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Safety and factors associated with early discharge in revisional laparoscopic Roux-en-Y gastric bypass: analysis of the MBSAQIP database

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Abstract

Background Improvements in bariatric surgery outcomes have prompted policy initiatives that explore shifting bariatric surgery toward outpatient procedures. While the safety of early discharge after primary laparoscopic Roux-en-Y gastric bypass (LRYGB) has been reported, its safety for revisional LRYGB remains uncertain. Our study aimed to investigate the safety and patient factors associated with early discharge in patients undergoing revisional LRYGB compared with primary LRYGB.

Methods We identified adult patients who underwent primary and revisional LRYGB from 2020 to 2022 in the MBSAQIP database. Patients discharged early, i.e., same-day discharge (SDD) and next-day discharge (NDD) were compared to inpatients. Outcomes included 30-day complications (minor = Clavien–Dindo 1–2; major = Clavien–Dindo 3–4), mortality, readmissions, and reoperations. Multivariable logistic regression models adjusting for patient demographics, comorbidities, and operative time were fitted to assess the study outcomes.

Results SDD rate was similar after primary (3,422/137,406; 2.5%) and revisional LRYGB (781/32,721; 2.4%), while NDD rate was higher in primary LRYGB (59.8% vs 54.7%, respectively; $p < 0.001$). SDD patients had lower odds of major complications compared to inpatients following primary (2% vs 7%, aOR: 0.30, 95%CI 0.24–0.38) and revisional LRYGB (3.7% vs 9.3%, aOR: 0.43, 95%CI 0.29–0.62, respectively). NDD patients had similarly lower odds of morbidity outcomes. ASA Classification IV/V was associated with lower odds of SDD compared to Class I/II (Primary: 0.9% vs. 3%, aOR: 0.61, 95% CI 0.48–0.78; Revisions: 0.9% vs. 3%, aOR: 0.24, 95%CI 0.10–0.55).

Conclusion Early discharge after revisional LRYGB, particularly after an overnight stay, can be accomplished safely in carefully selected patients. However, SDD rates remain low limiting its safety assessment. Further, almost half of the patients stay more than 48 h in the hospital suggesting that policy initiatives toward outpatient management after bariatric surgery may be inappropriate for this patient population.

Keywords Outpatient · Early discharge · Bariatric surgery · Revision surgery · Gastric bypass

There has been a growing trend toward early discharge following minimally invasive surgery [1, 2], particularly following the COVID-19 pandemic [3, 4]. Early discharge, that is same-day discharge (SDD) and discharge on postoperative day 1 (i.e., next-day discharge [NDD]), has been hypothesized to improve healthcare resource utilization and overall patient satisfaction [5, 6]. Early discharge following minimally invasive surgery has also been proven safe in urologic and colorectal surgery [7–9]. In bariatric surgery, the continued improvements in patient outcomes have led to the development of policy initiatives that explore shifting bariatric surgery toward more outpatient procedures.

The safety of outpatient management and early discharge has been investigated in both sleeve gastrectomy and Roux-en-Y gastric bypass (RYGB) with promising results for primary procedures in select patients [10–13]. However, the safety of early discharge for patients undergoing revisional surgery has not been investigated. Revisional surgery may be required for patients with weight regain or inadequate weight loss, gastroesophageal reflux disease, and dysphagia among

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other symptoms [14]. Revision of RYGB has been demonstrated to have higher risks for complications compared to those undergoing primary operations [15–18] and may not lend itself appropriate for early discharge.

Understanding the trends and impact of early discharge on patient outcomes following revisional RYGB will provide valuable insights for policymakers and surgeons to ensure optimal patient care. In this study, we aim to evaluate the frequency of early discharge for patients undergoing primary and revisional laparoscopic RYGB (LRYGB), the safety of early discharge compared to patients with a hospital stay of 2 days or more, and patient factors associated with earlier discharge.

