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Changes in bariatric surgery procedure use in Michigan, 2006–2013

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INTRODUCTION

Bariatric surgery is the most effective therapy available for significant and sustainable weight loss in morbidly obese patients.[1,2] As a result of the rising prevalence of obesity, improvements in perioperative safety, and expanded insurance coverage, bariatric surgery utilization has increased in the last decade.[3,4] Changes in procedure use over time reflect emerging evidence regarding the comparative safety and effectiveness of available procedures.[1,2,5] An understanding of current trends in bariatric procedure utilization is essential to primary care physicians counseling morbidly obese patients considering surgical intervention.

Though recent reports have documented increased use of sleeve gastrectomy (SG) in certain populations,[4,6] the extent to which this procedure has supplanted other procedures, such as Roux-en-Y gastric bypass (RYGB) or laparoscopic adjustable gastric banding (LAGB), is poorly understood. Moreover, it is unclear if relative utilization differs within clinical subgroups that might be predicted to have better outcomes with a specific procedure. To better understand current trends in bariatric surgery utilization, we examined procedure rates in patients undergoing bariatric surgery in Michigan between 2006 and 2013.

METHODS

We studied adults undergoing primary inpatient and outpatient bariatric surgery within the 39-hospital Michigan Bariatric Surgery Collaborative (MBSC) between June 2006 and December 2013. Details of prospective data collection have been previously described.[5] In

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Author Contributions: BNR had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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brief, trained data abstractors review the medical record and collect information on patient demographics, comorbidities, intraoperative and perioperative processes, and 30-day outcomes of all patients undergoing bariatric surgery in participating hospitals. Hospitals are audited annually to ensure data accuracy. There is no missing data.

We calculated relative utilization stratified by procedure type and year of procedure, and we examined procedure rates within clinically important subgroups. Cuzick's test for trend was used to assess differences in procedure use across years, and Chi squared was used to evaluate differences in procedure use between subgroups. All p-values are two-tailed, with alpha set at 0.05. Analyses were performed using STATA version 12.1(StataCorp). This study was considered exempt by the Institutional Review Board at the University of Michigan.

RESULTS

The final cohort included 43,732 patients undergoing bariatric surgery. As shown in Figure 1, relative utilization of SG increased 61%, from 6.0%(95%CI:5.4–6.6%) of all procedures in 2008, to 67.3%(95%CI:66.0–68.6%) of all procedures in 2013. During the same period, use of RYGB decreased from 58.0%(95%CI:56.8–59.1%) to 27.4%(95%CI:26.2–28.6), and use of LAGB decreased from 34.5%(95%CI:33.3–35.6%) to 4.6%(95%CI:4.1–5.2).

Changes in utilization over time within clinically important subgroups (Table 1) were similar to the overall trend: use of SG increased, while rates of RYGB and LAGB decreased. While SG was the most common procedure across all subgroups in 2012 and 2013, SG rates were relatively lower in patients 65 years and older [43.0%, 95%CI: 39.4–46.6%vs.57.9%, 95%CI:56.9–58.9% in patients <65 years, P< 0.001], patients with gastroesophageal reflux disease (52.9%, 95%CI:51.9–54.5%vs.60.8%,95%CI:59.5–62.1% without reflux, P<0.001) and patients with type II diabetes (49.1%,95%CI:48.3–51.6% vs.60.4%,95%CI:59.3–61.5% without diabetes, P< 0.001).

DISCUSSION

Analysis of recent practice in Michigan revealed SG to be the most common procedure performed for patients pursuing bariatric surgery, surpassing RYGB in 2012. Moreover, despite controversy regarding the optimal procedure for patients with gastroesophageal reflux disease and type II diabetes,[1] SG has become the predominant procedure in both groups.

This analysis is limited to procedures performed in a single state. While use of this detailed bariatric-specific registry in Michigan allows a more accurate assessment of trends in procedure utilization than administrative data, it may limit the generalizability of our results. Although unmeasured confounders may influence procedure use, this bias is unlikely to alter these findings given the large magnitude of the differences observed.

