



ELSEVIER

Surgery for Obesity and Related Diseases ■ (2018) 00–00

SURGERY FOR OBESITY
AND RELATED DISEASES

Original article

American Society for Metabolic and Bariatric Surgery estimation of metabolic and bariatric procedures performed in the United States in 2016

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Received December 11, 2017; accepted December 13, 2017

Abstract

Background: Bariatric surgery, despite being the most successful long-lasting treatment for morbid obesity, remains underused as only approximately 1% of all patients who qualify for surgery actually undergo surgery. To determine if patients in need are receiving appropriate therapy, the American Society for Metabolic and Bariatric Surgery created a Numbers Taskforce to specify annual rate of use for obesity treatment interventions.

Objectives: The objective of this study was to determine metabolic and bariatric procedure trends since 2011 and to provide the best estimate of the number of procedures performed in the United States in 2016.

Setting: United States.

Methods: We reviewed data from the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program, National Surgical Quality Improvement Program, Bariatric Outcomes Longitudinal Database, and Nationwide Inpatient Sample. In addition, data from industry and outpatient centers were used to estimate outpatient center activity. Data from 2016 were compared with the previous 5 years of data.

Results: Compared with 2015, the total number of metabolic and bariatric procedures performed in 2016 increased from approximately 196,000 to 216,000. The sleeve gastrectomy trend is increasing, and it continues to be the most common procedure. The gastric bypass and gastric band trends continued to decrease as seen in previous years. The percentage of revision procedures and biliopancreatic diversion with duodenal switch procedures increased slightly. Finally, intragastric balloons placement emerged as a significant contributor to the cumulative total number of procedures performed.

Conclusions: There is increasing use of metabolic and bariatric procedures performed in the United States from 2011 to 2016, with a nearly 10% increase noted from 2015 to 2016. (Surg Obes Relat Dis 2018;■:00–00.) © 2018 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords:

Bariatric surgery; Procedure trends; Bariatric surgery procedure trends; Numbers task force; Estimated numbers; 2016

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<https://doi.org/10.1016/j.soard.2017.12.013>

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The obesity rate has alarmingly increased over the past 5 decades, from 13.4% in 1962 to 36.4% in 2014. Currently, over 98.7 million U.S. residents are affected.

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Medical costs for treatment of co-morbidities associated with obesity, ranging from diabetes to Alzheimer's disease, has become quite substantial as well. In 2014, the direct medical expenses associated with treating obesity and its co-morbidities accounted for 14.3% of U.S. healthcare spending, and the indirect costs related to obesity due to loss of employee output were estimated to exceed \$988 billion. When adding the indirect costs of obesity, the overall economic impact is calculated to be \$1.42 trillion, which is equivalent to 8.2% of the U.S. gross domestic product in 2014 and over twice what is spent on national defense [1].

Bariatric surgery, as the only successful and durable long-term treatment for obesity, remains underused in treating the obesity epidemic in the United States and surgery is used as a treatment option by approximately 1% of all patients who qualify as candidates for metabolic and bariatric surgery [2,3]. To determine if patients in need are receiving appropriate therapy, the American Society for Metabolic and Bariatric Surgery (ASMBS) created a Numbers Taskforce to specify annual rate of utilization for obesity treatment interventions.

Here, the ASMBS Numbers Taskforce is reporting the 2016 estimate of the number of metabolic and bariatric surgery procedures performed in the United States. This report provides the best approximation using the methodology described in the following.

Methods

A comprehensive review of the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database was completed, which included 100% of the primary and revisional metabolic and bariatric procedures performed within metabolic and bariatric surgery centers that are accredited by MBSAQIP.

In addition, a comprehensive review of the National Surgical Quality Improvement Program (NSQIP) database was also performed, which included 100% of the primary and revisional metabolic and bariatric procedures performed within non-MBSAQIP-accredited metabolic and bariatric surgery centers. A major limitation of using data from NSQIP is that participating centers are only required to report at least 20% of surgical cases, which includes metabolic and bariatric procedures. Underreporting at these centers is expected; however, some centers may report up to 100% of all metabolic and bariatric surgery procedures.

A review of other national registries was also undertaken, including the Bariatric Outcomes Longitudinal Database (BOLD) and Nationwide Inpatient Sample (NIS). A limitation of using the NIS database is that it does not record outpatient metabolic and bariatric procedures or track patients longitudinally.