Materials and methods

We utilized the Metabolic and Bariatric Surgery Accreditation Quality Improvement Program (MBSAQIP) participant use data file (PUF). This prospectively collected and managed dataset includes comprehensive 30-day postoperative data on at least 80% of patients from participating institutions. We identified adult patients (≥ 18 years) who underwent laparoscopic Roux-en-Y gastric bypass between January 1, 2020 and December 31, 2022. Patients were included according to common procedural terminology (CPT) code 43,644 for primary LRYGB and revisional LRYGB, including conversions from sleeve gastrectomy. Open and endoscopic procedures, as well as emergent cases, were excluded. Additionally, patients who died before hospital discharge were excluded from the analysis.

Patient demographics were recorded, including age, sex (male, female), race (White, Black or African American (AA), Other, or unknown), and body mass index (BMI). Additionally, patient comorbidities were recorded, including diabetes mellitus, hypertension, tobacco use, obstructive sleep apnea, chronic obstructive pulmonary disease (COPD), chronic steroid or immunosuppressive therapy, as well as the American Society of Anesthesiologists (ASA) classification (I–V), patient functional status (independent, partially, or totally dependent), and operative time.

Patients were categorized according to the day of discharge: (a) same-day discharge (SDD), (b) next-day discharge (NDD) on postoperative day 1 (POD1), or (c) discharge after an inpatient stay of ≥ 2 days (inpatient). 30-day postoperative outcomes, including complications, mortality, readmissions, and reoperations were analyzed. Complications were categorized according to the Clavien–Dindo (CD) classification [19], with grades I and II defined as minor complications and grades III and IV defined as major complications.

Patients with SDD, NDD, and inpatients were compared using a χ^2 test of association for sex, race, comorbidities, ASA class, functional status, and outcomes, while an analysis of variance (ANOVA) was used for age and BMI. A multivariable logistic regression model which included patient demographics, comorbidities, and operative time was used to assess the association of SDD and NDD with clinical outcomes in primary and revisional LRYGB. Possible predictive factors for successful early discharge (SDD or NDD) in LRYGB were similarly examined using the same multivariable logistic regression model. Patients with missing demographic, comorbidity, or 30-day postoperative outcomes data were removed from the analysis. The adjusted odds ratios (aOR), p values, and the corresponding 95% confidence intervals (95% CI) were reported as follows: rate of variable in SDD or NDD cohort vs inpatient cohort, aOR compared to reference group for each variable, and 95% CI.

Statistical analyses were performed using STATA 18 (StataCorp, Texas, USA). Statistical significance was set at a two-sided p value < 0.05. Due to the use of de-identified MBSAQIP patient data only, this study was considered non-human subjects research by the Institutional Review Board of Indiana University.

Results

A total of 170,127 patients underwent LRYGB from 2020 to 2022, with 137,406 (80.8%) undergoing primary procedures and 32,721 (19.2%) undergoing revisional surgery. Rates of SDD were similarly low among primary (2.5%, 3,422 patients) and revisional procedures (2.4%, 781 patients). However, rates of NDD were significantly different between primary and revisional procedures, with 59.8% (82,165 patients) of primary procedures discharged on POD1 compared to 54.7% (17,888 patients) of revisional procedures ($p < 0.001$). Consequently, primary LRYGB had lower rates of inpatients (37.7%, 51,819 patients) compared to revisional LRYGB (42.9%, 14,052 patients; $p < 0.001$). Overall, 99.7% of primary LRYGB patients and 99.6% of revisional LRYGB were discharged home.

