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Evaluating Disparities in Inpatient Surgical Cancer Care Among American Indian/Alaska Native Patients

Vlad V. Simianu, MD, MPH¹, Arden M. Morris, MD, MPH², Thomas K. Varghese Jr., MD, MS¹, Michael P. Porter, MD, MS³, Jeffrey A. Henderson, MD, MPH⁴, Dedra S. Buchwald, MD⁵, David R. Flum, MD, MPH¹, and Sara H. Javid, MD¹

¹Surgical Outcomes Research Center, Department of Surgery, University of Washington, Seattle, WA

²Department of Surgery, University of Michigan, Ann Arbor, MI

³Department of Urology, University of Washington, Seattle, WA

⁴Black Hills Center for American Indian Health, Rapid City, SD

⁵Department of Epidemiology, University of Washington, Seattle, WA

Abstract

Background—American Indian/Alaska Native (AI/AN) patients with cancer have the lowest survival rates of all racial and ethnic groups, possibly because they are less likely to receive “best practice” surgical care than patients of other races.

Methods—Prospective cohort study comparing adherence to generic and cancer-specific guidelines on processes of surgical care between AI/AN and non-Hispanic white (NHW) patients in Washington State (2010–2014).

Results—156 AI/AN and 6,030 NHW patients underwent operations for 10 different cancers, and had similar mean adherence to generic surgical guidelines (91.5% vs 91.9%, $p=0.57$). AI/AN patients with breast cancer less frequently received preoperative diagnostic core-needle biopsy (81% versus 94%, $p=0.004$). AI/AN patients also less frequently received care adherent to prostate cancer-specific guidelines (74% versus 92%, $p=0.001$).

Conclusions—While AI/ANs undergoing cancer operations in Washington receive similar overall best practice surgical cancer care to NHW patients, there remain important, modifiable disparities that may contribute to their lower survival.

CORRESPONDING AUTHOR FOR MANUSCRIPT. Vlad V. Simianu, MD; Surgical Outcomes Research Center (SORCE); UW Medical Center, Box 354808; 1107 NE 45th St., Suite 502; Seattle, WA 98105; Phone: (317) 445-7792; Fax: (206) 616-9032; vsimianu@uw.edu.

CORRESPONDING AUTHOR FOR REPRINTS. Sara H. Javid, MD; University of Washington Medical Center; 1959 NE Pacific St. Box 356410; Seattle, WA 98195; Phone: (206) 221-2958; Fax: (206) 543-8136; sjavid@uw.edu

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Keywords

American Indian/Alaska Natives; cancer; surgery; process of care

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INTRODUCTION

Cancer is the second leading cause of death in the American Indian and Alaska Native (AI/AN) population,^{1,2} just as it is in the U.S. population overall.^{3,4} Among all U.S. racial and ethnic groups, AI/ANs have the poorest five-year survival rate for all cancers combined.^{2,3} The four leading causes of cancer mortality among AI/ANs are breast, colorectal, lung, and prostate cancer, again mirroring the U.S. all-races population.⁴ However, while other racial and ethnic groups have seen consistent declines in mortality from these cancers since 1975, AI/ANs have not.^{2,3,5}

Research on cancer survival rates among AI/ANs is scarce for several reasons. First, although the AI/AN population increased from 2.1 million in 2000 to 5.2 million in 2010, AI/ANs still comprise only 1.7% of the U.S. population.⁶ Second, although race classification in national clinical databases such as the Surveillance Epidemiology and End Results (SEER) database is fairly robust, AI/ANs are often misclassified as other racial/ethnic groups.⁷⁻⁹ Third, studies that collect primary data have historically been hampered by perceived cultural insensitivity, resulting in low rates of participation by AI/ANs.¹⁰ All these factors lead to very small numbers of AI/AN patients in any circumscribed dataset, so that AI/ANs are often evaluated only as part of a broader minority cohort.^{11,12}

Within these constraints, our previous research has shown that AI/ANs at the national level are less likely to receive guideline-concordant cancer care, including any surgery, appropriate surgery, adjuvant therapies, and surveillance,^{13,14} all of which have been linked to cancer survival. Although our national dataset enabled an assessment of population-based disparities, it did not permit a more granular analysis of potential lapses in delivery of optimal surgical care processes at the hospital level.

