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Breast

The National Surgical Quality Improvement Program 30-Day Challenge: Microsurgical Breast Reconstruction Outcomes Reporting Reliability

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Background: The aim was to assess reliability of the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) 30-day perioperative outcomes and complications for immediate, free-tissue transfer breast reconstruction by direct comparisons with our 30-day and overall institutional data, and assessing those that occur after 30 days.

Methods: Data were retrieved for consecutive immediate, free-tissue transfer breast reconstruction patients from a single-institution database (2010–2015) and the ACS-NSQIP (2011–2014). Multiple logistic regressions were performed to compare adjusted outcomes between the 2 datasets.

Results: For institutional versus ACS-NSQIP outcomes, there were no significant differences in surgical-site infection (SSI; 30-day, 3.6% versus 4.1%, $P = 0.818$; overall, 5.3% versus 4.1%, $P = 0.198$), wound disruption (WD; 30-day, 1.3% versus 1.5%, $P = 0.526$; overall, 2.3% versus 1.5%, $P = 0.560$), or unplanned readmission (URA; 30-day, 2.3% versus 3.3%, $P = 0.714$; overall, 4.6% versus 3.3%, $P = 0.061$). However, the ACS-NSQIP reported a significantly higher unplanned reoperation (URO) rate (30-day, 3.6% versus 9.5%, $P < 0.001$; overall, 5.3% versus 9.5%, $P = 0.025$). Institutional complications consisted of 5.3% SSI, 2.3% WD, 5.3% URO, and 4.6% URA, of which 25.0% SSI, 28.6% WD, 12.5% URO, and 7.1% URA occurred at 30–60 days, and 6.3% SSI, 14.3% WD, 18.8% URO, and 42.9% URA occurred after 60 days.

Conclusion: For immediate, free-tissue breast reconstruction, the ACS-NSQIP may be reliable for monitoring and comparing SSI, WD, URO, and URA rates. However, clinicians may find it useful to understand limitations of the ACS-NSQIP for complications and risk factors, as it may underreport complications occurring beyond 30 days. *(Plast Reconstr Surg Glob Open 2018;6:e1643; doi: 10.1097/GOX.0000000000001643; Published online 6 March 2018.)*

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INTRODUCTION

The use of large-volume databases in surgical outcomes research has grown substantially over the last decade, with surgeon, hospital, and regional-level outcomes increasingly being evaluated using clinical outcomes and measures of resource utilization.[1–29] Large volume databases can be broadly categorized as either administrative or clinical. These databases offer unique opportunities to study large-scale patterns of care, variation in practice, and outcomes following surgical intervention. Studies based on national registries and other administrative datasets have made significant contributions to the field of breast cancer surgery.[1–24] In recent years, research derived from

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these large data registries has played an increasing role in the development of clinical guidelines and health policy within the field of breast cancer treatment.[1–24] One such validated large-volume clinical database is the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database.[30] Its validity hinges on the number of involved hospitals, accurate recording of key patient variables, and methodical follow-up to 30 days postoperatively.[31] This database has helped in multiple areas within plastic surgery, including the recognition of risk factors for venous thromboembolism in breast reconstruction, the complications associated with contralateral prophylactic mastectomy, and the impact of surgical resident involvement in breast reduction.[15,17,23]

Despite the versatility of the ACS-NSQIP database, several studies in multiple disciplines have questioned its validity, primarily in terms of the coding process and built-in variables.[32–37] Within plastic surgery, the ACS-NSQIP Surgical Risk Calculator has been assessed and deemed inaccurate for predicting risk factors for complications after breast reconstruction.[32,33] Furthermore, the reported incidence of complications as defined by variables in the database has come under question, and by extension, the validity of the risk factors identified using the database.[34–37] These issues primarily stem from the question of whether 30 days' follow-up is sufficient to capture the full scope of complications. Recently published literature investigated the rate of complications occurring beyond 30 days in patients undergoing alloplastic breast reconstruction.[34–36]

