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Original article

# Factors associated with completion of patient surveys 1 year after bariatric surgery

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## Abstract

**Background:** Patient-reported outcomes (PRO) obtained from follow-up survey data are essential to understanding the longitudinal effects of bariatric surgery. However, capturing data among patients who are well beyond the recovery period of surgery remains a challenge, and little is known about what factors may influence follow-up rates for PRO.

**Objectives:** To assess the effect of hospital practices and surgical outcomes on patient survey completion rates at 1 year after bariatric surgery.

**Setting:** Prospective, statewide, bariatric-specific clinical registry.

**Methods:** Patients at hospitals participating in the Michigan Bariatric Surgery Collaborative are surveyed annually to obtain information on weight loss, medication use, satisfaction, body image, and quality of life following bariatric surgery. Hospital program coordinators were surveyed in June 2017 about their practices for ensuring survey completion among their patients. Hospitals were ranked based on 1-year patient survey completion rates between 2011 and 2015. Multivariable regression analyses were used to identify associations between hospital practices, as well as 30-day outcomes, on hospital survey completion rankings.

**Results:** Overall, patient survey completion rates at 1 year improved from 2011 (33.9% ± 14.5%) to 2015 (51.0% ± 13.0%), although there was wide variability between hospitals (21.1% versus 77.3% in 2015). Hospitals in the bottom quartile for survey completion rates had higher adjusted rates of 30-day severe complications (2.6% versus 1.7%, respectively;  $P = .0481$ ), readmissions (5.0% versus 3.9%, respectively;  $P = .0157$ ), and reoperations (1.5% versus .7%, respectively;  $P = .0216$ ) than those in the top quartile. While most hospital practices did not significantly impact survey completion at 1 year, physically handing out surveys during clinic visits was independently associated with higher completion rates (odds ratio, 13.60; 95% confidence interval, 1.99–93.03;  $P = .0078$ ).

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**Conclusions:** Hospitals vary considerably in completion rates of patient surveys at 1 year after bariatric surgery, and lower rates were associated with hospitals that had higher complication rates. Hospitals with the highest completion rates were more likely to physically hand surveys to patients during clinic visits. Given the value of PRO on longitudinal outcomes of bariatric surgery, improving data collection across multiple hospital systems is imperative. (*Surg Obes Relat Dis* 2021;17:538–547.) Published by Elsevier Inc. on behalf of American Society for Bariatric Surgery.

*Key words:*

Bariatric surgery; Metabolic surgery; Weight loss surgery; Patient-reported outcomes; PRO; PRO completion rates; Hospital practices; Early complications; Bariatric surgery outcomes; Healthcare policy

With mounting evidence for the safety and effectiveness of bariatric surgery in treating morbid obesity and its related illnesses [1], the total number of bariatric operations performed yearly in the United States continues to rise [2]. As the utilization of bariatric surgery grows, it has become increasingly important to capture long-term data on the effectiveness of these procedures. This goal is difficult to achieve, as the long-term follow-up by bariatric surgery patients at typical programs is overall low, ranging from 40.6% to 55.0% [3–5]. Patient-reported outcomes (PRO) represent a viable and relatively inexpensive way of capturing these data. Moreover, PRO have proven to be highly reliable in multiple settings. For example, self-reported weights following bariatric surgery have been shown to closely match measured values [6,7]. Additionally, PRO can provide valuable insight into long-term symptoms, as well as functional and psychological aspects of health, in bariatric surgery patients.

Even with PRO, however, follow-up rates are highly variable. In a recent systematic review of 86 studies focusing on PROs following bariatric surgery, 73% reported missing data and 19% did not report on the completeness of their data set [8]. To date, there are no studies that have examined predictors of survey completion among bariatric surgery patients. Understanding the drivers of survey completion will be critical for developing strategies to engage patients over the long term.

In this context, we examined data from a statewide, prospective, bariatric-specific clinical registry to determine hospital-level predictors on rates of completion of a PRO survey 1 year after bariatric surgery. Our analysis included hospital and patient factors, including 30-day outcomes. We also surveyed hospitals to determine the impact of specific practices designed to improve survey completion rates.

