

Appendix 1 (as submitted by the authors): Supplemental tables and figures

TABLES

Supplemental Table 1. International Classification of Disease, 10th Revision (ICD-10) Codes for the Charlson-Deyo Comorbidity Index (CDCI), Elixhauser Comorbidity Index (ECI), and Candidate Variables for the Cardiac-Specific Comorbidity Index (CSCI)	
Condition	ICD-10 codes
Charlson-Deyo Comorbidity Index (CDCI)	
Myocardial infarction	I21.x, I22.x, I25.2
Chronic heart failure	I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5–I42.9, I43.x, I50.x, P29.0
Peripheral arterial disease	I70.x, I71.x, I73.1, I73.8, I73.9, I77.1, I79.0, I79.2, K55.1, K55.8, K55.9, Z95.8, Z95.9
Cerebrovascular disease	G45.x, G46.x, H34.0, I60.x–I69.x
Dementia	F00.x–F03.x, F05.1, G30.x, G31.1
Chronic pulmonary disease	I27.8, I27.9, J40.x–J47.x, J60.x–J67.x, J68.4, J70.1, J70.3
Connective tissue disease / Rheumatic disease	M05.x, M06.x, M31.5, M32.x–M34.x, M35.1, M35.3, M36.0
Peptic ulcer disease	K25.x–K28.x
Mild liver disease	B18.x, K70.0–K70.3, K70.9, K71.3–K71.5, K71.7, K73.x, K74.x, K76.0, K76.2–K76.4, K76.8, K76.9, Z94.4
Uncomplicated diabetes	E10.0, E10.1, E10.6, E10.8, E10.9, E11.0, E11.1, E11.6, E11.8, E11.9, E12.0, E12.1, E12.6, E12.8, E12.9, E13.0, E13.1, E13.6, E13.8, E13.9, E14.0, E14.1, E14.6, E14.8, E14.9
Complicated diabetes	E10.2–E10.5, E10.7, E11.2–E11.5, E11.7, E12.2–E12.5, E12.7, E13.2–E13.5, E13.7, E14.2–E14.5, E14.7
Paraplegia and hemiplegia	G04.1, G11.4, G80.1, G80.2, G81.x, G82.x, G83.0–G83.4, G83.9
Renal disease	I12.0, I13.1, N03.2–N03.7, N05.2–N05.7, N18.x, N19.x, N25.0, Z49.0–Z49.2, Z94.0, Z99.2
Cancer	C00.x–C26.x, C30.x–C34.x, C37.x–C41.x, C43.x, C45.x–C58.x, C60.x–C76.x, C81.x–C85.x, C88.x, C90.x–C97.x
Moderate or severe liver disease	I85.0, I85.9, I86.4, I98.2, K70.4, K71.1, K72.1, K72.9, K76.5, K76.6, K76.7
Metastatic carcinoma	C77.x–C80.x
AIDS/HIV	B20.x–B22.x, B24.x
Elixhauser Comorbidity Index (ECI)	
Chronic heart failure	I09.9, I11.0, I13.0, I13.2, I25.5, I42.0, I42.5–I42.9, I43.x, I50.x, P29.0
Cardiac arrhythmia	I44.1–I44.3, I45.6, I45.9, I47.x–I49.x, R00.0, R00.1, R00.8, T82.1, Z45.0, Z95.0
Valvular disease	A52.0, I05.x–I08.x, I09.1, I09.8, I34.x–I39.x, Q23.0–Q23.3, Z95.2–Z95.4
Pulmonary circulation disorders	I26.x, I27.x, I28.0, I28.8, I28.9
Peripheral vascular disorders	I70.x, I71.x, I73.1, I73.8, I73.9, I77.1, I79.0, I79.2, K55.1, K55.8, K55.9, Z95.8, Z95.9
Uncomplicated hypertension	I10.x
Complicated hypertension	I11.x–I13.x, I15.x
Paralysis	G04.1, G11.4, G80.1, G80.2, G81.x, G82.x, G83.0–G83.4, G83.9
Other neurological disorders	G10.x–G13.x, G20.x–G22.x, G25.4, G25.5, G31.2, G31.8, G31.9, G32.x, G35.x–G37.x, G40.x, G41.x, G93.1, G93.4, R47.0, R56.x
Chronic pulmonary disease	I27.8, I27.9, J40.x–J47.x, J60.x–J67.x, J68.4, J70.1, J70.3
Uncomplicated diabetes	E10.0, E10.1, E10.9, E11.0, E11.1, E11.9, E12.0, E12.1, E12.9, E13.0, E13.1, E13.9, E14.0, E14.1, E14.9
Complicated diabetes	E10.2–E10.8, E11.2–E11.8, E12.2–E12.8, E13.2–E13.8, E14.2–E14.8
Hypothyroidism	E00.x–E03.x, E89.0
Renal failure	I12.0, I13.1, N18.x, N19.x, N25.0, Z49.0–Z49.2, Z94.0, Z99.2
Liver disease	B18.x, I85.x, I86.4, I98.2, K70.x, K71.1, K71.3–K71.5, K71.7, K72.x–K74.x, K76.0, K76.2–K76.9, Z94.4
Peptic ulcer disease excluding bleeding	K25.7, K25.9, K26.7, K26.9, K27.7, K27.9, K28.7, K28.9
AIDS/HIV	B20.x–B22.x, B24.x
Lymphoma	C81.x–C85.x, C88.x, C96.x, C90.0, C90.2
Metastatic cancer	C77.x–C80.x
Solid tumor without metastasis	C00.x–C26.x, C30.x–C34.x, C37.x–C41.x, C43.x, C45.x–C58.x, C60.x–C76.x, C97.x
Rheumatoid arthritis / Collagen vascular disease	L94.0, L94.1, L94.3, M05.x, M06.x, M08.x, M12.0, M12.3, M30.x, M31.0–M31.3, M32.x–M35.x, M45.x, M46.1, M46.8, M46.9
Coagulopathy	D65–D68.x, D69.1, D69.3–D69.6
Obesity	E66.x