Incidence and timing of complications were investigated by Luce et al.[34] for tissue expander explantation and by Cohen et al.[36] and Sinha et al.[35] for infections in implants and tissue expanders. In autologous breast reconstruction, Duraes et al.[37] reported on the incidence of institutional late complications occurring after 30 days in abdominal-based free flap procedures. However, to date, there is a lack of literature on the presence and timing of complications in ACS-NSQIP for autologous breast reconstruction. To the best of our knowledge, no previous studies have directly compared institutional data with ACS-NSQIP to assess whether the national database is valid and applicable to institutional practice, within both the 30-day perioperative period or after 30 days.

Given this lack of knowledge, the aim of this study was to evaluate the reliability of the complications captured by the ACS-NSQIP within its early 30-day window for immediate, free-tissue breast reconstruction (IFTBR). This will be conducted by direct comparison of the outcomes reported in the ACS-NSQIP to both our 30-day and overall (complications that occur within 30 days and onward) institutional data, to determine whether the database is reliable for complication monitoring and comparison studies. A secondary aim was to report the incidence and timing breakdown of late complications after autologous breast reconstruction, to determine whether ACS-NSQIP is reliable for a true overall complication profile and risk factor calculation studies.

METHODS

Institutional review board approval was obtained. Data were collected from patient records within a single institution from 2010 to 2015 with a minimum follow-up of 1 year, and ACS-NSQIP data were retrieved for the years 2011–2014 using Current Procedural Terminology (CPT) codes (**see table, Supplementary Digital Content 1**, which displays the CPT mastectomy and breast reconstruction codes, ***http://links.lww.com/PRSGO/A659***). We extracted data from the respective time periods to account for as many possible data points for the variables of interest. Our inclusion criteria consisted of female patients over the age of 18 years who underwent IFTBR following mastectomy. We excluded patients who underwent combined free tissue reconstruction with other autologous or alloplastic techniques. In ACS-NSQIP, a patient was considered to have undergone IFTBR if concurrent mastectomy and reconstruction CPT codes were registered.

Patient characteristics of interest were restricted to those recorded in both the institutional and ACS-NSQIP databases, to enable direct comparison. These included age, body mass index (BMI), smoking, diabetes, hypertension, coagulopathy, steroid use, number of comorbidities, mastectomy type, operation time (OT) in minutes, and length of stay (LOS) in days. Bilateral mastectomy was determined based on the presence of 2 CPT codes for mastectomy. Outcomes of interest were surgical-site infection (SSI), wound disruption (WD), unplanned reoperation (URO), unplanned readmission (URA), and the specific causes of URO or readmission. Before 2011, the ACS-NSQIP data did not include the cause of URO and URA variables. As such, URO and readmission data were extracted from ACS-NSQIP 2012–2014. Institutional complications were only recorded if they were related to the index IFTBR procedure and fit the ACS-NSQIP definitions for SSI, WD, URO, and URA.

URO was classified into categories based on correlating ACS-NSQIP variables for the root cause, consisting of complications pertaining to the flap itself, SSI, wound-site disruption, hemorrhage, hematoma, and seroma. URA was classified into categories based on correlating ACS-NSQIP variables for the root cause, consisting of complications pertaining to the flap itself, SSI, wound-site disruption, hematoma, seroma, and postoperative pain. These were extracted from the ACS-NSQIP (2012–2014) using the inbuilt reason for URO variable and International Classification of Diseases, Ninth Revision, Clinical Modification codes (**see table, Supplementary Digital Content 2**, which displays International Classification of Diseases, Ninth Revision, Clinical Modification cause of URO or readmission codes, ***http://links.lww.com/PRSGO/A660***).