## Methods

### *Data source, PRO survey, and study population*

The Michigan Bariatric Surgery Collaborative is a statewide consortium of 42 hospitals and 85 surgeons that maintains a prospective, audited clinical registry [9,10]. This clinical registry accounts for over 95% of the patients undergoing bariatric surgery across the state. Hospitals within the collaborative provide data on primary and revisional sleeve

gastrectomy (SG), Roux-en-Y gastric bypass (RYGB), biliopancreatic diversion with and without duodenal switch (BPD-DS), and laparoscopic adjustable gastric banding (LAGB). Centrally trained nurse data abstractors review medical records using a standardized and validated instrument capturing patient demographic characteristics, clinical characteristics, and co-morbidities, as well as perioperative processes of care and outcomes. Verification of the data for accuracy and completeness is ensured by annual visits to participating hospitals. The study protocol was approved by the institutional review board and the requirement for informed consent was waived.

Patients are surveyed by the coordinating center at baseline and annually after surgery to obtain information on weight loss and co-morbidity remission. This process involves an emailed survey link sent to patients before their 1-year surgery anniversary date. Email reminders are sent at 1 and 2 weeks and at 1, 2, and 4 months for those not responding. Surveys are then sent by mail to patients for whom an email address is not available or those who do not respond to electronic communication. Finally, those not responding to mailed questionnaires are surveyed by telephone. The PRO survey provided to patients is included as [Appendix A](#).

The PRO survey has been a requirement for all participating hospitals since the inception of the statewide collaborative in 2006. For this study we included all hospitals ( $n = 36$ ) with survey completion rates available for at least 2 years during the study period from 2011 to 2015. The study period followed a collaborative-wide effort to focus attention on improving survey completion rates. We examined data from all patients 18 years and older undergoing primary and revisional bariatric procedures at these hospitals during the study period who would have been eligible to complete a 1-year survey ( $n = 14,008$ ). Patients undergoing revisional surgery received the same PRO survey at the same interval as those undergoing primary bariatric surgery.

### *Data collected*

Patient characteristics included age, sex, insurance type, race, income, preoperative body mass index (BMI), preoperative percent excess weight loss, procedure type (RYGB, LAGB, SG, or BPD-DS), marital status, education level, employment status, and co-morbidities, including smoking

history, cardiovascular disease, hypertension, hyperlipidemia, diabetes, obstructive sleep apnea, gastroesophageal reflux disease, asthma, liver disease, kidney disease, mobility limitation, and psychological disorders.

Postoperative complications captured within 30 days of surgery included bowel obstruction, leak, abdominal abscess, wound complication, dehiscence, hemorrhage, venous thromboembolism, myocardial infarction or cardiac arrest, renal failure, pneumonia, reintubation, prolonged ventilator use, shock, hospital-acquired infections, and death. Severe complications were defined as potentially life-threatening complications, including those that required invasive interventions such as percutaneous drainage or reoperation, blood transfusions of 4 or more units of blood, respiratory failure requiring greater than 2 days of intubation, renal failure requiring in-hospital or long-term dialysis, venous thromboembolism, myocardial infarction or cardiac arrest, and death. Utilization measures captured at 30 days included emergency department (ED) visits, readmissions, and reoperations.

### Hospital survey

Bariatric program coordinators at each hospital were surveyed to obtain information on their practices for ensuring survey completion among their patients. They were also asked to identify perceived barriers to completion and strategies for improving survey completion rates. The instrument used to survey bariatric program coordinators is included as [Appendix B](#).

### Statistical analysis

The primary outcome of the study was annual hospital-level patient survey completion rates 1 year after bariatric surgery. The completion rate was calculated as the fraction of that hospital's patients who responded to the 1-year postoperative survey of those initially having completed a baseline survey. Because yearly survey completion rates varied for a single hospital, showing various trends over the study period, we chose to calculate a composite survey completion score that would account for current performance and improvement over time. Hospitals were then ranked according to this composite survey completion score, which was determined by a combination of their 2015 survey completion rate, accounting for current performance, and their improvement over the study period, calculated by subtracting their completion rate in the earliest available year within the study period from their 2015 completion rate. The composite survey completion score for each hospital was then obtained by the sum of its current performance and its improvement score ([Appendix C](#)).