We investigated differences in patient characteristics based on discharge day for primary and revisional LRYGB. In primary LRYGB, Black or AA patients had lower rates of SDD (15.9%) and NDD (14%) vs inpatient (18.5%, $p < 0.001$) as shown in Table 1**.** There was also a small but statistically significant difference in patient sex with males having higher rates of NDD (16.8%) when compared to SDD (15.7%) and inpatient (15.9%, $p < 0.001$)**.** Similarly, revisional LRYGB exhibited the same trend for Black or AA patients with lower rates of SDD (24.8%) and NDD (24.6%) compared to inpatient (28.2%, $p < 0.001$); however, there were no significant differences in sex (Table 2)**.**

We compared outcomes between the discharge groups using univariable and multivariable analyses. On univariable

Table 1 Demographics and comorbidities of patients who underwent primary laparoscopic Roux-en-Y gastric bypass categorized by day of discharge

	Same-day discharge $N=3422$	Next-day discharge $N=82,165$	Inpatient $N=51,819$	p value
Mean Age (years)*				
–	44.0 ± 11.4	44.0 ± 11.3	45.2 ± 11.7	**< 0.001**
Race				
White	2439 (71.3%)	58,706 (71.4%)	35,496 (68.5%)	**< 0.001**
Black or African American	545 (15.9%)	11,514 (14.0%)	9594 (18.5%)	
Others or Unknown	438 (12.8%)	11,945 (14.5%)	6729 (13.0%)	
Sex				
Female	2886 (84.3%)	68,340 (83.2%)	43,578 (84.1%)	**< 0.001**
Male	536 (15.7%)	13,825 (16.8%)	8241 (15.9%)	
Mean BMI (kg/m^2)*				
–	44.9 ± 7.3	45.4 ± 7.3	45.7 ± 7.8	**< 0.001**
Smoking status				
Non-smoker	3231 (94.4%)	77,311 (94.1%)	48,740 (94.1%)	0.68
Smoker	191 (5.6%)	4854 (5.9%)	3079 (5.9%)	
Diabetes status				
Non-diabetic	2476 (72.4%)	58,686 (71.4%)	35,078 (67.7%)	**< 0.001**
Diabetic	946 (27.6%)	23,479 (28.6%)	16,741 (32.3%)	
Hypertension				
No	1884 (55.1%)	43,878 (53.4%)	25,372 (49.0%)	**< 0.001**
Yes	1538 (44.9%)	38,287 (46.6%)	26,447 (51.0%)	
Chronic immunosuppression or corticosteroid use				
No	3357 (98.1%)	80,438 (97.9%)	50,518 (97.5%)	**< 0.001**
Yes	65 (1.9%)	1727 (2.1%)	1301 (2.5%)	
Sleep apnea				
No	2216 (64.8%)	47,302 (57.6%)	28,884 (55.7%)	**< 0.001**
Yes	1206 (35.2%)	34,863 (42.4%)	22,935 (44.3%)	
COPD				
No	3392 (99.1%)	81,303 (99.0%)	50,893 (98.2%)	**< 0.001**
Yes	30 (0.9%)	862 (1.0%)	926 (1.8%)	
ASA classification				
Class I & II	669 (19.5%)	12,126 (14.8%)	7605 (14.7%)	**< 0.001**
Class III	2664 (77.8%)	67,120 (81.7%)	42,106 (81.3%)	
Class IV & V	89 (2.6%)	2919 (3.6%)	2108 (4.1%)	
Functional status				
Independent	3413 (99.7%)	81,851 (99.6%)	51,405 (99.2%)	**< 0.001**
Dependent (partially/totally)	9 (0.3%)	314 (0.4%)	414 (0.8%)	

Bold values indicate statistical significance ($p < 0.05$)

BMI body mass index, *COPD* chronic obstructive sleep apnea

*Indicates ANOVA for statistical analysis. Otherwise, χ^2 test was used for comparison

analysis, there was a statistically significant difference in rates of 30-day outcomes for primary and revisional surgery when comparing patients by day of discharge (Fig. 1). Inpatients had higher rates of complications, readmissions, and reoperation for both primary and revisional surgeries. There was a small but statistically significant difference in mortality rates after primary LRYGB with 0.09% in the SDD group, 0.06% in NDD, and 0.11% for inpatients, $p = 0.009$. However, there was no difference in mortality rates following revisional LRYGB which was 0.1% for all groups ($p = 0.92$). After adjusting for demographics, comorbidities, and operation length, patients discharged on SDD and NDD after primary and revisional LRYGB had lower odds of minor and major complications compared to inpatient stays (Table 3). Compared to inpatients, revisional procedures also had lower odds of readmissions when discharged on the same day (4.2% vs. 9%, aOR: 0.52, 95% CI: 0.37–0.74) or the following day (5.6% vs. 9%, aOR: 0.67,

