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ORIGINAL ARTICLE

Breast

# Adoption of Enhanced Recovery after Surgery Protocols in Breast Reconstruction in Alberta Is High before a Formal Program Implementation

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**Background:** Enhanced recovery after surgery (ERAS) techniques have consistently demonstrated improved patient outcomes across multiple surgical specialties. We have lead international consensus guidelines on ERAS protocols for breast reconstruction and recently implemented these guidelines in Alberta. This study looks at adoption rates of ERAS pathways for breast reconstruction within Alberta, whereas also addressing barriers to ERAS implementation.

**Methods:** A retrospective analysis of online operative reports in the Synoptec database consisting of patients undergoing alloplastic or autogenous breast reconstruction in Alberta was conducted. Primary outcomes of interest included whether ERAS protocols were utilized and what the reported barriers to ERAS utilization were.

**Results:** Of the 372 patients undergoing breast reconstruction surgery, 215 (57%) patients were placed on an ERAS protocol. Autogenous reconstruction patients were more likely than alloplastic reconstruction patients to be placed on ERAS protocols (72% versus 53%, $P = 0.002$). A lack of resources was the most commonly cited reason for not adopting ERAS protocols for both autogenous and alloplastic reconstruction groups (53% and 53%). Surgeons in Southern Alberta were more likely than surgeons in Northern Alberta to utilize ERAS protocols for their alloplastic (73% versus 8%, $P < 0.001$) and autogenous (99% versus 4%, $P < 0.001$) reconstructions.

**Conclusions:** Adoption of ERAS protocols in Alberta was strong (57% adherence) before a formal program implementation. We are encouraged that the recent official launch of ERAS protocols in breast reconstruction within the province will further enhance the uptake and care of this unique surgical population.
*(Plast Reconstr Surg Glob Open 2019;7:e2249; doi: 10.1097/GOX.0000000000002249; Published online 16 May 2019.)*

## INTRODUCTION

When compared to traditional recovery after surgery (TRAS) techniques, enhanced recovery after surgery (ERAS) protocols have demonstrated improved patient outcomes across multiple disciplines.[1–8] Common aspects of ERAS protocols include preoperative patient education and counseling, reduced preoperative fasting, prophylactic antiemetic treatment, early postoperative feeding, and multimodal pain management. These elements have been shown to increase patient satisfaction, whereas also decreasing postsurgical pain scores, length of hospital stay, and associated healthcare costs.[1,9–11]

ERAS pathways have been adopted by colorectal, general, thoracic, urologic, and gynecological surgery services in Canada and the United States in the past decade.[12] The extension of ERAS protocols within the field of plastic surgery, however, has been more recent. Batdorf et al (2014) were the first to demonstrate the benefit of an ERAS pro-

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*These results have not previously been presented.*

*Received for publication March 7, 2019; accepted March 15, 2019.*


DOI: 10.1097/GOX.0000000000002249

**Disclosure:** *The authors have no financial interest to declare in relation to the content of this article.*

Supplemental digital content is available for this article. Clickable URL citations appear in the text.

tocol for patients undergoing microvascular breast reconstruction. In Alberta, we have since led international expert consensus on breast reconstruction ERAS guidelines and are interested in determining how many patients undergoing breast reconstructive surgery in Alberta are following an ERAS protocol.[13] Furthermore, we would like to elucidate what factors are serving as a barrier to ERAS adoption.

In Alberta, we have a unique online surgical reporting tool, Synoptec (formerly known as WebSMR) that was developed by cancer surgeons in Alberta.[14] Synoptec replaces traditional dictated operative reports and facilitates comprehensive, structured, and consistent operative reports for a given surgical procedure. Hence, we are uniquely poised to explore ERAS adherence for breast reconstructive surgery within this province.

## METHODS

### Patient Information

All patients undergoing breast reconstructive surgery in Alberta whose information was collected using the Synoptec database were eligible for inclusion in the study. Only patients whose surgery occurred after the implementation of the ERAS protocol and corresponding Synoptec questionnaire (described below) were included. Patients were excluded from the study if an ERAS status (adherent or nonadherent) or reconstructive details specifying if the patient underwent alloplastic or autogenous reconstruction were not provided.