Baseline hospital and patient characteristics between hospitals in the top (highest PRO survey completion composite scores) and bottom (lowest PRO survey completion composite scores) quartiles were compared using  $\chi^2$  tests for categorical variables and *t* tests for continuous variables.

We similarly compared these 2 groups with regard to the use of specific practices to improve survey completion rates, as obtained from the hospital surveys.

Multivariable logistic and linear regression models were then used to compare hospitals in the top and bottom quartiles for survey completion rates with regard to 30-day outcomes while adjusting for patient characteristics and procedure type.

To determine whether hospital PRO collection practices and perceived barriers were independently associated with PRO completion scores, factors with  $P < .2$  differences at the univariate level between the bottom and top hospital quartiles were selected. We then performed risk-adjusted logistic regression analyses to determine whether hospital-level data collection techniques influence allocation into the top quartile. Analyses were performed using SAS 9.4, 64-bit (SAS Institute Inc., Cary, NC).

## Results

### Patient survey completion rates

[Fig. 1](#) illustrates PRO survey completion rates, composite scores, and quartile ranking for all hospitals within the state-wide collaborative during the 5-year study period. PRO survey completion rates improved from  $33.9\% \pm 14.5\%$  to  $51.0\% \pm 13.0\%$  during the study period ([Fig. 1A](#)). There was wide variability in hospitals' PRO completion rates, ranging from 21.1% to 77.3% in 2015 ([Fig. 1B](#)), and in the composite PRO completion rate scores, which ranged from 21.0 to 120.2 ([Fig. 1C](#)). Mean (standard deviation [SD]) composite PRO completion rate scores for the bottom and top quartiles were 39.5 (SD, 10.6) and 101.3 (SD, 11.6), respectively. One-third of top- and bottom-quartile hospitals stratified differently when ranked by composite completion score compared to 2015 completion rates alone.

### Patient and hospital characteristics and 30-day outcomes

Baseline patient and hospital characteristics are compared between the bottom and top hospital quartiles in [Table 1](#). Patient characteristics, including age, sex, surgical procedure, preoperative BMI, excess body weight loss, income, employment status, education, distance from home to hospital, and insurance payor, were similar between both quartiles. Patients in the top hospital quartile were more likely to be White (82.4% versus 58.5%, respectively;  $P < .0001$ ), suffer from liver disease (12.5% versus 3.7%, respectively;  $P < .0001$ ) and psychological disorders (56.9% versus 46.0%, respectively;  $P < .0001$ ), and smoke (41.7% versus 37.7%, respectively;  $P < .0001$ ) than those in the bottom quartile. Hospital characteristics, including the number of surgeons per hospital and the operative volume, did not statistically differ between bottom and top quartiles. Interestingly, a higher proportion of hospitals in the bottom quartile than in the top quartile was classified as academic

