

ASMBS Guidelines/Statements

American Society for Metabolic and Bariatric Surgery 2022 estimate of metabolic and bariatric procedures performed in the United States

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Abstract

Background: Metabolic and bariatric surgery (MBS), despite being the most effective durable treatment for obesity, remains underused as approximately 1% of all qualified patients undergo surgery. The American Society for Metabolic and Bariatric Surgery established a Numbers Taskforce to specify the annual rate of obesity treatment interventions utilization and to determine if patients in need are receiving appropriate treatment.

Objective: To provide the best estimated number of metabolic and bariatric procedures being performed in the United States in 2022.

Setting: United States.

Methods: We reviewed data from the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program and National Surgical Quality Improvement Program. In addition, data from industry and state databases were used to estimate activity at non-accredited centers. Data from 2022 were compared mainly with data from the previous 2 years.

Results: Compared with 2021, the total number of MBS performed in 2022 increased from approximately 262,893 to 280,000. The sleeve gastrectomy (SG) continues to be the most commonly performed procedure. The gastric bypass procedure trend remained relatively stable. The percentage of revision procedures and biliopancreatic diversion with duodenal switch procedures increased slightly. Intra-gastric balloon placement increased from the previous year. Endoscopic sleeve gastroplasty increased in numbers.

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Conclusions: There was a 6.5% increase in MBS volume from 2021 to 2022 and a 41% increase from 2020, which demonstrates a recovery from the COVID-19 pandemic. SG continues to be the most dominant MBS procedure. (*Surg Obes Relat Dis* 2024;20:425–431.) © 2024 American Society for Metabolic and Bariatric Surgery. Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Keywords: Bariatric surgery; Procedure trends; Numbers task force; Estimated numbers; 2022

The adult obesity rate in the United States increased from 13.4% in 1962 to 42.4% in 2018, an increase of approximately 200%, and currently affects more than 108 million adults aged ≥ 20 years in the United States. The percentage of patients with a body mass index >40 kg/m² is approximately 9.2%, or 20 million adults aged ≥ 20 [1]. As a result, the economic impact of treating medical conditions associated with obesity has risen significantly. It has been demonstrated that patients with obesity, compared with patients who do not suffer from obesity, experience increases in annual healthcare costs of 36% and medication costs of 77% [2]. Additionally, obesity, as a risk factor, is by far the greatest contributor to the burden of chronic diseases in the United States, accounting for 47.1% of the total cost of chronic diseases nationwide. Subsequently, the overall economic burden of obesity is calculated to be \$1.72 trillion, which is equivalent to 9.3% of the U.S. gross domestic product [2].

Metabolic and bariatric surgery (MBS) is the most effective and durable treatment for obesity; however, MBS remains underused in treating the obesity epidemic in the United States. Based on the previous American Society for Metabolic and Bariatric Surgery (ASMBS) Task Force estimates, surgery as a treatment option is used by approximately 1% of all patients who qualify as candidates for MBS [3]. Therefore, the ASMBS Numbers Taskforce has been charged with specifying the annual rate of utilization for obesity treatment interventions.

In March 2020, the COVID-19 pandemic stopped all elective surgeries across the United States [4]. There was a severe decline in the number of MBS cases, as was demonstrated by the last Task Force Estimate [5]. In fact, there was a decrease of 22.5% from 2019 to 2020. Nevertheless, there was a trend toward a return to normal case volume in the third and fourth quarters of 2020. This trend continues to the present time.

Here, the ASMBS Numbers Taskforce is reporting the biennial 2022 estimate of the number of MBS 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. This included 100% of the primary and revisional MBS procedures performed within the 924 metabolic and bariatric surgery centers accredited by MBSAQIP in 2022.

