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Relationship Between Surgical Oncologic Outcomes and Publically Reported Hospital Quality and Satisfaction Measures

Jason D. Wright, Ana I. Tergas, Cande V. Ananth, William M. Burke, Ling Chen, Alfred I. Neugut, Catherine A. Richards, Dawn L. Hershman

Affiliations of authors: Department of Obstetrics and Gynecology (JDW, AIT, CVA, WMB, LC), Department of Medicine (AIN, DLH), and Herbert Irving Comprehensive Cancer Center (JDW, AIT, AIN, DLH, WMB), Columbia University College of Physicians and Surgeons, New York, NY; Department of Epidemiology, Mailman School of Public Health, Columbia University (AIT, CVA, AIN, CAR, DLH).

Correspondence to: Jason D. Wright, MD, Division of Gynecologic Oncology, Department of Obstetrics and Gynecology, Columbia University College of Physicians and Surgeons, 161 Fort Washington Ave, 8th Floor, New York, NY 10032 (e-mail: jw2459@columbia.edu).

Abstract

Background: Hospital-level measures of patient satisfaction and quality are now reported publically by the Centers for Medicare and Medicaid Services. There are limited metrics specific to cancer patients. We examined whether publically reported hospital satisfaction and quality data were associated with surgical oncologic outcomes.

Methods: The Nationwide Inpatient Sample was utilized to identify patients with solid tumors who underwent surgical resection in 2009 and 2010. The hospitals were linked to Hospital Compare, which collects data on patient satisfaction, perioperative quality, and 30-day mortality for medical conditions (pneumonia, myocardial infarction [MI], and congestive heart failure [CHF]). The risk-adjusted hospital-level rates of morbidity and mortality were calculated for each hospital and the means compared between the highest and lowest performing hospital quartiles and reported as absolute reduction in risk (ARR), the difference in risk of the outcome between the two groups. All statistical tests were two-sided.

Results: A total of 63 197 patients treated at 448 hospitals were identified. For patients at high vs low performing hospitals based on Hospital Consumer Assessment of Healthcare Providers and Systems scores, the ARR in perioperative morbidity was 3.1% (95% confidence interval [CI] = 0.4% to 5.7%, $P = .02$). Similarly, the ARR for mortality based on the same measure was -0.4% (95% CI = -1.5% to 0.6%, $P = .40$). High performance on perioperative quality measures resulted in an ARR of 0% to 2.2% for perioperative morbidity ($P > .05$ for all). Similarly, there was no statistically significant association between hospital-level mortality rates for MI (ARR = 0.7%, 95% CI = -1.0% to 2.5%), heart failure (ARR = 1.0%, 95% CI = -0.6% to 2.7%), or pneumonia (ARR = 1.6%, 95% CI = -0.3% to 3.5%) and complications for oncologic surgery patients.

Conclusion: Currently available measures of patient satisfaction and quality are poor predictors of outcomes for cancer patients undergoing surgery. Specific metrics for long-term oncologic outcomes and quality are needed.

The measurement of quality has become a major focus of US medicine (1,2). Prior work has shown that quality is often

highly variable. While patients often do not receive treatments and interventions that are known to be beneficial, overuse of

unnecessary and sometimes harmful treatments is also common (3).

A number of sources have advocated the public reporting of hospital quality and satisfaction data to help medical consumers make informed choices about where they receive care and to help hospitals improve quality (4). The Hospital Quality Alliance, a public and private collaborative, collects data on process measures for common medical conditions including acute myocardial infarction, pneumonia, heart failure, and perioperative surgical care, as well as measures of patient satisfaction (4). These hospital-level quality data are updated regularly and have now been made available to the public (5).

Although hospital satisfaction and quality data are now widely available, whether these measures correlate with improved patient outcomes remains uncertain (6–8). Studies in other disciplines have reported mixed results on whether process measures and satisfaction correlate with outcomes (7,9–14). In oncology, although a number of initiatives are underway to improve the quality of cancer care, public reporting of outcomes and the subjective experiences of cancer patients remains infrequent (15,16). Aside from data on procedural volume, comparative data to guide newly diagnosed cancer patients requiring surgery are often sparse. Given the lack of specific data in oncology, cancer patients are forced to rely on publically available hospital data that is often derived from general medical and surgical patients to guide decision making.

Given the relative lack of publically reported hospital data for inpatient oncologic care and outcomes, we explored whether currently available publically reported hospital data for medical and surgical conditions could be used as a surrogate for quality of cancer care. Specifically, we examined whether hospital-level patient satisfaction and quality metrics for common medical and surgical conditions were correlated with perioperative outcomes for patients undergoing inpatient oncologic surgery.