Although long-term outcomes of SG are still unclear, these changes may reflect the favorable perioperative safety profile and emerging evidence of successful weight-loss at 2 to 3 years after SG.[5] These findings are important to inform primary care physicians of the

predominant procedure used in bariatric surgery today, regardless of preexisting comorbidity, and will assist the preoperative counseling of patients considering surgical therapy for morbid obesity.

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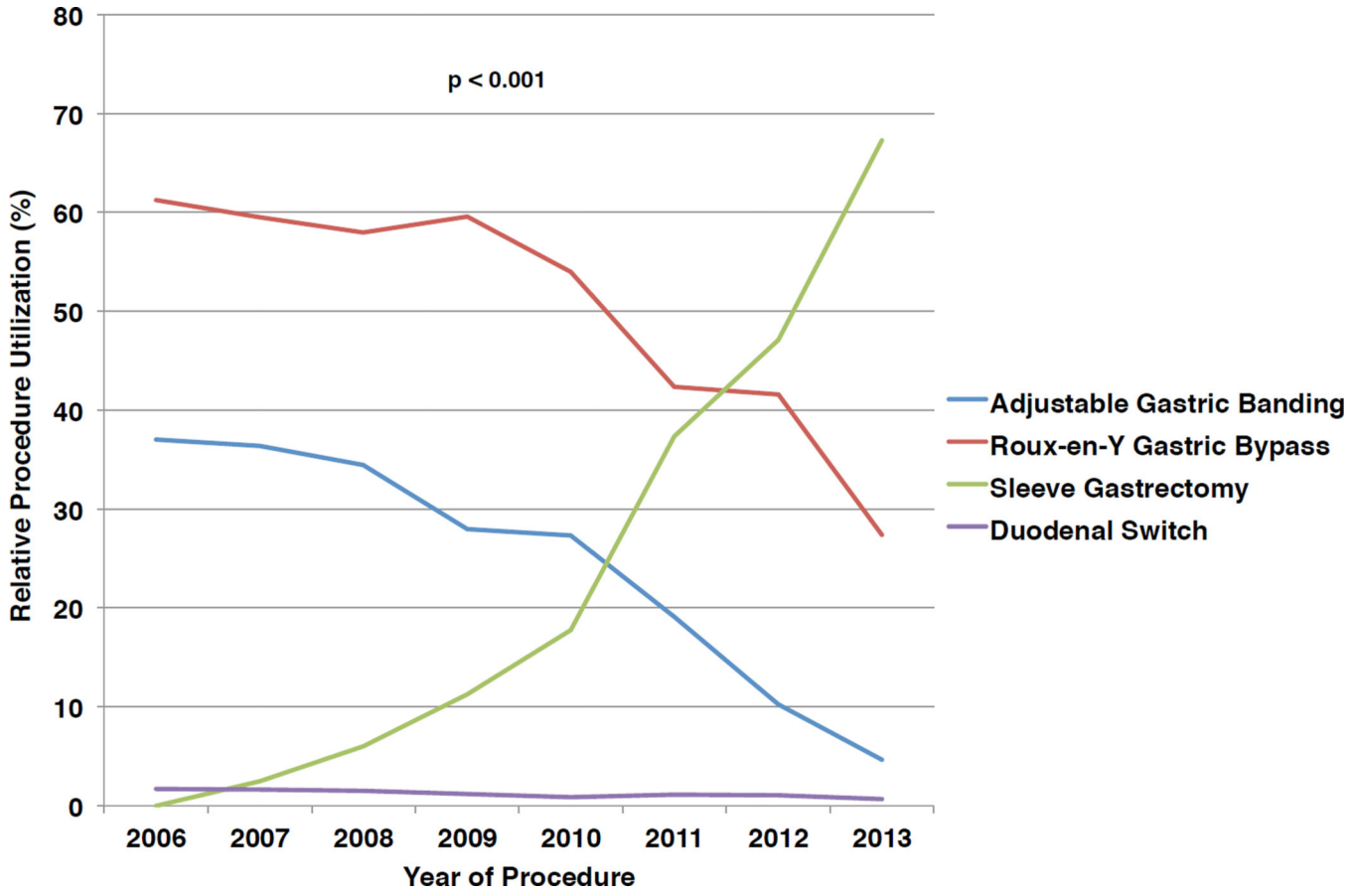

Figure 1.

