

Supplementary Online Content

Haneuse S, Dominici F, Normand S-L, Schrag D. Assessment of between-hospital variation in readmission and mortality after cancer surgical procedures. *JAMA Netw Open*. 2018;1(6):e183038. doi:10.1001/jamanetworkopen.2018.3038

eFigure 1. Flow Diagram of Patients in the Study

eFigure 2. Distributions of Performance Metrics Among 260 Hospitals With at Least 10 Cancer Surgery Patients per Year, on Average, for In-Hospital Mortality, 30-Day Post-Discharge Readmission and 90-Day Post-Discharge Mortality

eTable 1. Characteristics of the Study Patients at the Time of Surgery

eTable 2. Estimated Adjusted Odds Ratio and 95% Confidence Intervals From Hierarchical Mixed Effects Logistic Regression Analyses for In-Hospital Mortality

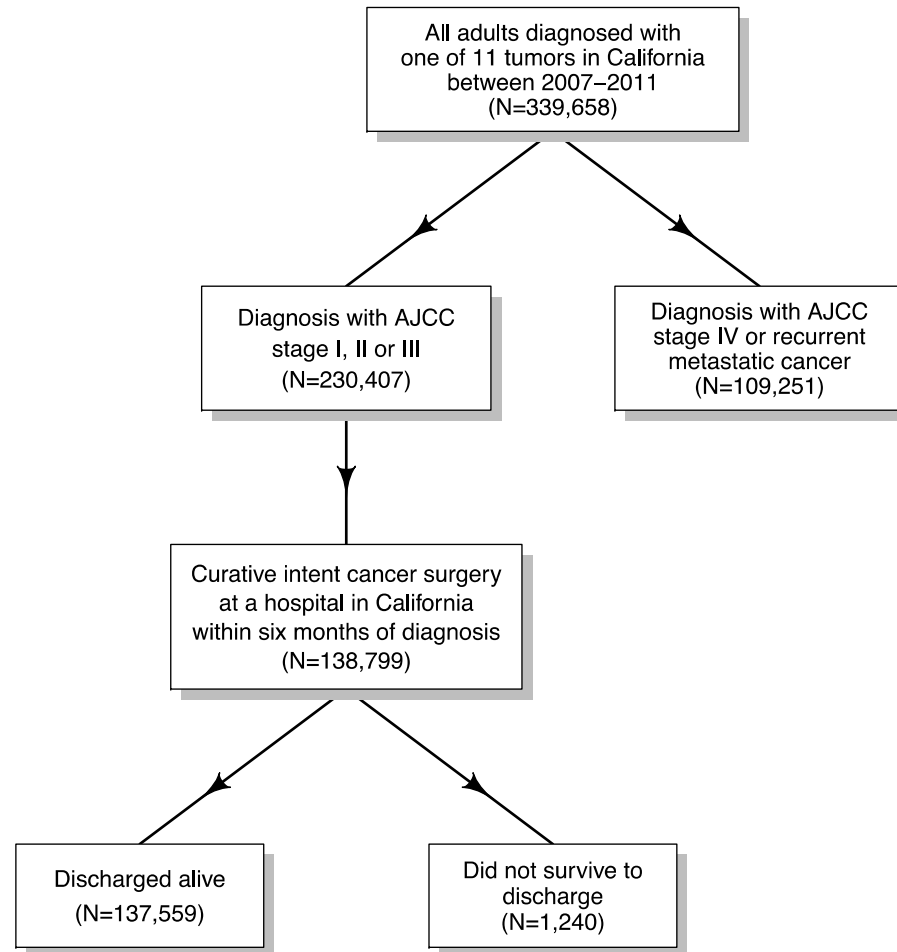
eTable 3. Estimated Adjusted Odds Ratio and 95% Confidence Intervals From Hierarchical Mixed Effects Logistic Regression Analyses for 90-Day Readmission and Mortality

eTable 4. Estimated Adjusted Odds Ratio and 95% Confidence Intervals From Hierarchical Mixed Effects Logistic Regression Analyses for 30-Day Readmission and Mortality

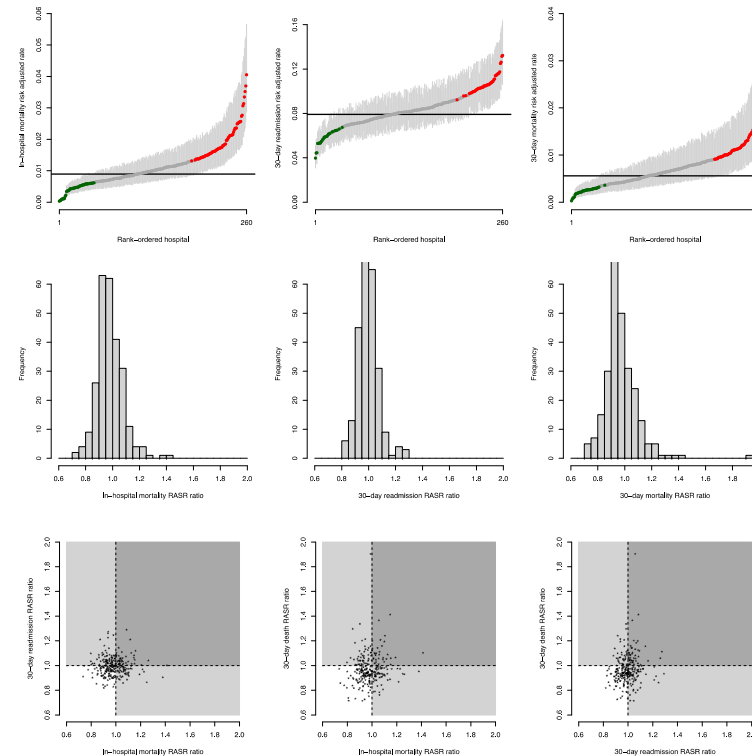
eTable 5. Estimates of the Random Effects Standard Deviation (SD), Median Odds Ratio and Hospital Odds Ratio Based on Hierarchical Logistic Regression Analyses of In-Hospital Mortality and 30- and 90-Day Post-Discharge Readmission and Mortality