To accomplish this, the current study focused on surgical intervention – the only curative treatment for most solid cancers – and examined both generic and cancer-specific measures of care processes. This approach can yield novel insights into disparities in cancer care^{15,16} and might offer advantages over more traditional outcome-oriented measures. Certain traditional outcome measures are unique to specific cancers or surgical procedures, or require adjustment in analyses, leading to reductions in sample sizes that are already small. Furthermore, adverse outcomes for most surgical procedures are infrequent, so that large samples of surgical patients are needed to detect statistically significant results. Best-practice guidelines, on the other hand, are intended for universal application, so patient samples of sufficient size to assess their implementation should be readily available.

Accordingly, the objective of this study was to compare receipt of surgical care consistent with best-practice guidelines between AI/AN and NHW patients at hospitals participating in the Surgical Care Outcomes Assessment Program (SCOAP) in Washington State, which is home to a sizeable population of AI/AN individuals. Eleven SCOAP hospitals collect data

on cancer-specific surgeries for 10 cancer types, including breast, colorectal, lung, and prostate cancers. Given the disparities in receipt of guideline-concordant cancer care we observed among AI/AN patients at a macro level using the SEER-Medicare dataset, we hypothesized that AI/ANs with cancer would also less frequently receive surgical care that adhered to generic and cancer-specific best practice guidelines in Washington.

METHODS

This study was exempted from human subjects review by the University of Washington's Institutional Review Board.

Study Design, Data Sources, and Population

Our prospectively-gathered cohort was defined by adult patients (≥ 18 years old) who underwent inpatient operations indicated for 10 different cancer types between January 1, 2010, and December 31, 2014, in Washington State hospitals participating in SCOAP (Table 1). To minimize racial misclassification of AI/AN patients,^{7–9} race and ethnicity training was provided to registrars, admitting personnel, and abstractors at each hospital. Training sessions used materials developed by the Health Research and Educational Trust¹⁷ and were customized to harmonize with individual hospital policies, procedures, and processes. In particular, strategies to facilitate patients' self-report of race and ethnicity were tailored to each site. Accordingly, race and ethnicity for all patients were ascertained by using a combination of self-report, Indian Health Services (IHS) insurance status, and chart abstraction. A modified Charlson comorbidity index was also calculated for each patient,¹⁸ and sociodemographic, clinical, and operative details were extracted from inpatient medical records by trained chart abstractors at each hospital. A complete list of SCOAP metrics, including short-term (30-day) complications and a data dictionary, is available through a secure link at www.SCOAP.org.

For descriptive purposes, patients who self-identified as Black or African American, Asian, Native Hawaiian or Other Pacific Islander, or White with Hispanic ethnicity have been grouped as "Other" in Table 1. These patients were excluded from the study cohort to allow direct comparisons of surgical care between AI/AN and NHW patients.

Process of Care Definitions

The primary outcome was adherence to "best practice" surgical process guidelines, as assessed by generic and cancer-specific measures. SCOAP evaluates more than 50 generic in-hospital process measures for all inpatient surgical cases, and also gathers more detailed (e.g., cancer-specific) data for certain procedures. These process measures were adopted by SCOAP leadership and clinicians after iterative discussions that considered their broad support in contemporary literature, their widespread acceptance for assessing standards of care, and their feasibility of implementation and measurement. Importantly, these measures are not meant to identify appropriate or inappropriate decision-making regarding an individual patient's case. Rather, the measures reflect quantifiable data that is expected to be typically available in current health systems.

Generic—Generic process measures were reported across patients with all 10 cancer types. The four generic measures reported in this study were: perioperative glycemic monitoring for diabetics,¹⁹ continuation of perioperative beta blockade,²⁰ receipt of prophylactic antibiotics within 60 minutes of incision,²¹ and pathologic reporting of resection margin status. These measures have previously shown high precision and variation across SCOAP hospitals.^{22,23}