Relative utilization of common bariatric procedures in Michigan during the period June 2006 to December 2013.

Table 1

Trends in relative procedure utilization of the three most commonly used bariatric procedures during the period June 2006 to December 2013, stratified by clinically important patient subgroups [GERD: Gastroesophageal Reflux Disease; CI: Confidence Interval; values shown are number (percentage) unless otherwise noted; p-values represent Cuzick's test for trend

	2006 – 2007	95% CI	2008 – 2009	95% CI	2010 – 2011	95% CI	2012 – 2013	95% CI	p-value
Total	**5610 (100.0)**		**14,384 (100.0)**		**12,843 (100.0)**		**10,895 (100.0)**		
Adjustable Gastric Banding	2046 (36.5)	35.2 – 37.7	4467 (31.1)	30.3 – 31.8	3006 (23.4)	22.7 – 24.1	820 (7.5)	7.0 – 8.0	
Roux-en-Y Gastric Bypass	3356 (59.8)	58.5 – 61.1	8459 (58.8)	58.0 – 59.6	6222 (48.4)	47.5 – 49.3	3780 (34.7)	33.8 – 35.6	< 0.001
Sleeve Gastrectomy	115 (2.0)	1.7 – 2.4	1265 (8.8)	8.3 – 9.2	3486 (27.1)	26.4 – 27.9	6201 (56.9)	56.0 – 57.8	
Age < 65 years	**5446 (97.1)**		**13,714 (95.3)**		**12,148 (94.6)**		**10,174 (93.4)**		
Adjustable Gastric Banding	1961 (36.0)	34.7 – 37.3	4135 (30.2)	29.4 – 30.9	2766 (22.8)	22.0 – 23.5	723 (7.1)	6.6 – 7.6	
Roux-en-Y Gastric Bypass	3279 (60.2)	58.9 – 61.5	8173 (58.6)	58.8 – 60.4	5821 (47.9)	47.0 – 48.8	3477 (34.2)	33.2 – 35.1	< 0.001
Sleeve Gastrectomy	114 (2.1)	1.7 – 2.5	1213 (8.8)	8.4 – 9.3	3445 (28.4)	27.6 – 29.2	5891 (57.9)	56.9 – 58.9	
Age ≥ 65 years	**164 (2.9)**		**670 (4.7)**		**695 (5.4)**		**721 (6.6)**		
Adjustable Gastric Banding	85 (51.8)	44.2 – 59.5	332 (49.6)	45.8 – 53.3	240 (34.5)	31.0 – 38.1	97 (13.4)	11.0 – 15.9	
Roux-en-Y Gastric Bypass	77 (47.0)	39.2 – 54.6	286 (42.7)	38.9 – 46.4	401 (57.7)	54.0 – 61.4	303 (42.0)	38.4 – 45.6	< 0.001
Sleeve Gastrectomy	1 (0.6)	0 – 1.8	52 (7.8)	5.7 – 9.8	41 (5.9)	4.1 – 7.6	310 (43.0)	39.4 – 46.6	
BMI < 60 kg/m^2	**5088 (90.7)**		**13134 (91.3)**		**11772 (91.7)**		**9965 (91.5)**		
Adjustable Gastric Banding	1969 (38.7)	37.4 – 40.0	4320 (32.9)	32.1 – 33.7	2909 (24.7)	23.9 – 25.5	786 (7.9)	7.3 – 8.4	
Roux-en-Y Gastric Bypass	2944 (57.9)	56.5 – 59.2	7623 (58.0)	57.2 – 58.9	5607 (47.6)	46.7 – 48.5	3395 (34.1)	33.1 – 35.0	< 0.001
Sleeve Gastrectomy	96 (1.9)	1.5 – 2.3	1027 (7.8)	7.4 – 8.3	3144 (26.7)	25.9 – 27.5	5706 (57.3)	56.3 – 58.2	
BMI ≥ 60 kg/m^2	**522 (9.3)**		**1250 (8.7)**		**1071 (8.3)**		**930 (8.5)**		
Adjustable Gastric Banding	77 (14.8)	11.7 – 17.8	147 (11.8)	10.0 – 13.5	97 (9.1)	7.3 – 10.8	34 (3.7)	2.4 – 4.9	
Roux-en-Y Gastric Bypass	412 (78.9)	75.4 – 82.4	836 (66.9)	64.3 – 69.5	615 (57.4)	54.4 – 60.4	385 (41.4)	38.2 – 44.6	< 0.001
Sleeve Gastrectomy	19 (3.6)	2.0 – 5.2	238 (19.0)	16.9 – 21.2	342 (31.9)	29.1 – 34.7	495 (53.2)	50.0 – 56.4	
GERD	**2754 (49.1)**		**6874 (47.8)**		**6422 (50.0)**		**5552 (51.0)**		
Adjustable Gastric Banding	975 (35.4)	33.6 – 37.2	2023 (29.4)	28.4 – 30.5	1556 (24.2)	23.2 – 25.3	461 (8.3)	7.6 – 9.0	
Roux-en-Y Gastric Bypass	1662 (60.4)	58.5 – 62.2	4171 (60.7)	59.5 – 61.8	3249 (50.6)	49.4 – 51.8	2096 (37.8)	49.3 – 51.8	< 0.001
Sleeve Gastrectomy	45 (1.63)	1.2 – 2.1	553 (8.0)	7.4 – 8.7	1558 (24.3)	23.2 – 25.3	2953 (53.2)	51.9 – 54.5	