To capture outpatient procedures performed at centers that do not submit data to MBSAQIP, NSQIP, or BOLD,

device companies were surveyed to obtain the total number of gastric bands and intragastric balloons sold in 2016; however, estimates were made to deduct devices purchased but not used. Large outpatient centers performing stapling procedures, mainly laparoscopic sleeve gastrectomies, were also queried to help account for outpatient procedures performed outside of MBSAQIP.

MBSAQIP and BOLD data were considered accredited centers for purposes of this assessment. Data from NIS and NSQIP were used to estimate nonaccredited inpatient center activity. Data from industry and outpatient centers were used to estimate outpatient center activity. A 5% reduction in the overall number was applied to account for devices purchased, but not used, in keeping with supply chain industry standards.

When considering procedures performed, primary procedure categories were sleeve gastrectomy, Roux-en-Y gastric bypass, gastric banding, biliopancreatic diversion with duodenal switch, and gastric balloons. Revisions and conversions included procedures in which primary procedures were previously performed and included gastric band removals. The "Other" procedure category included, but was not limited to, gastric plication, single-anastomosis gastric bypass, vertical-banded gastroplasty, endoscopic therapies (not including gastric balloons), unlisted procedures, and other investigational procedures.

Results

Compared with 2015, the total number of bariatric procedures performed in 2016 increased from approximately 196,000 to 216,000. The overall estimated number of metabolic and bariatric procedures for 2016, as well as the trend and percentage breakdown from 2011 to 2016, is listed in Fig 1 and Tables 1 and 2 [3,4].

The sleeve gastrectomy continues to be the most common procedure, comprising 58.1% of all procedures in 2016. An 18.8% increase was noted from 2015 (105,448 to 125,318),

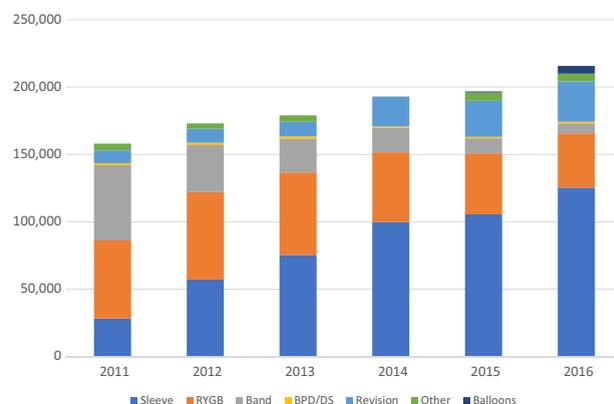


Fig 1. Metabolic and bariatric surgery procedure trend, 2011–2016.

RYGB = Roux-en-Y gastric bypass; BPD/DS = biliopancreatic diversion with duodenal switch.

Table 1
Percentage breakdown of metabolic and bariatric procedures, 2011–2016

	2011	2012	2013	2014	2015	2016
Total	158,000	173,000	179,000	193,000	196,000	216,000
RYGB	36.7%	37.5%	34.2%	26.8%	23.1%	18.7%
Band	35.4%	20.2%	14%	9.5%	5.7%	3.4%
Sleeve	17.8%	33%	42.1%	51.7%	53.8%	58.1%
BPD/DS	.9%	1%	1%	.4%	.6%	0.6%
Revisions	6%	6%	6%	11.5%	13.6%	13.9%
Other	3.2%	2.3%	2.7%	.1%	3.2%	6.9%
Balloons					<.3%	2.7%

RYGB = Roux-en-Y gastric bypass; BPD/DS = biliopancreatic diversion with duodenal switch.

but even more striking was the observed growth trend of >346% since 2011.

The gastric bypass and gastric band trends continued to decrease, as seen in previous years. The number of gastric bypass procedures comprised 18.7% of all procedures, declining 11% from 45,276 in 2015 to 40,316 in 2016. The percentage of gastric bypass procedures decreased 30.5% since 2011. The number of gastric band procedures was only 3.4% of all procedures performed, declining 34.6% from 11,172 in 2015 to 7310 in 2016. An 87% decrease was observed since 2011, further reinforcing the fact that gastric banding is increasingly losing popularity in the United States.