Weight loss	E40.x–E46.x, R63.4, R64
Fluid and electrolyte disorders	E22.2, E86.x, E87.x
Blood loss anemia	D50.0
Deficiency anemia	D50.8, D50.9, D51.x–D53.x
Alcohol abuse	F10, E52, G62.1, I42.6, K29.2, K70.0, K70.3, K70.9, T51.x, Z50.2, Z71.4, Z72.1
Drug abuse	F11.x–F16.x, F18.x, F19.x, Z71.5, Z72.2
Psychoses	F20.x, F22.x–F25.x, F28.x, F29.x, F30.2, F31.2, F31.5
Depression	F20.4, F31.3–F31.5, F32.x, F33.x, F34.1, F41.2, F43.2
Cardiac-Specific Comorbidity Index (CSCI)	
ST-elevation and non-ST-elevation myocardial infarction (STEMI and NSTEMI)	I21.0–I21.4, I21.9, I22.0–I22.2, I22.8, I22.9
Hemorrhagic stroke, ischemic stroke, transient ischemic attack	I60.x–I62.x, H34.1x, I63.x, H34.0x, G45.0, G45.1, G45.2, G45.3, G45.8, G45.9
Atrial fibrillation	I48.x
Atrioventricular block	I44.2, I44.7, I45.0–I45.3
Cardiac arrest, ventricular tachycardia and fibrillation, cardiogenic shock	I46.2, I46.8, I46.9, I47.2x, I49.00–I49.02, R57.0
Acute pulmonary embolism	I26.0x, I26.9x
Acute respiratory failure	J80, J96.0
Acute kidney failure	N17.0–N17.2, N17.8, N17.9
Pulmonary hypertension	I26.x, I27.x, I28.0, I28.8, I28.9
Presence of an implantable cardioverter-defibrillator	Z95.02
Heart failure (unspecified)	I50.1, I50.20, I50.30, I50.40, I50.9
Peripheral arterial disease, cerebrovascular disease	I70.x–I71.x, I73.1, I73.8, I73.9, I77.1, I79.0, I79.2, K55.0, K55.1, K55.8, K55.9, Z95.8, Z95.9, G45.x–G46.x, H34.0, I60.x–I69.x
Chronic pulmonary disease	I27.8, I27.9, J40.x–J47.x, J60.x–J67.x, J68.4, J70.1, J70.3
Liver disease	B18.x, I85.x, I86.4, I98.2, K70.x, K71.1, K71.3–K71.5, K71.7, K72.x–K74.x, K76.0, K76.2–K76.9, Z94.4
Uncomplicated and complicated diabetes	E10.0, E10.1, E10.9, E11.0, E11.1, E11.9, E12.0, E12.1, E12.9, E13.0, E13.1, E13.9, E14.0, E14.1, E14.9, E10.2–E10.8, E11.2–E11.8, E12.2–E12.8, E13.2–E13.8, E14.2–E14.8
Uncomplicated and complicated hypertension	I10.x, I11.x–I13.x, I15.x
Chronic kidney disease	I12.0, I13.1, N03.2–N03.7, N05.2–N05.7, N18.x, N19.x, N25.0, Z49.0–Z49.2, Z94.0, Z99.2
Cancer	C00.x–C26.x, C30.x–C34.x, C37.x–C41.x, C43.x, C45.x–C58.x, C60.x–C85.x, C88.x, C90.x–C97.x
Neurological disorders	G10.x–G13.x, G20.x–G22.x, G25.4, G25.5, G31.2, G31.8, G31.9, G32.x, G35.x–G37.x, G40.x–G41.x, G93.1, G93.4, R47.0, R56.x
Coagulopathy	D65–D68.x, D69.1, D69.3–D69.6
Obesity	E66.x
Fluid and electrolyte disorders	E22.2, E86.x, E87.x

Supplemental Table 2. Candidate Predictors for the Cardiac-Specific Comorbidity Index and their Univariate Association with Length of Stay

		LOS ≤2 days (n=6,685)	LOS 3-7 days (n=2,155)	LOS ≥8 days (n=1,297)	Odds ratio (95% confidence interval)	p
Age (years)		63.5±12.1	63.2±11.8	67.0±11.5	LOS ≥8d: 1.03 (1.02 to 1.03) LOS 3-7d: 1.00 (0.99 to 1.00)	<0.001
Male sex	Absent	2,198 (69.4%)	613 (19.3%)	358 (11.3%)	LOS ≥8d: 1.29 (1.13 to 1.47) LOS 3-7d: 1.23 (1.11 to 1.37)	<0.001
	Present	4,487 (64.4%)	1,542 (22.1%)	939 (13.5%)		
STEMI and NSTEMI	Absent	5,047 (72.2%)	1,090 (15.6%)	855 (12.2%)	LOS ≥8d: 1.59 (1.40 to 1.81) LOS 3-7d: 3.01 (2.72 to 3.33)	<0.001
	Present	1,638 (52.1%)	1,065 (33.9%)	442 (14.1%)		
Stroke, TIA	Absent	6,677 (66.0%)	2,150 (21.3%)	1,284 (12.7%)	LOS ≥8d: 8.44 (3.49 to 20.41)	<0.001
	Present	8 (30.8%)	5 (19.2%)	13 (50.0%)		