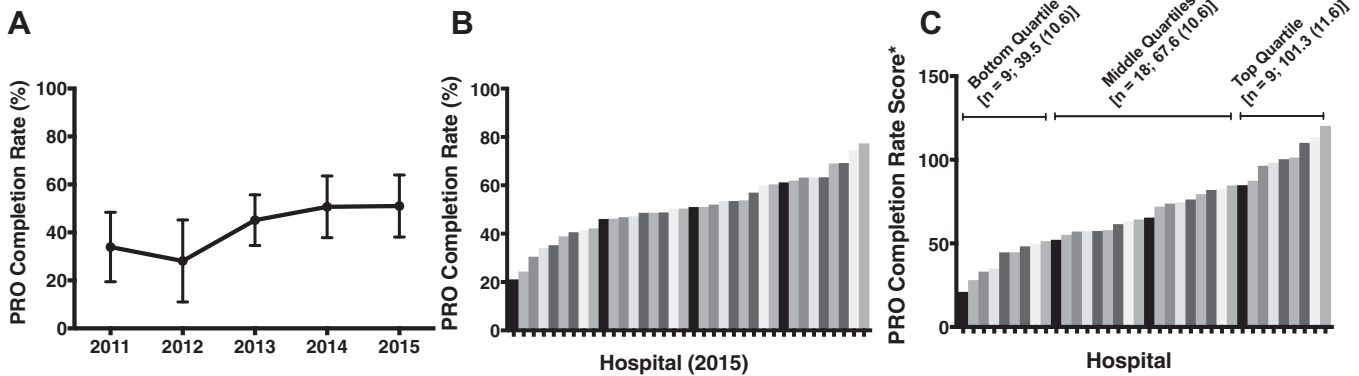


Fig. 1. Statewide PRO survey completion rates and scores. (A) Yearly mean and standard deviation of PRO survey completion rates for all studied hospitals participating in the statewide collaborative. (B) PRO survey completion rate for each hospital in 2015. (C) PRO completion rate score for each hospital during the 5-year study period and quartiles with corresponding mean and standard deviation. \*PRO completion rate score = 2015 PRO completion rate + (PRO completion rate for earliest available year within study period – 2015 PRO completion rate score). PRO = patient-reported outcomes.

(88.9% versus 33.3%, respectively;  $P = .0498$ ). Though this study was not designed to systematically investigate differences in PRO completion rate by procedure type, a comparison of these data between top- and bottom-quartile hospitals, ranked by composite score, is included in [Appendix D](#). PRO completion rates tended to be higher for primary procedures compared with revisional bariatric surgery, regardless of procedure type. Primary SG, the most commonly performed operation, accounted for the higher PRO completion rate observed in hospitals ranked in the top quartile, compared with those allocated to the bottom quartile.

[Table 2](#) compares risk-adjusted 30-day outcomes between patients in the bottom and top hospital quartiles. Patients in the bottom hospital quartile experienced significantly higher rates of severe complications (2.6% versus 1.7%, respectively;  $P = .0481$ ), reoperations (1.5% versus .7%, respectively;  $P = .0216$ ), ED visits (9.4% versus 8.7%, respectively;  $P = .0593$ ), and 30-day readmissions (5.0% versus 3.9%, respectively;  $P = .0157$ ) than those in the top quartile. Notably, though not quite reaching statistical significance, hospitals in the top quartile trended toward a higher operative volume over the study period (922.6 [SD, 579.5] versus 633.9 [SD, 611.0] operations per hospital;  $P = .0703$ ; [Table 1](#)).

#### Bariatric program survey results and hospital practices

Results from the bariatric program coordinator survey are summarized for all 36 hospitals and are contrasted between bottom and top hospital quartiles in [Table 3](#). The response rate was 100%. Notably, only 61% of coordinators perceived that their surgeons prioritize PRO completion, and this rate did not differ between quartiles. The baseline PRO survey was most often obtained by registered nurses (44.4%), registered dietitians (RDs; 30.6%), and medical assistants (MAs; 22.2%). Most hospitals (77.8%)

offered lifelong patient follow-up. Patient reminders about the 1-year PRO survey were provided by 66.7% of hospitals, most commonly in clinic (75.0%), by mail (20.8%), or via phone (8.3%). Providers seeing patients during the 1-year visit included surgeons (86.1%), nurse practitioners/physician assistants (55.6%), and RDs (47.2%). Most hospitals (83.3%) had implemented changes at some point to improve the PRO completion rate, including handing out the survey during the 1-year visit (73.3%), staff education (20.0%), and email reminders (10.0%). At the time coordinators were surveyed, 80.6% of hospitals handed out the survey to patients during the 1-year visit. This was more frequently done by MAs (48.3%) and clerks (44.8%). Hospitals in the top quartile were more likely to hand out the 1-year PRO survey relative to institutions in the bottom quartile (100.0% versus 44.4%, respectively;  $P = .0106$ ). Barriers to 1-year PRO completion identified by surveyed coordinators included a lack of patient interest (80.6%), patients no longer having ties with hospitals at 1 year (44.4%), the length of the survey (36.1%), and a lack of staff/resources (33.3%).

The association between hospital practices/barriers and ranking in the top PRO completion rate score group are shown in [Table 4](#). Hospitals in the top quartile were more likely to hand the 1-year PRO survey to patients during clinic visits (odds ratio, 13.60; 95% confidence interval, 1.99–93.03;  $P = .0078$ ).