Institutional outcomes in the 30-day window and overall, including both 30-day complications and those occurring after 30 days, were each independently compared with ACS-NSQIP outcomes to assess reliability of the database. Late complications occurring after 30 days are representative of the number of complications potentially missed by ACS-NSQIP. Institutional outcomes were subgrouped into those that occurred within the 30-day window (early), those that occurred after 30 days (late), and the overall (early and late) complication incidence. In addition, complications that occurred after 30 days were further subcategorized into 60-day and 60-day+ groups.

Statistical Analysis

Data were compared using Pearson's χ^2 or Fisher's exact test tests and Wilcoxon-Mann-Whitney for categorical and nonparametric continuous variables, respectively. To account and adjust for potential confounders when analyzing outcomes of interest, logistic regression models were used to assess patient outcomes of SSI, WD, URO, URA, and causes of URO or readmission. Statistical analysis was performed using SPSS Version 22 (IBM, Armonk, N.Y.). For all analysis, a value of $P < 0.05$ was considered statistically significant.

RESULTS

Patient Characteristics

During the study period, a total of 2,402 patients were admitted for IFTBR, with 304 (12.6%) patients from our institution and 2,098 (87.3%) patients from the ACS-NSQIP (2011–2014; Table 1). Patients were well matched for most patient characteristics. No significant differences were observed in age ($P = 0.315$), diabetes ($P = 0.680$), coagulopathy ($P = 0.675$), steroid use ($P = 0.613$), number of comorbidities ($P = 0.350$), LOS ($P = 0.274$), and proportion of radical mastectomy ($P = 0.114$). Although the average patient in both was classified by BMI as "obese," patients in our institution had a significantly lower BMI (28.2 ± 5.6 versus 29.9 ± 5.9 kg/m^2, $P < 0.001$), longer OT (702.4 ± 166.9 versus 524.0 ± 182.3 minutes, $P < 0.001$), and underwent more bilateral (55.9% versus 40.2%, $P < 0.001$) and total simple mastectomies (96.7% versus 82.3%, $P < 0.001$) when compared with the ACS-NSQIP database. However, fewer patients in our institutional group were smokers (3.6% versus 8.9%, $P = 0.002$), had hypertension (18.4% versus 24.6%, $P = 0.018$), or underwent modified radical mastectomy (1.6% versus 14.0%, $P < 0.001$) compared with the ACS-NSQIP database. Patients in our institutional database underwent deep inferior epigastric perforator (96.2%), superior gluteal artery perforator (3.3%), and free transverse rectus abdominis myocutaneous (free TRAM) (0.2%) flap reconstructions, whereas this breakdown was not able to be assessed in the ACS-NSQIP database.

Table 1. Institutional Versus the ACS-NSQIP Patient Characteristics

	Institutional		ACS-NSQIP		
Patient Characteristics	**n**	**(%)**	**n**	**(%)**	***P***
Total	**304**	**(12.6)**	**2,098**	**(87.3)**	
Age (y)	51.19	± 9.14	50.55	± 9.16	0.315
BMI (kg/m^2)	28.2	± 5.6	29.9	± 5.9	**< 0.001**
Smoking	11	(3.6)	187	(8.9)	**0.002**
Diabetes	13	(4.3)	101	(4.8)	0.680
Hypertension	56	(18.4)	516	(24.6)	**0.018**
Coagulopathy	2	(0.7)	11	(0.5)	0.675
Steroid use	3	(1.0)	32	(1.5)	0.613
No. comorbidities					0.350
0	233	(76.6)	1,531	(73.0)	0.176
1	63	(20.7)	498	(23.7)	0.246
≥ 2	8	(2.6)	68	(3.2)	0.570
Mastectomy					
Bilateral	170	(55.9)	844	(40.2)	**< 0.001**
Simple	294	(96.7)	1,726	(82.3)	**< 0.001**
Modified radical	5	(1.6)	293	(14.0)	**< 0.001**
Radical	2	(0.7)	44	(2.1)	0.114
OT (min)	702.4	± 166.9	524.0	± 182.3	**< 0.001**
Length of stay (d)	4.33	± 1.41	4.64	± 8.42	0.274

Bold type signifies *p*-value has reached statistical significance.