Table 2 Demographics and comorbidities of patients who underwent revisional laparoscopic Roux-en-Y gastric bypass categorized by day of discharge

	Same-day discharge $N=781$	Next-day discharge $N=17,888$	Inpatient $N=14,052$	p value
Mean Age (years)*				
–	46.6 ± 10.6	46.5 ± 10.4	47.6 ± 10.8	**< 0.001**
Race				
White	501 (64.1%)	11,367 (63.5%)	8360 (59.5%)	**< 0.001**
Black or African American	194 (24.8%)	4408 (24.6%)	3960 (28.2%)	
Other/Unknown	86 (11.0%)	2113 (11.8%)	1732 (12.3%)	
Sex				
Female	718 (91.9%)	16,210 (90.6%)	12,742 (90.7%)	0.47
Male	63 (8.1%)	1678 (9.4%)	1310 (9.3%)	
Mean BMI (kg/m^2)*				
–	38.9 ± 7.4	40.0 ± 7.8	39.4 ± 8.4	**< 0.001**
Smoking status				
Non-smoker	740 (94.8%)	17,068 (95.4%)	13,377 (95.2%)	0.5
Smoker	41 (5.2%)	820 (4.6%)	675 (4.8%)	
Diabetes status				
Non-diabetic	678 (86.8%)	15,961 (89.2%)	12,257 (87.2%)	**< 0.001**
Diabetic	103 (13.2%)	1927 (10.8%)	1795 (12.8%)	
Hypertension				
No	492 (63.0%)	11,743 (65.6%)	8775 (62.4%)	**< 0.001**
Yes	289 (37.0%)	6145 (34.4%)	5277 (37.6%)	
Chronic immunosuppression or corticosteroid use				
No	760 (97.3%)	17,415 (97.4%)	13,623 (96.9%)	0.09
Yes	21 (2.7%)	473 (2.6%)	429 (3.1%)	
Sleep apnea				
No	614 (78.6%)	13,926 (77.9%)	10,694 (76.1%)	**< 0.001**
Yes	167 (21.4%)	3962 (22.1%)	3358 (23.9%)	
COPD				
No	768 (98.3%)	17,726 (99.1%)	13,831 (98.4%)	**< 0.001**
Yes	13 (1.7%)	162 (0.9%)	221 (1.6%)	
ASA classification				
Class I & II	262 (33.5%)	4923 (27.5%)	3640 (25.9%)	**< 0.001**
Class III	513 (65.7%)	12,659 (70.8%)	10,072 (71.7%)	
Class IV & V	6 (0.8%)	306 (1.7%)	340 (2.4%)	
Functional status				
Independent	778 (99.6%)	17,820 (99.6%)	13,960 (99.3%)	**0.002**
Dependent (partially/totally)	3 (0.4%)	68 (0.4%)	92 (0.7%)	

Bold values indicate statistical significance ($p < 0.05$)

BMI body mass index, *COPD* chronic obstructive sleep apnea

*Indicates ANOVA for statistical analysis. Otherwise, χ^2 test was used for comparison

95% CI: 0.61–0.73). Similarly, reoperation odds were lower when discharged on the same day (1.7% vs. 4.4%, aOR: 0.43, 95% CI: 0.25–0.76) or the following day (1.8% vs. 4.4%, aOR: 0.46, 95% CI: 0.40–0.53).