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

eFigure 1. Flow Diagram of Patients in the Study.



eFigure 2. Distributions of Performance Metrics Among 260 Hospitals With at Least 10 Cancer Surgery Patients per Year, on Average, for In-Hospital Mortality, 30-Day Post-Discharge Readmission and 90-Day Post-Discharge Mortality. The top row presents model-based hospital-specific risk rates and 95% confidence intervals (CI); green/red dots indicate that the 95% CI is entirely below/above, and red dots entirely above, the statewide rate. The middle row displays the number of hospitals in discrete categories of model-based risk-adjusted standardized rate (RASR) ratios. The bottom row presents bivariate scatter-plots for all three two-way combinations with each point representing a hospital; hospitals in the white (non-shaded) area had optimal performance with RASR ratios < 1.0 , indicating lower than expected rates, for both outcomes; hospitals in the dark shaded region had RASR ratios > 1.0 , indicating higher than expected rates, for both outcomes; hospitals in the light shaded region had lower than expected rates for one metric and higher than expected rates for the other.



eTable 1. Characteristics of the Study Patients at the Time of Surgery									
		Discharged alive							
		Overall			30-day readmission			30-day mortality	
		N	% ^a		N	Rate, %		N	Rate, %
Total		137,559			10,880	7.9		766	0.6
Cancer type									
Colorectal		27,203	19.8		3,031	11.1		401	1.5
Breast		30,356	22.1		1,645	5.4		32	0.1
Lung		8,695	6.3		978	11.2		115	1.3
Prostate		27,267	19.8		981	3.6		26	0.1
Bladder		1,888	1.4		453	24.0		24	1.3
Thyroid		10,530	7.7		990	9.4		2	0.0
Kidney		12,956	9.4		994	7.7		62	0.5
Endometrium		14,661	10.7		1,035	7.1		45	0.3
Pancreas		2,320	1.7		470	20.3		31	1.3
Liver		902	0.7		163	18.1		13	1.4
Esophagus		781	0.6		140	17.9		15	1.9
AJCC stage									
Stage I		55,693	40.5		4,258	7.6		203	0.4
Stage II		52,144	37.9		3,728	7.1		261	0.5
Stage III		29,722	21.6		2,894	9.7		302	1.0

	Discharged alive							
	Overall		30-day readmission		30-day mortality			
	N	% ^a	N	Rate, %	N	Rate, %		
Sex								
Male	58,352	42.4	4,721	8.1	391	0.7		
Female	79,207	57.6	6,159	7.8	375	0.5		
Age, yrs								
18-44	12,364	9.0	973	7.9	3	0.0		
45-54	23,770	17.3	1,514	6.4	23	0.1		
55-64	38,742	28.2	2,567	6.6	97	0.3		
65-74	36,061	26.2	2,818	7.8	146	0.4		
75-84	20,108	14.6	2,195	10.9	276	1.4		
85+	6,514	4.7	813	12.5	221	3.4		
Charlson-Deyo score^b								
0	119,959	87.2	8,084	6.7	385	0.3		
1	8,315	6.0	1,097	13.2	119	1.4		
2+	9,285	6.7	1,699	18.3	262	2.8		
Type of admission^c								
Not scheduled	17,105	12.4	2,182	12.8	332	1.9		
Scheduled	120,454	87.6	8,698	7.2	434	0.4		
Length of admission, days								
≤ 1	40,282	29.3	1,978	4.9	20	0.0		

	Discharged alive							
	Overall		30-day readmission		30-day mortality			
	N	% ^a	N	Rate, %	N	Rate, %		
2-4	56,321	40.9	3,286	5.8	97	0.2		
5-7	21,473	15.6	2,126	9.9	122	0.6		
8-14	13,825	10.1	2,161	15.6	222	1.6		
> 14	5,658	4.1	1,329	23.5	305	5.4		
Disposition at discharge								
Home without services	117,085	85.1	7,681	6.6	224	0.2		
Home with services	13,056	9.5	1,687	12.9	144	1.1		
Skilled nursing/Intermediate care	6,235	4.5	1,294	20.8	328	5.3		
Other	1,183	0.9	218	18.4	70	5.9		
Marital status								
Not Married	52,883	38.4	4,646	8.8	440	0.8		
Married	84,676	61.6	6,234	7.4	326	0.4		
Race								
White	112,480	81.8	8,914	7.9	631	0.6		
Black	9,005	6.5	863	9.6	72	0.8		
Asian	14,987	10.9	1,050	7.0	57	0.4		
American Indian	615	0.4	35	5.7	4	0.7		
Other	472	0.3	18	3.8	2	0.4		