	2006 – 2007	95% CI	2008 – 2009	95% CI	2010 – 2011	95% CI	2012 – 2013	95% CI	p-value
No GERD	**2856 (50.9)**		**7510 (52.2)**		**6421 (50.0)**		**5343 (49.0)**		
Adjustable Gastric Banding	1071 (37.5)	35.7 – 39.3	2444 (32.5)	31.5 – 33.6	1450 (22.6)	21.6 – 23.6	359 (6.7)	6.0 – 7.4	
Roux-en-Y Gastric Bypass	1694 (59.3)	57.5 – 61.1	4288 (57.1)	56.0 – 58.2	2973 (46.3)	45.1 – 47.5	1684 (31.5)	30.3 – 32.8	< 0.001
Sleeve Gastrectomy	70 (2.4)	1.9 – 3.0	712 (9.5)	8.8 – 10.1	1928 (30.0)	28.9 – 31.1	3248 (60.8)	59.4 – 62.1	
Type II Diabetes	**1720 (30.6)**		**4721 (32.8)**		**4202 (32.7)**		**3625 (33.3)**		
Adjustable Gastric Banding	552 (32.1)	29.9 – 34.3	1276 (27.0)	25.8 – 28.3	854 (20.3)	19.1 – 21.5	222 (6.1)	5.3 – 6.9	
Roux-en-Y Gastric Bypass	1110 (64.5)	62.3 – 66.8	2955 (62.6)	61.2 – 64.0	2304 (54.8)	53.3 – 56.3	1563 (43.1)	41.5 – 44.7	< 0.001
Sleeve Gastrectomy	32 (1.9)	1.2 – 2.5	428 (9.1)	8.2 – 9.9	996 (23.7)	22.4 – 25.0	1810 (49.9)	48.3 – 51.6	
No Type II Diabetes	**3890 (69.4)**		**9663 (67.2)**		**8641 (67.3)**		**7270 (66.7)**		
Adjustable Gastric Banding	1494 (38.4)	36.9 – 39.9	3191 (33.0)	32.1 – 34.0	2152 (24.9)	24.0 – 25.8	598 (8.2)	7.6 – 8.8	
Roux-en-Y Gastric Bypass	2246 (57.7)	56.2 – 59.3	5504 (57.0)	56.0 – 57.9	3918 (45.3)	44.3 – 46.4	2217 (30.5)	29.4 – 31.6	< 0.001
Sleeve Gastrectomy	83 (2.1)	1.7 – 2.6	837 (8.7)	8.1 – 9.2	2490 (28.8)	27.9 – 29.8	4391 (60.4)	59.3 – 61.5	