0.944	0.1
Diabetes with complications	8.0	7.4	8.1	0.137	2.6
Drug abuse	2.7	2.8	2.7	0.730	0.6
Hypertension	61.2	60.4	61.4	0.262	2.1
Hypothyroidism	10.5	9.4	10.8	0.008	4.5
Liver disease	2.7	3.2	2.6	0.033	3.4
Lymphoma	0.7	0.8	0.7	0.784	0.4
Fluid and electrolyte disorders	56.9	60.2	56.0	<0.001	8.4
Metastatic cancer	1.5	1.6	1.5	0.328	1.5
Other neurological disorders	8.9	8.3	9.0	0.189	2.3
Obesity	13.1	13.0	13.1	0.933	0.2
Paralysis	3.1	2.8	3.2	0.153	2.3
Peripheral vascular disease	15.3	16.5	14.9	0.008	4.5
Peptic ulcer disease (non-bleeding)	<0.1	0.0	<0.1	0.257	2.2
Pulmonary circulation disorders	3.0	3.5	2.8	0.019	3.8
Psychoses	2.8	2.7	2.8	0.693	0.6
Renal failure (chronic)	27.3	26.5	27.5	0.240	2.1
Solid tumor without metastasis	1.9	2.0	1.9	0.605	0.8
Valvular disease	4.2	5.0	4.0	0.004	4.7
Weight loss	10.3	12.3	9.8	<0.001	8.2
≥3 Elixhauser comorbidities	68.7	70.3	68.2	0.042	4.6

Mean ± standard deviation for age, otherwise percentages. AIDS = acquired immunodeficiency syndrome.

Table S4. Procedures in acute myocardial infarction subgroup.

	Overall (n = 129,330)	LVAD Hospital (n = 26,650)	Non-LVAD Hospital (n = 102,680)	P value	Std Diff (%)
Procedures					
CPR or intubated <24 hours of admission	36.4	35.5	36.7	0.235	2.4
IABP	31.8	33.2	31.4	0.085	3.8
Percutaneous support (Impella/TandemHeart)	3.4	4.6	3.1	<0.001	7.7
ECMO	1.1	4.4	0.2	<0.001	28.0
PCI or CABG	52.8	53.6	52.6	0.272	2.0
CABG	13.1	18.5	11.7	<0.001	19.2
PCI	42.0	37.4	43.2	<0.001	11.9
Mechanical Ventilation	52.4	53.7	52.1	0.096	3.3
Pulmonary Artery Catheter	6.3	12.8	4.7	<0.001	29.1

AMI = acute myocardial infarction; CS = cardiogenic shock; CPR = cardiopulmonary resuscitation; IABP = intra-aortic balloon pump; PCI = percutaneous coronary intervention; CABG = coronary artery bypass graft.

Table S5. Baseline characteristics in non-acute myocardial infarction subgroup.