	Discharged alive							
	Overall		30-day readmission		30-day mortality			
	N	% ^a	N	Rate, %	N	Rate, %		
Hispanic								
No	115,081	83.7	9,043	7.9	680	0.6		
Yes	22,478	16.3	1,837	8.2	86	0.4		
Payer category								
Medicare	56,914	41.4	5,417	9.5	599	1.1		
Medicaid	8,340	6.1	842	10.1	41	0.5		
Commercial	67,675	49.2	4,224	6.2	114	0.2		
Other Indigent	2,732	2.0	219	8.0	7	0.3		
Self Pay/Other/Unknown	1,898	1.4	178	9.4	5	0.3		
Median income (\$1,000)								
< 50	18,421	13.4	1,384	7.5	127	0.7		
50-59	75,135	54.6	6,164	8.2	443	0.6		
60-69	10,589	7.7	816	7.7	52	0.5		
70-79	22,654	16.5	1,722	7.6	100	0.4		
80+	10,760	7.8	794	7.4	44	0.4		
Percent below poverty line								
< 10	10,726	7.8	765	7.1	55	0.5		
10-14	49,561	36.0	3,792	7.7	231	0.5		
15-19	65,806	47.8	5,497	8.4	407	0.6		

	Discharged alive							
	Overall		30-day readmission		30-day mortality			
	N	% ^a	N	Rate, %	N	Rate, %		
20+	11,466	8.3	826	7.2	73	0.6		
Average annual patient volume								
0-9	1,490	1.1	169	11.3	26	1.7		
10-49	14,276	10.4	1,253	8.8	132	0.9		
50-99	19,742	14.4	1,600	8.1	134	0.7		
100-199	37,177	27.0	2,884	7.8	201	0.5		
200+	64,874	47.2	4,974	7.7	273	0.4		
Hospital type								
Non-profit	115,708	84.1	8,945	7.7	606	0.5		
For-profit	10,918	7.9	964	8.8	92	0.8		
Public	10,933	7.9	971	8.9	68	0.6		
Teaching hospital								
No	107,164	77.9	8,225	7.7	656	0.6		
Yes	30,395	22.1	2,655	8.7	110	0.4		
Safety-net hospital								
No	129,419	94.1	10,051	7.8	721	0.6		
Yes	8,140	5.9	829	10.2	45	0.6		
Critical access hospital								
No	136,794	99.4	10,806	7.9	756	0.6		

	Discharged alive								
	Overall		30-day readmission		30-day mortality				
	N	% ^a	N	Rate, %	N	Rate, %			
Yes	765	0.6	74	9.7	10	1.3			
NCI-designated cancer center									
No	121,556	88.4	9,607	7.9	726	0.6			
Yes	16,003	11.6	1,273	8.0	40	0.2			
Year									
2007	23,817	17.3	1,889	7.9	112	0.5			
2008	29,144	21.2	2,314	7.9	176	0.6			
2009	29,174	21.2	2,390	8.2	155	0.5			
2010	28,515	20.7	2,264	7.9	175	0.6			
2011	26,909	19.6	2,023	7.5	148	0.6			
^a Column percentage									
^b Range 0-25, with higher scores indicating greater co-morbidity burden.									
^c Arranged with the hospital at least 24 hours prior to the admission									

eTable 2. Estimated Adjusted Odds Ratio (aOR) and 95% Confidence Intervals (CI) From Hierarchical Mixed Effects Logistic Regression Analyses for In-Hospital Mortality. Model 1 includes patient and tumor characteristics. Model 2 additionally includes hospital-level characteristics.

		In-hospital mortality			
		Model 1		Model 2	
		aOR	95% CI	aOR	95% CI
Cancer type					
Colorectum		REF		REF	
Breast		0.10	(0.07, 0.16)	0.10	(0.07, 0.16)
Lung		2.01	(1.66, 2.42)	2.06	(1.7, 2.48)
Prostate		0.05	(0.02, 0.08)	0.05	(0.03, 0.09)
Bladder		0.76	(0.51, 1.14)	0.84	(0.56, 1.26)
Thyroid		0.00	-	0.00	-
Kidney		0.72	(0.57, 0.92)	0.75	(0.59, 0.95)
Endometrium		0.31	(0.2, 0.47)	0.32	(0.21, 0.49)
Pancreas		2.57	(1.99, 3.31)	2.80	(2.17, 3.62)
Liver		3.64	(2.51, 5.28)	4.17	(2.87, 6.06)
Esophagus		4.57	(3.25, 6.44)	4.80	(3.41, 6.75)
AJCC stage					
Stage I		REF		REF	
Stage II		1.70	(1.45, 2)	1.71	(1.45, 2.01)
Stage III		1.92	(1.63, 2.27)	1.94	(1.65, 2.29)