					LOS 3-7d: 1.94 (0.63 to 5.94)	
Atrial fibrillation	Absent	6,130 (69.5%)	1,882 (21.3%)	813 (9.2%)	LOS ≥8d: 6.58 (5.70 to 7.58)	<0.001
	Present	555 (42.3%)	273 (20.8%)	484 (36.9%)	LOS 3-7d: 1.60 (1.37 to 1.87)	
Atrioventricular block	Absent	6,576 (66.4%)	2,100 (21.2%)	1,235 (12.5%)	LOS ≥8d: 3.03 (2.21 to 4.16)	<0.001
	Present	109 (48.2%)	55 (24.3%)	62 (27.4%)	LOS 3-7d: 1.58 (1.14 to 2.19)	
Cardiac arrest, VT/VF, shock	Absent	6,548 (67.4%)	2,022 (20.8%)	1,143 (11.8%)	LOS ≥8d: 6.44 (5.07 to 8.17)	<0.001
	Present	137 (32.3%)	133 (31.4%)	154 (36.3%)	LOS 3-7d: 3.14 (2.46 to 4.01)	
Acute PE	Absent	6,680 (66.0%)	2,152 (21.3%)	1,284 (12.7%)	LOS ≥8d: 13.50 (4.81 to 37.94)	<0.001
	Present	5 (23.8%)	< 5	13 (61.9%)	LOS 3-7d: 1.87 (0.45 to 7.80)	
Acute respiratory failure	Absent	6,682 (66.2%)	2,151 (21.3%)	1,268 (12.6%)	LOS ≥8d: 50.74 (15.46 to 166.51)	<0.001
	Present	< 5	< 5	29 (80.6%)	LOS 3-7d: 4.13 (0.92 to 18.42)	
Acute kidney failure	Absent	6,648 (66.6%)	2,126 (21.3%)	1,214 (12.2%)	LOS ≥8d: 12.28 (8.30 to 18.18)	<0.001
	Present	37 (24.8%)	29 (19.5%)	83 (55.7%)	LOS 3-7d: 2.45 (1.50 to 3.99)	
Pulmonary hypertension	Absent	6,573 (66.4%)	2,111 (21.3%)	1,221 (12.3%)	LOS ≥8d: 3.65 (2.71 to 4.92)	<0.001
	Present	112 (48.3%)	44 (19.0%)	76 (32.8%)	LOS 3-7d: 1.22 (0.86 to 1.74)	
ICD	Absent	6,650 (66.3%)	2,117 (21.1%)	1,269 (12.6%)	LOS ≥8d: 4.19 (2.54 to 6.92)	<0.001
	Present	35 (34.7%)	38 (37.6%)	28 (27.7%)	LOS 3-7d: 3.41 (2.15 to 5.41)	
Heart failure	Absent	6,577 (66.8%)	2,080 (21.1%)	1,190 (12.1%)	LOS ≥8d: 5.47 (4.16 to 7.20)	<0.001
	Present	108 (37.2%)	75 (25.9%)	107 (36.9%)	LOS 3-7d: 2.20 (1.63 to 2.96)	
PAD and CVD	Absent	5,887 (66.7%)	1,927 (21.8%)	1,012 (11.5%)	LOS ≥8d: 2.08 (1.79 to 2.42)	<0.001
	Present	798 (60.9%)	228 (17.4%)	285 (21.7%)	LOS 3-7d: 0.87 (0.75 to 1.02)	
Chronic pulmonary disease	Absent	6,156 (67.2%)	1,930 (21.1%)	1,082 (11.8%)	LOS ≥8d: 2.31 (1.95 to 2.74)	<0.001
	Present	529 (54.6%)	225 (23.2%)	215 (22.2%)	LOS 3-7d: 1.36 (1.15 to 1.60)	
Liver disease	Absent	6,638 (66.0%)	2,141 (21.3%)	1,275 (12.7%)	LOS ≥8d: 2.44 (1.46 to 4.06)	0.001
	Present	47 (56.6%)	14 (16.9%)	22 (26.5%)	LOS 3-7d: 0.92 (0.51 to 1.68)	
Diabetes	Absent	5,068 (66.5%)	1,647 (21.6%)	903 (11.9%)	LOS ≥8d: 1.37 (1.20 to 1.56)	<0.001
	Present	1,617 (64.2%)	508 (20.2%)	394 (15.6%)	LOS 3-7d: 0.97 (0.86 to 1.08)	
Hypertension	Absent	3,165 (69.5%)	925 (20.3%)	466 (10.2%)	LOS ≥8d: 1.60 (1.42 to 1.81)	<0.001
	Present	3,520 (63.1%)	1,230 (22.0%)	831 (14.9%)	LOS 3-7d: 1.20 (1.08 to 1.32)	
Chronic kidney disease	Absent	6,087 (66.3%)	1,998 (21.8%)	1,096 (11.9%)	LOS ≥8d: 1.87 (1.57 to 2.22)	<0.001
	Present	598 (62.6%)	157 (16.4%)	201 (21.0%)	LOS 3-7d: 0.80 (0.67 to 0.96)	
Cancer	Absent	6,625 (66.0%)	2,137 (21.3%)	1,279 (12.7%)	LOS ≥8d: 1.56 (0.92 to 2.65)	0.21
	Present	60 (62.5%)	18 (18.8%)	18 (18.8%)	LOS 3-7d: 0.93 (0.55 to 1.58)	
Neurological disorders	Absent	6,626 (66.2%)	2,132 (21.3%)	1,250 (12.5%)	LOS ≥8d: 4.22 (2.87 to 6.22)	<0.001
	Present	59 (45.7%)	23 (17.8%)	47 (36.4%)	LOS 3-7d: 1.21 (0.75 to 1.97)	
Coagulopathy	Absent	6,649 (66.2%)	2,135 (21.2%)	1,268 (12.6%)	LOS ≥8d: 4.22 (2.58 to 6.91)	<0.001
	Present	36 (42.4%)	20 (23.5%)	29 (34.1%)	LOS 3-7d: 1.73 (1.00 to 3.00)	

Obesity	Absent	5,179 (66·7%)	1,604 (20·7%)	978 (12·6%)	LOS ≥8d: 1·12 (0·98 to 1·29) LOS 3-7d: 1·18 (1·06 to 1·32)	0·009
	Present	1,506 (63·4%)	551 (23·2%)	319 (13·4%)		
Fluid/electrolyte disorders	Absent	6,676 (66·0%)	2,148 (21·2%)	1,287 (12·7%)	LOS ≥8d: 5·76 (2·34 to 14·21) LOS 3-7d: 2·42 (0·90 to 6·50)	<0·001
	Present	9 (34·6%)	7 (26·9%)	10 (38·5%)		

Data are expressed as n (%). A length of stay ≤2 days is considered the reference category for odds ratio calculations. Abbreviations: CVD, cerebrovascular disease; ICD, implantable cardioverter-defibrillator; LOS, length of stay; NSTEMI, non-ST-elevation myocardial infarction; PAD, peripheral arterial disease; PE, pulmonary embolism; STEMI, ST-elevation myocardial infarction; TIA, transient ischemic attack; VT/VF, ventricular tachycardia/ventricular fibrillation.