To capture outpatient procedures performed at centers that do not submit data to MBSAQIP, relevant medical device companies were surveyed to obtain the total number of gastric bands, intragastric balloons and endoscopic suturing devices sold in 2021 and 2022. However, estimates were made to determine devices purchased, but not used. Furthermore, data from the State of Texas Inpatient and Outpatient Public Use Data File were applied to the estimate for procedures being performed outside of MBSAQIP, and to estimate the nationwide numbers of cases not reported to the MBSAQIP [6,7]. For the first time, we have also included the California Department of Health Care Access and Information to refine our estimate [8]. MBSAQIP data were considered to originate from accredited centers for the purposes of this assessment. A 5% reduction in the overall number was applied to account for devices purchased but not used, in keeping with supply chain industry standards.

In the past, the National Surgical Quality Improvement Program (NSQIP) database was included, with primary metabolic and bariatric procedures performed within non-MBSAQIP-accredited MBS centers. However, a major limitation of using NSQIP data is that participating centers are only required to report a minimum of 20% of surgical cases, only a portion of which are metabolic and bariatric procedures. There were also only 1445 cases reported in the last estimate [5]. Given these factors, the NSQIP numbers were not included this year as they make up less than .5% of reported cases. The Bariatric Outcomes Longitudinal Database (BOLD) was also not included this year for the same reasons.

Primary surgical procedure categories were sleeve gastrectomy (SG), Roux-en-Y gastric bypass (RYGB), adjustable gastric banding (AGB), biliopancreatic diversion with duodenal switch (BPD-DS), single-anastomosis duodeno-ileostomy with sleeve gastrectomy (SADI-S), one-anastomosis gastric bypass (OAGB), endoscopic sleeve gastroplasties (ESG), and intragastric balloon (IGB). Revisions and conversions included procedures in which primary surgeries were previously performed, including gastric band removal, gastric bypass reversal, perforated marginal ulcer repair, and internal hernia correction. The “other” procedure

category included, but was not limited to, gastric plication, vertical-banded gastroplasty, vagal blockade, endoscopic therapies (not including gastric balloons), unlisted procedures, and other investigational procedures.

Results

Overall volume

In 2022, compared with 2021, the total number of bariatric procedures increased by almost 6.5% from 262,893 to 280,000. The overall estimated number of metabolic and bariatric procedures for 2022, as well as the trend and procedure breakdown from 2011 to 2022 is listed in Figs. 1 and 2 and Tables 1 and 2.

The SG continues to be the most common procedure, comprising 57.4% of all procedures in 2022. This has remained consistent over the past 10 years with the SG being the dominant procedure since 2013.

After a decline of the numbers of RYGB procedures to 17% in 2018, the RYGB has now increased to 22.2% of total surgical volume in 2022.

The AGB trend has remained relatively stable as seen in previous years. The number of gastric band procedures was only .9% of all procedures performed in 2022. There were 968 reported in the MBSAQIP database but industry estimates that 2500 AGB were placed overall. This was unable to be validated externally.

The percentage of revision procedures stayed relatively stable at 11% of total cases in 2022, with approximately

30,894 revisional procedures being performed. These numbers are comparable to those in 2021, which represented 11.8%.

The percentage of BPD +/- DS procedures in 2022 was 2.2%, from 2.1% in 2021, with 6096 cases. The SADI-S had 1567 cases in 2022 and the OAGB had 1057, which was slightly down from 1149 in 2021.

Intragastric balloon placements were once again reported in the MBSAQIP with 440 cases in 2022. This included placement and removals. According to industry estimates, a total of 4358 IGB were placed in 2022.

When considering primary procedures including the SG, RYGB, AGB and BPD +/- DS, SADI-S, and OAGB, there were 233,926 cases. SG was performed 65.7% of the time, RYGB 26.5%, AGB 1% and BPD +/- DS 2.6%, SADI-S .7%, and OAGB .5% (Table 3).

For the first time, the number of robot-assisted cases were reported. The number of robot-assisted MBS cases in 2022 was 69,751, or 30% of the total. In 2021 it was 23% of the total.

MBSAQIP

In 2022, a total of 230,707 procedures, or approximately 83% of all procedures, were performed at MBSAQIP-accredited centers (Table 4). During the 2022 calendar year, 924 centers reported data in the MBSAQIP registry, a 9.8% increase from 902 centers in 2021. Canadian and International centers also participate in MBSAQIP but were not included in this analysis.