Methods

Nationwide Inpatient Sample

Data from Nationwide Inpatient Sample (NIS) (2009–2010) was linked to Hospital Compare (2008) data describing hospital-level patient satisfaction, compliance with perioperative process measures, and medical condition mortality. NIS, developed and maintained by the Agency for Healthcare Research and Quality, includes a random sample of 20% of all hospital discharges within the United States. In 2010, NIS captured approximately eight million hospital stays from 45 states (17). The study was deemed exempt by the Columbia University Institutional Review Board.

Patients and Procedures

Patients with an ICD-9 code for esophageal, pancreatic, breast, lung, gastric, colon, uterine, ovarian, prostate, and bladder cancer in combination with an ICD-9 code for the site-specific cancer-directed surgery were included (Supplementary Table 1, available online). For each surgical procedure, the extent of surgery (ie, partial vs total organ resection) and utilization of a minimally invasive surgical approach were noted. Patients with codes for multiple tumor types were excluded. All patients were deidentified so written informed consent was not required.

Each patient's age (<40, 40–49, 50–59, 60–69, 70–79, ≥80 years), gender, race (white, black, Hispanic, other, unknown), income (low, medium, high, highest, unknown), and insurance status (Medicare, Medicaid, commercial, self pay, other, unknown) were

noted. The hospital admission was classified as elective, urgent, or other/unknown. Comorbid medical conditions were measured using the Elixhauser index (18).

Hospitals

Hospitals were classified based on teaching status (teaching, nonteaching), location (urban, rural), region (northeast, midwest, south, west), size (small, medium, large), and ownership (government, private/not for profit, private/for profit, and unknown). Procedural volume was estimated as annualized volume (total number of procedures divided by the number of years in which a given hospital performed at least one procedure). Separate volume calculations were performed for each procedure and hospital volume classified as low, intermediate, or high.

Outcomes

The primary outcomes were hospital-level risk-adjusted mortality, risk-adjusted complication rates, and failure to rescue. Risk-adjusted mortality rates for each hospital were calculated as previously described (19,20). A logistic regression model was used to predict the probability of death for each individual patient. The models included the clinical and demographic characteristics of patients, procedure volume, type of surgery, and hospital characteristics. The predicted probabilities of all patients at a given hospital were then summed to determine the hospital-specific expected mortality. The risk-adjusted mortality rate for each hospital was then estimated by multiplying the ratio of the observed to expected mortality by the overall mortality of the cohort.

We examined major perioperative complications including myocardial infarction, cardiopulmonary arrest, renal failure, respiratory failure, stroke, venous thromboembolism, shock, hemorrhage, gastrointestinal bleeding, pneumonia, bacteremia/sepsis, abscess, and wound complications (19,21). Risk-adjusted complication rates were calculated for each hospital using methodology similar to the analysis of risk-adjusted mortality. Failure to rescue was defined as death in patients with any of the complications listed above (19,20,22). The failure-to-rescue rate for each hospital was determined by dividing the number of patients who died after a complication by the total number of patients with a complication in the given hospital.

Hospital Compare

Hospital Compare is a repository of data that is publically reported and includes structural measures, process measures, outcomes, hospital resource utilization, and patient satisfaction (5). It is estimated that 98% of hospitals now participate (8). Hospital-level data on patient satisfaction (Hospital Consumer Assessment of Healthcare Providers and Systems), surgical process measures (Surgical Care Improvement Project), and mortality for medical conditions were obtained from Hospital Compare.

Hospital Consumer Assessment of Healthcare Providers and Systems

Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is a survey administered nationally to measure patients' perceptions of their hospital experience. HCAHPS has been validated by Centers for Medicare and Medicaid Services (CMS) and Agency for Healthcare and research Quality (AHRQ) (23).

The HCAHPS survey consists of 27 questions about hospital experience that focus on communication with staff, staff responsiveness, cleanliness and quietness, pain management, medication communication, and discharge planning. The survey

contains two global questions in which patients are asked to rate their overall experience (responses from 0, worst to 10, best, and grouped as low [0–6], medium [7–8], and high [9–10]) and whether they would recommend the hospital to others (responses as no [probably not or definitely not], yes, probably recommend, and yes, definitely recommend). Additionally, the survey includes a number of items to characterize patient attributes that are used for risk adjustment across hospitals. The survey is administered to a random sample of patients between 48 hours and six weeks after discharge (23,24).

Our analysis focused on the two questions directed at the global assessment of patient experiences. For overall satisfaction, we ranked hospitals based on the percentage of patients who reported their experience as high (9–10). Similarly, we ranked hospitals based on the proportion of respondents who would definitely recommend the hospital to family or friends (23).