The percentage of revision procedures increased slightly, from 13.6% to 13.9%. The number of revision procedures performed increased 12.8% from 26,656 in 2015 to 30,077 in 2016, with an observed 217% increase since 2011.

The percentage of biliopancreatic diversion with duodenal switch procedures slightly increased from .4% to .6%. The number of procedures increased 5.1%, with 1236 in 2016 compared with 1176 in 2015. However, an overall decrease of 13.1% is noted since 2011.

For the first time, gastric balloons made a significant contribution to the aggregate procedure number. An estimated 5744 balloons were placed, representing 2.7% of all procedures.

Table 2
Number of metabolic and bariatric procedures, 2011–2016

	2011	2012	2013	2014	2015	2016
Total	158,000	173,000	179,000	193,000	196,000	215,666
RYGB	57,986	64,875	61,218	51,724	45,276	40,316
Band	55,932	34,946	25,060	18,335	11,172	7310
Sleeve	28,124	57,090	75,359	99,781	105,448	125,318
BPD/DS	1422	1730	1790	772	1176	1236
Revisions	9480	10,380	10,740	22,195	26,656	30,077
Other	5056	3979	4833	193	6272	5665
Balloons					700	5744

RYGB = Roux-en-Y gastric bypass; BPD/DS: = biliopancreatic diversion with duodenal switch.

Table 3
Number of metabolic and bariatric procedures performed at MBSAQIP centers in the United States

Procedure	2015	2016
Laparoscopic sleeve gastrectomy	93,379	107,321
Open sleeve gastrectomy	-	22
Laparoscopic gastric bypass	41,559	38,966
Open gastric bypass	-	409
Revision/conversion	24,627	29,003
Laparoscopic gastric banding	4447	2866
BPD/DS	1026	1187
Gastric balloon	-	1003
Other	5985	5113
Total	171,023	185,890

MBSAQIP = Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program; BPD/DS = biliopancreatic diversion with duodenal switch.

Procedures performed at accredited centers

MBSAQIP. In 2016, 86.2% of all procedures in this estimation, or 185,890 procedures, were performed at MBSAQIP-accredited centers. This is an increase of 8.7% compared with 171,023 procedures in 2015 (Table 3).

During the 2016 calendar year, 795 centers reported data in the MBSAQIP registry. Seventy-two centers became newly accredited, submitting data on 8688 procedures.

Canadian MBSAQIP centers were not included in this analysis. If these procedures were included in the aggregate number, an estimate of up to 218,000 metabolic and bariatric procedures were performed in the United States and Canada. The majority of procedures (74%) being performed at Canadian MBSAQIP centers were Roux-en-Y gastric bypass (Table 4).

BOLD. A total of 18 centers were contributing data to BOLD at the time of this assessment. Nine centers were dual entry programs, entering data into MBSAQIP and BOLD, and were not included in the BOLD number estimate. The remaining 9 centers were included in the estimate as BOLD-only programs.

Procedures performed at nonaccredited centers

NSQIP. Data from NSQIP centers not participating in MBSAQIP were obtained from the American College of Surgeons. A total of 5125 procedures were performed, with the sleeve gastrectomy representing 80% of all cases being performed at these centers (Table 5).

Of 174 NSQIP centers not participating in MBSAQIP but performing metabolic and bariatric surgery, only 57 (32.8%) reported at least 25 procedures and 34 centers reported only 1 procedure in 2016 (range, 1–288). This lower volume per NSQIP/non-MBSAQIP centers may be due to centers not meeting MBSAQIP volume standards. The procedure number provided by the American College of Surgeons was used as a conservative estimate for the NSQIP data, which were not extrapolated to account for the

Table 4
Number of procedures performed at Canadian centers participating in MBSAQIP

Procedure	N	%
Laparoscopic sleeve gastrectomy	214	12
Laparoscopic gastric bypass	1305	74
Revision/conversion	150	8
Laparoscopic gastric banding	1	.05
BPD/DS	0	0
Gastric balloon	0	0
Other	104	6
Total	1774	100

MBSAQIP = Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program; BPD/DS = biliopancreatic diversion with duodenal switch.

potential reporting differences. Therefore, the true number of procedures performed at NSQIP centers that are not participating in MBSAQIP may be higher than estimated in this report.