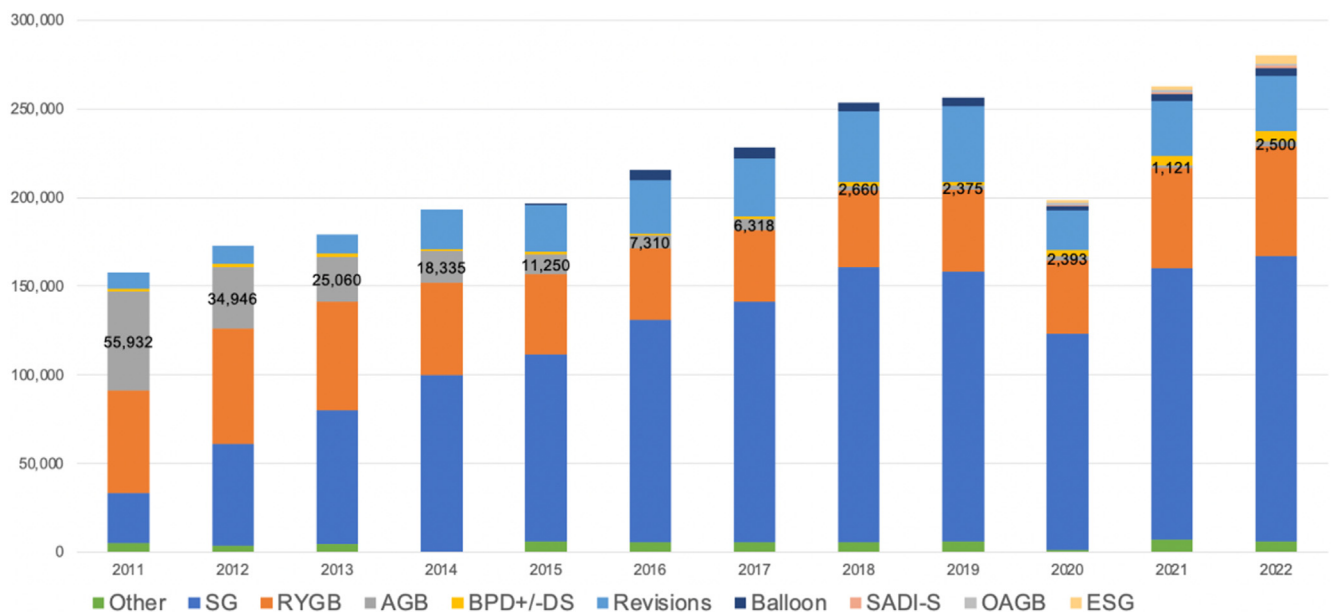


Fig. 1. Metabolic and bariatric surgery procedure trends: 2011–2022. AGB = adjustable gastric band; BPD-DS = biliopancreatic diversion with duodenal switch; ESG = endoscopic sleeve gastroplasty; OAGB = one-anastomosis gastric bypass; RYGB = Roux-en-Y gastric bypass; SADI-S = single-anastomosis duodeno-ileostomy with sleeve; SG = sleeve gastrectomy.