Surgical Care Improvement Project

The Surgical Care Improvement Project (SCIP) measures consist of perioperative process measures (25). SCIP measures use of perioperative antibiotics for high-risk surgical patients (antibiotic administered within one hour of incision, appropriate antibiotic chosen, antibiotic discontinued within 24 hours of surgery), hair removal, urinary catheter removal, perioperative glucose control, temperature monitoring, and compliance with venous thromboembolism (VTE) prophylaxis (VTE prophylaxis ordered, VTE prophylaxis administered). Data from SCIP is abstracted and is one of the Joint Commission's core measures (25). We utilized compliance with the three perioperative antibiotic measures and the two perioperative VTE prophylaxis measures.

Mortality for Medical Conditions

CMS and Hospital Quality Alliance (HQA) began reporting hospital-level 30-day mortality rates for acute myocardial infarction (AMI) and heart failure (HF) in 2007 and for pneumonia (PN) in 2008. These mortality measures are risk-standardized to facilitate comparisons across hospitals (26). We ranked hospitals based on their 30-day risk-standardized mortality rates for AMI, HF, and PN.

Statistical Analysis

Hospital-level data from Hospital Compare (HCAHPS scores, SCIP measures, and the mortality for medical conditions) are displayed as medians with interquartile ranges. Patient and hospitals were grouped into quartiles based on HCAHPS scores for satisfaction (based on percentage of patients reporting high satisfaction) and willingness to recommend the hospital (based on percentage of patients that would definitely recommend the hospital). Across these quartiles, frequency distributions between categorical variables were compared using χ^2 tests while continuous variables were compared with t-test, analysis of variance, and Wilcoxon rank-sum tests.

The correlation between the HCAHPS scores for satisfaction and willingness to recommend the hospital and risk-adjusted mortality and risk-adjusted complication rates are reported using the Pearson's correlation coefficient. Each hospital's HCAHPS scores and SCIP and mortality measures were determined. Hospitals were then ranked based on their respective scores for each measure. We then compared surgical outcomes (risk-adjusted mortality, complication rates, and failure-to-rescue rates) between high and low performing hospitals. Specifically, we compared surgical outcomes between hospitals

performing at the highest quartile (75th percentile) and lowest quartile (25th percentile) for HCAHPS, SCIP, and the mortality measures. We report the percentage absolute risk reduction (ARR) for the outcomes between the highest and lowest performing hospitals for the measures. The ARR is the incremental difference in risks of an outcome between two groups. All analyses were performed with SAS version 9.4 (SAS Institute Inc, Cary, NC). All statistical tests were two-sided. A P value of less than .05 was considered statistically significant.

Results

From 2009 to 2010 we identified 135 132 surgical oncology patients treated at 1384 hospitals in the NIS database. In 2010, 18 states did not supply hospital-level identifiers to NIS, thus 92 041 (68.1%) patients at 797 (57.6%) hospitals were successfully matched to the Hospital Compare. The final cohort includes the 63 197 (46.8%) patients at 448 (32.4%) hospitals that reported responses to HCAHPS questions.

Overall, the median value for high patient satisfaction across hospitals was 62.0% (IQR = 56.0%-69.0%), while the median value for whether patients would recommend the hospital was 68.0% (IQR = 61.0%-74.0%) (Table 1). The median hospital-level scores for the five SCIP measures we examined ranged from 83.0% (receipt of appropriate antibiotics) to 95.0% (appropriate discontinuation after antibiotics within 24 hours of surgery). The median hospital-level mortality rates for medical conditions were 10.8% (IQR = 10.1%-11.7%) for heart failure, 11.3% (IQR = 10.3%-12.2%) for pneumonia, and 15.9% (IQR = 15.3%-16.7%) for myocardial infarction.

Hospitals were then stratified into quartiles based on the median overall satisfaction scores. The median overall satisfaction rate was 52.0% (IQR = 46.0%-55.0%) at the lowest-satisfaction hospitals, 60.0% (IQR = 59.0%-61.0%) at the intermediate-satisfaction hospitals, 65.0% (IQR = 64.0%-67.0%) at the high-satisfaction facilities, and 72.0% (IQR = 70.0%-75.0%) at the highest-satisfaction hospitals (Table 2). Patients at low-satisfaction hospitals were older ($P < .001$), more often female ($P < .001$), had higher reported incomes ($P < .001$), more frequently had Medicare ($P < .001$), and were more often black or Hispanic ($P < .001$) than those at the highest-satisfaction hospitals. Patients at the lowest-satisfaction hospitals were more often admitted urgently ($P < .001$) and had a greater number of comorbid medical conditions ($P < .001$). Low-satisfaction hospitals were more often large centers ($P = .03$), were more often located outside the Midwest ($P = .01$), more often private and for profit centers ($P < .001$). Similar trends were noted when hospitals were stratified based on how often patients would recommend the hospital.