### Synoptec Database

The Synoptec template for reporting breast reconstructive procedures was predetermined by a group of Albertan surgeons, collectively known as Cancer Surgery Alberta (CSA), who developed the specific questions needed to adequately describe the surgical procedure and related research questions. From this database, patient and surgeon demographics, reconstruction details, and information pertaining to ERAS adherence were extracted retrospectively. Queried information on patient demographics included age and comorbidities (cardiovascular disease, diabetes, respiratory disease, peripheral vascular disease, autoimmune disease, smoking status, and others). Surgeon location was determined to be Northern or Southern Alberta by practitioner ID. Reconstructive details obtained from the operative reports included date of surgery, timing (immediate, delayed, or combined), laterality (unilateral or bilateral), and reconstructive method (alloplastic, autogenous, or a combination). ERAS adherence was operationally reported as "yes" or "no," or could be left blank and recorded as "incomplete."

Barriers to ERAS adherence were collected in both a closed-entry format and an open-entry format. Closed-entry answers included the following exclusion criteria for the ERAS pathway: "ASA >2," "BMI >35," "Lives >1 hour from hospital," or "No supportive caregiver at home." Under previously published ERAS guidelines, patients who undergo alloplastic reconstruction are able to be discharged on the day of their procedure, provided they do not meet any of the aforementioned exclusion criteria.[13] As ERAS protocols for autologous reconstruction do not require the patient to be discharged the same day as surgery, the same exclusion criteria did not apply to this group of patients. Therefore, alloplastic and autologous reconstruction groups were analyzed separately to determine what factors may be influencing the decision to pursue ERAS for these distinct subpopulations.

### Statistical Analyses

Statistical analyses were performed using a chi-square test for proportional comparisons and a 2-tailed $t$ test for continuous variables using the software available on www.scoscistatistics.com. A $P$-value of 0.05 was considered statistically significant.

### Ethics

According to the Alberta Innovates A pRoject Ethics Community Consensus Initiative (ARECCI) Ethics Guidelines for Quality Improvement and Evaluation Projects' ethics screening score, our project was deemed minimal risk. We are, therefore, following the ARECCI Ethics Guidelines for Quality Improvement and Evaluation Projects and did not require formal ethics approval for this study.

## RESULTS

### Patient and Surgeon Demographics

Four hundred twenty-five patients undergoing reconstructive breast surgery between August 2015 and April 2018 were recorded using the Synoptec database. Of these patients, 24 (6%) patients were excluded from analysis because an ERAS status was not provided. Additional 29 (7%) patients were excluded as sufficient reconstructive details were not provided. This yielded a total of 372 patients for subsequent analyses (Fig. 1).

Patient demographic variables are presented in Tables 1 and 2. Women undergoing alloplastic reconstruction were younger than those undergoing autogenous reconstruction (48.4 ± 10.3 versus 50.9 ± 9.6 years; $P = 0.05$). Smoking status was reported in 87% of patients and was similar between patients undergoing alloplastic and autogenous reconstructions (5% versus 2%; $P = 0.31$). The presence of a comorbidity (cardiovascular disease, peripheral vascular disease, respiratory disease, autoimmune disease, or others) was reported in 82% of patients. There was no difference between the number of comorbidities in patients undergoing alloplastic reconstruction and the number of comorbidities in patients undergoing autogenous reconstruction (21% versus 10%; $p = 0.05$).

This study included patient information collected from 11 surgeons. Two surgeons were located in Northern Alberta and provided details on 30% of included patients. Nine surgeons were located in Southern Alberta, accounting for 70% of patients included in this study.

### ERAS Adoption

Fifty-seven percent of patients undergoing breast reconstruction were placed on an ERAS protocol. As shown

