

ASMBS guidelines/statements

American Society for Metabolic and Bariatric Surgery 2020 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 only effective durable treatment for obesity, remains underused as approximately 1% of all patients who qualify undergo surgery. The American Society for Metabolic and Bariatric Surgery created a Numbers Taskforce to specify annual rate of utilization for obesity treatment interventions and to determine if patients in need are receiving appropriate treatment.

Objective: The objective of this study was to provide the best estimated number of metabolic and bariatric procedures performed in the United States in 2020.

Setting: United States.

Methods: We reviewed data from the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP), National Surgical Quality Improvement Program, Bariatric Outcomes Longitudinal Database, and Nationwide Inpatient Sample. In addition, data from industry and state databases were used to estimate activity at nonaccredited centers. Data from 2020 were compared mainly with data from the previous 2 years.

Results: Compared with 2019, the total number of MBS performed in 2020 decreased from approximately 256,000 to 199,000. Sleeve gastrectomy continues to be the most common procedure. The gastric bypass procedure trend remained relatively stable, and the gastric band procedure trend continued to decline. The percentage of revision procedures and biliopancreatic diversion with duodenal switch procedures increased slightly. Single-anastomosis duodeno-ileostomy was listed for the first time in 2020. Intra-gastric balloons placement declined from the previous year.

Conclusion: There was a 22.5% decrease in MBS volume from 2019 to 2020, which coincided with the COVID-19 pandemic. Sleeve gastrectomy continues to be the dominant procedure, and for the first time, single-anastomosis duodeno-ileostomy is reported in the MBSAQIP

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The adult obesity rate in the United States (US) increased from 13.4% in 1962 to 42.4% in 2018, an increase of approximately 200%, and currently affects >108 million adults aged ≥ 20 years in the US. The percentage of patients with a body mass index (BMI) >40 kg/m² is approximately 9.2%, or approximately 20 million adults aged ≥ 20 years [1]. As a result, the economic impact of treating comorbidities associated with obesity has risen significantly. It has been demonstrated that patients with obesity, compared with patients who are not obese, experience increases in annual healthcare costs of 36% and medication costs of 77% [2]. Obesity as a risk factor is by far the greatest contributor to the burden of chronic diseases in the US, 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 US gross domestic product [2].

Metabolic and bariatric surgery, the only effective and durable treatment for obesity, remains underused in treating the obesity epidemic in the US. 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 metabolic and bariatric surgery [3]. The ASMBS Numbers Taskforce has been tasked to specify annual rate of utilization for obesity treatment interventions.

In March 2020, the COVID-19 pandemic exploded across the US. The country went into lockdown and all elective surgeries were stopped. Despite the fact that bariatric surgery has been repeatedly shown to be life-saving surgery for patients who suffer from the chronic disease of obesity, many hospitals shut down bariatric surgery programs for prolonged periods of time during the pandemic because of the elective nature of surgery scheduling [4]. The return to normal case volume varied across the country but the third and fourth quarters of 2020 saw a rebound prior to the second wave in December and January.

Herein, the AASMBS Numbers Taskforce reports the 2020 estimate of the number of metabolic and bariatric surgery procedures performed in the US. This report provides the best approximation using the methodology described in the following section.

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 metabolic and bariatric procedures performed within the 885 metabolic and bariatric surgery centers accredited by MBSAQIP in 2020.

In addition, a review of the National Surgical Quality Improvement Program (NSQIP) database was also performed, which included primary metabolic and bariatric procedures performed within non-MBSAQIP-accredited metabolic and bariatric surgery centers. A major limitation of using NSQIP data is that participating centers are only required to report a minimum of 20% of surgical cases, a portion of which are 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. Additionally, a review of other national registries was undertaken including the Bariatric Outcomes Longitudinal Database (BOLD).

To capture outpatient procedures performed at centers that do not submit data to MBSAQIP, NSQIP, or BOLD, relevant medical device companies were surveyed to obtain the total number of gastric bands, intragastric balloons, and endoscopic suturing devices sold in 2020. 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 [5]. MBSAQIP and BOLD data were considered to originate from accredited centers for purposes of this assessment. Data from Nationwide Inpatient Sample (NIS) and NSQIP were used to estimate non accredited inpatient center activity [3]. 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.