	Overall (n = 142,745)	LVAD Hospital (n = 44,035)	Non-LVAD Hospital (n = 98,710)	P value	Std Diff (%)
Age	66.1 ± 15.4	62.4 ± 15.9	67.7 ± 14.9	<0.001	15.4
≥ 75 yrs	32.9	23.7	37.0	<0.001	29.2
Female	40.7	39.0	41.4	<0.001	4.9
Race				<0.001	
White	62.8	56.9	65.4		17.5
Black	16.6	20.5	14.9		14.6
Hispanic	7.8	5.2	8.9		14.6
Asian or Pacific Islander	2.8	2.0	3.1		6.6
Native American	0.6	0.5	0.6		2.2
Other	3.3	5.0	2.5		13.1
Unknown/missing	6.2	9.9	4.5		20.8
Primary/expected payer				<0.001	
Medicare	63.3	56.8	66.2		19.3
Medicaid	11.1	12.5	10.5		6.3
Private insurance	17.9	23.6	15.3		21.3
Self-pay	4.6	3.7	4.9		5.9
No charge	0.3	0.3	0.3		0.3
Other	2.6	2.7	2.6		0.4
Unknown/missing	0.2	0.3	0.2		1.1
Median household income				0.270	
0-25th percentile	30.0	29.4	30.3		1.9
26th-50th percentile	25.5	24.6	25.9		3.2
51st-75th percentile	22.6	23.0	22.5		1.1
76th-100th percentile	19.6	20.8	19.0		4.4
Unknown/missing	2.2	2.2	2.2		0
Weekend admission	24.4	22.4	25.3	<0.001	6.9
Hospital characteristics					
Bed size				<0.001	
Small	9.4	0.7	13.3		50.8
Medium	22.4	7.5	29.1		58
Large	68.2	91.7	57.7		85.2
Urban Location	96.0	>99.9	94.2	<0.001	34.7
Teaching Hospital	70.2	98.7	57.5	<0.001	115
Region				<0.001	
Northeast	18.1	23.0	15.9		18
Midwest	21.1	23.8	19.9		9.5
South	39.3	39.6	39.2		0.7
West	24.4	13.6	24.9		29.1
Cardiac Comorbidities					
Known coronary artery disease	39.4	37.9	40.1	0.010	4.6
Family history of coronary artery disease	1.8	2.2	1.6	0.006	4.4
Prior myocardial infarction	10.4	10.9	10.1	0.112	2.3

Prior percutaneous coronary intervention	7.4	8.1	7.1	0.021	3.6
Prior coronary artery bypass surgery	8.8	8.5	8.9	0.315	1.5
Elixhauser Comorbidities					
AIDS	0.2	0.3	0.2	0.046	2.5
Alcohol abuse	6.4	5.4	6.9	<0.001	6.1
Collagen vascular disease	2.9	3.1	2.8	0.256	1.6
Congestive heart failure	32.2	29.4	33.4	<0.001	8.7
Chronic blood loss anemia	1.1	1.2	1.1	0.368	1.3
Chronic pulmonary disease	26.8	22.9	28.5	<0.001	12.6
Coagulopathy	23.3	26.9	21.7	<0.001	12.2
Deficiency anemias	25.4	22.7	26.5	<0.001	8.9
Depression	7.9	8.1	7.9	0.646	0.7
Diabetes (uncomplicated)	25.8	24.6	26.3	0.015	3.9
Diabetes with complications	7.8	6.3	8.5	<0.001	8.6
Drug abuse	4.7	4.6	4.8	0.436	1.2
Hypertension	54.9	52.0	56.2	<0.001	8.4
Hypothyroidism	12.9	12.3	13.1	0.126	2.4
Liver disease	5.9	6.3	5.8	0.123	2.2
Lymphoma	1.4	1.7	1.3	0.005	3.5
Fluid and electrolyte disorders	66.7	65.5	67.3	0.044	3.8
Metastatic cancer	2.5	2.3	2.6	0.130	2
Other neurological disorders	10.1	8.5	10.8	<0.001	8
Obesity	15.1	15.1	15.1	0.950	0.1
Paralysis	3.2	3.0	3.2	0.490	0.9
Peripheral vascular disease	12.5	12.1	12.7	0.249	1.8
Peptic ulcer disease (non-bleeding)	<0.1	0.1	<0.1	0.045	2.3
Pulmonary circulation disorders	9.8	10.1	9.7	0.360	1.3
Psychoses	3.9	3.7	4.0	0.299	1.4
Renal failure (chronic)	35.0	35.8	34.7	0.182	2.3
Solid tumor without metastasis	2.4	2.3	2.4	0.616	0.7
Valvular disease	9.4	8.6	9.8	0.007	4
Weight loss	15.0	16.5	14.3	0.001	6.2
≥3 Elixhauser comorbidities	79.9	78.2	80.6	0.015	5.8

Mean ± standard deviation for age, otherwise percentages. AIDS = acquired immunodeficiency syndrome.