Figure 1 displays the correlation graphs comparing risk-adjusted, hospital-level outcomes with HCAHPS satisfaction scores. There was a weak correlation between high hospital satisfaction and risk-adjusted mortality ($r = 0.03$) and risk-adjusted complication rates ($r = -0.13$). Similarly, when hospitals were stratified based on the percentage of HCAHPS respondents that would definitely recommend the hospital, there was a weak correlation with risk-adjusted mortality ($r = 0.02$) and a weak negative correlation with risk-adjusted complication rates ($r = -0.09$).

After risk-adjustment, outcomes were compared between hospitals in the 25th and 75th percentile for each measure (Table 3). For example, among hospitals with an overall satisfaction score in the 25th percentile, the risk adjusted complication rate was 21.8%, while the complication rate was 18.8% among hospitals in the 75th percentile of patient satisfaction. The absolute risk reduction in complications between low- and high-performing

Table 1. Median hospital performance on measures of satisfaction, quality, and outcomes*

Metric	Hospitals	Patients	Median, %	IQR, %
HCAHPS				
Overall satisfaction	448	63 197	62.0	56.0–69.0
Recommend hospital to family or friends	448	63 197	68.0	61.0–74.0
SCIP				
Received antibiotics one hour before incision	338	47 878	90.0	85.0–94.0
Received appropriate antibiotic	332	46 879	83.0	72.0–89.0
Antibiotics stopped within 24 hours of surgery	338	47 878	95.0	92.0–97.0
VTE prophylaxis ordered	332	46 879	87.5	79.0–92.0
VTE prophylaxis received	338	47 878	85.0	76.0–91.0
Mortality measures				
Myocardial infarction	440	63 013	15.9	15.3–16.7
Heart failure	442	62 924	10.8	10.1–11.7
Pneumonia	442	62 318	11.3	10.3–12.2

* HCAHPS = Hospital Consumer Assessment of Healthcare Providers and Systems; IQR = interquartile range; SCIP = Surgical Care Improvement Project; VTE = venous thromboembolism.

Table 2. Comparison of hospitals based on adjusted HCAHPS scores for high patient satisfaction

Characteristic	Low satisfaction	Intermediate satisfaction	High satisfaction	Highest satisfaction	P†
	No. (%)	No. (%)	No. (%)	No. (%)	
Hospitals	113 (25.2)	116 (25.9)	106 (23.7)	113 (25.2)	
Patients	13 279 (21.0)	16 451 (26.0)	17 555 (27.8)	15 912 (25.2)	
Range	33.0–56.0	57.0–62.0	63.0–68.0	69.0–91.0	
Mean (SD)*	49.6 (5.99)	59.9 (1.68)	65.4 (1.63)	73.0 (4.27)	<.001
Median (IQR)*	52.0 (46.0–55.0)	60.0 (59.0–61.0)	65.0 (64.0–67.0)	72.0 (70.0–75.0)	<.001
Patient characteristics					
Age, y					
<40	344 (2.6)	417 (2.5)	453 (2.6)	383 (2.4)	<.001
40–49	1141 (8.6)	1416 (8.6)	1515 (8.6)	1323 (8.3)	
50–59	2787 (21.0)	3732 (22.7)	4126 (23.5)	3703 (23.3)	
60–69	4075 (30.7)	5055 (30.7)	5701 (32.5)	5377 (33.8)	
70–79	3005 (22.6)	3671 (22.3)	3811 (21.7)	3444 (21.6)	
≥80	1927 (14.5)	2160 (13.1)	1949 (11.1)	1682 (10.6)	
Sex					
Male	5557 (41.8)	7206 (43.8)	8306 (47.3)	7578 (47.6)	<.001
Female	7673 (57.8)	9130 (55.5)	9189 (52.3)	8290 (52.1)	
Unknown	49 (0.4)	115 (0.7)	60 (0.3)	44 (0.3)	
Primary site					
Bladder	254 (1.9)	390 (2.4)	431 (2.5)	378 (2.4)	<.001
Breast	2316 (17.4)	2999 (18.2)	3191 (18.2)	2781 (17.5)	
Colon	3573 (26.9)	4007 (24.4)	3532 (20.1)	3333 (20.9)	
Esophageal	38 (0.3)	69 (0.4)	176 (1.0)	126 (0.8)	
Lung	1544 (11.6)	2458 (14.9)	2400 (13.7)	2261 (14.2)	
Ovary	824 (6.2)	728 (4.4)	743 (4.2)	697 (4.4)	
Pancreas	246 (1.9)	298 (1.8)	444 (2.5)	437 (2.7)	
Prostate	2585 (19.5)	3506 (21.3)	4577 (26.1)	4104 (25.8)	
Gastric	357 (2.7)	382 (2.3)	419 (2.4)	355 (2.2)	
Uterine	1542 (11.6)	1614 (9.8)	1642 (9.4)	1440 (9.0)	
Race					
White	9254 (69.7)	11 288 (68.6)	13 555 (77.2)	10 885 (68.4)	<.001
Black	1369 (10.3)	1668 (10.1)	1207 (6.9)	1075 (6.8)	
Hispanic	1300 (9.8)	1498 (9.1)	1165 (6.6)	449 (2.8)	
Other	1114 (8.4)	921 (5.6)	791 (4.5)	961 (6.0)	
Unknown	242 (1.8)	1076 (6.5)	837 (4.8)	2542 (16.0)	
Year of surgery					
2009	7484 (56.4)	9139 (55.6)	7280 (41.5)	8857 (55.7)	<.001
2010	5795 (43.6)	7312 (44.4)	10 275 (58.5)	7055 (44.3)	