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 (SADI-S), one-anastomosis gastric bypass (OAGB), endoscopic sleeve gastroplasties (ESG), and intragastric balloon (IGB). Revisions and conversions included procedures in which primary procedures 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 2020, compared with 2019, the total number of bariatric procedures decreased almost 22% from approximately 256,000 to 199,000. The overall estimated number of metabolic and bariatric procedures for 2020, as well as the trend and procedure breakdown from 2011 to 2020 is listed in Figs. 1 and 2 and Tables 1 and 2.

Sleeve gastrectomy continues to be the most common procedure, comprising 58.8% of all procedures in 2020. A 20% decrease since 2019 was noted (152,413 to 121,985), dropping the number of SG just below the level it was in 2016.

The number of gastric bypass procedures comprised 20.8% of all procedures in 2020. The impact of COVID-19 was not as severe in RYGB; there were 41,370 in 2020, a decrease of only 9.6% from the previous year.

The AGB trend has remained relatively stable as seen in previous years. The number of gastric band procedures was only 1.2% of all procedures performed in 2020. There were 2393 AGB in 2020 from 2375 in 2019.

The percentage of revision procedures decreased, from 16.7% to 11.1%. The number of revisional procedures performed decreased from 42,881 in 2019 to 22,006 in 2020. This was a 48.7% decrease.

The percentage of BPD+/-DS procedures increased from .9% to 1.8% with 3555 cases. SADI-S was reported for the first time in 2020 with 488 primary cases.

Intra-gastric balloon placements were once again reported in the MBSAQIP with 588 cases. According to industry estimates, a total of 2800 IGB were placed.

When considering primary procedures including SG, RYGB, AGB, BPD+/-DS, SADI-S, and OAGB, there were 171,128 cases. SG was performed 71.3% of the time, and RYGB 24.2%, AGB 1.4% and BPD+/-DS 2.1%, SADI-S .3%, and OAGB .8% (Table 3).

MBSAQIP

In 2020, 168,568 procedures, or approximately 84.9% of all procedures, were performed at MBSAQIP-accredited centers (Table 4). During the 2020 calendar year, 885 centers reported data in the MBSAQIP registry, a 3% increase from 859 centers in 2019. Canadian and International centers also participate in MBSAQIP but were not included in this analysis.

BOLD

A total of 14 centers were contributing data to BOLD at the time of this assessment. Six centers were dual entry programs, entering data into MBSAQIP and BOLD, and were not included in the BOLD number estimate. The remaining 8 centers were included in the estimate as BOLD-only programs. A total of 3838 procedures were performed at BOLD centers in 2018, but only 2346 procedures were applied to the estimate given 57% of BOLD centers were not participating in MBSAQIP.

NSQIP

Data from NSQIP centers not participating in MBSAQIP (NSQIP/non-MBSAQIP) were obtained from the American College of Surgeons (ACS). A total of 1445 procedures were reported, with SG representing 59% of all cases being reported at these centers.

Of the 72 NSQIP/non-MBSAQIP centers performing metabolic and bariatric surgery, 3 centers (4%) reported more than 100 cases, only 20 (27.8%) reported at least 25 procedures, 33 centers (45.8%) reported fewer than 10 cases, while 16 centers (19%) reported only 1 procedure in 2020 (range, 1–144).