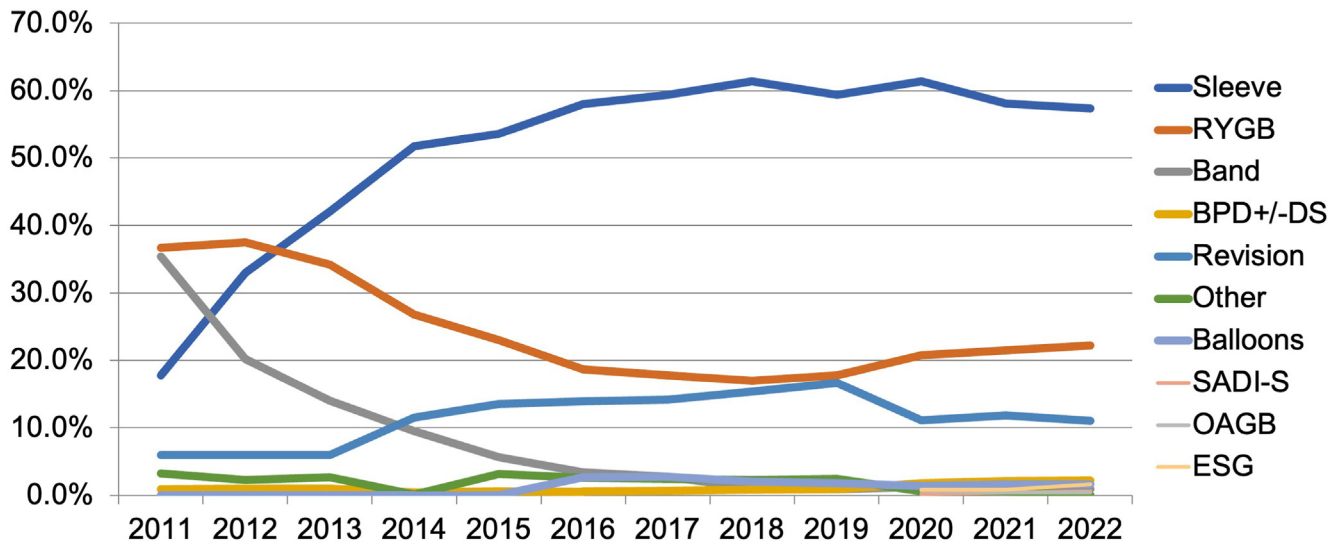


Fig. 2. Metabolic and bariatric surgery procedure percentage trends: 2011–2022. AGB = adjustable gastric band; BPD-DS = biliopancreatic diversion with duodenal switch; ESG = endoscopic sleeve gastroplasty; OAGB = one-anastomosis gastric bypass; RYGB = Roux-en-Y gastric bypass; SADI-S = single-anastomosis duodeno-ileostomy with sleeve; SG = sleeve gastrectomy.

In 2022, the percentage of female patients undergoing primary MBS was 82.3% and for revisions was 88.8% with 77 nonbinary patients reported. The median age for female patients undergoing primary MBS was 42 and for revisions was 49. For male patients, the median age was 45 and for revisions was 52. For primary operations, the median body mass index for female patients was 43 kg/m² and for male patients 45 kg/m². The average length of stay was 1 day. The readmission rate for primary cases was 3% and 5.3% for revisions.

Gastric bands, intragastric balloons, and endoscopic sleeve gastroplasties

Industry estimates determined that approximately 2500 gastric bands were sold in the United States in 2022. There was a 55% increase from 2021. Using supply chain industry

standards, a 5% reduction in the overall number was applied to account for devices purchased, but not used.

There were 440 IGB procedures reported in the MBSAQIP in 2022. However, industry estimates showed 4358 were sold in 2022. This is an increase of .9% compared with 2021. It is important to note that this is reported in the MBSAQIP as insertions and removals.

The ESG is not accurately reported to the MBSAQIP as these procedures are primarily performed by gastroenterologists. The ESG is reported in the 2022 MBSAQIP PUF and there were 727 listed for 2022. There were 4600 ESG primary procedures performed in the United States in 2022 based on industry estimates. The endoscopic suturing device was also used for endoscopic revisions, such as stomal reduction, and 3840 endoscopic revisions were performed in 2022 based on industry estimates. These cases were counted in the “revision” category.