Cancer-Specific—Cancer-specific process measures were reported for breast, colon, lung, and prostate cancers in a manner identical to the generic measures. The majority of measures were not stage-specific and were intended to be applicable to most or all patients in each cancer cohort. Measures for breast cancer included receipt of preoperative core-needle biopsy for diagnosis,²⁴ reporting of hormone receptor status on pathologic reports,²⁵ axillary lymph node evaluation²⁶ for invasive cancer, and axillary lymph node dissection for node-positive mastectomy patients.²⁶ Measures for colon cancer included receipt of bowel prep (mechanical or antibiotic),²⁷ performance of anastomotic leak test,²⁸ pathologic evaluation of at least 12 lymph nodes,²⁹ and negative resection margins.²⁹ Measures for lung cancer included documentation of preoperative multidisciplinary evaluation and pulmonary function tests (PFTs),³⁰ sampling of at least three lymph node stations,³¹ and smoking cessation counseling for current smokers.³⁰ Measures for prostate cancer included preoperative documentation of the prostate-specific antigen (PSA) test, urinary continence, and potency, as well as postoperative pathologic reporting of Gleason score and cancer stage.³²

Statistical Analysis

Patient characteristics, risk factors, and outcomes were summarized by using frequency distributions for categorical variables, and median [range] for continuous variables. All data were stratified by race (NHW or AI/AN). Categorical variables were compared by Fisher's exact test, and continuous variables were compared by a two-sided test for the median. Adherence to process guidelines is reported as the mean percentage of adherence across generic or cancer-specific measures for which each patient was eligible (e.g., patients were eligible for postoperative continuation of beta blockade only if they received beta blockers before surgery). Percentage adherence across metrics was compared using the Wilcoxon rank-sum (Mann-Whitney) test. A p-value of less than 0.05 was considered statistically significant throughout. All analyses were performed by using STATA version 13 (STATA Corp, College Station, Tex).

RESULTS

Between 2010 and 2014, 156 AI/AN patients (median age 56 years, 41% male) and 6,030 NHW patients (median age 65 years, 48% male) underwent inpatient operations for 10 cancer types at SCOAP hospitals (Table 1). Across all 10 cancers, AI/AN patients were more often active smokers (26% versus 13%, $p<0.001$), obese (52% versus 32%, $p<0.001$), and diabetic (24% versus 17%, $p=0.02$), and had more comorbidities ($p=0.01$) (Table 2). Despite important differences in demographics and risk factors, rates of perioperative

complication (13% versus 12%, $p=0.84$) and discharge home (93% versus 89%, $p=0.11$) were similar between AI/AN and NHW patients.

Across all 10 cancer types, mean adherence to the four generic surgical process guidelines was similar in AI/AN (91.5%; 95% CI 88.1%–95.9%) and NHW patients (91.9%; 95% CI 91.4%–92.3%; $p=0.57$ Table 3). Individual measures reflecting management of perioperative conditions (diabetes and beta blockade), receipt of antibiotic prophylaxis, and pathologic reporting of margin status did not differ (all $p>0.05$).

Consistent with national data, the four most common cancers observed were breast, lung, colon, and prostate (114 AI/ANs, 4,920 NHWs; Table 4). Adherence to aggregated cancer-specific process guidelines across these four cancers was similar in AI/AN (83.8%; 95% CI: 79.5%–88.1%) and NHW patients (85.7%; 95% CI: 85.1%–86.3%; $p=0.64$), as was mean adherence across aggregated breast cancer measures ($p=0.13$) and aggregated colon and lung cancer measures ($p>0.05$ for both).

Several differences in adherence were identified within individual cancer types. For example, AI/AN patients with breast cancer less frequently received preoperative diagnostic core-needle biopsy (81% versus 94%, $p=0.004$), and their tumor's hormone receptor (ER/PR) status was less frequently reported (92% versus 99%, $p=0.008$). AI/AN patients also less frequently received care adherent to prostate cancer-specific guidelines (74.4%; 95% CI: 60.5%–88.3%) as compared to NHW patients (91.6%; 95% CI: 90.0%–92.6%; $p=0.001$). This result appears to be driven by less frequent preoperative documentation of urinary continence (50% versus 90%, $p=0.002$) and sexual function (36% versus 76%, $p=0.007$) in AI/AN patients.