Table 2. Continued

Characteristic	Low satisfaction	Intermediate satisfaction	High satisfaction	Highest satisfaction	P†
	No. (%)	No. (%)	No. (%)	No. (%)	
Income					<.001
Low	2236 (16.8)	2715 (16.5)	2850 (16.2)	3301 (20.7)	
Intermediate	3147 (23.7)	3194 (19.4)	4171 (23.8)	3903 (24.5)	
High	3827 (28.8)	4026 (24.5)	4656 (26.5)	3370 (21.2)	
Highest	3753 (28.3)	6225 (37.8)	5547 (31.6)	5005 (31.5)	
Unknown	316 (2.4)	291 (1.8)	331 (1.9)	333 (2.1)	
Insurance status					<.001
Medicare	6540 (49.3)	7783 (47.3)	8119 (46.2)	7363 (46.3)	
Medicaid	791 (6.0)	1032 (6.3)	961 (5.5)	652 (4.1)	
Commercial	5390 (40.6)	7043 (42.8)	7892 (45.0)	7331 (46.1)	
Self pay	267 (2.0)	194 (1.2)	237 (1.4)	231 (1.5)	
Other	291 (2.2)	396 (2.4)	333 (1.9)	330 (2.1)	
Unknown	0	3 (0.02)	13 (0.1)	5 (0.03)	
Admission type					<.001
Urgent	2244 (16.9)	2052 (12.5)	1739 (9.9)	1849 (11.6)	
Elective	8219 (61.9)	10 326 (62.8)	12 292 (70.0)	11 528 (72.4)	
Other	2816 (21.2)	4073 (24.8)	3524 (20.1)	2535 (15.9)	
Admission source					<.001
ER	476 (3.6)	462 (2.8)	371 (2.1)	180 (1.1)	
Hospital/facility	9074 (68.3)	11 107 (67.5)	13 126 (74.8)	12 635 (79.4)	
Other	3729 (28.1)	4882 (29.7)	4058 (23.1)	3097 (19.5)	
Elixhauser comorbidity					<.001
1	6870 (51.7)	8749 (53.2)	9741 (55.5)	8989 (56.5)	
2	3669 (27.6)	4531 (27.5)	4731 (26.9)	4305 (27.1)	
≥3	2740 (20.6)	3171 (19.3)	3083 (17.6)	2618 (16.5)	
Hospital characteristics					
Hospital size					.03
Small	13 (11.5)	25 (21.6)	23 (21.7)	36 (31.9)	
Medium	39 (34.5)	37 (31.9)	33 (31.1)	32 (28.3)	
Large	61 (54.0)	54 (46.6)	50 (47.2)	45 (39.8)	
Region					.01
Northeast	33 (29.2)	37 (31.9)	35 (33.0)	27 (23.9)	
Midwest	6 (5.3)	18 (15.5)	22 (20.8)	25 (22.1)	
South	38 (33.6)	22 (19.0)	20 (18.9)	30 (26.5)	
West	36 (31.9)	39 (33.6)	29 (27.4)	31 (27.4)	
Location					.01
Rural	20 (17.7)	25 (21.6)	17 (16.0)	38 (33.6)	
Urban	93 (82.3)	91 (78.4)	89 (84.0)	75 (66.4)	
Teaching status					.97
Nonteaching	82 (72.6)	82 (70.7)	77 (72.6)	83 (73.5)	
Teaching	31 (27.4)	34 (29.3)	29 (27.4)	30 (26.5)	
Hospital ownership					<.001
Government	5 (4.4)	6 (5.2)	8 (7.5)	15 (13.3)	
Private, not for profit	19 (16.8)	27 (23.3)	21 (19.8)	32 (28.3)	
Private, for profit	33 (29.2)	10 (8.6)	12 (11.3)	4 (3.5)	
Unknown	56 (49.6)	73 (62.9)	65 (61.3)	62 (54.9)	

* Mean and median represent values of Hospital Consumer Assessment of Healthcare Providers and Systems scores within each group. HCAHPS = Hospital Consumer Assessment of Healthcare Providers and Systems; IQR = interquartile range.