Table 1
Primary metabolic and bariatric surgery procedure percentage breakdown: 2022

Procedure	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sleeve	17.8%	33.0%	42.1%	51.7%	53.6%	58.1%	59.4%	61.4%	59.4%	61.4%	58.1%	57.4%
RYGB	36.7%	37.5%	34.2%	26.8%	23.0%	18.7%	17.8%	17.0%	17.8%	20.8%	21.5%	22.2%
Band	35.4%	20.2%	14.0%	9.5%	5.7%	3.4%	2.8%	1.1%	.9%	1.2%	.4%	.9%
BPD-DS	.9%	1.0%	1.0%	.4%	.6%	.6%	.7%	.8%	.9%	1.8%	2.1%	2.2%
Revision	6.0%	6.0%	6.0%	11.5%	13.6%	13.9%	14.1%	15.4%	16.7%	11.1%	11.8%	11.0%
SADI										.2%	.4%	.6%
OAGB										.7%	.4%	.4%
Other	3.2%	2.3%	2.7%	.1%	3.2%	2.6%	2.5%	2.3%	2.4%	.6%	2.8%	2.2%
ESG										.8%	.8%	1.6%
Balloons					.4%	2.7%	2.8%	2.0%	1.8%	1.4%	1.6%	1.6%

RYGB = Roux-en-Y gastric bypass; BPD-DS = biliopancreatic diversion with duodenal switch; SADI = single-anastomosis duodeno-ileostomy with sleeve; OAGB = one-anastomosis gastric bypass; ESG = endoscopic sleeve gastroplasty.

Table 2
ASMBS metabolic and bariatric surgery numbers estimate for 2022

Procedure	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sleeve	28,124	57,090	75,359	99,781	105,448	125,318	135,401	154,976	152,413	122,056	152,866	160,600
RYGB	57,986	64,875	61,218	51,724	45,276	40,316	40,574	42,945	45,744	41,280	56,527	62,100
Band	55,932	34,946	25,060	18,335	11,172	7310	6318	2660	2375	2393	1121	2500
BPD-DS	1422	1730	1790	772	1176	1236	1588	2123	2272	3555	5525	6100
Revision	9480	10,380	10,740	22,195	26,656	30,077	32,238	38,971	42,881	22,022	31,021	31,000
SADI										488	1025	1600
OAGB										1338	1149	1000
Other	5056	3979	4833	193	6272	5665	5606	5847	6060	1221	7339	6100
ESG										1500	2220	4600
Balloons					700	5744	6280	5042	4655	2800	4100	4400
Total	158,000	173,000	179,000	193,000	196,700	215,666	228,005	252,564	256,400	198,651	262,893	280,000

ASMBS = American Society for Metabolic and Bariatric Surgery; RYGB = Roux-en-Y gastric bypass; BPD-DS = biliopancreatic diversion with duodenal switch; SADI = single-anastomosis duodeno-ileostomy with sleeve; OAGB = one-anastomosis gastric bypass; ESG = endoscopic sleeve gastropasty.

Texas Public Use Data Files and California Health Care Access and Information

The combined amount of bariatric surgery in the Inpatient and Outpatient Public Use Data Files (PUDF) for 2022 was 28,856 cases. Only 24,918 cases (86.4%) were reported from the State of Texas in the MBSAQIP 2022 PUF. The State of Texas outpatient data registry reported a total of 11,091 cases with 7197 SG, 879 RYGB, 234 BPD-DS, 92 AGB, and 1101 AGB removals. In the inpatient data registry, there were 17,765 total cases. This broke down to 10,842 SG, 4937 RYGB, 830 SADI, and 171 BPD-DS. There was a 3.5% increase in volume from 2021 to 2022. SG remained the dominant procedure and the percentage of outpatient SG was 40%.

In California in 2022, there were 4095 cases reported in their outpatient database and 19,928 in the inpatient databases, giving a total of 24,023. The number of reported cases in MBSAQIP for California was 18,944, a 21.1% difference. Estimating that 13.6% of the procedures were not captured in the State of Texas, and 21.1% for California, we estimated that 17.1% of cases were not reported in the

MBSAQIP. Extrapolating this to the rest of the United States as the combined populations of California and Texas reach almost 80 million people and account for almost a quarter of the population of the United States, we calculated the following. Based on the 2022 MBSAQIP number of 230,707 cases, 39,451 cases were not captured in MBSAQIP.