Patient Outcomes (Institution Versus ACS-NSQIP)

Table 2 summarizes the adjusted patient outcomes for 30-day and overall institutional versus the ACS-NSQIP, respectively. No significant differences were seen when comparing either institutional 30-day or overall complications to ACS-NSQIP outcomes for SSI (30-day, 3.6% versus 4.1%, $P = 0.818$; overall, 5.3% versus 4.1%, $P = 0.198$), WD (30-day, 1.3% versus 1.5%, $P = 0.526$; overall, 2.3% versus 1.5%, $P = 0.560$), and URA (30-day, 2.3% versus 3.3%, $P = 0.714$; overall, 4.6% versus 3.3%, $P = 0.061$). However, there were significantly lower URO rates in our institutional data compared with ACS-NSQIP data (30-day, 3.6% versus 9.5%, $P < 0.001$; overall, 5.3% versus 9.5%, $P = 0.025$). Institutionally, 5 (31.3%) of 16 UROs and 3 (21.4%) of 14 URAs were independent, with an overlap between UROs and readmissions in the remaining 11 cases. In the ACS-NSQIP, 136 (78.6%) of 173 UROs and 23 (38.3%) of 60 URAs were independent, with an overlap between UROs and readmissions in the remaining 37 cases. The discrepancy may be due to some reoperations not necessarily necessitating a readmission, or vice versa, due to the ACS-NSQIP definition of an URA being for an "inpatient" stay or an URO being performed within the same index inpatient stay.

URO (Institutional Versus ACS-NSQIP)

Reasons for URO are listed in Table 3. There were significantly fewer UROs reported in our institutional database compared with the ACS-NSQIP after selecting for specific complications (30-day, 3.6% versus 9.5%, $P < 0.001$; overall, 5.3% versus 9.5%, $P = 0.025$). Compared with institutional data, there were a greater number of hematomas requiring URO in the ACS-NSQIP database (30-day, 1.0% versus 4.1%, $P = 0.009$; overall, 1.0% versus 4.1%, $P = 0.009$).

Table 2. Institutional (Total and ≤ 30 Days) Versus the ACS-NSQIP Outcomes

	Institutional		ACS-NSQIP		
Patient Outcomes	**n**	**(%)**	**n**	**(%)**	***P***
SSI					
Total	16	(5.3)	86	(4.1)	0.198
30-d	11	(3.6)	86	(4.1)	0.818
WD					
Total	7	(2.3)	31	(1.5)	0.560
30-d	4	(1.3)	31	(1.5)	0.526
URO					
Total	16	(5.3)	173*	(9.5)	**0.025**
30-d	11	(3.6)	173*	(9.5)	**< 0.001**
URA					
Total	14	(4.6)	60†	(3.3)	0.061
30-d	7	(2.3)	60†	(3.3)	0.714

*This value was determined after excluding any UROs not categorizable for comparison. It was extracted from ACS-NSQIP (2012–2014).
†This value was determined after excluding any URAs not categorizable for comparison. It was extracted from ACS-NSQIP (2012–2014).
Bold type signifies *p*-value has reached statistical significance.

Table 3. Institutional (Total and ≤ 30 Days) Versus the ACS-NSQIP (2012–2014) Categorized Unplanned Reoperations