DISCUSSION

AI/AN patients have the lowest survival rates among U.S. racial and ethnic groups for breast, colorectal, lung, and prostate cancer, as well as for all cancers combined.^{1–3,11} This disparity has been partly attributed to findings that AI/AN patients present with more advanced stages of cancer, resulting in reduced rates of curative treatment and survival.^{33,34} Furthermore, lower survival rates may be attributable to reduced access to and receipt of optimal cancer treatments in Native communities.¹³ However, it is uncertain whether the relatively slow improvement in survival rates among AI/AN cancer patients^{1–3} compared to other racial groups is truly attributable to persistent disparities, or whether inability to detect improvement is an artifact secondary to the combination of AI/ANs' relatively small share (1.7%) of the U.S. population,⁶ and widespread racial misclassification documented in cancer registries.^{7–9}

Tracking and feedback registries have been proposed as a way to reduce racial disparities in cancer care by identifying barriers to care, presenting solutions, and tracking subsequent performance.^{15,16} The implementation of surgical oncology surveillance protocols in an established, effective program like SCOAP enables the investigation of points in the trajectory of care where breakdowns occur. Interventions can then be developed to address these breakdowns and improve surgical care. Washington has a particularly large AI/AN

patient population,^{6,13} and most hospitals in the state participate in SCOAP, so their staff have been trained to record race and ethnicity data in a manner that minimizes racial misclassification. Since 78% of AI/ANs nationwide live in non-tribal areas³⁵ and the IHS provides healthcare and collects epidemiologic data for only 42% of all AI/ANs,³⁶ SCOAP is uniquely placed to identify disparities in surgical processes.

To our knowledge, this is the first study to compare disparities in surgical processes of care across cancer types between AI/AN and NHW patients in a prospective, state-wide registry. In this cohort, during five years of data collection for 10 different cancer types, only 156 AI/AN patients were identified as undergoing cancer surgery, compared to more than 6,000 NHW patients. This small AI/AN sample reflects the imbalanced sizes of the two populations, both statewide and nationally. As in our study of AI/ANs using SEER-Medicare data,¹³ we found that AI/AN patients with cancer were younger, had greater numbers of comorbid conditions, and were less likely to have private insurance than their NHW counterparts.

Our study hypothesis was that AI/AN patients would be less likely than NHW to receive surgical care that adhered to generic or cancer-specific best practices, as assessed by process measures. We discovered that aggregate receipt of generic best-practice surgical processes was similarly high in AI/AN and NHW patients, with rates approaching 92% in both groups. Indeed, appropriate receipt of prophylactic antibiotics preoperatively, a nationally-recognized indicator of surgical quality,²¹ was nearly ubiquitous. Among patients of both races, adherence to aggregate cancer-specific guidelines was also comparable at ~85%. These findings suggest that, overall, AI/AN patients in Washington receive inpatient surgical care that is highly adherent to national best practices and similar to NHW patients. This result is especially significant, as national reports on oncologic surgery have proposed adherence benchmarks target the range of 75% to 90%^{37–39} to account for variations in healthcare delivery systems, patient and physician preferences, and unique community practices. Systematic deviations from these guidelines may highlight disparities in care.

The high adherence rates that we report might be related to the “Hawthorne effect,” of benchmarking and feedback reporting of process measures, as previously noted at SCOAP hospitals.^{22,23} In this view, observation of a behavior – in the present case, benchmarking and feedback reporting of process measures – leads to improvement in that behavior. Thus, SCOAP activities appear to have had a positive impact on both racial groups. Our findings might also be interpreted to suggest that alternate pre- or post-surgery disparities in AI/ANs play a critical role to their elevated cancer mortality.

We found notable differences in individual, cancer-specific measures which might offer important targets for quality improvement, with potentially significant consequences. For example, in breast cancer operations, rates of preoperative diagnostic core-needle biopsy and reporting of hormone receptor status were approximately 10% lower in AI/AN patients. Similarly, in colon cancer surgeries, rates of appropriate nodal evaluation were 10% lower in AI/ANs. Whether these differences are clinically relevant or simply statistically different should be cautiously interpreted by readers. However, it is notable that although the number of patients in each category measured was small, these measures directly influence

appropriate pre- and post-surgical staging, treatment, surveillance, and adjuvant therapy.^{29,40} AI/AN patients experience disparities in all these aspects of care, with significant negative impact on their survival.^{13,14}

Furthermore, our cohort included very small numbers of AI/AN patients that underwent operations for lung and prostate cancers, consistent with the small percentage of patients in the all-races population undergoing surgery for these cancers.^{3,13} The very small numbers of AI/AN patients surgically treated for lung (n=11) cancer in WA may have limited our ability to detect significant variation in lung cancer-specific processes of care compared to NHW. In addition, these small numbers could point to another potential disparity, namely of AI/AN lung cancer patients being less likely to consult with a surgeon or undergo surgery, a disparity we observed nationally in SEER-Medicare.¹³ Notably, among AI/ANs with prostate cancer, overall receipt of best-practice care was significantly lower than among NHW patients. These low adherence rates appear to be driven by deficiencies in the documentation of important quality indicators in these patients,³² highlighting additional goals for reducing AI/AN cancer disparities.