Discussion

The data presented represent the best overall estimate of metabolic and bariatric procedures performed in the United States in the year 2022. Trends over the years for which these estimates have been presented demonstrate a reversal of the annual decreases in volume that were present before the COVID-19 pandemic. There was an increase of 6.5% from 2021 to 2022. The percentage of revisions had been steady for the past 3 years.

Our main source of data was the MBSAQIP database, but the Task Force also considered industry estimates, the Texas PUDF, and for the first time, data from California. The MBSAQIP data show that Texas and California perform 19% of the total volume of MBS in the United States. There was a 17.1% difference in cases reported to the MBSAQIP and those reported to the PUDF. Since this represents a 21% sample of the population of the United States and MBS cases, we extrapolated this difference to the rest of the United States. Until we have access to other state databases, we will continue to use this technique to estimate nationwide case volume. The difference in reported cases in the MBSAQIP from total cases was even more striking in 2021. The MBSAQIP reported 211,254 cases but the Texas and California numbers were 21.7% larger, with an additional 45,842 cases not captured in the PUF. The 4.6% difference was likely due to more cases being performed in ambulatory surgery centers during the COVID-19 pandemic that persisted into 2021. The decision to not include BOLD and NSQIP in this year's estimate was not taken lightly. The

Table 3
2022 data from MBSAQIP-accredited centers in the United States by type of primary procedure

Procedure	Number of procedures	Primary procedure %
SG	160,609	65.7%
RYGB	62,097	26.5%
Band	2500	1%
BPD +/- DS	6096	2.6%
SADI-S	1567	.7%
OAGB	1057	.5%
Total	233,926	100%

MBSAQIP = Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program; SG = sleeve gastrectomy; RYGB = Roux-en-Y gastric bypass; BPD +/- DS = biliopancreatic diversion with or without duodenal switch; SADI = single-anastomosis duodeno-ileostomy with sleeve; OAGB = one-anastomosis gastric bypass.

Table 4
2022 data from MBSAQIP-accredited centers in the United States for total numbers

Procedure	Number of cases	Percentage of all cases
Sleeve	137,155	59.5%
Bypass	53,029	23%
Revision/conversion	26,383	11.4%
Lap band	968	.4%
BPD +/- DS	5206	2.3%
Gastric balloon insertions and removal	440	.2%
SADI	1338	.6%
OAGB	903	.4%
Other	5285	2.3%
ESG	727	.3%
Total	230,707	100%

MBSAQIP = Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program; BPD +/- DS = biliopancreatic diversion with or without duodenal switch; SADI = single-anastomosis duodeno-ileostomy with sleeve; OAGB = one-anastomosis gastric bypass; ESG = endoscopic sleeve gastropasty.

NSQIP is subject to sampling error and reports very low numbers. There were only 1403 SG reported and 414 RYGB in 2022. These only make up .8% of the total reported SG and .7% of the RYGB cases for 2022. These numbers are so low as to be in the range of a sampling error. Similarly, the BOLD numbers are so low that they do not make any appreciable difference in the overall estimate. As we collect more data from individual states, we expect this will also cause us to refine the data in a much more meaningful way.

An additional factor that may play a role in increasing utilization of metabolic and bariatric surgery includes a recent Focused Practice Designation in Metabolic and Bariatric Surgery that the American Board of Surgery has implemented with the American Board of Medical Specialties, thus providing an opportunity for increasing awareness of, and further legitimizing, metabolic and bariatric surgery as a surgical specialty. The first round of testing took place in April 2022. As a result, it is possible that a significant increase in patients undergoing metabolic and bariatric surgery may be realized in the future [9].