Table S6. Procedures in non-acute myocardial infarction subgroup.

	Overall (n = 142,745)	LVAD Hospital (n = 44,035)	Non-LVAD Hospital (n = 98,710)	P value	Std Diff (%)
Procedures					
CPR or intubated <24 hours of admission	33.3	28.5	35.4	<0.001	14.9
IABP	6.9	9.9	5.6	<0.001	15.9
Percutaneous support (Impella/TandemHeart)	0.9	1.5	0.6	<0.001	8.6
ECMO	1.5	4.2	0.2	<0.001	27.1
PCI or CABG	6.8	8.1	6.2	<0.001	7.2
CABG	4.7	5.9	4.1	<0.001	8.4
PCI	2.3	2.3	2.3	0.869	0.2
Mechanical Ventilation	54.6	50.1	56.6	<0.001	12.9
Pulmonary Artery Catheter	7.6	15.6	4.0	<0.001	39.7

AMI = acute myocardial infarction; CS = cardiogenic shock; CPR = cardiopulmonary resuscitation; IABP = intra-aortic balloon pump; PCI = percutaneous coronary intervention; CABG = coronary artery bypass graft.

Table S7. Baseline characteristics in LVAD vs. large, non-LVAD, CABG-capable hospitals.

	Overall (n = 171,210)	LVAD Hospital (n = 70,685)	Non-LVAD, CABG- Capable Hospital (n = 100,525)	P value	Std Diff (%)
Age	66.4 ± 14.5	64.1 ± 15.1	68.0 ± 13.9	<0.001	12.0
≥ 75 yrs	31.7	26.3	35.4	<0.001	20.0
Female	38.7	38.0	39.1	0.049	2.3
Race				<0.001	
White	65.5	59.8	69.4		20.2
Black	13.0	17.1	10.1		20.4
Hispanic	7.2	5.3	8.5		12.7
Asian or Pacific Islander	2.8	2.2	3.1		5.4
Native American	0.6	0.5	0.6		0.8
Other	4.0	5.3	3.0		11.2
Unknown/missing	7.1	9.8	5.2		17.3
Primary/expected payer				<0.001	
Medicare	61.6	57.8	64.3		13.5
Medicaid	10.3	11.2	9.7		5.0
Private insurance	19.8	23.3	17.3		15.0
Self-pay	4.9	4.2	5.4		5.6
No charge	0.4	0.4	0.4		0.4
Other	2.8	2.9	2.8		0.6
Unknown/missing	0.2	0.3	0.1		1.3
Median household income				<0.001	
0-25th percentile	30.2	29.0	31.1		4.5
26th-50th percentile	26.3	24.4	27.7		7.5
51st-75th percentile	22.7	22.9	22.5		0.9
76th-100th percentile	18.5	21.4	16.5		12.6
Unknown/missing	2.3	2.3	2.2		0.8
Weekend admission	25.3	23.3	26.6	<0.001	7.6
Hospital characteristics					
Bed size				<0.001	
Small	0.3	0.8	0.0		12.9
Medium	3.3	8.0	0.0		41.7
Large	96.4	91.2	100		43.9
Urban Location	96.7	99.9	94.4	<0.001	33.8
Teaching Hospital	70.9	98.1	51.8	<0.001	126.0
Region				<0.001	
Northeast	17.2	23.9	12.5		30.0
Midwest	22.6	22.9	22.4		1.3
South	39.1	39.7	38.7		2.1
West	21.1	13.5	26.5		33.0
Cardiac Comorbidities					
Known coronary artery disease	54.8	50.7	57.7	<0.001	14.1