Supplemental Table 3. Recalibration of the Charlson-Deyo Comorbidity Index and Elixhauser Comorbidity Index for the Prediction of All-Cause Death Using Multivariable Analysis			
	Parameter estimate	Odds ratio (95% confidence interval)	p
Charlson-Deyo Comorbidity Index			
Intercept	-5·8945		<0·001
Myocardial infarction	1·7546	5·78 (3·75 to 8·91)	<0·001
Chronic heart failure	1·6999	5·47 (3·66 to 8·19)	<0·001
Peripheral arterial disease	-0·1579	0·85 (0·49 to 1·50)	0·58
Cerebrovascular disease	1·4343	4·20 (2·32 to 7·58)	<0·001
Dementia	1·0377	2·82 (0·35 to 22·81)	0·33
Chronic pulmonary disease	-0·00652	0·99 (0·59 to 1·69)	0·98
Connective tissue disease / Rheumatic disease	-0·3577	0·70 (0·09 to 5·39)	0·73
Peptic ulcer disease	-11·9859	<0·01 (<0·01 to >999·99)	0·99
Mild liver disease	1·1622	3·20 (0·92 to 11·17)	0·07
Uncomplicated diabetes	-0·1358	0·87 (0·58 to 1·32)	0·52
Complicated diabetes	0·4464	1·56 (0·44 to 5·58)	0·49
Paraplegia and hemiplegia	-0·6903	0·50 (0·06 to 4·46)	0·54
Renal disease	0·5176	1·68 (1·05 to 2·69)	0·03
Cancer	1·7485	5·75 (2·39 to 13·83)	<0·001
Moderate or severe liver disease	1·9888	7·31 (0·81 to 65·62)	0·08
Metastatic carcinoma	1·4711	4·35 (0·44 to 42·93)	0·21
AIDS/HIV	-12·1624	<0·01 (<0·01 to >999·99)	0·99
<i>Recalibrated model C-statistic</i>		<i>0·81 (95% CI, 0·77 to 0·84)</i>	
<i>(Uncalibrated model C-statistic)*</i>		<i>(0·72)</i>	
Hosmer-Lemeshow test			0·44
Elixhauser Comorbidity Index			
Intercept	-5·2646		<0·001
Chronic heart failure	1·3309	3·79 (2·45 to 5·84)	<0·001
Cardiac arrhythmia	1·2090	3·35 (2·26 to 4·98)	<0·001
Valvular disease	-0·1386	0·87 (0·55 to 1·38)	0·56
Pulmonary circulation disorders	0·8018	2·23 (1·09 to 4·56)	0·03
Peripheral vascular disorders	0·0500	1·05 (0·60 to 1·86)	0·86
Uncomplicated hypertension	-0·2992	0·74 (0·49 to 1·13)	0·16
Complicated hypertension	0·8589	2·36 (1·04 to 5·36)	0·04
Paralysis	-0·8423	0·43 (0·05 to 4·14)	0·47
Other neurological disorders	3·1972	24·46 (14·43 to 41·47)	<0·001
Chronic pulmonary disease	0·0967	1·10 (0·63 to 1·92)	0·73
Uncomplicated diabetes	0·1230	1·13 (0·71 to 1·79)	0·60
Complicated diabetes	1·0349	2·82 (0·77 to 10·35)	0·12
Hypothyroidism	0·1501	1·16 (0·61 to 2·22)	0·65
Renal failure	-0·1118	0·89 (0·45 to 1·79)	0·75
Liver disease	2·0846	8·04 (3·25 to 19·87)	<0·001
Peptic ulcer disease excluding bleeding	-13·5331	<0·01 (<0·01 to >999·99)	0·99
AIDS/HIV	-13·8575	<0·01 (<0·01 to >999·99)	0·99
Lymphoma	2·1804	8·85 (1·55 to 50·62)	0·01
Metastatic cancer	0·5913	1·81 (0·11 to 29·07)	0·68
Solid tumor without metastasis	0·5865	1·80 (0·33 to 9·85)	0·50
Rheumatoid arthritis / Collagen vascular disease	-0·2319	0·79 (0·11 to 5·92)	0·82
Coagulopathy	1·1863	3·28 (1·20 to 8·94)	0·02

Obesity	-0.5028	0.61 (0.36 to 1.02)	0.06
Weight loss	-13.7319	<0.01 (<0.01 to >999.99)	0.99
Fluid and electrolyte disorders	2.3469	10.45 (3.14 to 34.86)	<0.001
Blood loss anemia	0.8368	2.31 (0.27 to 19.75)	0.44
Deficiency anemia	0.7091	2.03 (0.56 to 7.41)	0.28
Alcohol abuse	-1.3107	0.27 (0.05 to 1.41)	0.12
Drug abuse	0.3278	1.39 (0.15 to 12.71)	0.77
Psychoses	0.5292	1.70 (0.57 to 5.09)	0.34
Depression	0.1789	1.20 (0.16 to 9.24)	0.86
Recalibrated model C-statistic		0.86 (95% CI 0.82 to 0.89)	
(Uncalibrated model C-statistic)*		(0.67)	
Hosmer-Lemeshow test			0.73

Abbreviations: AIDS, acquired immunodeficiency syndrome; HIV, human immunodeficiency syndrome.
* Original index categorized as 0, 1, 2 or ≥3.