	Institutional		ACS-NSQIP		
Patient Outcomes	**n**	**(%)**	**n**	**(%)**	***P***
URO					
Total	16	(5.3)	173*	(9.5)	**0.025**
30-d	11	(3.6)	173*	(9.5)	**< 0.001**
Flap complication					
Total	5	(1.6)	40	(2.2)	0.675
30-d	5	(1.6)	40	(2.2)	0.675
Infection					
Total	1	(0.3)	15	(0.8)	0.454
30-d	0	(0.0)	15	(0.8)	0.994
WD					
Total	6	(2.0)	41	(2.2)	0.887
30-d	3	(1.0)	41	(2.2)	0.297
Hemorrhage					
Total	1	(0.3)	5	(0.3)	0.865
30-d	1	(0.3)	5	(0.3)	0.865
Hematoma					
Total	3	(1.0)	75	(4.1)	**0.009**
30-d	3	(1.0)	75	(4.1)	**0.009**
Seroma					
Total	3	(1.0)	6	(0.3)	0.118
30-d	2	(0.7)	6	(0.3)	0.393

*This value was determined after excluding any UROs not categorizable for comparison.
Bold type signifies *p*-value has reached statistical significance.

URA (Institutional Versus ACS-NSQIP)

Reasons for URA are listed in Table 4. There were no significant differences in URAs reported in our institutional database compared with the ACS-NSQIP after selecting for specific complications (30-day, 2.3% versus 3.3%, $P = 0.714$; overall, 4.6% versus 3.3%, $P = 0.061$). The number of infections requiring URA occurring after 30 days was substantial enough to show a significantly higher rate in overall institutional versus the ACS-NSQIP data (30-day, 1.6% versus 1.8%, $P = 0.850$; overall, 3.3% versus 1.8%, $P = 0.031$).

Table 4. Institutional (Total and ≤ 30 Days) Versus the ACS-NSQIP (2012–2014) Categorized Unplanned Readmissions

	Institutional		ACS-NSQIP		
Patient Outcomes	**n**	**(%)**	**n**	**(%)**	***P***
URA					
Total	14	(4.6)	60*	(3.3)	0.061
30-d	7	(2.3)	60*	(3.3)	0.714
Flap complication					
Total	1	(0.3)	6	(0.6)	0.526
30-d	1	(0.3)	6	(0.6)	0.526
Infection					
Total	10	(3.3)	33	(1.8)	**0.031**
30-d	5	(1.6)	33	(1.8)	0.850
WD					
Total	1	(0.3)	15	(0.8)	0.631
30-d	0	(0.0)	15	(0.8)	0.994
Hematoma					
Total	1	(0.3)	4	(0.2)	0.714
30-d	1	(0.3)	4	(0.2)	0.714
Seroma					
Total	1	(0.3)	1	(0.1)	0.204
30-d	0	(0.0)	1	(0.1)	0.995
Postoperative pain					
Total	1	(0.3)	2	(0.1)	0.806
30-d	1	(0.3)	2	(0.1)	0.806

*This value was determined after excluding any UROs not categorizable for comparison.
Bold type signifies *p*-value has reached statistical significance.

Early Versus Late Complications (Institution)

In our institutional database, the complication profile consisted of 5.3% SSIs, 2.3% WDs, 5.3% UROs, and 4.6% URAs. Table 5 summarizes the percentage of these complications occurring after the 30 days. When observing what percentage of total complications were late, we found that 31.3% (25.0% by 30–60 days, 6.3% after 60 days) of SSIs, 42.9% of WDs (28.6% by 30–60 days, 14.3% after 60 days), 31.3% of UROs (12.5% by 30–60 days, 18.8% after 60 days), and 50.0% of URAs (7.1% by 30–60 days, 42.9% after 60 days) occurred after 30 days.