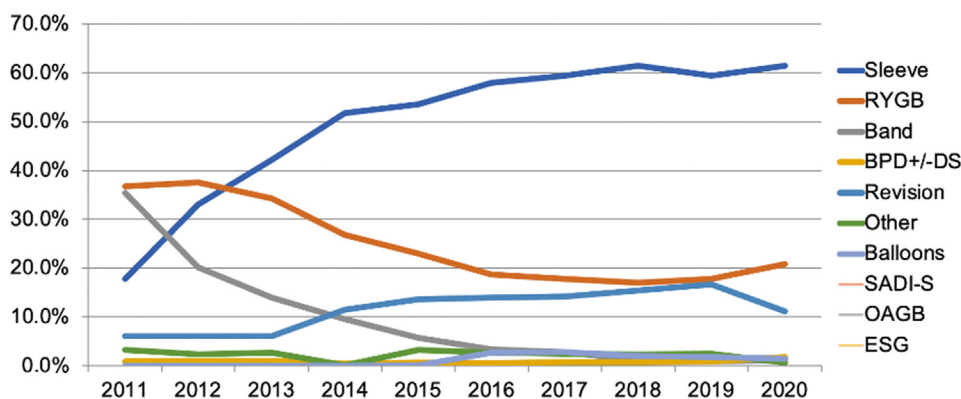


Fig. 1. Metabolic and bariatric surgery procedure percentage trends: 2011–2020. AGB = adjustable gastric band; BPD-DS = biliopancreatic diversion-duodenal switch; ESG = endoscopic sleeve gastroplasty; OAGB = one-anastomosis gastric bypass; RYGB = Roux-en-Y gastric bypass; SADI-S = single-anastomosis duodeno-ileostomy with sleeve; SG = sleeve gastrectomy.

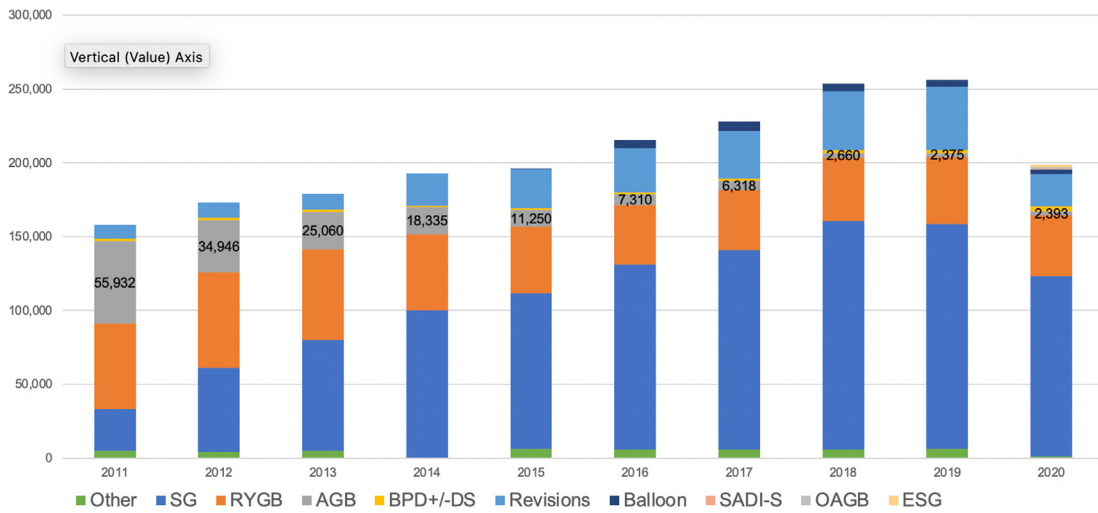


Fig. 2. Metabolic and bariatric surgery procedure trends: 2011–2020. AGB = adjustable gastric band; BPD-DS = biliopancreatic diversion-duodenal switch; ESG = endoscopic sleeve gastroplasty; OAGB = one-anastomosis gastric bypass; RYGB = Roux-en-Y gastric bypass; SADI-S = single-anastomosis duodeno-ileostomy with sleeve; SG = sleeve gastrectomy.

Notably, there was a 51.7% decrease in the number of NSQIP/non-MBSAQIP centers since 2016, possibly accounting for some of the newly accredited MBSAQIP centers. The lower volume per NSQIP/non-MBSAQIP centers may be due to centers not meeting MBASQIP volume standards. The procedure number provided by the ACS was used as a conservative estimate for the NSQIP data, which were not extrapolated to account for the potential reporting differences. Therefore, the true number of procedures performed at NSQIP/non-MBSAQIP centers may be significantly higher than estimated in this report.

Gastric bands, balloons, and endoscopic sleeve gastroplasties

Industry estimates determined approximately 2940 gastric bands were sold in the US in 2020. There was a

30%–40% decrease from 2019 due to COVID-19. Using supply chain industry standards, a 5% reduction in the overall number was applied to account for devices purchased, but not used. This estimated number of gastric bands implanted in 2020 was 2393.

There were 588 IGB procedures reported in the MBSAQIP. However, industry estimates showed 2940 were sold in 2020. This is down from a volume of 4655 reported in 2019.