	In-hospital mortality			
	Model 1		Model 2	
	aOR	95% CI	aOR	95% CI
Sex				
Male	REF		REF	
Female	0.61	(0.54, 0.7)	0.62	(0.54, 0.7)
Age, yrs				
18-44	REF		REF	
45-54	1.34	(0.67, 2.7)	1.33	(0.66, 2.69)
55-64	2.41	(1.26, 4.6)	2.39	(1.25, 4.57)
65-74	3.76	(1.95, 7.22)	3.66	(1.9, 7.05)
75-84	6.42	(3.33, 12.35)	6.23	(3.23, 12)
85+	10.41	(5.36, 20.19)	10.10	(5.2, 19.62)
Charlson-Deyo score^a				
0	REF		REF	
1	1.40	(1.17, 1.67)	1.40	(1.18, 1.67)
2+	2.65	(2.31, 3.04)	2.67	(2.33, 3.06)
Type of admission^b				
Not scheduled	REF		REF	
Scheduled	0.38	(0.33, 0.44)	0.40	(0.35, 0.46)
Marital status				
Not Married	REF		REF	
Married	0.88	(0.77, 0.99)	0.88	(0.78, 1)

	In-hospital mortality			
	Model 1		Model 2	
	aOR	95% CI	aOR	95% CI
Race				
White	REF		REF	
Black	1.11	(0.87, 1.41)	1.11	(0.87, 1.42)
Asian	0.95	(0.77, 1.17)	0.94	(0.77, 1.16)
American Indian	1.16	(0.46, 2.89)	1.13	(0.45, 2.82)
Other	0.41	(0.06, 2.99)	0.38	(0.05, 2.79)
Hispanic				
No	REF		REF	
Yes	0.96	(0.8, 1.14)	0.96	(0.8, 1.15)
Payer category				
Medicare	REF		REF	
Medicaid	0.97	(0.72, 1.31)	0.98	(0.72, 1.32)
Commercial	0.78	(0.63, 0.97)	0.78	(0.63, 0.96)
Other Indigent	0.64	(0.33, 1.23)	0.64	(0.33, 1.25)
Self Pay/Other/Unknown	1.41	(0.89, 2.24)	1.39	(0.87, 2.21)
Median income (\$1,000)				
< 50	1.07	(0.82, 1.41)	1.03	(0.8, 1.33)
50-59	REF		REF	
60-69	0.83	(0.6, 1.15)	0.84	(0.62, 1.15)
70-79	1.03	(0.79, 1.34)	1.00	(0.78, 1.28)

	In-hospital mortality			
	Model 1		Model 2	
	aOR	95% CI	aOR	95% CI
80+	1.18	(0.85, 1.66)	1.13	(0.83, 1.54)
Percent below poverty line				
< 10	1.06	(0.81, 1.38)	1.11	(0.86, 1.43)
10-14	REF		REF	
15-19	1.17	(0.94, 1.47)	1.16	(0.94, 1.43)
20+	1.67	(1.15, 2.44)	1.69	(1.19, 2.4)
Hospital type				
Non-profit			REF	
For-profit			1.38	(1.14, 1.67)
Public			1.21	(0.95, 1.53)
Average annual patient volume				
0-9			1.30	(0.91, 1.87)
10-49			REF	
50-99			1.05	(0.85, 1.29)
100-199			1.04	(0.85, 1.26)
200+			0.88	(0.71, 1.1)
Teaching hospital				
No			REF	
Yes			0.90	(0.73, 1.11)

		In-hospital mortality			
		Model 1		Model 2	
		aOR	95% CI	aOR	95% CI
Safety-net hospital					
No				REF	
Yes				0.82	(0.62, 1.09)
Critical access hospital					
No				REF	
Yes				1.23	(0.72, 2.09)
NCI-designated cancer center					
No				REF	
Yes				0.81	(0.6, 1.09)
^a Range 0-25, with higher scores indicating greater co-morbidity burden.					
^b Arranged with the hospital at least 24 hours prior to the admission					

eTable 3. Estimated Adjusted Odds Ratio and 95% Confidence Intervals From Hierarchical Mixed Effects Logistic Regression Analyses for 90-Day Readmission and Mortality. Model 1 includes patient and tumor characteristics. Model 2 additionally includes hospital-level characteristics.