† Analysis of variance and Wilcoxon rank-sum tests were used to compare continuous variables, while χ^2 tests were used to compare categorical variables. All tests were two-sided.

hospitals based on this rating was 3.1% (95% CI = 0.4% to 5.7%, $P = .02$). The ARR in complications was 1.1% (95% CI = -1.4% to 3.5%, $P = .38$) across low- and high-performing hospitals based on patient recommendation. The ARR based on performance on the SCIP measures ranged from 0% to 2.2% across the measures, although none of the measures was associated with a statistically significant reduction in complications. Similarly, there was no statistically significant association between high- and low-mortality hospitals for myocardial infarction (MI) (ARR = 0.7%,

95% CI = -1.0% to 2.5%), heart failure (ARR = 1.0%, 95% CI = -0.6% to 2.7%), and pneumonia (ARR = 1.6%, 95% CI = -0.3% to 3.5%) and complications for oncologic surgery patients.

The absolute risk reductions for perioperative mortality based on performance on HCAHPS scores (range = -0.4%-0.2%), SCIP measures (range = -1.0%-0.7%), and medical condition mortality measures (range = -0.9%-0.3%) were small. The only statistically significant association was for heart failure mortality in which mortality for surgical oncology patients was 2.2% at the

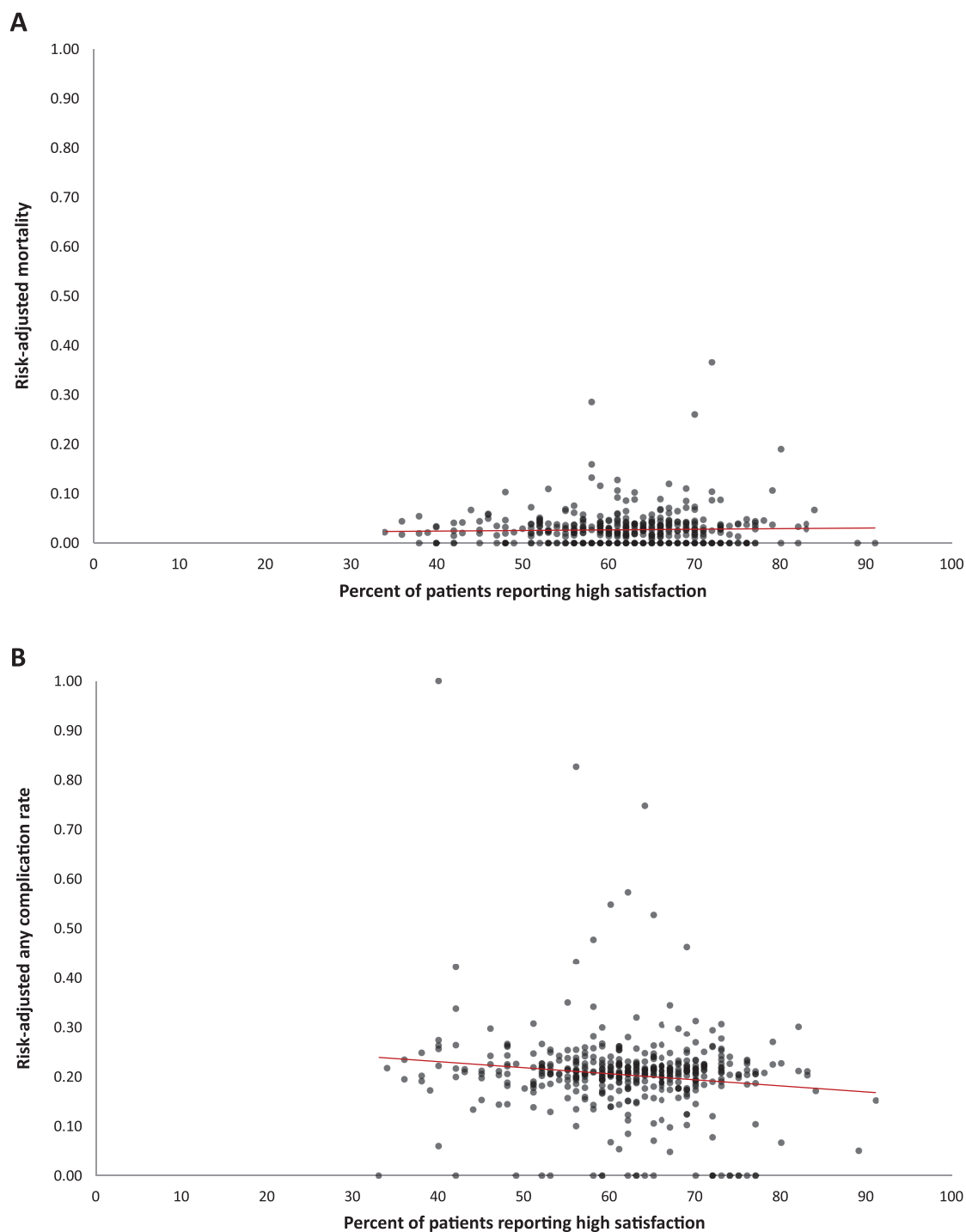


Figure 1. Comparison between patient satisfaction and outcomes. **A)** Correlation between hospital-level satisfaction and risk-adjusted mortality. **B)** Correlation between hospital-level satisfaction and risk-adjusted complication rates.

highest heart failure mortality hospitals compared with 3.2% at those centers in the 75th percentile for mortality from heart failure (ARR = -0.9, 95% CI = -1.7% to -0.2%) ($P = .01$). Similar trends were noted for failure to rescue; hospitals in the highest quartile of mortality from heart failure had higher failure-to-rescue rates.

Discussion

Our findings suggest that publically reported hospital performance data is a poor surrogate for outcomes for cancer patients

undergoing surgical resection. Hospital satisfaction, measures of adherence to surgical quality measures, and mortality for common medical conditions were all associated with very small differences in morbidity and mortality for oncologic surgery.