The ESG is not accurately reported to the MBSAQIP as these procedures are primarily performed by gastroenterologists. Therefore, the ESG is included in the “other” category of the total number of procedures. There were 1500 ESG procedures performed in the US in 2020 based on industry estimates. The device was also used for endoscopic revisions, such as stomal reduction, and 1700 endoscopic revisions were performed in 2020 based on industry

Table 1
ASMBS metabolic and bariatric surgery numbers estimate for 2020

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total	158,000	178,000	179,000	193,000	196,000	216,000	228,000	252,000	256,000	199,000
SG	17.8%	33.0%	42.1%	51.7%	53.6%	58.1%	59.4%	61.4%	59.4%	61.4%
RYGB	36.7%	37.5%	34.2%	26.8%	23.0%	18.7%	18.7%	17.0%	17.8%	20.8%
AGB	35.4%	20.2%	14.0%	9.5%	5.7%	3.4%	2.8%	1.1%	.9%	1.2%
BPD-DS	.9%	1.0%	1.0%	.4%	.6%	.6%	.7%	.8%	.9%	1.8%
Revision	6.0%	6.0%	6.0%	11.5%	13.6%	13.9%	14.1%	15.4%	16.7%	11.1%
SADI-S										.2%
OAGB										.7%
Other	3.2%	2.3%	2.7%	.1%	3.2%	2.6%	2.5%	2.3%	2.4%	.6%
ESG										.8%
Balloons					.4%	2.7%	2.8%	2.0%	1.8%	1.4%

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

Table 2
Primary metabolic and bariatric surgery procedure percentage breakdown: 2020

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
SG	28,124	57,090	75,359	99,781	105,448	125,318	135,401	154,976	152,413	122,056
RYGB	57,986	64,875	61,218	51,724	45,276	40,316	40,574	42,945	45,744	41,280
AGB	55,932	34,946	25,060	18,335	11,172	7310	6318	2660	2375	2,393
BPD/DS	1422	1730	1790	772	1176	1236	1588	2123	2272	3555
Revision	9480	10,380	10,740	22,195	26,656	30,077	32,238	38,971	42,881	22,022
SADI										488
OAGB										1338
Other	5056	3979	4833	193	6272	5665	5606	5847	6060	1221
ESG										1500
Balloons					700	5744	6280	5042	4655	2800
Total	158,000	173,000	179,000	193,000	196,700	215,666	228,005	252,564	256,400	198,651

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

estimates. These cases were counted in the “revision” category.

Texas Public Use Data File

The combined amount of bariatric surgery in the Inpatient and Outpatient Public Use Data Files (PUDF) for 2020 was 21,043 cases. Only 18,337 cases (87.1%) were reported from the State of Texas in the MBSAQIP 2020 PUF. The State of Texas outpatient data registry reported a total of 7183 cases with 5311 SG, 473 RYGB, 137 BPD-DS, 65 AGB, 32 gastric bypass reversals, and 1165 AGB removals. In the inpatient data registry, there were 13,860 total cases. This broke down to 8883 SG, 3810 RYGB, and 1167 BPD-DS. There was an 11% decrease in volume from 2019 to 2020. SG remained the dominant procedure and the percentage of outpatient SG increased from 30% to 37%. The PUDF databases collect data by quarter. When compared with 2019, in the first quarter of 2020, there was a 11.3% decrease in volume. In the second quarter, there was a 7% decrease and in the third quarter, a 2% decrease. A dip in the number of cases was seen in the fourth quarter with a

6.3% decrease from fourth quarter 2019. This correlates with the second surge of COVID-19.

Estimating that 12.9% of the procedures were not captured in the State of Texas, a conservative estimate of 12.9% was used for outpatient procedures not captured in the MBSAQIP registry throughout all other states.

Discussion

The data presented represent the best overall estimate of metabolic and bariatric procedures performed in the US in the year 2020. Trends over the years in which these estimates have been presented demonstrate a significant increase in the number of procedures, with the year 2020 being notable as an exception. There was a decrease of 22.5% from 2019 to 2020. The main factor that contributed to the decreased number of procedures in 2020 is almost certainly the global COVID-19 pandemic. This was especially true in the second and fourth quarters of 2020 when elective surgical operations were suspended across the entire country. There was a significant decrease in revisions. The trend of revisions had been going up steadily since 2011 and had increased 311% through 2019.