	90-day readmission				90-day mortality			
	Model 1		Model 2		Model 1		Model 2	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
Cancer type								
Colorectum	REF		REF		REF		REF	
Breast	0.97	(0.92, 1.03)	0.97	(0.92, 1.03)	0.54	(0.44, 0.66)	0.54	(0.44, 0.66)
Lung	1.33	(1.24, 1.42)	1.33	(1.24, 1.42)	2.40	(2.03, 2.83)	2.47	(2.09, 2.92)
Prostate	0.33	(0.31, 0.36)	0.33	(0.31, 0.36)	0.21	(0.15, 0.29)	0.21	(0.15, 0.3)
Bladder	2.14	(1.92, 2.39)	2.14	(1.91, 2.38)	1.72	(1.32, 2.23)	1.82	(1.4, 2.37)
Thyroid	2.93	(2.75, 3.13)	2.93	(2.74, 3.13)	0.21	(0.11, 0.43)	0.22	(0.11, 0.44)
Kidney	0.88	(0.83, 0.94)	0.88	(0.83, 0.94)	0.89	(0.72, 1.1)	0.92	(0.75, 1.14)
Endometrium	1.08	(1.01, 1.16)	1.08	(1.01, 1.16)	1.11	(0.88, 1.4)	1.14	(0.9, 1.43)
Pancreas	2.06	(1.86, 2.28)	2.05	(1.85, 2.27)	2.42	(1.88, 3.11)	2.56	(1.99, 3.3)
Liver	1.81	(1.54, 2.13)	1.80	(1.53, 2.12)	3.20	(2.15, 4.74)	3.51	(2.36, 5.22)
Esophagus	1.66	(1.40, 1.96)	1.65	(1.39, 1.95)	2.48	(1.7, 3.63)	2.58	(1.76, 3.77)
AJCC stage								
Stage I	REF		REF		REF		REF	
Stage II	1.22	(1.17, 1.28)	1.22	(1.17, 1.28)	1.48	(1.28, 1.7)	1.48	(1.29, 1.71)
Stage III	1.53	(1.47, 1.60)	1.53	(1.47, 1.6)	2.49	(2.17, 2.84)	2.49	(2.18, 2.85)

	90-day readmission					90-day mortality				
	Model 1		Model 2		Model 1		Model 2			
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI		
Sex										
Male	REF		REF		REF		REF			
Female	0.88	(0.85, 0.92)	0.89	(0.85, 0.92)	0.75	(0.67, 0.85)	0.75	(0.67, 0.84)		
Age, yrs										
18-44	REF		REF		REF		REF			
45-54	0.85	(0.79, 0.9)	0.85	(0.79, 0.9)	1.99	(1.07, 3.68)	1.99	(1.07, 3.69)		
55-64	0.84	(0.79, 0.89)	0.84	(0.79, 0.89)	3.51	(1.95, 6.31)	3.51	(1.95, 6.31)		
65-74	0.83	(0.77, 0.9)	0.84	(0.78, 0.9)	4.01	(2.21, 7.27)	4.00	(2.21, 7.25)		
75-84	0.85	(0.78, 0.93)	0.86	(0.79, 0.93)	6.92	(3.81, 12.57)	6.90	(3.8, 12.53)		
85+	0.81	(0.73, 0.9)	0.81	(0.74, 0.9)	11.21	(6.14, 20.49)	11.14	(6.1, 20.37)		
Charlson-Deyo score^a										
0	REF		REF		REF		REF			
1	1.39	(1.31, 1.47)	1.39	(1.31, 1.47)	1.33	(1.15, 1.54)	1.33	(1.14, 1.54)		
2+	2.00	(1.89, 2.11)	2.00	(1.9, 2.11)	1.96	(1.73, 2.22)	1.96	(1.73, 2.21)		
Type of admission^b										
Not scheduled	REF		REF		REF		REF			
Scheduled	0.85	(0.81, 0.89)	0.85	(0.81, 0.89)	0.59	(0.52, 0.67)	0.59	(0.52, 0.67)		
Disposition at discharge										
Home without services	REF		REF		REF		REF			
Home with services	1.46	(1.38, 1.53)	1.46	(1.39, 1.54)	1.91	(1.65, 2.21)	1.92	(1.65, 2.22)		

	90-day readmission					90-day mortality				
	Model 1		Model 2		Model 1		Model 2			
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI		
Skilled nursing/Intermediate care	2.21	(2.07, 2.36)	2.22	(2.08, 2.37)	5.34	(4.65, 6.12)	5.33	(4.64, 6.11)		
Other	2.04	(1.79, 2.33)	2.04	(1.79, 2.33)	6.98	(5.61, 8.68)	6.92	(5.56, 8.61)		
Marital status										
Not Married	REF		REF		REF		REF			
Married	1.03	(1, 1.07)	1.03	(1, 1.07)	0.94	(0.84, 1.04)	0.94	(0.84, 1.05)		
Race										
White	REF		REF		REF		REF			
Black	1.17	(1.1, 1.25)	1.17	(1.1, 1.25)	1.31	(1.08, 1.59)	1.30	(1.06, 1.58)		
Asian	0.83	(0.79, 0.88)	0.83	(0.78, 0.88)	0.83	(0.68, 1)	0.82	(0.68, 1)		
American Indian	0.60	(0.45, 0.79)	0.60	(0.45, 0.79)	2.17	(1.14, 4.12)	2.14	(1.12, 4.07)		
Other	0.46	(0.31, 0.67)	0.46	(0.32, 0.67)	1.25	(0.44, 3.5)	1.24	(0.44, 3.47)		
Hispanic										
No	REF		REF		REF		REF			
Yes	1.05	(1, 1.1)	1.04	(1, 1.09)	0.87	(0.74, 1.02)	0.86	(0.73, 1.01)		
Payer category										
Medicare	REF		REF		REF		REF			
Medicaid	1.08	(1, 1.17)	1.05	(0.97, 1.14)	1.32	(1.03, 1.68)	1.32	(1.03, 1.69)		
Commercial	0.86	(0.81, 0.91)	0.86	(0.82, 0.91)	0.85	(0.71, 1.02)	0.86	(0.72, 1.02)		
Other Indigent	0.87	(0.77, 0.99)	0.84	(0.74, 0.95)	0.88	(0.54, 1.44)	0.89	(0.54, 1.46)		