The strategies most frequently suggested by surveyed bariatric program coordinators that, if implemented, could improve the 1-year PRO completion rate included providing patient education materials at baseline (19.4%), hospital-initiated phone/mail/email reminders (19.4%), handing out the survey during the 1-year visit (16.6%), availability of electronic resources for survey completion in the office or at home (13.8%), more staff (13.8%), patient incentive (13.8%), staff education (11.1%), and centralizing handing out of the survey by 1 person (11.1%).

Table 1  
Patient and hospital characteristics

Characteristic	Bottom quartile, 9 hospitals	Top quartile, 9 hospitals	<i>P</i> value
n	5705 (40.7%)	8303 (59.3%)	
Procedure type, %			
RYGB	31.5	36.4	<.0001
LAGB	6.3	5.4	.0190
SG	60.9	58.0	.0006
BPD/DS	1.1	.1	<.0001
Academic, %	88.9	33.3	.0498
Number of surgeons per hospital, mean (SD)	3.56 (3.61)	2.67 (1.00)	.8892
Operations per hospital over the study period, mean (SD)	633.9 (611.0)	922.6 (579.5)	.0703
Age at operation, mean (SD)	45.6 (11.2)	46.4 (11.9)	<.0001
BMI, mean (SD)	48.0 (8.6)	47.4 (8.4)	<.0001
Male, %	19.6	22.0	.0008
Preoperative % EBWL, mean (SD)	4.0 (20.6)	4.8 (13.0)	.0122
Insurance payor, %			
Private insurance	76.9	71.0	<.0001
Medicaid	4.7	6.5	<.0001
Medicare	14.3	16.0	.0050
No insurance/self-pay	3.9	6.4	<.0001
White or Caucasian, non-Hispanic	58.5	82.4	<.0001
Income <\$25 K, %	23.3	25.4	.0088
Income ≥\$45 K, %	54.6	51.4	.0006
Married or living with significant other, %	57.1	64.2	<.0001
Some college/technical school or greater, %	79.4	75.8	<.0001
Working part- or full-time, %	65.2	62.2	.0009
Distance in miles from home to hospital, mean (SD)	33.7 (128.0)	34.0 (112.2)	.8752
Any smoking, %	37.7	41.6	<.0001
Current smoking, %	9.9	9.9	.9495
Cardiovascular disease, %	57.3	56.2	.2027
Hypertension, %	55.2	54.2	.2491
Hyperlipidemia, %	47.2	48.7	.0819
Diabetes, %	32.3	34.7	.0035
Diabetes, type II, %	31.0	33.0	.0140
Requiring insulin, %	10.7	11.0	.5108
Obstructive sleep apnea, %	44.1	43.8	.6800
Gastroesophageal reflux disease, %	55.9	53.5	.0055
Asthma, %	24.2	22.9	.0549
Liver disease, %	3.7	12.5	<.0001
Kidney disease, %	.4	.4	.7460
Mobility limitation, %	7.5	5.9	.0002
psychological disorder, %	45.9	56.9	<.0001
Total number of co-morbidities, mean (SD)	4.4 (2.0)	4.7 (2.1)	<.0001

RYGB = Roux-en-Y gastric bypass; LAGB = laparoscopic adjustable gastric banding; SG = sleeve gastrectomy; BPD/DS = biliopancreatic diversion with duodenal switch; SD = standard deviation; BMI = body mass index; EBWL = excess body weight loss.

Table 2  
Risk-adjusted complications at 30 days and 1-year outcomes

Characteristic	Bottom quartile, 9 hospitals	Top quartile, 9 hospitals	<i>P</i> value
n	5705	8303	
Any complication, %	8.2	7.7	.4266
Emergency department visit, %	9.4	8.7	.0593
Severe complication, %	2.6	1.7	.0481
Readmission, %	5.0	3.9	.0157
Reoperation, %	1.5	.7	.0216

Data were adjusted for procedure type, patient characteristics, patient co-morbidities, and clustering within sites.