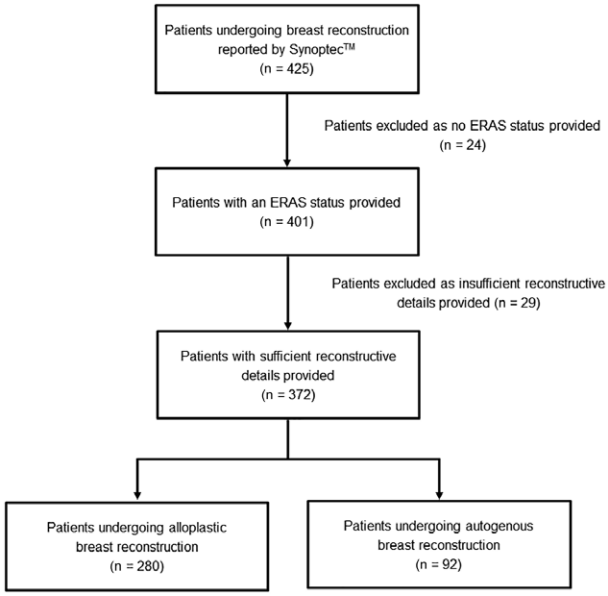


**Fig. 1.** A flowchart describing patient inclusion for this study.

**Table 1. Demographics and ERAS Adherence of Patients Undergoing Alloplastic Reconstruction (N = 280)**

| | ERAS Patients | TRAS Patients | *P* |
|---|---|---|---|
| Location | | | |
| Southern Alberta | 142 | 53 | <0.001 |
| Northern Alberta | 7 | 78 | |
| Age (y) | | | |
| 20–39 | 32 | 27 | 0.89 |
| 40–59 | 95 | 82 | |
| 60–79 | 22 | 22 | |
| Smoking status | | | |
| Unreported | 18 | 23 | |
| Smoker | 7 | 5 | 0.80 |
| Nonsmoker | 124 | 103 | |
| Comorbidities | | | |
| Unreported | 24 | 28 | |
| ≥1 comorbidity | 29 | 18 | 0.29 |
| None | 96 | 85 | |

**Table 2. Demographics and ERAS Adherence of Patients Undergoing Autogenous Reconstruction (N = 92)**

| | ERAS Patients | TRAS Patients | *P* |
|---|---|---|---|
| Location | | | |
| Southern Alberta | 65 | 1 | <0.001 |
| Northern Alberta | 1 | 25 | |
| Age (y) | | | |
| 20–39 | 8 | 4 | 0.55 |
| 40–59 | 44 | 19 | |
| 60–79 | 14 | 3 | |
| Smoking status | | | |
| Unreported | 7 | 1 | 1.00 |
| Smoker | 2 | 0 | |
| Nonsmoker | 57 | 25 | |
| Comorbidities | | | |
| Unreported | 14 | 0 | 0.05 |
| ≥1 comorbidity | 8 | 0 | |
| None | 44 | 26 | |

in Figure 2, ERAS adoption was higher in patients undergoing autogenous reconstruction than in patients undergoing alloplastic reconstruction (72% versus 53%; $P = 0.03$). There were no differences in demographic variables with respect to age, smoking status, or presence of comorbidities between ERAS and TRAS groups among patients undergoing alloplastic reconstruction (Table 1) or autogenous reconstruction (Table 2). Patients undergoing immediate reconstruction were equally as likely to be put on an ERAS protocol as those undergoing delayed reconstruction (58% versus 62%; $P = 0.53$). Similarly, there was no difference in ERAS adoption between patients undergoing bilateral breast reconstruction and patients undergoing unilateral reconstruction (58% versus 58%; $P = 0.98$; Table 3).

A discrepancy in patients placed on ERAS protocols existed between the northern and southern regions of the province. As shown in Figure 3, patients undergoing alloplastic breast reconstruction in Southern Alberta were more likely to be placed on an ERAS pathway when compared with patients undergoing similar surgery in Northern Alberta (73% versus 8%; $P < 0.001$). This disparity was more pronounced for patients undergoing autogenous reconstruction (Fig. 4). Although nearly all patients in this reconstructive category were placed on the ERAS pathway in Southern Alberta, only 1 patient was

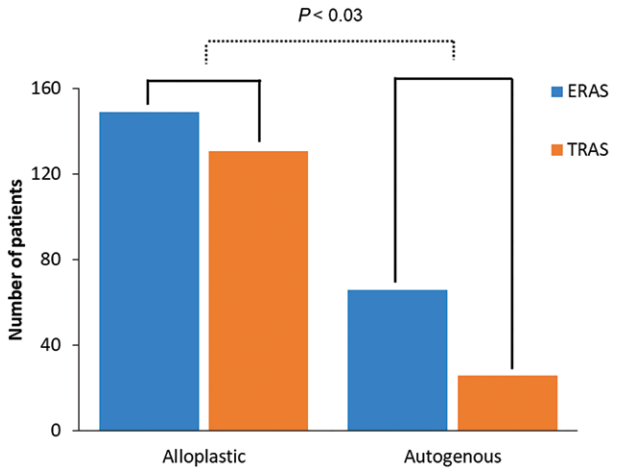


**Fig. 2.** Patients undergoing autogenous breast reconstruction were more likely to be placed on an ERAS pathway as compared with patients undergoing alloplastic reconstruction ($P = 0.03$).