Our main source of data was the MBSAQIP database, but the Task Force also considered the NSQIP, BOLD, industry estimates, and once again the Texas PUDF. The MBSAQIP data show that Texas performs 11% of the total volume of MBS in the US. There was a 12.9% difference in cases reported to the MBSAQIP and those reported to the PUDF. Since this represents an 11% sample of the population of the US and MBS cases, we extrapolated this difference to the rest of the US. Until we have access to other state databases, we will continue to use this technique to estimate nationwide case volume.

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

Table 3
2020 data from MBSAQIP-accredited centers in the United States by type of primary procedure

Procedure	Number of procedures	Primary procedure percentage
SG	121,985	71.3%
RYGB	41,370	24.2%
AGB	2393	1.4%
BPD+/-DS	3555	2.1%
SADI-S	488	.3%
OAGB	1338	.8%
Total	171,128	100%

MBSAQIP = Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program; SG = sleeve gastrectomy; RYGB = Roux-en-Y gastric bypass; AGB = adjustable gastric band; BPD+/-DS = biliopancreatic diversion-duodenal switch; SADI-S = single-anastomosis duodeno-ileostomy with sleeve; OAGB = one-anastomosis gastric bypass.

Table 4
2020 data from MBSAQIP-accredited centers in the United States for total numbers

Procedure	Number of cases	Percentage of all cases
SG	103,782	61.6%
RYGB	38,781	23%
Revision/Conversion	18,131	10.8%
AGB	812	.5%
BPD+/-DS	3436	2%
Gastric balloon insertions and removal	588	.3%
SADI	488	.3%
OAGB	1338	.8%
Other	1212	.7%
Total	168,568	100%

MBSAQIP = Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program; SG = sleeve gastrectomy; RYGB = Roux-en-Y gastric bypass; AGB = adjustable gastric band; BPD+/-DS = biliopancreatic diversion-duodenal switch; SADI-S = single-anastomosis duodeno-ileostomy with sleeve; OAGB = one-anastomosis gastric bypass.

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 near future [6].

Although there was a decrease in the number of revision procedures performed in 2020 when compared with 2019 there has been overall growth in revision procedures over the last 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 [7]. 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, but as revisions and conversions are generally not emergencies but elective, 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 last 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 [8,9]. In the State of Texas, there was a rebound in the last quarter of 2020, so we would expect to see a continued rebound and return to pre-COVID levels in 2021. Lastly, 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 non-surgeon proceduralists are performing these techniques. This is especially true of IGBs and ESGs. IGBs

are captured in the MBSAQIP database when performed at an accredited center, while the ESG is not. There is no way to accurately capture the number of ESGs being performed in the US given there is no Current Procedural Terminology code, and most are being performed by gastroenterologists. The ESG uses an endosuturing device and this device can also be used for stomal reduction, further confusing the issue.

There may be significant numbers of SADI-S procedures being performed in outpatient settings. The year 2020 is the first year that BPD+/-DS procedures are broken down and the single-anastomosis variation of the DS was counted. We anticipate an increasing trend of SADI-S and OAGB volume in the future as they were recently recognized as endorsed procedures by ASMBS [10,11]. Internationally, it has been reported that OAGB has overtaken SG as the most common operation [12].

A review of NIS data looking at national trends for adolescent bariatric surgery suggests MBSAQIP is only capturing 23.5% of adolescent procedures, but this is not translatable to the adult data as most adolescent centers are currently not participating in MBSAQIP. Additional limitations exist due to different age definitions in MBSAQIP (<18 years) compared with the NIS review (age 9-19 years) [13].

Limitations

The limitations of this paper are related to the difficulty of collecting comprehensive data on a nationwide scale. The MBSAQIP data are reliable and give us a good estimate, but we may be missing up to 13% of cases or more. This estimate is mainly based on the Texas database and may not apply to every state. There is also the fact that the NSQIP only reports a fraction of the cases performed at participating centers as does the NIS. There is also a significant number of SG, endobariatric cases, and possibly SADI-S and RYGB cases not being reported at all if they are performed at nonaccredited inpatient centers, endoscopic centers, or ambulatory surgery centers.

Conclusion

There was a 22.5% decrease in MBS volume from 2019 to 2020. This is likely secondary to the COVID-19 pandemic. SG continues to be the dominant procedure, and for the first time, SADI-S is reported in the MBSAQIP database. We anticipate that SADI-S and OAGB will gain popularity in coming years and will continue to be reported in future estimates.

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