	90-day readmission					90-day mortality				
	Model 1		Model 2		Model 1		Model 2			
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI		
Self Pay/Other/Unknown	0.94	(0.82, 1.08)	0.92	(0.8, 1.06)	0.73	(0.41, 1.3)	0.73	(0.41, 1.3)		
Median income (\$1,000)										
< 50	0.89	(0.81, 0.98)	0.91	(0.82, 1)	0.95	(0.74, 1.21)	0.94	(0.74, 1.2)		
50-59	REF		REF		REF		REF			
60-69	1.07	(0.97, 1.19)	1.08	(0.97, 1.2)	0.89	(0.68, 1.16)	0.88	(0.67, 1.15)		
70-79	1.11	(1.01, 1.22)	1.11	(1.01, 1.21)	0.84	(0.66, 1.06)	0.85	(0.68, 1.07)		
80+	1.04	(0.92, 1.17)	1.04	(0.92, 1.16)	0.80	(0.59, 1.09)	0.80	(0.59, 1.09)		
Percent below poverty line										
< 10	0.92	(0.85, 1)	0.93	(0.86, 1.01)	0.96	(0.75, 1.23)	0.96	(0.76, 1.23)		
10-14	REF		REF		REF		REF			
15-19	1.13	(1.04, 1.23)	1.13	(1.04, 1.22)	1.04	(0.86, 1.26)	1.05	(0.87, 1.27)		
20+	1.15	(1, 1.31)	1.13	(0.99, 1.29)	1.28	(0.91, 1.8)	1.25	(0.9, 1.76)		
Hospital type										
Non-profit			REF				REF			
For-profit			1.05	(0.96, 1.15)			0.92	(0.76, 1.12)		
Public			1.05	(0.95, 1.17)			1.18	(0.94, 1.47)		
Average annual patient volume										
0-9			1.10	(0.94, 1.28)			1.23	(0.87, 1.73)		

	90-day readmission					90-day mortality				
	Model 1		Model 2		Model 1		Model 2			
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI		
10-49			REF				REF			
50-99			1.02	(0.93, 1.11)			0.89	(0.73, 1.08)		
100-199			1.01	(0.93, 1.1)			0.87	(0.72, 1.05)		
200+			1.06	(0.97, 1.17)			0.94	(0.77, 1.15)		
Teaching hospital										
No			REF				REF			
Yes			1.13	(1.03, 1.25)			0.87	(0.71, 1.07)		
Safety-net hospital										
No			REF				REF			
Yes			1.14	(1.01, 1.28)			0.97	(0.74, 1.26)		
Critical access hospital										
No			REF				REF			
Yes			1.19	(0.93, 1.51)			1.04	(0.59, 1.82)		
NCI-designated cancer center										
No			REF				REF			
Yes			0.92	(0.8, 1.07)			0.76	(0.57, 1.01)		
^a Range 0-25, with higher scores indicating greater co-morbidity burden.										
^b Arranged with the hospital at least 24 hours prior to the admission										

eTable 4. Estimated Adjusted Odds Ratio and 95% Confidence Intervals From Hierarchical Mixed Effects Logistic Regression Analyses for 30-Day Readmission and Mortality. Model 1 includes patient and tumor characteristics. Model 2 additionally includes hospital-level characteristics.

	30-readmission				30-day mortality			
	<u>Model 1</u>		<u>Model 2</u>		<u>Model 1</u>		<u>Model 2</u>	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
Cancer type								
Colorectum	REF		REF		REF		REF	
Breast	0.68	(0.63, 0.73)	0.68	(0.63, 0.73)	0.30	(0.21, 0.45)	0.30	(0.21, 0.45)
Lung	1.16	(1.07, 1.26)	1.16	(1.07, 1.26)	1.85	(1.45, 2.37)	1.93	(1.51, 2.48)
Prostate	0.40	(0.36, 0.44)	0.40	(0.36, 0.43)	0.30	(0.2, 0.47)	0.32	(0.2, 0.5)
Bladder	2.19	(1.94, 2.47)	2.17	(1.92, 2.45)	0.96	(0.62, 1.5)	1.06	(0.68, 1.65)
Thyroid	1.33	(1.21, 1.45)	1.32	(1.21, 1.45)	0.13	(0.03, 0.54)	0.14	(0.03, 0.56)
Kidney	0.83	(0.77, 0.9)	0.83	(0.77, 0.9)	0.97	(0.72, 1.3)	1.01	(0.76, 1.36)
Endometrium	0.96	(0.88, 1.04)	0.95	(0.87, 1.04)	1.01	(0.71, 1.42)	1.04	(0.74, 1.48)
Pancreas	2.08	(1.85, 2.33)	2.05	(1.83, 2.31)	1.64	(1.1, 2.44)	1.78	(1.2, 2.66)
Liver	1.86	(1.54, 2.23)	1.83	(1.52, 2.2)	2.40	(1.32, 4.38)	2.79	(1.52, 5.13)
Esophagus	1.58	(1.3, 1.92)	1.57	(1.29, 1.91)	2.06	(1.18, 3.57)	2.16	(1.24, 3.76)
AJCC stage								
Stage I	REF		REF		REF		REF	
Stage II	1.09	(1.03, 1.15)	1.09	(1.03, 1.15)	1.24	(1, 1.52)	1.24	(1.01, 1.53)
Stage III	1.26	(1.19, 1.33)	1.26	(1.19, 1.33)	1.93	(1.58, 2.35)	1.94	(1.59, 2.36)