**Table 3. Comparison of Procedures Between ERAS and TRAS Uses in Alberta**

| | ERAS Patients | TRAS Patients | *P* |
|---|---|---|---|
| Timing of reconstruction | | | |
| Immediate | 160 | 118 | 0.53 |
| Delayed | 45 | 28 | |
| Type of procedure | | | |
| Bilateral | 144 | 105 | 0.98 |
| Unilateral | 71 | 52 | |

ERAS adoption was not moderated by timing of reconstruction ($P = 0.53$) or the laterality of procedure ($P = 0.98$).

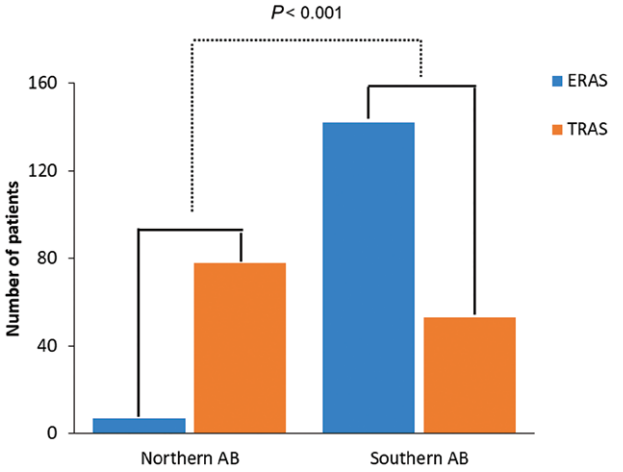


**Fig. 3.** Patients undergoing alloplastic reconstruction in Alberta. Patients in Southern Alberta (AB) were more likely to be placed on the ERAS pathway (blue) compared to a TRAS pathway (gray) than patients in Northern AB ($P < 0.001$).

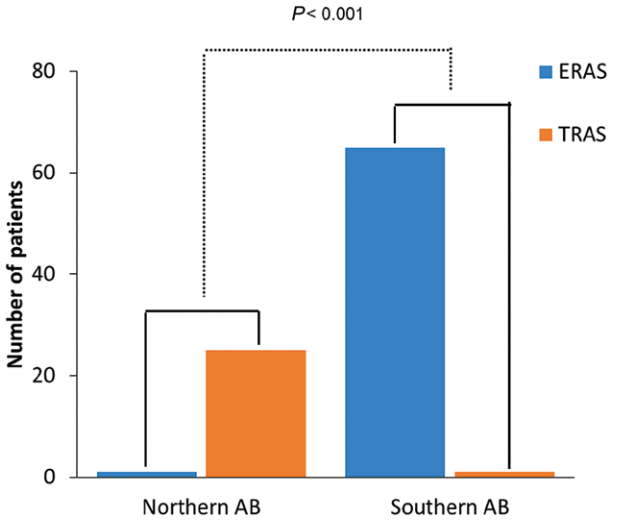


**Fig. 4.** Patients undergoing autogenous reconstruction in Alberta. Patients in Southern Alberta (AB) were more likely to be placed on the ERAS pathway (blue) compared to a TRAS pathway (gray) than patients in Northern AB ($P < 0.001$).

placed on the ERAS pathway in Northern Alberta (99% versus 4%; $P < 0.001$).

### Barriers to ERAS Adoption

Of the 157 patients not placed on an ERAS protocol, 83% underwent alloplastic reconstruction. Reasons for not adopting an ERAS protocol were provided for 59% of these patients and 65% of patients undergoing autogenous reconstruction. Most surgeons cited only one reason (88%) for nonadherence. Among patients receiving alloplastic reconstruction, 42% were placed on a TRAS inpatient pathway because ERAS exclusion criteria were met. For those meeting ERAS inclusion criteria, the most frequently recorded barrier to ERAS adoption was insufficient resources (53%). Other reasons listed for continuing