Patient factors independently associated with discharge day included patient health status (ASA class), race, and sex. In primary LRYGB, patients with ASA class IV & V were less likely to be discharged on the same day of surgery (0.9% vs. 3%, aOR: 0.61, 95% CI: 0.48–0.78) compared to ASA I & II. Additionally, patients who were Black or AA were less likely to be discharged the next day when compared to White patients (53.2% vs. 60.7%, aOR: 0.76, 95% CI: 0.73–0.78). Black or AA patients also had statistically higher rates of complications compared to White patients in the NDD and inpatient groups, although not in the SDD group. Male patients undergoing primary LRYGB were more likely than female patients to be discharged the same day (2.4% vs. 2.5%, aOR: 1.14, 95%

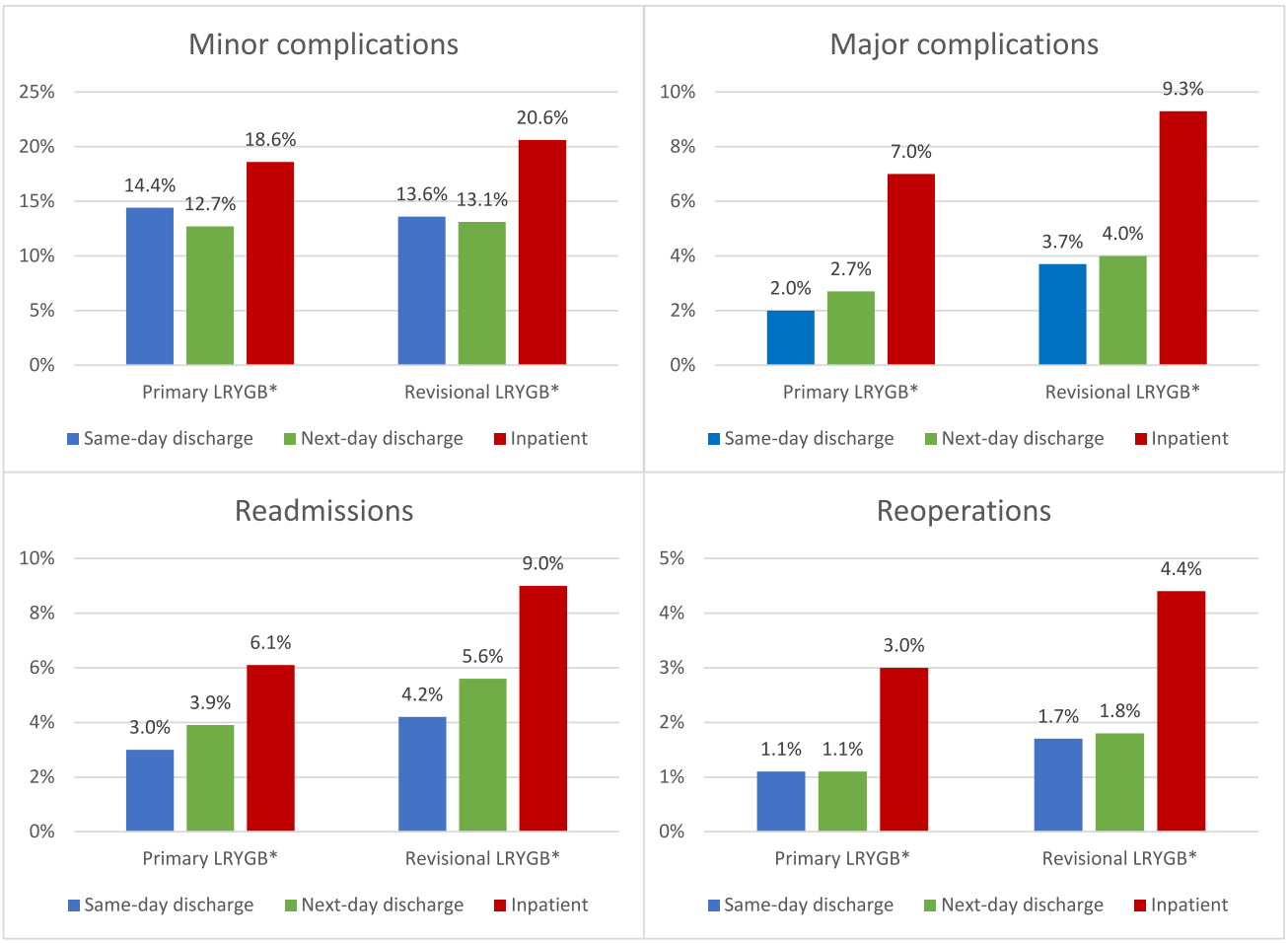

Fig. 1 Rates of 30-day outcomes of patients who underwent primary or revisional laparoscopic Roux-en-Y gastric bypass categorized based on day of discharge. *Difference in rates between discharge day groups was statistically significant ($p < 0.001$). *LRYGB* Laparoscopic Roux-en-Y gastric bypass

CI: 1.04–1.26)—and the next day (61.2% vs. 59.5%, aOR: 1.13, 95% CI 1.10–1.17).

For those undergoing revisional LRYGB, similar factors were independently associated with discharge day. Those who were ASA Class III were less likely to be discharged home the same day (2.2% vs. 3%, aOR: 0.72, 95% CI: 0.60–0.85) or the next day (54.5% vs. 55.8%, aOR: 0.92, 95% CI: 0.87–0.97) in comparison to ASA I & II. Similarly, those with ASA class IV & V had lower odds of SDD (0.9% vs. 3%, aOR: 0.24, 95% CI: 0.10–0.55) and NDD (46.9% vs. 55.8%, aOR: 0.63, 95% CI: 0.53–0.75). As was the case for primary LRYGB patients, Black or AA patients were less likely to have an NDD compared to White patients (51.5% vs. 56.2%, aOR: 0.82, 95% CI: 0.78–0.87).