Table 3  
Bariatric program coordinator survey results

Item	All, 36 hospitals	Bottom quartile, 9 hospitals	Top quartile, 9 hospitals	P value
Coordinator survey response rate, %	100.0			
Surgeon(s) prioritizes 1-yr PRO survey completion? Yes, %	61.1	66.7	66.7	>.99
RN obtains baseline PRO survey, %	44.4	44.4	44.4	>.99
RD obtains baseline PRO survey, %	30.6	44.4	11.1	.1250
MA obtains baseline PRO survey, %	22.2	0	33.3	.0652
Coordinator obtains baseline PRO survey, %	16.7	22.2	33.3	.6091
Patients followed for 5 yr, %	16.7	22.2	22.2	>.99
Lifelong patient follow-up, %	77.8	77.8	77.8	>.99
Does your program formally remind patients about completing the 1-yr PRO survey? Yes, %	66.7	88.9	55.6	.1250
Patient reminded in clinic, %	75.0	50.0	100.0	.0680
Patient reminded by mail, %	20.8	50.0	0	.0679
Patient reminded by phone call, %	8.3	12.5	0	.4292
Surgeon sees the patient at 1 yr, %	86.1	100.0	77.8	.1449
Another MD sees the patient at 1 yr, %	19.4	0	11.1	.3173
NP/PA sees the patient at 1 yr, %	55.6	44.4	66.7	.3564
RD sees the patient at 1 yr, %	47.2	22.2	44.4	.3312
Has your program implemented changes to increase your 1-yr PRO survey completion rate? Yes, %	83.3	100.0	77.8	.1449
Patient education at baseline, %	16.7	22.2	14.3	.6963
Phone call reminder, %	16.7	33.3	14.3	.3982
Email reminder, %	10.0	33.3	0	.1009
Staff education, %	20.0	22.2	0	.1967
Check who has not completed it, %	10.0	11.1	14.3	.8534
Hand it out at 1-yr visit, %	73.3	44.4	85.7	.1015
Reasons perceived to negatively affect PRO survey completion rate, %				
Do you hand out the 1-yr PRO survey to your patients? Yes, %	80.6	44.4	100.0	.0106
Surgeon hands out the PRO survey to patients, %	3.5	25.0	0	.1336
NP/PA hands out the PRO survey to patients, %	3.5	25.0	0	.1336
RN hands out the PRO survey to patients, %	10.3	0	11.1	.5050
MA hands out the PRO survey to patients, %	48.3	0	55.6	.0679
Clerk hands out the PRO survey to patients, %	44.8	50.0	55.6	.8585
Lack of staff/resources, %	33.3	44.4	11.1	.1250
Lack of surgeon engagement, %	19.4	22.2	11.1	.5388
Patients no longer have ties to our program at 1 yr, %	44.4	33.3	66.7	.1692
Lack of patient interest, %	80.6	77.8	88.9	.5388
Lack of patient phone access, %	13.9	33.3	0	.0652
Length of PRO survey, %	36.1	22.2	33.3	.6091
PRO survey content is too personal and deters patients from completing it, %	8.3	0	22.2	.1449

PRO = patient-reported outcomes; RN = registered nurse; RD = registered dietician; MA = medical assistant; MD = Doctor of Medicine; NP = nurse practitioner; PA = physician assistant.

## Discussion

This is the first multicenter study exploring patient factors and hospital practices that may impact longitudinal PRO collection after bariatric surgery. We found that among 36 hospitals participating in a statewide quality collaborative,

overall rates of PRO survey completion improved during the study period but plateaued at around 50%, and rates varied widely across hospitals. When comparing hospitals by PRO survey completion rate scores, centers in the bottom quartile had higher rates of risk-adjusted 30-day severe complications, reoperations, and ED visits and



Table 4  
Risk-adjusted odds for hospital allocation to top patient-reported outcomes completion quartile

Hospital practice	Odds ratio (95% CI)*	P value
RD obtains baseline PRO survey	.49 (.07–3.65)	.4835
MA obtains baseline PRO survey	3.14 (.69–14.17)	.1370
Surgeon sees patient at 1 yr	.53 (.08–3.47)	.5073
Program formally reminds patients about completing the 1-yr PRO survey	.37 (.09–1.64)	.1930
Program hands out the 1-yr PRO survey to patients	13.60 (1.99–93.03)	.0078
Program has implemented changes to increase 1-yr PRO survey completion rate	.28 (.05–1.56)	.1472
Perceived barrier		
Lack of resources/staff	.36 (.09–1.36)	.1304
Patients no longer have ties with program	1.14 (.28–4.63)	.8529
Lack of patient phone access	.29 (.04–2.04)	.2129
PRO survey content is too personal and deters patients from completing it	4.95 (.45–54.7)	.1920

CI = confidence interval; RD = registered dietician; PRO = patient-reported outcomes; MA = medical assistant.