The measurement of patient experience has become an important focus of hospitals and is now tied to reimbursement by CMS through their Value-Based Purchasing initiative (27). However, whether subjective measures of patient satisfaction correlate with quality of care has been difficult to demonstrate (4,28–33). An analysis of over 800 hospitals noted an association

Table 3. Comparison of absolute risk for complications, mortality, and failure to rescue between lowest-performing (25th percentile) and highest-performing (75th percentile) hospitals for each hospital measure (HCAHPS, SCIP, and mortality measures)

Metric	Perioperative complications, %				Perioperative mortality, %				Failure to rescue, %			
	25 th	75 th	ARR (95% CI)	P*	25 th	75 th	ARR (95% CI)	P	25 th	75 th	ARR (95% CI)	P*
HCAHPS												
Highest (9–10) overall rating	21.8	18.8	3.1 (0.4 to 5.7)	.02	2.4	2.9	-0.4 (-1.5 to 0.6)	.40	5.2	5.3	-0.1 (-2.0 to 1.8)	.92
Would definitely recommend hospital	20.5	19.4	1.1 (-1.4 to 3.5)	.38	2.8	2.6	0.2 (-0.7 to 1.2)	.67	5.3	5.4	-0.1 (-1.9 to 1.9)	.99
SCIP												
Received antibiotics within 1 hour of Surgery	21.4	19.2	2.2 (-0.8 to 5.2)	.15	3.0	2.6	0.4 (-0.8 to 1.6)	.51	6.2	5.3	0.8 (-1.3 to 2.9)	.43
Received treatment to prevent blood clots	20.6	20.6	0 (-3.2 to 3.1)	.99	2.6	2.2	0.4 (-0.5 to 1.4)	.35	5.2	4.4	0.8 (-0.9 to 2.5)	.35
Received appropriate antibiotics	21.7	20.4	1.2 (-1.7 to 4.2)	.40	2.2	3.2	-1.0 (-2.3 to 0.2)	.09	4.1	6.1	-2.0 (-3.8 to -0.2)	.03
Doctor ordered treatment to prevent blood clot	20.9	19.0	1.9 (-0.4 to 4.2)	.10	2.6	2.3	0.3 (-0.7 to 1.3)	.56	5.3	5.1	0.2 (-1.8 to 2.2)	.84
Patients whose antibiotics were stopped within 24 hours after surgery	20.8	20.5	0.3 (-2.9 to 3.5)	.85	2.8	2.1	0.7 (-0.4 to 1.9)	.20	5.6	4.3	1.3 (-0.6 to 3.2)	.19
Mortality Measures												
30-day death from MI	21.2	20.4	0.7 (-1.0 to 2.5)	.41	2.6	2.3	0.3 (-0.5 to 1.0)	.50	5.1	5.3	-0.2 (-1.8 to 1.5)	.85
30-day death from heart failure	21.3	20.2	1.0 (-0.6 to 2.7)	.20	2.2	3.2	-0.9 (-1.7 to -0.2)	.01	4.6	6.7	-2.1 (-3.7 to -0.6)	.008
30-day death from pneumonia	20.9	19.4	1.6 (-0.3 to 3.5)	.10	2.7	2.8	-0.1 (-1.0 to 0.8)	.79	6.0	5.5	0.5 (-1.3 to 2.3)	.56