**Table 4**

| Reason for ERAS Nonadherence | No. Patients, n (%) |
|---|---|
| Insufficient resources for ERAS protocol | 41 (53) |
| Met ERAS exclusion criteria | 30 (39) |
| No supportive caregiver at home | 16 (21) |
| Live >1 h from hospital | 13 (17) |
| BMI >35 | 1 (1) |
| Error in ordering/executing pathway | 8 (10) |
| Significant comorbidity | 2 (3) |
| Patient preference | 1 (1) |
| Surgeon preference | 1 (1) |
| ASA >2 | 0 (0) |
| Others | 3 (4) |

Of the 131 patients undergoing alloplastic reconstruction who followed a TRAS pathway, at least one reason for nonadherence was provided for 77 patients (59%). Of these patients, 11 patients had more than one reason provided. Percentages reported reflect the number of patients with a given reason provided as a function of the total number of patients with at least one reason provided (N = 77).

with a TRAS protocol in this population included an error reported in ordering or executing the ERAS pathway (10%), the existence of a patient comorbidity that the surgeon felt was significant enough to continue with TRAS protocols (3%), patient preference (1%), or surgeon preference (1%). Among autogenously reconstructed patients, 53% of surgeons cited insufficient resources as the main barrier to ERAS implementation. For the remaining patients, limiting barriers were ascribed to the listed exclusion criteria for alloplastic reconstruction, which does not apply to this surgical population.

## DISCUSSION

### ERAS Adoption and Barriers to Implementation

The benefits of ERAS protocols are clear. The use of an ERAS pathway has consistently demonstrated improved patient satisfaction, pain and nausea control, reduced length of stay in hospital, and the potential for reduced postoperative complications. These promising outcomes provide a motivating impetus for a diverse range of surgical specialties to adopt ERAS guidelines.[4,5,12,15,16] Yet, despite their growing popularity, few authors have examined the adoption of ERAS protocols. To our knowledge, this is the first study examining the adherence to ERAS protocols by reconstructive breast surgeons.

Our data suggest an overall adoption rate of 57%, because the ERAS protocols were first disseminated in 2015. This finding is comparable to adherence rates reported by Gramlich et al[15] who evaluated the influence of a formal implementation program on compliance to items within a colorectal ERAS protocol. These authors found that among the 6 Albertan hospitals evaluated, compliance improved from 39% to 60% after a formal institutional launch. Notably, our preimplementation rates (57%) are similar to the postimplementation rates (60%), which is found within this colorectal population, making us hopeful that the compliance with breast reconstruction ERAS protocols will continue to improve following the recent formal guideline launch in Alberta. A possible explanation for our higher earlier adoption rates was the surgeon-

driven nature of establishing ERAS guidelines for breast reconstructive surgery. It is conceivable that other ERAS protocols may have had a more top-down administrative implementation where the surgical staff were not as heavily involved in the development and dissemination of their respective ERAS pathways.

In addition to evaluating an overall adherence rate, we examined possible patient factors and reconstructive details that might mitigate ERAS adoption. We surprisingly found no difference between patients undergoing immediate reconstruction and those undergoing bilateral breast surgery, despite the potential for these patients to especially benefit from an ERAS pathway. Patients undergoing immediate reconstruction endure two operations at once, such as a mastectomy and a reconstructive procedure, likely resulting in increased pain and increased anxiety for many patients. This is reflected in the decision making of many patients who elect to pursue the smaller procedure involved in an alloplastic reconstruction for their immediate reconstructions as opposed to a major autologous reconstruction. Choosing to abide by ERAS guidelines for immediate reconstruction procedures could benefit patients even further by reducing their postoperative pain and preoperative stress and anxiety.[4,5,12,17,18] Similarly, undergoing a bilateral reconstruction, whether it is immediate or delayed, puts the stress of a longer procedure and increases surgical trauma on the patient. We have observed that 58% of patients undergoing bilateral reconstruction are currently following ERAS guidelines. The remaining 42% of patients could certainly benefit from ERAS techniques.