	Parameter estimate	Odds ratio (95% confidence interval)	p
Charlson-Deyo Comorbidity Index			
Intercept (LOS ≥8 days)	-2.2542		<0.001
Intercept (LOS 3-7 days)	-1.6040		<0.001
Myocardial infarction	0.4855 0.9731	LOS ≥8d: 1.63 (1.44 to 1.84) LOS 3-7d: 2.65 (2.40 to 2.92)	<0.001
Chronic heart failure	1.3427 0.4774	LOS ≥8d: 3.83 (3.20 to 4.59) LOS 3-7d: 1.61 (1.33 to 1.96)	<0.001
Peripheral arterial disease	0.3819 -0.0850	LOS ≥8d: 1.47 (1.23 to 1.75) LOS 3-7d: 0.92 (0.77 to 1.09)	<0.001
Cerebrovascular disease	1.1349 -0.0741	LOS ≥8d: 3.11 (2.35 to 4.12) LOS 3-7d: 0.93 (0.65 to 1.32)	<0.001
Dementia	0.5481 0.2714	LOS ≥8d: 1.73 (0.54 to 5.53) LOS 3-7d: 1.31 (0.48 to 3.57)	0.63
Chronic pulmonary disease	0.6260 0.2531	LOS ≥8d: 1.87 (1.56 to 2.24) LOS 3-7d: 1.29 (1.09 to 1.53)	<0.001
Connective tissue disease / Rheumatic disease	0.9920 0.5489	LOS ≥8d: 2.70 (1.56 to 4.68) LOS 3-7d: 1.73 (1.01 to 2.98)	0.001
Peptic ulcer disease	0.5492 1.0805	LOS ≥8d: 1.73 (0.58 to 5.16) LOS 3-7d: 2.95 (1.27 to 6.85)	0.04
Mild liver disease	-0.0281 -0.2353	LOS ≥8d: 0.97 (0.50 to 1.90) LOS 3-7d: 0.79 (0.42 to 1.50)	0.77
Uncomplicated diabetes	0.1510 -0.0286	LOS ≥8d: 1.16 (1.01 to 1.34) LOS 3-7d: 0.97 (0.86 to 1.10)	0.07
Complicated diabetes	0.7645 -0.1061	LOS ≥8d: 2.15 (1.22 to 3.77) LOS 3-7d: 0.90 (0.47 to 1.74)	0.02
Paraplegia and hemiplegia	0.3016 -0.0251	LOS ≥8d: 1.35 (0.48 to 3.84) LOS 3-7d: 0.98 (0.30 to 3.15)	0.83
Renal disease	0.2459 -0.2860	LOS ≥8d: 1.28 (1.06 to 1.54) LOS 3-7d: 0.75 (0.62 to 0.91)	<0.001
Cancer	0.2704 -0.1490	LOS ≥8d: 1.31 (0.74 to 2.31) LOS 3-7d: 0.86 (0.49 to 1.52)	0.48
Moderate or severe liver disease	2.0958 0.8460	LOS ≥8d: 8.13 (1.83 to 36.23) LOS 3-7d: 2.33 (0.37 to 14.77)	0.02
Metastatic carcinoma	0.6222 0.4199	LOS ≥8d: 1.86 (0.34 to 10.32) LOS 3-7d: 1.52 (0.27 to 8.45)	0.74
AIDS/HIV	-10.0756 0.4878	LOS ≥8d: <0.01 (<0.01 to >999.99) LOS 3-7d: 1.63 (0.28 to 9.47)	0.86
Akaike information criterion (AIC)		16,778	
Elixhauser Comorbidity Index			
Intercept (LOS ≥8d)	-2.8467		<0.001
Intercept (LOS 3-7d)	-1.3341		<0.001
Chronic heart failure	0.8724 0.2756	LOS ≥8d: 2.39 (1.97 to 2.91) LOS 3-7d: 1.32 (1.08 to 1.60)	<0.001
Cardiac arrhythmia	1.5797 0.6776	LOS ≥8d: 4.85 (4.20 to 5.61) LOS 3-7d: 1.97 (1.72 to 2.25)	<0.001
Valvular disease	0.3127	LOS ≥8d: 1.37 (1.17 to 1.60)	<0.001