Discussion

The safety of early discharge has not been previously assessed for revisional laparoscopic Roux-en-Y gastric bypass. In our study, we have found that while SDD is uncommon, about half of the patients are discharged the next day after revisional RYGB. Patients discharged within this timeframe had lower odds of postoperative complications, readmissions, and reoperations compared to inpatients, while mortality did not significantly differ between the groups. Factors associated with SDD and NDD included ASA class and race. Patients with ASA class III–V were less likely to be discharged before the

Table 3 Adjusted odds of postoperative outcomes for primary and revisional laparoscopic Roux-en-Y gastric bypass patients with same-day and next-day discharge compared to inpatients

	Primary LRYGB		Revisional LRYGB	
	Rate (%)	aOR (95% CI)	Rate (%)	aOR (95% CI)
Minor complications				
Inpatient (ref)	18.6	–	20.6	–
Same-day discharge	14.4	0.79 (0.72–0.87)	13.6	0.65 (0.53–0.80)
Next-day discharge	12.7	0.66 (0.64–0.68)	13.1	0.62 (0.58–0.66)
Major complications				
Inpatient (ref)	7.0	–	9.3	–
Same-day discharge	2.0	0.30 (0.24–0.38)	3.7	0.43 (0.29–0.62)
Next-day discharge	2.7	0.39 (0.37–0.41)	4.0	0.45 (0.41–0.49)
Readmissions				
Inpatient (ref)	6.1	–	9.0	–
Same-day discharge	3.0	0.55 (0.45–0.67)	4.2	0.52 (0.37–0.74)
Next-day discharge	3.9	0.67 (0.64–0.71)	5.6	0.67 (0.61–0.73)
Reoperations				
Inpatient (ref)	3.0	–	4.4	–
Same-day discharge	1.1	0.39 (0.28–0.54)	1.7	0.43 (0.25–0.76)
Next-day discharge	1.1	0.37 (0.34–0.40)	1.8	0.46 (0.40–0.53)

LRYGB Laparoscopic Roux-en-Y gastric bypass

second postoperative day. Similarly, Black or AA patients were more likely to stay as inpatients for both primary and revisional procedures.