* Two-sample t tests were used, and all tests were two-sided. ARR = absolute risk reduction; HCAHPS = Hospital Consumer Assessment of Healthcare Providers and Systems; SCIP = Surgical Care Improvement Project.

between patient experiences measured by HCAHPS and medical and surgical process measures of quality and found some association between HCAHPS scores and patient safety indicators, although results for some of these indicators were mixed (28). A second study examined the association between patient satisfaction and quality indicators after myocardial infarction. Among over 1800 respondents, the investigators noted that there was no association with satisfaction and either quality of care or survival (32). Further, patient perception of quality often differs from reported quality (34). We were unable to identify a consistent association between hospital satisfaction scores and perioperative outcomes for patients undergoing cancer-directed surgery.

Unlike patient satisfaction that is largely subjective, process measures that are reported by hospitals represent best practice and are typically developed based on rigorous data of an intervention's association with outcomes. Despite the rationale for reporting process measures, prior work has shown mixed results in linking process measure adherence and outcomes (7,9–12). An analysis of Hospital Compare performance measures for acute myocardial infarction, pneumonia, and heart failure found that hospital compliance with performance measures was associated with only small differences in mortality (7). A large analysis of the SCIP measures noted that compliance with the composite of all measures was associated with a reduction in infectious morbidity, however there was no association with any of the individual measures, which is the data that is publically reported, and infection rates (12). Similarly, we found no association between SCIP compliance rates and all-cause morbidity and mortality among oncologic surgery patients. While process metrics may have a direct effect on outcome, there is growing recognition that these measures likely also reflect other underlying hospital characteristics and unmeasured factors (11).

To date, quality in surgical oncology has focused largely on procedural volume and process measures. The recognition of the importance of the relationship between procedural volume and outcomes for high-risk procedures led to public reporting of volume data and the development of recommended volume minimums for some procedures, including pancreatectomy and esophagectomy (35–39). Importantly, there is evidence that the recognition of this relationship has not only altered referral patterns, but also improved survival (40). More recently, national quality metrics have been proposed for breast, colon, and rectal cancer (41). These metrics largely focus on process measures such as lymph node counts, but currently are not easily accessible by health consumers. A recent analysis of Hospital Compare data found the accredited cancer centers performed better on measures of patient experience and process measures but worse on outcomes measures (42). The modest associations we found between publically reported, hospital-level data from Hospital Compare and outcomes for surgical oncology patients suggest that using available data for decision-making is of limited value.

We recognize a number of important limitations. First, we were unable to perform complete risk adjustment. Risk adjustment was performed for numerous characteristics, although detailed oncologic characteristics of patients that may have influenced outcomes were limited. Further, given that disease severity in oncology is often highly variable, differences in case mix unmeasured and confounders may have influenced our findings (43). Second, the magnitude of differences in scores for individual measures between high- and low-performing hospitals was often modest. Although we performed a number of sensitivity analyses stratifying hospitals into deciles and tertiles in which our findings were largely unchanged, differences may exist between some

hospitals. Additional sensitivity analyses were also performed, examining the other individual HCAHPS metrics.

Third, measurement of inpatient care using administrative data may undercapture complications (44). To mitigate this bias, we examined only major complications likely to generate a code. Further, overall mortality and failure to rescue after a complication do not rely on billing data and should not vary across hospitals. We recognize that patient satisfaction scores and adherence to process measures were not specific to patients undergoing oncologic surgery. The goal of our study was to determine whether publically reported hospital data were associated with outcomes for surgical oncology patients. Although our models of risk adjustment correct for hospital volume, we recognize that differing sample sizes across hospitals may have influenced our findings. Lastly, as some states do not report hospital identifiers to NIS, we were unable to match all hospitals and some hospitals did not provide HCAHPS scores.

Based on these data, currently available publically reported hospital quality and satisfaction data appear to be of modest value for cancer patients attempting to determine hospital outcomes for cancer-directed surgery. Encouragingly, a number of initiatives specific to cancer patients are currently underway to measure the quality of both inpatient and outpatient care (45,46). Efforts should be made to ensure that these metrics correlate with outcomes, measure both short- and long-term outcomes, and are readily available to newly diagnosed cancer patients.

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