	-0.7107	LOS 3-7d: 0.49 (0.42 to 0.58)	
Pulmonary circulation disorders	0.4585 0.3329	LOS ≥8d: 1.58 (1.12 to 2.23) LOS 3-7d: 1.40 (0.96 to 2.02)	0.02
Peripheral vascular disorders	0.3434 -0.0829	LOS ≥8d: 1.41 (1.17 to 1.70) LOS 3-7d: 0.92 (0.78 to 1.09)	<0.001
Uncomplicated hypertension	0.4143 0.1745	LOS ≥8d: 1.51 (1.31 to 1.75) LOS 3-7d: 1.19 (1.07 to 1.32)	<0.001
Complicated hypertension	0.6368 0.0296	LOS ≥8d: 1.89 (1.33 to 2.68) LOS 3-7d: 1.03 (0.73 to 1.46)	0.001
Paralysis	0.2355 -0.0166	LOS ≥8d: 1.27 (0.42 to 3.79) LOS 3-7d: 0.98 (0.30 to 3.18)	0.90
Other neurological disorders	1.2504 0.0507	LOS ≥8d: 3.49 (2.24 to 5.44) LOS 3-7d: 1.05 (0.64 to 1.73)	<0.001
Chronic pulmonary disease	0.4371 0.2323	LOS ≥8d: 1.55 (1.27 to 1.88) LOS 3-7d: 1.26 (1.07 to 1.49)	<0.001
Uncomplicated diabetes	0.1265 -0.1103	LOS ≥8d: 1.14 (0.97 to 1.33) LOS 3-7d: 0.90 (0.79 to 1.01)	0.03
Complicated diabetes	0.7530 -0.0975	LOS ≥8d: 2.12 (1.17 to 3.85) LOS 3-7d: 0.91 (0.47 to 1.76)	0.03
Hypothyroidism	0.4286 0.5543	LOS ≥8d: 1.54 (1.21 to 1.95) LOS 3-7d: 1.74 (1.44 to 2.11)	<0.001
Renal failure	-0.1049 -0.2817	LOS ≥8d: 0.90 (0.69 to 1.18) LOS 3-7d: 0.75 (0.59 to 0.96)	0.07
Liver disease	0.2110 -0.1750	LOS ≥8d: 1.24 (0.67 to 2.29) LOS 3-7d: 0.84 (0.45 to 1.57)	0.60
Peptic ulcer disease excluding bleeding	0.5824 1.3940	LOS ≥8d: 1.79 (0.47 to 6.79) LOS 3-7d: 4.03 (1.55 to 10.49)	0.02
AIDS/HIV	-11.8465 0.4299	LOS ≥8d: <0.01 (<0.01 to >999.99) LOS 3-7d: 1.54 (0.25 to 9.30)	0.90
Lymphoma	0.5421 -11.8355	LOS ≥8d: 1.72 (0.44 to 6.65) LOS 3-7d: <0.01 (<0.01 to >999.99)	0.73
Metastatic cancer	-0.1487 0.0881	LOS ≥8d: 0.86 (0.11 to 6.74) LOS 3-7d: 1.09 (0.20 to 6.04)	0.98
Solid tumor without metastasis	0.3655 0.1019	LOS ≥8d: 1.44 (0.64 to 3.26) LOS 3-7d: 1.11 (0.56 to 2.20)	0.68
Rheumatoid arthritis / Collagen vascular disease	0.5850 0.2624	LOS ≥8d: 1.80 (1.01 to 3.19) LOS 3-7d: 1.30 (0.78 to 2.17)	0.13
Coagulopathy	1.2207 0.5930	LOS ≥8d: 3.39 (1.93 to 5.95) LOS 3-7d: 1.81 (1.03 to 3.17)	<0.001
Obesity	0.000479 0.1467	LOS ≥8d: 1.00 (0.85 to 1.17) LOS 3-7d: 1.16 (1.03 to 1.31)	0.05
Weight loss	-1.3831 -12.4360	LOS ≥8d: 0.25 (0.01 to 8.18) LOS 3-7d: <0.01 (<0.01 to >999.99)	0.74
Fluid and electrolyte disorders	1.2322 0.5836	LOS ≥8d: 3.43 (1.28 to 9.19) LOS 3-7d: 1.79 (0.65 to 4.93)	0.05
Blood loss anemia	0.5437 0.3064	LOS ≥8d: 1.72 (0.48 to 6.25) LOS 3-7d: 1.36 (0.33 to 5.61)	0.70
Deficiency anemia	2.2947 1.6578	LOS ≥8d: 9.92 (4.97 to 19.81) LOS 3-7d: 5.25 (2.65 to 10.39)	<0.001
Alcohol abuse	1.0253 0.5723	LOS ≥8d: 2.79 (1.71 to 4.56) LOS 3-7d: 1.77 (1.11 to 2.83)	<0.001
Drug abuse	1.3250 1.3181	LOS ≥8d: 3.76 (1.45 to 9.79) LOS 3-7d: 3.74 (1.79 to 7.79)	0.001
Psychoses	3.1617 0.6147	LOS ≥8d: 23.61 (13.53 to 41.21) LOS 3-7d: 1.85 (0.86 to 3.98)	<0.001
Depression	0.9208 0.8200	LOS ≥8d: 2.51 (1.34 to 4.72) LOS 3-7d: 2.27 (1.38 to 3.75)	0.001
<i>Akaike information criterion (AIC)</i>		16,134	

A length of stay ≤2 days is considered the reference category for parameter estimation and odds ratio calculations.
Abbreviations: AIDS, acquired immunodeficiency syndrome; HIV, human immunodeficiency syndrome; LOS, length of stay.

Supplemental Table 5. Distribution of Baseline Characteristics, ICD Comorbid Conditions, Outcomes and C-Statistics for In-Hospital and 1-Year Mortality in the Validation Cohort.