\* Risk adjusted for patient baseline characteristics and complications.

readmissions, and had a higher proportion of non-White patients compared with hospitals in the top quartile. Among hospital-specific practices, physically handing out the patient survey during the 1-year clinic visit was the only practice independently associated with higher survey completion rates.

Our data show statewide rates leveling at 50% during the last 2 years studied. PRO completion rates vary widely across the surgical literature, making determination of a benchmark frequency difficult. Following breast reconstruction, for example, rates at which 1-year PRO surveys are obtained have been reported to range from 31.3% (Canada) and 46.5% (United States) to 79.9% (Norway) [11–13]. Some of the variation observed in these studies may be attributable to geographic differences, with associated variations in patient populations and health systems. Moreover, geographic differences in PRO completion rates are also observed for orthopedic surgery, with multicenter reports from Sweden and the United States noting completion rates of 91.4% and 34.7%, respectively. Multicenter studies of PRO completion rates after bariatric surgery are lacking, and this metric is often unreported by many single-center studies [8]. Nevertheless, contemporary PRO completion rates following bariatric operations in the United States have been reported to range from 40.6% to 55.0%, with 1 randomized controlled trial reporting a completion rate of 97.0% [3–5,14]. Clearly, geography is just 1 of the variables which may affect PRO survey completion rates; other factors, such as hospital practices, procedure type, patient characteristics, study methodology, and survey-specific practices (i.e., mail, electronic, phone, face-to-face, timing, etc.) may also influence the rates at which PRO surveys are obtained. Interestingly, the bottom

quartile included a significantly higher proportion of academic hospitals. Factors which may explain potential differences in PRO survey completion rates between academic and nonacademic centers may include disparities between the patient population served and organizational variation in processes of care.

Hospitals within the collaborative varied widely regarding their PRO completion rates, affording a unique opportunity to study those hospital-level factors which may influence the frequency at which PRO surveys are acquired. Consistently achieving high PRO completion is challenging despite collaborative-wide centralized practices targeting this metric and may demand additional leadership and strategies by individual hospitals and surgeons. Handing the survey to patients during their 1-year clinic visit was independently associated with higher rates of PRO completion. Redundancy of complementary methods for PRO delivery increases completion rates and has been documented following orthopedic surgery [15,16]. Additionally, surgeons that prioritize completion of PRO with their patients may positively influence the rates at which these data are captured [17]. Though this item did not reach significance between the top and bottom quartiles of PRO completion in our study, only 61.0% of surgeons across the collaborative were perceived to prioritize PRO completion. Strategies aimed at increasing surgeon engagement, therefore, have the potential to positively impact 1-year PRO completion across hospitals. Lack of staff and resources was identified as a barrier to high PRO completion by 33.3% of bariatric program coordinators and was reported 4 times more often in bottom-quartile hospitals. The addition of dedicated personnel, such as research assistants, has been shown to improve PRO completion rates

[18]. Although the Michigan Bariatric Surgery Collaborative coordinating center has an established system for obtaining survey results, 19% of bariatric coordinators identified additional reminders from the treating hospital/physician as a strategy which could improve PRO completion. Other studies suggest that the addition of phone reminders may improve PRO completion [17]. However, implementation of such practices may be costly and even cost-prohibitive for some hospitals. Given the inherent importance of these data for patient care and the growing interest in their collection by public and private insurers, strong partnerships between hospitals and payors targeting hospital incentives and support for achieving high PRO completion rates have great potential.