	30-readmission				30-day mortality			
	Model 1		Model 2		Model 1		Model 2	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
Sex								
Male	REF		REF		REF		REF	
Female	0.84	(0.8, 0.89)	0.84	(0.8, 0.89)	0.65	(0.55, 0.77)	0.64	(0.54, 0.76)
Age, yrs								
18-44	REF		REF		REF		REF	
45-54	0.85	(0.78, 0.93)	0.85	(0.78, 0.93)	2.46	(0.74, 8.25)	2.47	(0.74, 8.27)
55-64	0.89	(0.82, 0.97)	0.89	(0.82, 0.97)	5.30	(1.67, 16.84)	5.30	(1.67, 16.82)
65-74	0.85	(0.77, 0.94)	0.86	(0.77, 0.95)	5.17	(1.61, 16.58)	5.12	(1.6, 16.44)
75-84	0.89	(0.8, 1)	0.90	(0.81, 1)	9.74	(3.03, 31.27)	9.63	(3, 30.91)
85+	0.87	(0.76, 0.99)	0.87	(0.77, 0.99)	16.16	(5, 52.23)	15.95	(4.94, 51.54)
Charlson-Deyo score^a								
0	REF		REF		REF		REF	
1	1.35	(1.26, 1.46)	1.35	(1.26, 1.46)	1.27	(1.01, 1.58)	1.27	(1.01, 1.58)
2+	1.81	(1.69, 1.93)	1.81	(1.7, 1.93)	1.79	(1.49, 2.15)	1.79	(1.49, 2.15)
Type of admission^b								
Not scheduled	REF		REF		REF		REF	
Scheduled	0.89	(0.84, 0.95)	0.90	(0.85, 0.95)	0.68	(0.56, 0.81)	0.68	(0.57, 0.82)

	30-readmission				30-day mortality			
	Model 1		Model 2		Model 1		Model 2	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
Disposition at discharge								
Home without services	REF		REF		REF		REF	
Home with services	1.47	(1.38, 1.56)	1.47	(1.38, 1.57)	2.42	(1.93, 3.05)	2.44	(1.94, 3.07)
Skilled nursing/Intermediate care	2.19	(2.03, 2.37)	2.20	(2.03, 2.37)	6.75	(5.47, 8.32)	6.74	(5.47, 8.32)
Other	1.97	(1.69, 2.3)	1.96	(1.68, 2.29)	9.67	(7.16, 13.06)	9.61	(7.11, 12.99)
Marital status								
Not Married	REF		REF		REF		REF	
Married	1.02	(0.97, 1.06)	1.02	(0.98, 1.06)	0.83	(0.71, 0.98)	0.84	(0.71, 0.98)
Race								
White	REF		REF		REF		REF	
Black	1.22	(1.13, 1.33)	1.22	(1.13, 1.32)	1.59	(1.22, 2.08)	1.57	(1.2, 2.05)
Asian	0.83	(0.78, 0.89)	0.83	(0.77, 0.89)	0.82	(0.61, 1.1)	0.82	(0.61, 1.09)
American Indian	0.74	(0.53, 1.05)	0.74	(0.52, 1.05)	1.71	(0.61, 4.79)	1.66	(0.59, 4.68)
Other	0.54	(0.34, 0.88)	0.54	(0.34, 0.88)	1.45	(0.34, 6.08)	1.42	(0.34, 5.95)

	30-readmission				30-day mortality			
	Model 1		Model 2		Model 1		Model 2	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
Hispanic								
No	REF		REF		REF		REF	
Yes	1.03	(0.97, 1.09)	1.02	(0.96, 1.08)	0.87	(0.68, 1.1)	0.86	(0.67, 1.09)
Payer category								
Medicare	REF		REF		REF		REF	
Medicaid	1.17	(1.06, 1.29)	1.13	(1.02, 1.24)	1.35	(0.94, 1.94)	1.35	(0.93, 1.96)
Commercial	0.86	(0.8, 0.93)	0.87	(0.81, 0.93)	0.81	(0.62, 1.06)	0.81	(0.62, 1.06)
Other Indigent	0.88	(0.75, 1.03)	0.84	(0.71, 0.98)	0.72	(0.33, 1.6)	0.73	(0.33, 1.63)
Self Pay/Other/Unknown	1.02	(0.86, 1.2)	0.98	(0.83, 1.17)	0.69	(0.28, 1.7)	0.69	(0.28, 1.71)
Median income (\$1,000)								
< 50	0.93	(0.83, 1.03)	0.95	(0.85, 1.05)	1.22	(0.88, 1.69)	1.22	(0.88, 1.69)
50-59	REF		REF		REF		REF	
60-69	1.03	(0.92, 1.16)	1.04	(0.93, 1.16)	0.87	(0.59, 1.29)	0.87	(0.59, 1.29)
70-79	1.05	(0.95, 1.16)	1.04	(0.94, 1.14)	0.78	(0.56, 1.1)	0.80	(0.57, 1.12)
80+	1.07	(0.94, 1.21)	1.05	(0.93, 1.19)	0.82	(0.53, 1.28)	0.83	(0.54, 1.28)
Percent below poverty line								
< 10	0.89	(0.81, 0.98)	0.91	(0.82, 1)	1.13	(0.8, 1.61)	1.15	(0.81, 1.63)