This study has several limitations. First, although our study measures reflect granular aspects of perioperative care, SCOAP does not track longer-term outcomes such as cancer recurrence or survival. Therefore, we could not study the impact of adherence to best practices on more traditional oncologic outcomes. Second, our data do not capture outpatient surgeries or non-surgical management, both of which are common in breast and prostate cancer. For example, this study only included mastectomy patients, rather than breast-conservation surgery patients, who are far more likely to have their cases performed in the ambulatory setting. Nevertheless, inpatient surgery is the mainstay of curative therapy for many of the reported cancers, so our results likely provide an accurate perspective on the delivery of surgical cancer care to AI/AN patients. Third, our exclusive reliance on SCOAP data means that we did not capture measures of care at IHS facilities, where AI/ANs might have a different experience of surgical cancer care. Fourth, type I error (false positive) is a possibility in this study because of multiple, independent comparisons within the same group. To correct for this, one option is to correct for multiple comparisons by lowering the alpha levels (for each cancer, across 4 measures, this would mean lowering alpha to $=0.05/4$, or a significance level $=0.0125$). While the possibility of type I error remains, it is important to note that the differences in breast and prostate measures fell even below this corrected p-level of 0.0125. Finally, our study might have been underpowered to detect disparities in certain measures. For example, to detect a difference between 80% and 90% adherence (alpha = 0.05, power = 0.90) in any given process measure would require a sample containing more than 250 AI/AN patients. Practically, this means that the addition of another 100 AI/AN patients to our cohort could shift our findings from “not statistically significant” and thus substantially alter our conclusions.

Despite these limitations, the findings on the delivery of surgical cancer care to AI/ANs in this statewide cohort are robust, given the rigorous methods used by SCOAP to classify race and ensure data quality. In addition, since SCOAP data on important measures such as ER/PR status is collected from pathology reports, which are expected to be higher yield for identifying ER/PR status than chart review of providers' notes, these differences likely

reflect true disparities rather than artifact from reporting in clinician's records. We are confident that our results accurately reflect the care received by patients at Washington hospitals. Moreover, AI/ANs were well-represented in our study cohort, representing 7% of the total, even though they comprise only 1.5% of the state population.⁶ Given changes in guideline measures over time, it is unlikely that future studies will report on a larger sample in a similarly circumscribed region without tradeoffs in data quality for a larger sample size.

CONCLUSION

Our results indicate that AI/AN patients undergoing inpatient cancer surgery in Washington receive surgical care that, overall, is adherent with generic and cancer-specific best practices at levels similar to their NHW counterparts. These results are based on important, assessable measures of high-quality healthcare delivery, which offer a novel way to study disparities in cancer care for AI/ANs and other minority groups. While adherence to generic process guidelines was similarly high across racial groups, adherence to individual cancer guidelines was more variable and, in particular, lower for certain breast and prostate measures. These inequities in delivery of cancer care, especially with regard to appropriate preoperative evaluation and delivery of stage-appropriate therapy, might contribute to the poor outcomes documented among AI/AN oncology patients. Such modifiable pre- and post-hospital factors that are believed to contribute to worse cancer outcomes in AI/ANs, including screening and receipt of stage-appropriate therapy, warrant a more intensive study which is already underway by our research group.

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HIGHLIGHTS

American Indian/Alaska Native (AI/AN) patients have the lowest cancer survival rates of all racial and ethnic groups. While overall receipt of surgical and cancer-specific “best-practice” care was similar between AI/AN and Non-Hispanic White patients (the predominant racial and ethnic group), we identified important disparities in certain cancer measures to serve as targets for quality improvement.

Table 1

Patients having inpatient operations for 10 cancer types captured by SCOAP from 2010 to 2014.