Family history of coronary artery disease	3.3	3.1	3.5	0.163	2.2
Prior myocardial infarction	9.9	10.3	9.7	0.184	1.9
Prior percutaneous coronary intervention	9.1	9.5	8.8	0.102	2.3
Prior coronary artery bypass surgery	7.5	7.8	7.3	0.099	2.1
Elixhauser Comorbidities					
AIDS	0.2	0.2	0.1	0.011	2.7
Alcohol abuse	5.3	5.1	5.5	0.149	1.8
Collagen vascular disease	2.6	2.7	2.5	0.306	1.3
Congestive heart failure	23.1	24.5	22.1	<0.001	5.7
Chronic blood loss anemia	1.2	1.2	1.1	0.791	0.3
Chronic pulmonary disease	24.2	22.0	25.8	<0.001	8.9
Coagulopathy	22.2	25.2	20.2	<0.001	12.0
Deficiency anemias	23.4	21.8	24.6	<0.001	6.6
Depression	6.8	7.1	6.6	0.136	2.1
Diabetes (uncomplicated)	27.4	26.3	28.2	0.004	4.1
Diabetes with complications	7.6	6.7	8.3	<0.001	6.0
Drug abuse	3.7	3.9	3.6	0.220	1.6
Hypertension	56.9	55.1	58.2	<0.001	6.2
Hypothyroidism	11.5	11.2	11.7	0.247	1.5
Liver disease	4.5	5.1	4.1	<0.001	4.9
Lymphoma	1.1	1.4	1.0	0.001	3.7
Fluid and electrolyte disorders	62.0	63.5	61.0	0.006	5.1
Metastatic cancer	1.9	2.0	1.7	0.038	2.3
Other neurological disorders	8.9	8.4	9.3	0.025	2.9
Obesity	14.4	14.3	14.4	0.832	0.3
Paralysis	3.1	3.0	3.1	0.411	0.9
Peripheral vascular disease	13.7	13.8	13.6	0.790	0.4
Peptic ulcer disease (non-bleeding)	<0.1	<0.1	<0.1	0.719	0.4
Pulmonary circulation disorders	6.4	7.6	5.5	<0.001	8.4
Psychoses	3.3	3.3	3.3	0.754	0.4
Renal failure (chronic)	31.0	32.3	30.1	0.003	4.7
Solid tumor without metastasis	2.1	2.2	2.0	0.296	1.2
Valvular disease	6.7	7.3	6.2	0.002	4.1
Weight loss	12.8	14.9	11.4	<0.001	10.6
≥3 Elixhauser comorbidities	74.0	75.3	73.2	0.029	4.8

Mean ± standard deviation for age, otherwise percentages. LVAD = left ventricular assistance device; CABG = coronary artery bypass graft; AIDS = acquired immunodeficiency syndrome.

Table S8. Case presentations and procedures in LVAD vs. large, non-LVAD, CABG-capable hospitals.

	Overall (n = 171,210)	LVAD Hospital (n = 70,685)	Non-LVAD, CABG- Capable Hospital (n = 100,525)	P value	Std Diff (%)
Presentation					
Non-AMI-CS	53.5	62.3	47.2	<0.001	30.6
AMI-CS	46.5	37.7	52.8	<0.001	30.6
Procedures					
CPR or intubated <24 hours of admission	34.2	31.1	36.3	<0.001	11.0
IABP	20.4	18.7	21.6	<0.001	7.2
Percutaneous support (Impella/TandemHeart)	2.6	2.6	2.5	0.572	0.8
ECMO	2.0	4.3	0.3	<0.001	26.3
PCI or CABG	30.6	25.2	34.4	<0.001	20.2
CABG	10.5	10.7	10.3	0.441	1.3
PCI	21.6	15.5	25.8	<0.001	25.6
Mechanical Ventilation	53.3	51.5	54.5	<0.001	6.1
Pulmonary Artery Catheter	9.0	14.6	5.2	<0.001	31.8

LVAD = left ventricular assistance device; AMI = acute myocardial infarction; CS = cardiogenic shock; CPR = cardiopulmonary resuscitation; IABP = intra-aortic balloon pump; PCI = percutaneous coronary intervention; CABG = coronary artery bypass graft.