DISCUSSION

Large clinical databases such as the ACS-NSQIP serve as a unique platform for retrospective clinical studies, providing large patient populations suitable for studying outcomes and variations in treatment. Within the field of breast reconstruction, large-volume databases are being increasingly utilized.[1–20] Studies based on clinical databases have made significant contributions to the field of plastic surgery with development of clinical guidelines and health policy. It is important for clinicians and researchers to understand the strengths and weaknesses of these databases to enable appropriate data interpretation.[19]

The current study aims to assess the validity of the ACS-NSQIP database for IFTBR by comparing its reported incidence of complications to those reported in a reasonably high-volume academic center. Our results show that ACS-NSQIP may accurately represent the incidence of both 30-day and overall complications for SSI, WD, and URA, and as such be reliable for complication monitoring and comparison studies. However, it did not accurately capture overall URAs due to infection. The ACS-NSQIP also reported a significantly higher rate of URO than that found in our institutional data, which was attributable to the higher rate of URO for hematoma. Although there were no significant differences between overall versus ACS-NSQIP complication rates, we found that a large percentage of SSIs, WDs, UROs, and URAs occur after the 30-day window, suggesting that ACS-NSQIP may underreport complications. As such, it may not be reliable for studies evaluating true overall complication profiles or risk factor calculation.

URO rates were 1 important difference between institutional and ACS-NSQIP data, with ACS-NSQIP URO rates being significantly higher; this persisted when selecting for IFTBR-specific complications. It may be that variation exists in institutional operative practices and decision-making protocols for reoperation, explaining our findings. A study on autologous breast reconstruction conducted using the National Inpatient Sample Healthcare Cost and Utilization Project has shown that high-volume centers have lower complications, with the volume-outcome relationship being more strongly associated with surgery-specific rather than systematic complications.[38] The literature for microsurgical breast reconstruction has reported lower flap loss rates and improved salvage rates associated with tissue oximetry, with decreased rate of reexploration over time per 100 flaps operated on.[39–42] The

Table 5. Timing of Complications Breakdown (Institutional)

	Overall		30-d		60-d		60-d+	
Patient Outcomes	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**	**n**	**(%)**
SSI	16	(100.0)	11	(68.8)	4	(25.0)	1	(6.3)
WD	7	(100.0)	4	(57.1)	2	(28.6)	1	(14.3)
URO	16	(100.0)	11	(68.8)	2	(12.5)	3	(18.8)
Flap complication	5	(100.0)	5	(100.0)	0	(0.0)	0	(0.0)
Infection	1	(100.0)	0	(0.0)	1	(100.0)	0	(0.0)
WD	6	(100.0)	3	(50.0)	1	(16.7)	2	(33.3)
Hemorrhage	1	(100.0)	1	(100.0)	0	(0.0)	0	(0.0)
Hematoma	3	(100.0)	3	(100.0)	0	(0.0)	0	(0.0)
Seroma	3	(100.0)	2	(66.7)	0	(0.0)	1	(33.3)
URA	14	(100.0)	7	(50.0)	1	(7.1)	6	(42.9)
Flap complication	1	(100.0)	1	(100.0)	0	(0.0)	0	(0.0)
Infection	10	(100.0)	5	(50.0)	1	(10.0)	4	(40.0)
WD	1	(100.0)	0	(0.0)	0	(0.0)	1	(100.0)
Hematoma	1	(100.0)	1	(100.0)	0	(0.0)	0	(0.0)
Seroma	1	(100.0)	0	(0.0)	0	(0.0)	1	(100.0)
Postoperative pain	1	(100.0)	1	(100.0)	0	(0.0)	0	(0.0)

use of more than 1 venous outflow vessel may also prevent URO.[43]

When reviewing the causes for URO, hematoma appeared to contribute to the higher rates of URO in ACS-NSQIP, compared with institutional data. The lower rates found in our institutional data are supported by a previous review article outlining URO for hematomas in microvascular free tissue transfers, noting rates ranging from 0.2% to 9%.[44] Halle et al.[45] reported a 13% incidence of reoperations for hematomas in breast free flaps, highlighting the potential risk of antithrombotic use and importance of using drains. A study assessing risk factors for hematoma formation in 883 patients who underwent mastectomy and immediate reconstruction found no measurable preoperative, operative, or oncologic risk factors, citing that meticulous hemostasis may be 1 of the factors.[46]