Cancer type ^{d,e}	NHW ^a		AI/AN ^b		OTHER ^c		Total	
	No.	%	No.	%	No.	%	No.	%
Breast ^g	804	78.0	50	4.8	177	17.2	1031	100
Colon ^{f,g}	3041	80.3	46	1.2	698	18.4	3785	100
Esophageal	21	95.5	1	4.5	0	0.0	22	100
Kidney	48	64.9	7	9.5	19	25.7	74	100
Liver	10	45.5	8	36.4	4	18.2	22	100
Lung ^g	489	82.6	11	1.9	92	15.5	592	100
Pancreas	23	76.7	3	10.0	4	13.3	30	100
Prostate ^g	593	87.1	14	2.1	74	10.9	681	100
Rectal ^f	920	82.6	7	0.6	187	16.8	1114	100
Uterine	81	69.2	9	7.7	27	23.1	117	100

^a . NHW: non-Hispanic White

^b . AI/AN: American Indian / Alaska Native

^c . "Other" includes patients self-identified as Black or African American, Asian, Native Hawaiian or Other Pacific Islander, and White with Hispanic ethnicity

^d . Percentage calculated from the total number of patients with each cancer type.

^e . Only about 10% of cases of esophageal, kidney, liver, pancreatic, and uterine cancers were sampled between 2010 and 2014.

^f . Data on colon and rectal cancer were captured across 48 hospitals; other cancer modules were in place at 11 hospitals between 2010 and 2014.

^g . Breast, colon, lung, and prostate are the most prevalent cancers in the United States,⁴ and cancer-specific process of care metrics are reported for these four cancers.

Table 2

Basic demographics, risk factors, and perioperative outcomes in non-Hispanic White and American Indian/Alaska Native patients.

	NHW ^a		AI/AN ^b		Total ^c		p-value ^d
	No.	%	No.	%	No.	%	
	6,030	97.5	156	2.5	6,186	100	
Demographics							
Age (years)							<0.001
18–49	743	12.3	36	23.1	779	12.6	
50–59	1353	22.4	56	35.9	1409	22.8	
60–69	1719	28.5	35	22.4	1754	28.4	
70–79	1357	22.5	23	14.7	1380	22.3	
80+	858	14.2	6	3.8	864	14	
Median Age [range]	65 [18–102]		56 [28–86]		65 [18–102]		<0.001 ^e
Male	2877	47.8	63	40.6	2940	47.6	0.09
Private Insurance	4384	73	70	46.4	4454	72.3	<0.001
Current Smoker	717	12.6	36	25.9	753	12.9	<0.001
BMI 30+	1927	32.4	75	52.1	2002	32.8	<0.001
Comorbidity Index: 3+							0.01
0	4137	68.6	100	64.1	4237	68.5	
1	1469	24.4	42	26.9	1511	24.4	
2	342	5.7	13	8.3	355	5.7	
3+	82	1.4	1	0.6	83	1.4	
Risk Factors							
Diabetes	1007	16.7	36	23.8	1043	16.9	0.02
Beta Blockers	1398	23.2	23	14.8	1421	23	0.02

Outcomes	NHW ^a		AI/AN ^b		Total ^c		p-value ^d
	No.	%	No.	%	No.	%	
Nonoperative Complication ^f	671	11.1	16	10.3	687	11.1	0.90
Any Complication ^f	741	12.3	20	12.8	761	12.3	0.81
Median LOS ^g [range], days	4 [0–112]		3 [0–360]		4 [0–360]		0.02 ^e
Disposition at Discharge							0.08
Home	5373	89.1	144	92.9	5517	89.2	
Extended Care Facility ^g	586	9.7	8	5.2	594	9.6	
Death	68	1.1	3	1.9	71	1.1	

^a. NHW: non-Hispanic White.

^b. AI/AN: American Indian / Alaska Native.

^c. All non-Hispanic White and American Indian/Alaska Native patients who received inpatient operations for the 10 cancers listed in Table 1.

^d. Calculated as Fisher's exact test for difference in frequency between non-Hispanic Whites and American Indians/Alaska Natives unless otherwise stated.

^e. Reported as test of the medians, continuity corrected.

^f. List of 30-day operative and non-operative complications available on a secure page at www.SCOAP.org.

^gLOS: length of stay, defined as days elapsed from date of surgery to date of discharge.

^h. Includes transfer to different hospital, skilled nursing facility, or rehabilitation center.

Table 3

Adherence to generic surgical process of care guidelines in non-Hispanic White and American Indian/Alaska Native patients.