	APPROACH (n=17,877)
Age (years)	62.8±12.2

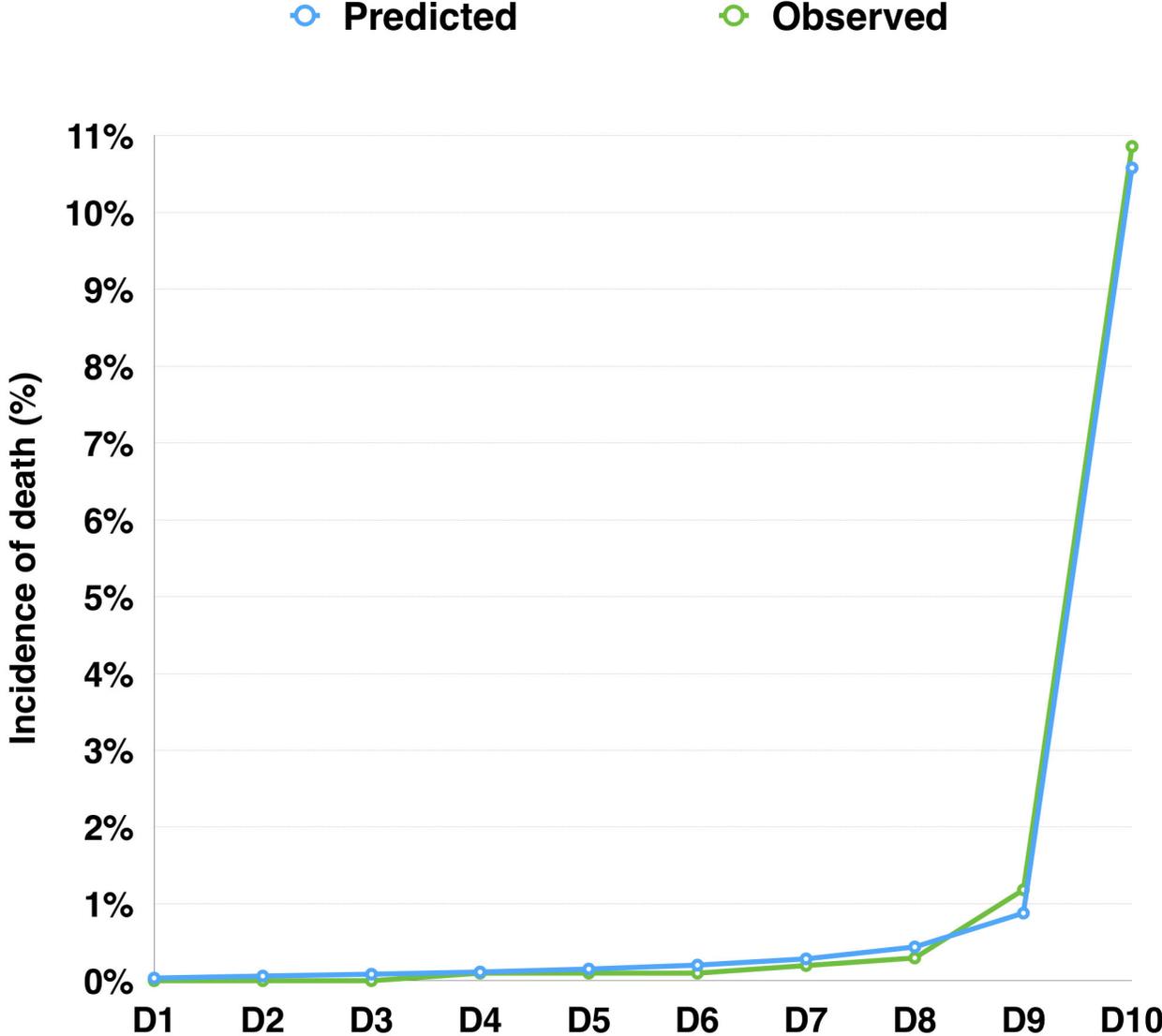
Male gender	12,196 (68.2%)
Main diagnoses	
Heart failure	118 (0.7%)
Myocardial infarction	7,315 (40.9%)
Atrial fibrillation	1,163 (6.5%)
Acute stroke / TIA	92 (0.5%)
Acute pulmonary embolism	59 (0.3%)
Cardiac arrest / cardiogenic shock / ventricular tachycardia/fibrillation	625 (3.5%)
Comorbidities	
Hypertension	9,997 (55.9%)
Obesity	258 (1.4%)
Diabetes mellitus	4,412 (24.7%)
Peripheral arterial disease	347 (1.9%)
Cerebrovascular disease	120 (0.7%)
Valvular heart disease	2165 (12.1%)
Acute kidney failure	329 (1.8%)
Chronic kidney disease	258 (1.4%)
Pulmonary artery hypertension	333 (1.9%)
Coagulopathy	79 (0.4%)
Dementia	39 (0.2%)
Chronic pulmonary disease	558 (3.1%)
Connective tissue disease	59 (0.3%)
Peptic ulcer disease	46 (0.3%)
Liver disease	77 (0.4%)
Cancer	145 (0.8%)
AIDS/HIV	< 5
Alcohol abuse	162 (0.9%)
Drug abuse	107 (0.6%)
Depression	70 (0.4%)
In-hospital all-cause death	136 (0.8%)
1 year all-cause death	612 (3.4%)
C-statistics (In-hospital mortality)	
Recalibrated CDCI	0.76 (0.71, 0.81)
Recalibrated ECI	0.82 (0.78, 0.86)
CSCI	0.92 (0.89, 0.94)
C-statistics (1 year mortality)	
Recalibrated CDCI	0.75 (0.73,0.77)
Recalibrated ECI	0.77 (0.75, 0.79)
CSCI	0.78 (0.76, 0.80)
Data are expressed as mean ± standard deviation or n (%), as appropriate. Abbreviations: CDCI, Charlson-Deyo comorbidity index; CSCI, cardiac-specific comorbidity index; ECI, Elixhauser comorbidity index; ICD, international classification of disease; TIA, transient ischemic attack.	