Although there was a slight decrease in the number of revision procedures performed in 2022 when compared with 2021, there has been overall growth in revision procedures over the past decade, emphasizing the fact that obesity is a chronic disease with variable treatment outcomes. Gastric band removal as a standalone procedure comprised 26% of all revision procedures at MBSAQIP centers in 2017 but only 10% in 2020 [10]. There is an increasing number of conversions from SG reported in 2020. These cases were included in the revisions category. The trend for reoperative metabolic and bariatric surgery declined this year; however,

as revisions and conversions are generally elective and are not emergencies, this likely reflects the effect of COVID-19. Surgeons may have put off conversions and revisions during the times they were able to operate in 2020, instead concentrating on primary cases. However, if the trend that was demonstrated in the past 10 years continues, revisions will increase with time. This may be especially true with SG, as up to 25%–49% may be converted in the long term [10–12].

Ambulatory surgery and endoscopic device procedures are likely underestimated due to the lack of reporting requirements for these interventions in nonaccredited centers where surgeon and nonsurgeon proceduralists are performing these techniques. This is especially true of intragastric balloons and ESGs, which are captured in the MBSAQIP database when performed at an accredited center. There is no way to accurately capture the number of ESGs being performed in the United States that are not in accredited centers, given the lack of Current Procedural Terminology code, and that most are being performed by gastroenterologists. The estimates for ESG and the AGB were solely given by their respective companies and may not accurately reflect the yearly volume. The ESG uses an endosuturing device and this device can also be used for stomal reduction, further confusing the issue.

This report included for the first time the number of cases that are robot assisted. The number of robot-assisted MBS cases in 2022 was 69,751, or 30% of the total. In 2021 it was 23%. There has been a steady increase in utilization of the robotic platform. Scarritt et al. recently reported on this trend using the MBSAQIP database and showed that in 2015 only 5.8% of cases were performed with robotic assistance. This had increased to 9.45% in 2018 and has now reached 30% [13]. Since the overall growth from 2012 to 2022 was 38.2% it seems like the effect of robotic surgery is to take a bigger piece of the pie, while the size of the pie remains the same.

There may be significant numbers of SADI-S procedures being performed in outpatient settings that are not collected in the MBSAQIP. For example, in Texas there were 141 SADI-S reported to the MBSAQIP but in the Texas PUDF, there were 365 SADI-S listed, with 224 of those in the outpatient database. The OAGB is harder to track outside of the MBSAQIP as the coding used for it is not standardized. There was a slight decrease in reported OAGB, and this may be due to difficulties with reimbursement. Internationally, it has been reported that OAGB has overtaken SG as the most common operation in some countries [14].

The impact of the new GLP1-RA has not been demonstrated yet in the 2022 data but is expected to drop the number of bariatric cases. This will likely be demonstrated in 2 years with the next Task Force report.

Limitations

The limitations of this paper are related to the difficulty of collecting comprehensive data on a nationwide scale. The MBSAQIP data is reliable and gives us a good estimate, but we may be missing up to 17% of cases or more. This estimate is mainly based on the Texas and California databases and may not apply to every state. There is also a significant number of SG, endobariatric cases and possibly SADI-S and OAGB cases not being reported at all if they are performed at nonaccredited inpatient centers, endoscopy centers, or ambulatory surgery centers.

Conclusion

There was a 6.5% increase in MBS volume from 2021 to 2022. SG continues to be the dominant procedure. We anticipate that the SADI-S and ESG will gain popularity in the coming years and will continue to be reported in future estimates.

Disclosures

B. Clapp is a consultant for Medtronic and Moon Surgical and has received a meal stipend from Ethicon. J. Ponce is a W.L. Gore speaker, Olympus speaker, ReShape Lifesciences consultant, Allurion consultant, Medtronic speaker and consultant, and Applied Medical consultant. M. Kurian has received honoraria for teaching from Medtronic, Ethicon, Ezisurge, W.L. Gore, Stryker, Vivid, and Novo Nordisk. A.M. Rogers is an Intuitive Surgical speaker and proctor, Medtronic speaker, and W.L. Gore speaker and proctor. R.M. Peterson is a speaker and proctor for Teleflex and Standard Bariatrics. T. LaMasters is a speaker for W.L. Gore, Intuitive Surgical, and Novo Nordisk. W. English is a principal investigator for Allurion. The other authors have no commercial associations that might be a conflict of interest in relation to this article.

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