	30-readmission				30-day mortality			
	Model 1		Model 2		Model 1		Model 2	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
10-14	REF		REF		REF		REF	
15-19	1.07	(0.98, 1.17)	1.06	(0.98, 1.16)	1.11	(0.85, 1.46)	1.12	(0.86, 1.47)
20+	1.03	(0.89, 1.2)	1.01	(0.87, 1.17)	1.12	(0.7, 1.8)	1.08	(0.68, 1.72)
Hospital type								
Non-profit			REF				REF	
For-profit			1.06	(0.97, 1.17)			0.94	(0.71, 1.23)
Public			1.08	(0.97, 1.2)			1.28	(0.94, 1.74)
Average annual patient volume								
0-9			1.09	(0.91, 1.32)			1.27	(0.79, 2.02)
10-49			REF				REF	
50-99			0.98	(0.89, 1.07)			0.88	(0.67, 1.15)
100-199			0.98	(0.9, 1.07)			0.82	(0.63, 1.06)
200+			1.05	(0.95, 1.15)			0.99	(0.75, 1.32)
Teaching hospital								
No			REF				REF	
Yes			1.09	(1, 1.19)			0.80	(0.6, 1.07)
Safety-net hospital								
No			REF				REF	
Yes			1.13	(1, 1.27)			0.99	(0.68, 1.44)

	30-readmission				30-day mortality			
	<u>Model 1</u>		<u>Model 2</u>		<u>Model 1</u>		<u>Model 2</u>	
	aOR	95% CI	aOR	95% CI	aOR	95% CI	aOR	95% CI
Critical access hospital								
No			REF				REF	
Yes			1.21	(0.91, 1.59)			1.13	(0.55, 2.35)
NCI-designated cancer center								
No			REF				REF	
Yes			1.01	(0.89, 1.14)			0.64	(0.42, 0.98)
^a Range 0-25, with higher scores indicating greater co-morbidity burden.								
^b Arranged with the hospital at least 24 hours prior to the admission								

eTable 5. Estimates of the Random Effects Standard Deviation (SD), Median Odds Ratio and Hospital Odds Ratio^a Based on Hierarchical Logistic Regression Analyses of In-Hospital Mortality and 30- and 90-Day Post-Discharge Readmission and Mortality

		Patient and census-based characteristics only			Patient, census-based and hospital-specific characteristics	
		Estimate	95% CI		Estimate	95% CI
In-hospital mortality						
Random effects SD		0.24	(0.14, 0.34)		0.11	(0.00, 0.29)
Median odds ratio		1.26	(1.15, 1.39)		1.11	(0.94, 1.31)
Hospital odds ratio ^a		1.62	(1.33, 1.98)		1.24	(0.87, 1.77)
30-day readmission						
Random effects SD		0.14	(0.11, 0.18)		0.13	(0.09, 0.16)
Median odds ratio		1.15	(1.11, 1.18)		1.13	(1.09, 1.16)
Hospital odds ratio ^a		1.33	(1.24, 1.43)		1.29	(1.21, 1.38)
30-day mortality						
Random effects SD		0.30	(0.18, 0.43)		0.25	(0.12, 0.38)
Median odds ratio		1.34	(1.19, 1.50)		1.27	(1.12, 1.44)
Hospital odds ratio ^a		1.84	(1.44, 2.34)		1.66	(1.28, 2.15)
90-day readmission						
Random effects SD		0.18	(0.16, 0.21)		0.17	(0.14, 0.20)
Median odds ratio		1.19	(1.16, 1.22)		1.17	(1.15, 1.20)
Hospital odds ratio ^a		1.45	(1.37, 1.53)		1.40	(1.33, 1.48)

	Patient and census-based characteristics only		Patient, census-based and hospital-specific characteristics	
	Estimate	95% CI	Estimate	95% CI
90-day mortality				
Random effects SD	0.26	(0.18, 0.33)	0.23	(0.15, 0.31)
Median odds ratio	1.28	(1.19, 1.38)	1.25	(1.16, 1.34)
Hospital odds ratio ^a	1.68	(1.44, 1.95)	1.58	(1.36, 1.85)
^a Odds ratio comparing risk of the outcome between a hospital one standard deviation above the (statewide) average to a hospital one standard deviation below the average				