Reference

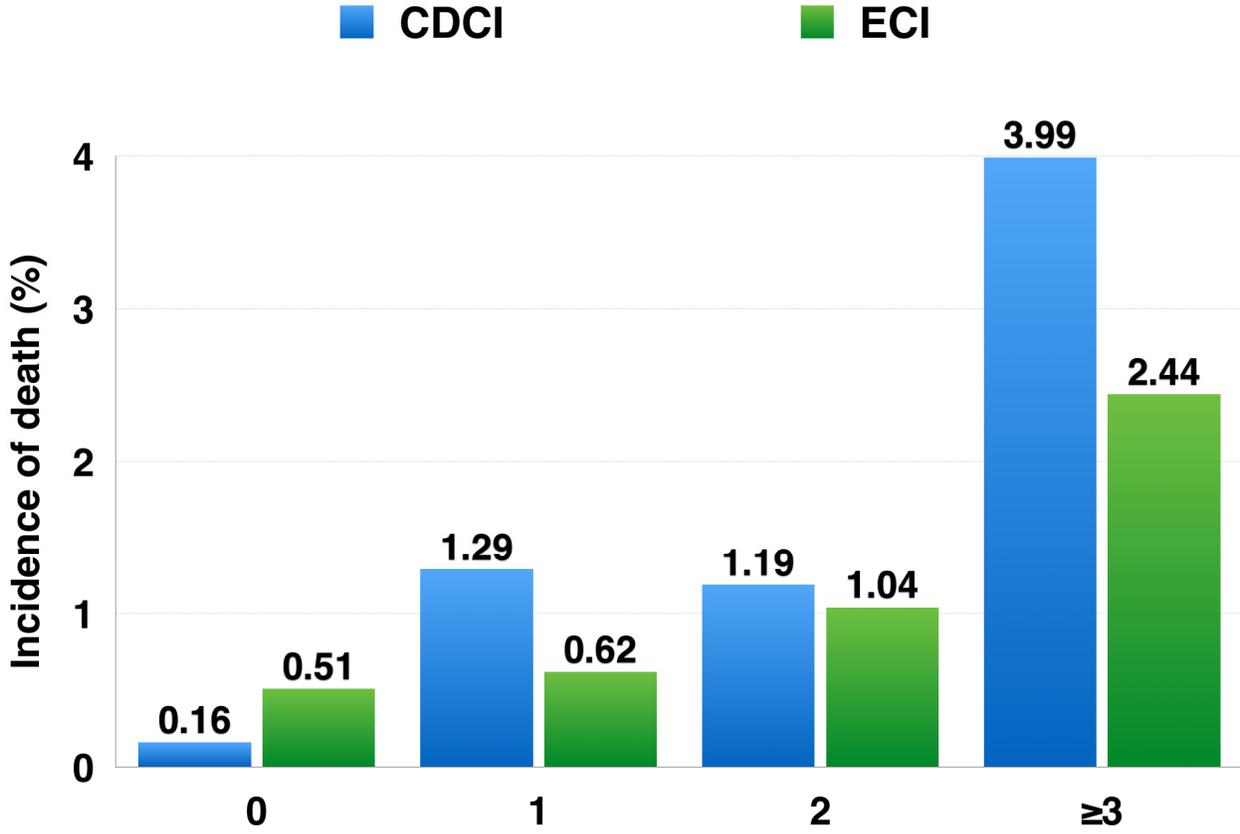
1. Mehta HB, Mehta V, Girman CJ, Adhikari D, Johnson ML. Regression coefficient-based scoring system should be used to assign weights to the risk index. Journal of clinical epidemiology. 2016;79:22-8.

FIGURES

Supplemental Figure 1: Comparison between observed and predicted probabilities of in-hospital all-cause death according to the Cardiac-Specific Comorbidity Index (CSCI), stratified by deciles of the predicted probabilities

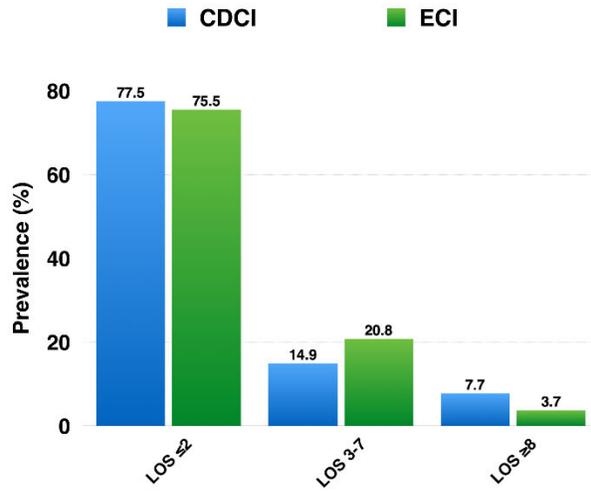


Supplemental Figure 2: Incidence of in-hospital all-cause death according to Charlson-Deyo Comorbidity Index (CDCI) and Elixhauser Comorbidity Index (ECI) categories.

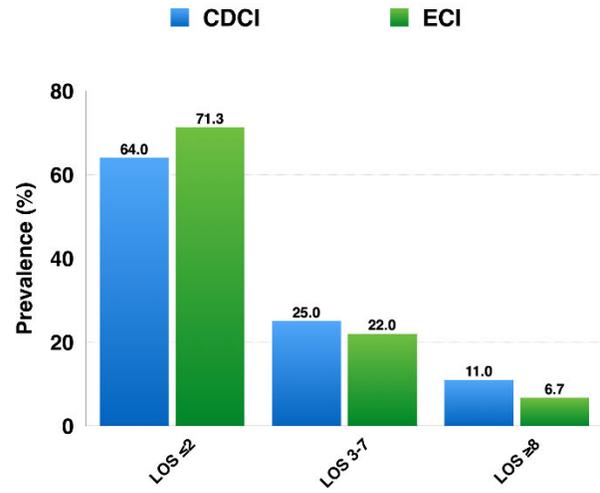


Supplemental Figure 3: Incidence of three categories of length of stay (LOS, ≤ 2 days, 3-7 days, ≥ 8 days) according to Charlson-Deyo Comorbidity Index (CDCI) and Elixhauser Comorbidity Index (ECI) categories.

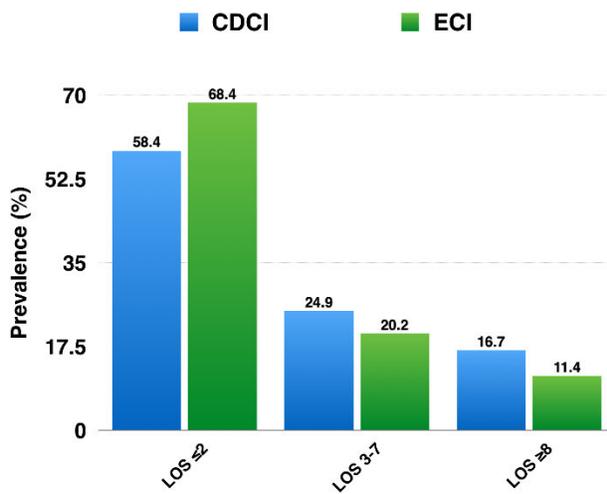
0



1



2



≥ 3