GENERIC PROCESS MEASURES ^a	Percent adherence in NHW ^b , % n=6022	Percent adherence in AI/AN ^c , % n=154	p-value ^d
If DM, ^e check glucose perioperatively	80.7	77.8	0.67
If on beta-blocker, order postop	93.9	85.0	0.13
Prophylactic antibiotics at incision	99.3	100.0	0.40
Pathology: margins reported	85.8	85.9	0.55
Mean adherence across general process measures ^f (95% CI)	91.9% (91.4% – 92.3%)	91.5% (88.1% – 95.9%)	0.57 ^g

^a. Process measures were evaluated for all non-Hispanic White and American Indian/Alaska Native patients who received inpatient operations for the 10 cancers listed in Table 1.

^b. NHW: non-Hispanic White.

^c. AI/AN: American Indian and Alaska Native.

^d. Reported as Fisher's exact test for difference in frequency between non-Hispanic Whites and American Indians/Alaska Natives unless otherwise stated.

^e. DM: diabetes mellitus

^f. Percentage adherence calculated across metrics for which a patient was eligible (e.g., patients who were not prescribed beta blockers were not eligible for beta-blocker continuation).

^g. Reported as two-sample Wilcoxon rank-sum (Mann-Whitney) test for differences.

Table 4

Adherence to cancer-specific process of care guidelines in non-Hispanic White and American Indian/Alaska Native patients.

CANCER-SPECIFIC PROCESS MEASURES ^a	Percent adherence in NHW ^b , %	Percent adherence in AI/AN ^c , %	p-value ^d
BREAST	n = 801	n = 44	
Preoperative core needle biopsy	94.3	81.4	0.004
Hormone receptor status reported	99.1	91.9	0.008
Lymph node evaluation (invasive cancer)	88.1	84.9	0.58
ALND ^e for node-positive mastectomy patients	74.1	73.3	0.58
Mean adherence across breast cancer measures ^f (95% CI)	92.0% (90.8%, 93.2%)	86.0% (78.5%, 93.5%)	0.13 ^g
COLON	n = 3,037	n = 45	
12 nodes evaluated	88.2	79.1	0.09
Bowel prep before surgery	98.0	100.0	0.68
Anastomosis tested	61.2	68.4	0.41
Negative resection margins	95.9	95.6	0.71
Mean adherence across colon cancer measures ^f (95% CI)	83.7% (83.0% – 84.4%)	83.7% (77.0% – 90.4%)	0.79 ^g
LUNG	n = 489	n = 11	
Multidisciplinary evaluation before surgery	65.7	83.3	0.67
Preoperative PFT ^h documented	87.1	100.0	0.37
3 lymph node basins sampled	83.3	100.0	0.41
Smoking cessation counseling (if current smoker)	69.8	50.0	0.37
Mean adherence across lung cancer measures ^f (95% CI)	80.9% (78.4% – 83.5%)	87.1% (74.5% – 99.7%)	0.68 ^g
PROSTATE	n = 593	n = 14	
PSA ⁱ documented preoperatively	98.5	100.0	0.81
Potency documented preoperatively	75.9	36.4	0.007
Urinary continence documented preoperatively	89.7	50.0	0.002
Gleason score and pathologic stage reported	99.7	92.9	0.07
Mean adherence across prostate cancer measures ^f (95% CI)	91.6% (90.0% – 92.6%)	74.4% (60.5% – 88.3%)	0.001 ^g
OVERALL CANCER ^a	n = 4920	n = 114	
Mean adherence across all four cancer measures ^f (95% CI)	85.7% (85.1% – 86.3%)	83.8% (79.5% – 88.1%)	0.64 ^g

^a Process measures were evaluated for all non-Hispanic White and American Indian/Alaska Native patients who received inpatient operations for breast, colon, lung, and prostate cancers.

^b . NHW: non-Hispanic White.

^c . AI/AN: American Indian and Alaska Native.

^d . Reported as Fisher's exact test for difference in frequency between non-Hispanic Whites and American Indians/Alaska Natives unless otherwise stated.

^e . ALND: axillary lymph node dissection.

^f . Percentage adherence was calculated across metrics for which a patient was eligible (e.g., non-smoking patients were not eligible for smoking cessation counseling).

^g . Reported as two-sample Wilcoxon rank-sum (Mann-Whitney) test for differences.

^h . PFT: pulmonary function tests.

ⁱ . PSA: prostate-specific antigen test.