Identifying the surgeon-reported barriers to ERAS adoption is crucial to facilitate patient access to enhanced perioperative pathways and improved postoperative outcomes. In our study, the overwhelming majority of surgeons cited potentially preventable factors at the institution-based (24%) and systems-based (48%) levels as the main barriers to ERAS implementation. This is relatively consistent with literature within colorectal surgery, where barriers were found to be equally distributed between site and unit (26%), provider (26%), patient (26%), and system (22%) levels of care.[15] Among both types of reconstructive groups in our study, 53% of patients were placed on a TRAS pathway due to a lack of sufficient resources to execute an ERAS protocol. Although the nature of our data collection precluded further elucidation of what was meant by insufficient resources, we might speculate that this stems from both a perceived financial restriction and an educational one. The process of creating and implementing an ERAS protocol is costly, requiring a noteworthy investment of personnel hours and monetary resources. However, the literature suggests that there is an overall cost-saving benefit to ERAS implementation. Ljunggvist (2017) performed a cost analysis among ERAS protocols in noncolorectal general surgery and gynecological oncologic surgery finding that the ensuing decreased length of hospital stay resulted in significant cost savings as compared to TRAS protocols. Other authors may argue that the earlier discharge seen in ERAS protocols increases a patient's risk of representation to the emergency department or readmission; however, this has not been found to be the case for patients undergoing alloplastic or microvascular breast reconstruction.[6,8] Previous research by our team has shown that patients benefit from an ERAS protocol with improved quality of life during recovery whether they are undergoing alloplastic or autologous reconstruction.[2,5,6,17] The implementation of ERAS protocols is safe for this surgical population, with the additional benefit of offsetting the current bed shortage seen in Canadian hospitals.[19–21]

An additional barrier to ERAS implementation that has been identified in the literature and resonates within our study is inadequate education. In addition to the 53% of patients placed on a TRAS pathway due to insufficient resources, 10% of patients in our study undergoing alloplastic reconstruction failed to be placed on an ERAS pathway due to an error in ordering or executing the protocol. Surgeon or patient preference, which could be due to a lack of sufficient information about the ERAS process, accounted for an additional 2% of ERAS nonadherence. Improved education for both patients and healthcare teams may help alleviate these types of system and site compliance barriers. Gramlich et al[15] demonstrated that educational site visits with an ERAS Society expert have been shown to improve ERAS compliance.

#### Importance of Synoptic Reporting for Quality Assurance and Research

Synoptec is a reliable database that provides real-time information on the use of ERAS protocols by surgeons who use the system for their breast reconstruction cases. The use of standardized synoptic operative reports has been shown to be superior to dictated and transcribed operative reports in both the quality of information and the time in which it is available for the patient's chart, making this form of operative reporting particularly useful for quality assurance studies such as ours.[14,22–26] A potential limitation that comes with the use of Synoptec software for our study is that not all breast reconstruction surgeons are using this dictation system. In 2010, 86% of Albertan breast surgeons were using Synoptec for their oncologic operative reports, covering more than two-thirds of this province's patient population.[14] CSA now estimates that 90%–95% of breast surgeons are using this system. Among all Albertan plastic surgeons, only 20% use Synoptec. Although not all plastic surgeons perform breast reconstruction surgery, this clearly demonstrates a marked disparity in Synoptec use as compared to the oncologic breast surgeons and suggests that our data reflect an incomplete representation of all of the potential barriers to ERAS utilization within the province. We are hopeful that trends in the use of Synoptec reporting for breast reconstructive surgery will mirror those seen by our oncologic breast surgeon colleagues, facilitating improved quality assurance research and evaluation of ERAS adoption in the future.

## CONCLUSIONS

ERAS techniques are economically efficient and have been shown to improve patient outcomes, reduce the length

of stay in hospital, and reduce postoperative complications. Among Albertan surgeons using Synoptec to input their breast reconstruction operative data, 57% are currently utilizing ERAS guidelines with wide disparities based on geographic location within the province. Additional resources, both financially and educationally, will likely facilitate improved ERAS adoption. We are encouraged that the recent official launch of ERAS protocols in breast reconstruction within the province of Alberta will further enhance the uptake and care of this unique surgical population.

## LIMITATIONS

We acknowledge that a limitation in the database review is a lack of comparisons of postoperative outcomes between the ERAS and TRAS cohort groups. However, we have previously published the improved recovery, reduction in narcotic use, earlier ambulation, shorter hospital stays, and improved quality of life in implant and flap patients. Although the Synoptec database provides excellent preoperative and intraoperative information on all patients, we are unable to obtain postoperative results on all these patients retrospectively across the province. Postoperative care in ERAS patients, however, is based on standard order sets.[27]

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## ACKNOWLEDGMENT

*The authors would like to thank Cancer Surgery Alberta for their generous assistance in data collection through the use of the Synoptec database.*

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