Rate of NDD following LRYGB has increased to almost 60% from a previously reported rate of 39% between 2015 and 2020 [11]. Similar trends have been described for other bariatric procedures [20, 21]. However, SDD remains rare in patients undergoing LRYGB which likely reflects concerns by bariatric surgeons about patient safety following SDD [22]. Both primary and revisional LRYGB patients with an SDD or NDD had lower odds of minor and major complications, readmissions, and reoperations compared to inpatients. Khorgami et al. similarly reported lower readmission and complication rates in primary RYGB patients discharged on POD1 compared to inpatients using data from the National Surgical Quality Improvement Program [23]. Others reported no difference in outcomes between patients discharged on the same or next day and inpatients for both primary LRYGB and sleeve gastrectomy [11, 24]. It is noteworthy that despite revisional surgeries having higher complication rates than primary procedures, the safety profile of NDD was similar. This likely reflects the selection bias of surgeons who are aware of the case complexity and are more likely to discharge patients earlier if they anticipate a lower risk of complications. Strict criteria applied for SDD may also limit postoperative risks of morbidity [8]. Similar to our findings for mortality after primary RYGB, Bharani et al. report higher mortality in SDD patients undergoing sleeve gastrectomy and argue against standardizing SDD [25].

Further evidence for selection bias in discharge timing is seen in our results that indicate revisional LRYGB patients with a higher ASA classification were less likely to be discharged on the same day or the next day. Higher ASA class has been well documented in the surgical literature to be associated with a higher risk for complications [26] and failure of early discharge [27]. Black or AA patients were also less likely to have an NDD compared to their White counterparts. This disparity may be caused by differences in social determinants of health, such as access to care, language barriers, and support systems upon discharge [22]. Additionally, the higher complication rates reported among Black or AA patients following bariatric surgery could prompt increased caution [28]; however, further studies are needed to understand these disparities.

The Centers for Medicare & Medicaid Services recently proposed a rule to remove bariatric procedures from the inpatient-only list that sparked criticism and discussion in the bariatric surgery community due to safety concerns [29, 30]. Our results suggest that NDD is safe in approximately half of patients after revisional RYGB; however, they also raise significant concerns about SDD given the increased mortality risk observed in that population. Given that half of the patients stay more than 2 days after revisional RYGB, our study also suggests that blanket policies that define the required length of stay after surgery may not be appropriate.

To maximize the success of early patient discharge, protocols to guide surgeons in carefully selecting patients appropriate for early discharge are paramount to ensure patient safety [31]. Community and system resources for outpatient support after discharge must be ensured, such as access to infusion centers, same-day or next-day clinic assessment, and transportation. Further, providing effective

patient education and a safety net such as postoperative communication and remote follow-up platforms leads to early detection of complications that require close monitoring or readmission [32, 33]. Lastly, taking patient perspectives into account can impact the decision-making for discharge and needs to be further evaluated.

This study has several limitations. First, the retrospective nature of this work prevents evaluation of causation. Second, other factors not accounted for may influence SDD or NDD outcomes. For example, surgeon expertise, patient (social and family) support upon discharge, availability of remote patient follow-up, patient proximity to the hospital, insurance status, and other factors that impact decision-making for early discharge are not available in the MBSAQIP database. Third, the data on mortality causes was not universally available and therefore could not be investigated. Nonetheless, this study provides a comprehensive review of the safety and patient outcomes of early discharge following revisional LRYGB.

In conclusion, this study shows that early discharge after revisional LRYGB, particularly after an overnight stay, can be accomplished safely in carefully selected patients. Implementation of standardized discharge criteria that prioritize patient safety, patient distance from the hospital, support systems after discharge, and patient readiness for discharge should be considered for safe early discharge. However, the higher mortality rates seen in same-day discharged patients after primary RYGB raise major concerns about this approach. Further, almost half of the patients stay more than 48 h in the hospital suggesting that policy initiatives toward outpatient management after bariatric surgery may be inappropriate for this patient population.

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Declarations

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