It is important to note that a large percentage of SSIs, WDs, UROs, and URAs occurred after 30 days, highlighting the possibility of an underreported complication rate in ACS-NSQIP. More specifically, the majority of SSIs and WDs occurred within 60 days, whereas the majority of UROs and URAs occurred after the 60-day period. This could be due to several temporal factors, including time taken for clinical deterioration sufficient to warrant URO or URA, or time required to arrange for patient hospital admission. All UROs and readmissions for flap complication, hemorrhage, or hematoma occurred within 30 days. The majority of UROs and readmissions for infection, seroma, and WD occurred after 30 days. It may be that the later reoperations and readmissions occurred as a result of managing conservatively at first for these complications. Furthermore, late management of seromas may be linked to the pathophysiology of seroma formation, which requires time for fluid collection. A study on abdominal-based free tissue breast reconstruction complications by Duraes et al.[37] also found that a large percentage of complications were late and inferred that the ACS-NSQIP 30-day follow-up may not be sufficient. The percentages of early 30-day and late infection complications found in our data differed from those reported by Duraes et al.[37] (early, 68.8% versus 89.0%; late, 31.3% versus 11.0%). This finding may be due to the differing surgical teams, surgical technique, patient characteristics, or type of reconstruction. It may be prudent to extend the ACS-NSQIP follow-up period to up to 3 months, with further studies evaluating the optimum follow-up time for maximum capture of complications.

Studies have also reported a large percentage of late complications within alloplastic breast reconstruction, with Luce et al.[34] reporting that 65% of tissue expanders destined for loss were still in situ at 30 days, Sinha et al.[35] reporting that 47–71% of SSIs were late (> 30 days), and Cohen et al.[36] reporting that 50% of infections were late (> 30 days). Compared with these studies of alloplastic reconstruction, we found a lower rate of late complications. Similar findings were described by Mioton et al.[47] in their report of 30-day complications, describing greater differences in autologous versus implant complications (infection, 5.46% versus 3.45%, $P < 0.001$; WD, 1.24% versus 0.44%, $P < 0.001$; reoperation, 9.59% versus 6.76%, $P < 0.001$). It may be interesting to assess the risk factors for early and late complications in autologous compared with implant reconstruction.

We acknowledge the limitations of our study. Retrospective chart reviews are at risk of human error in the data collection process. We were unable to assess certain parameters due to the presence of in-built variables in ACS-NSQIP, including radiotherapy and chemotherapy. For future reference, ACS-NSQIP may look to introduce these variables. We were also unable to subcategorize specific IFTBR procedures for comparison, such as deep inferior epigastric perforator, superior gluteal artery perforator, or free TRAM, due to limitations of CPT coding. The scope of the study was also limited to complications defined in ACS-NSQIP. As such, we could not analyze important outcomes such as donor versus recipient complications, mastectomy skin necrosis, fat necrosis, or abdominal hernia development. The inclusion of these variables may further surgical clinical outcomes' research, with more targeted, inclusive data. Due to the single-center study comparison, and the uniqueness of the protocol at our high-volume center, this may have led to differences in the comparison of our outcomes versus those hospitals captured by the ACS-NSQIP, who may perform a lower number of free tis-

sue breast reconstructions. Despite these, we believe that our study makes important contributions to the current literature, and to our knowledge, this is the first study to report a head-to-head comparison of outcomes between a single institution and a national database.

CONCLUSIONS

For complication monitoring and comparison studies, the ACS-NSQIP may reliably represent the general scope of SSIs, WDs, UROs, and URAs in institutional data for IF-TBR; however, it may not generally capture URAs for infection occurring after 30 days. There was also a significantly higher rate of UROs for ACS-NSQIP, which was due to the differences in UROs for hematoma. A large percentage of complications in our institutional database occurred after 30 days, and as such, clinicians and researchers should continue to exercise caution when reporting overall complication rates or assessing risk factors for future guidelines. An extension of the follow-up beyond 30 days should be considered.

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