NIS. Review of NIS data determined that 8% of inpatient centers performing metabolic and bariatric surgery were nonaccredited. This number was used to estimate the number of procedures performed in nonaccredited inpatient centers. In 2015, an estimated 15,680 procedures were performed at nonaccredited inpatient centers. As noted earlier, MBSAQIP added 72 newly accredited centers in 2016, accounting for 8688 procedures. Subtracting these procedures from the 2015 estimates results in a decreased number of cases performed in inpatient nonaccredited facilities in 2016 by more than half (8% to 3.6%). When taking into account the aggregate numbers, an estimated 7500 procedures were performed in nonaccredited inpatient centers in 2016. Because NSQIP data already demonstrated 5251 procedures, it was estimated that 2250 procedures were performed at other nonaccredited centers.

Outpatient procedure estimate

Bands and balloons. Industry estimates determined approximately 7500 gastric bands were sold in the United

Table 5
Number of metabolic and bariatric procedures performed at NSQIP centers not participating in MBSAQIP

Procedure	N	% of all cases
Sleeve	4204	80.00
Gastric bypass	102	1.93
Revision/conversion	631	12.02
Gastric band	69	1.31
BPD/DS	35	.66
Gastric balloon	-	-
Other	210	3.99
Total	5251	100

NSQIP = National Surgical Quality Improvement Program; MBSAQIP = Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program; BPD/DS = biliopancreatic diversion with duodenal switch.

States in 2016. It was estimated that 4259 gastric bandings were performed at outpatient centers when considering the number of bandings performed at accredited centers were already included in the overall estimate.

Industry estimates for placed gastric balloons were approximately 6000 for 2016. Accredited centers performed 1035 procedures; therefore, it was estimated that 4709 balloons were inserted in outpatient centers in 2016.

Stapling procedures. Sleeve gastrectomy is the primary stapling procedure being performed at outpatient ambulatory surgery centers. In 2015, an estimated 4000 stapling procedures were performed at outpatient centers. A more accurate number is difficult to obtain as many outpatient centers do not participate in MBSAQIP and do not enter data into a registry. Therefore, surveys of known large outpatient centers were performed. One center alone performed approximately 2000 procedures in 2016. The ASMBS Numbers Taskforce members feel that a very conservative estimated number of 10,000 outpatient stapling procedures is appropriate for the purpose of this analysis, based on prior sampling of ambulatory centers not reporting to MBSAQIP.

Discussion

This paper represents the best estimate of metabolic and bariatric procedures performed in the United States. Trends over time demonstrate a significant increase in usage of procedures, with a decided uptake in 2016. The determinants of this increase are likely multifactorial, including specialty society outreach, such as the ASMBS National Collaborative Care Summit, influential papers citing level 1 evidence, and raising awareness through media [5–7]. Of note, patients and referring physicians appear to be placing a premium on safety and ease of procedures (rapid rise in sleeves and balloons). This preference for safety was well expressed by the National Opinion Research Center survey commissioned by ASMBS last year [8]. Other factors likely influencing growth of procedures remain access to care; coverage for obesity treatment is far from universal [9]. Also, there has been a steady rise in revisional procedures, underscoring the chronic disease aspect of obesity with variable outcome response to interventions [10]. In addition, ambulatory and, in particular, endoscopic procedures are likely underestimated here due to the lack of reporting requirements for these interventions in those settings. All of these data are difficult to obtain and help underscore the significant utility of MBSAQIP as a clinical registry.

Conclusions

There has been a 9.6% increase in the number of metabolic and bariatric procedures performed in 2016 compared with 2015, with an overall increase of 36.5% since 2011. The sleeve gastrectomy continues to be the

most common procedure performed in the United States. The number of gastric banding procedures performed annually continues to decline precipitously, as do the number of gastric bypass procedures. Revisional bariatric procedures continue to increase, comprising approximately 1 of every 7 procedures currently. Revisions, including conversions from one procedure to another for various indications, may soon exceed the number of primary gastric bypass procedures done in the United States. The trend for gastric balloon remains to be seen but is anticipated to increase sharply.

The growing number of revision procedures suggests a need to develop better evidence-driven algorithms for matching patients to optimal procedure and a critical need to further categorize which revision strategies work best in various situations to optimize bariatric and metabolic surgery outcomes while minimizing the need for reoperations in the future.

Disclosures

The authors have no commercial or financial interests that would pertain to the content of the article.

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