This study links low PRO completion with higher incidences of risk-adjusted adverse events at 30 days after bariatric surgery, including severe complications, reoperations, readmissions, and ED visits. Interestingly, hospitals in the top quartile showed a trend toward higher operative volume, which could partially account for differences in risk-adjusted 30-day complications; however, this was not statistically significant. At least 1 single-center study ( $n = 209$ ) compared the incidence of ED visits and readmissions between PRO responders ( $n = 88$ ) and nonresponders ( $n = 121$ ) after bariatric surgery. [3] Though no statistical difference was reached, nonresponders trended toward higher rates of readmission (53.3% versus 46.7%, respectively;  $P = .64$ ) and almost doubled the rate of ED visits (62.5% versus 37.5%, respectively;  $P = .31$ ) compared to responders. Others have noted an association between complications after orthopedic surgery and low PRO survey completion at 1 year [19]. The reasons for this association are unclear but may be related to the fact that patients suffering more complications may be less likely to complete the 1-year PRO survey. Furthermore, hospitals with more complications may also struggle with achieving high PRO completion rates due to overall lower institutional performance. Quality improvement initiatives targeting other metrics of perioperative care could therefore secondarily improve PRO completion rates.

Overall, data are limited on which patient factors may influence PRO survey completion. In a study of patients following anterior cruciate ligament reconstruction, the authors found that male gender, higher BMI, infrequent physical exercise, and lack of self-identification as an athlete were all predictors of lower survey completion rates [20]. Notably, our data show that hospitals in the lowest quartile for PRO completion had a significantly higher proportion of non-White patients. Others have also identified non-White race as a risk factor for PRO noncompletion following bariatric and orthopedic surgery [3,19,21]. Language barriers may partially explain this finding, and making PRO surveys available in the patients' spoken language has been shown to

improve PRO completion [17]. This strategy has been recently adopted by our statewide collaborative.

The association between racial and ethnic minorities and lower survey completion is complex and goes beyond just language barriers. Historical mistreatment of underrepresented minorities during medical research may still hinder their participation in contemporary healthcare research [22,23]. Not surprisingly, mistrust is one of the most commonly cited barriers to health research participation across multiple racial and ethnic minority populations [24–26]. Having research staff representative of racial and ethnic minorities may help facilitate participation of minority patients in health research by enhancing rapport and communication [26–28]. Competing demands, such as those of working multiple jobs, being the single head of the household, and primarily caring for children or relatives, may detract patients from racial and ethnic minorities from research participation and may be difficult to capture by standard socioeconomic variables [25,29–31]. Further work is needed to identify the barriers that hinder survey completion after bariatric surgery by patients from racial and ethnic minorities. Subsequently, finding ways to engage non-White patients with follow-up survey completion is critical to ensure that long-term outcome analyses reflect the diversity of patients undergoing bariatric surgery.

Our findings should be interpreted with a few limitations in mind. Our study is retrospective and observational and hence is exposed to the biases associated with such a design. In addition, our data are derived from a single state, which may limit generalizability. However, Michigan is an ethnically and racially diverse state and participating hospitals reflect urban, suburban, and rural areas; the data also include both teaching and nonteaching facilities, both large and small. Furthermore, the questionnaire provided to bariatric program coordinators may not capture all hospital practices for obtaining PRO data. Nevertheless, this survey was designed and refined with input from bariatric program coordinators and leadership within the collaborative to capture key factors which were hypothesized to influence PRO completion. The rate at which patients are physically handed the survey is determined by their attendance at the 1-year clinic visit, which is not captured in our statewide database. Surgeons' and patients' perceptions toward PRO completion rates were not investigated. Consequently, how these perceptions may affect the rate at which PRO surveys are obtained cannot be assessed. Additional studies are needed to evaluate these.

## Conclusions

This multicenter study identified substantial variation in 1-year PRO completion rates after bariatric surgery across hospitals. Hospitals with higher PRO completion rates had

lower rates of 30-day serious complications and resource utilization, suggesting that higher PRO completion rates may correlate with higher-quality perioperative care. Individual hospitals also differed in their practices for obtaining PRO surveys, but only physically handing the survey to patients during their 1-year clinic visit was independently associated with higher PRO survey completion. The development of additional strategies to improve PRO completion rates are needed to understand and optimize the long-term outcomes of bariatric surgery. Particular focus should be placed on ensuring that PRO surveys reflect the racial and ethnic diversity of all patients undergoing surgery. Hospitals and payors should partner with the common goal of achieving higher PRO completion rates.

## Disclosures

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.soard.2020.10.028>.

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