ARTICLE

# Recent National Trends in the Use of Adolescent Inpatient Bariatric Surgery

## *2000 Through 2009*

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**Objectives:** To determine the current rate of inpatient bariatric surgical procedures among adolescents and to analyze national trends of use from 2000 to 2009.

**Design:** Retrospective cross-sectional study.

**Setting:** Discharge data obtained from the Healthcare Cost and Utilization Project Kids' Inpatient Database, 2000 through 2009.

**Participants:** Adolescents (defined herein as individuals aged 10-19 years) undergoing inpatient bariatric procedures.

**Intervention:** Inpatient bariatric surgery.

**Main Outcome Measures:** The primary outcome measure was the national population-based bariatric procedure rate. The secondary outcome measures were trends in procedure rates and type, demographics, complication rate, length of stay, and hospital charges from 2000 through 2009.

**Results:** The inpatient bariatric procedure rate increased from 0.8 per 100 000 in 2000 to 2.3 per 100 000 in 2003 (328 vs 987 procedures) but did not change significantly in 2006 (2.2 per 100 000) or 2009 (2.4 per 100 000), with 925 vs 1009 procedures. The use of laparoscopic adjustable gastric banding approached one-third (32.1%) of all procedures by 2009. The cohort was predominantly female and older than 17 years. The prevalence of comorbidities increased from 2003 (49.3%) to 2009 (58.6%) ($P = .002$), while the complication rate remained low and the in-hospital length of stay decreased by approximately 1 day ($P < .001$). Increasing numbers of patients had Medicaid as their primary payer source; however, most (68.3% in 2009) had private insurance.

**Conclusions:** Despite the worsening childhood obesity epidemic, the rate of inpatient bariatric procedures among adolescents has plateaued since 2003. The predominant procedure type has changed to minimally invasive techniques, including laparoscopic adjustable gastric banding and laparoscopic Roux-en-Y gastric bypass. Trends show low complication rates and decreasing length of stay, despite increasing comorbid conditions among patients.

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Obesity among children and adolescents has reached epidemic proportions, with almost 1 in 3 children in the United States being overweight or obese (a 3-fold increase since 1980).[1] More than 2 million US children and adolescents have a body mass index (BMI; calculated as weight in kilograms divided by height in meters squared) exceeding 40, and 4% have a BMI greater than the 99th percentile for age and sex based on 2000 Centers for Disease Control and Prevention growth charts.[2,3] Diseases associated with obesity such as type 2 diabetes mellitus, previously only seen in adults, are now being increasingly diagnosed in children.[4] In addition, most adolescents with obesity will carry the disease to adulthood[5-7] and have a higher morbidity and mortality risk than those diagnosed later in life.[6,8] Effective weight loss strategies are needed to curtail these changes. Although nonsurgical methods are the mainstay of obesity management, bariatric surgery may be the only strategy for achieving significant weight reduction for adolescents who are already morbidly obese.[9-15] The results of a 2012 randomized trial[16] in adults suggest that bariatric surgery may be the most effective treatment available for obesity-related illnesses, including diabetes, hypertension, and hyperlipidemia.

A 1991 National Institutes of Health Consensus Development Conference[17] es-



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tablished bariatric surgery as an important treatment option for adults with morbid obesity. For adolescents, surgical weight loss techniques were reported in the 1980s[18] but did not gain widespread use until the early 2000s. In 2004, surgical and pediatric experts recommended weight loss surgery as an appropriate treatment for adolescents with extreme obesity (BMI ≥40 with comorbidities or BMI ≥50 regardless of comorbidities) who had failed other attempts at weight loss for more than 6 months.[19] These conservative recommendations raised concerns that the strict BMI requirements would result in worsened outcomes for adolescents.[20,21] In light of the growing evidence of the safety and efficacy of weight loss procedures in adolescents,[14,22,23] the qualifying criteria were modified, lowering the BMI cutoffs to replicate those of adult patients (BMI ≥35 with major comorbidities or BMI ≥40 with minor comorbidities).[22,23]

Previous studies[23-26] have shown that adolescent bariatric surgery increased in frequency 3-fold to 5-fold from 1997 to 2003. Several types of bariatric procedures have been evaluated among adolescents, including Roux-en-Y gastric bypass (RYGB), gastric restriction procedures, and laparoscopic adjustable gastric banding (LAGB). Initial studies[9-15,27] of weight loss surgery in this population report short-term safety and efficacy similar to or better than those achievable among adults. Since its approval for adults in 2001, LAGB has been gaining acceptance as a procedure for older adolescents, with experimental use in those younger than 18 years.[27] While speculation exists that adolescent bariatric surgery is growing exponentially,[28] a contemporary assessment of national trends has not been reported to date. Recent studies[29,30] of adult bariatric surgery have reported a plateau in surgical volume since 2003, challenging similar beliefs about its continued growth among the adult population. One explanation for this plateau includes poor health care access, with a gap between adults who qualify for surgery and those who undergo the procedure.[31] Similar disparities likely exist in the adolescent population but have yet to be defined. In this study, we use the most recent national data to determine the current rate of inpatient bariatric surgical procedures among adolescents and to analyze national trends of use from 2000 to 2009.

## METHODS

### STUDY DESIGN

We conducted a retrospective cross-sectional study using the past 4 releases (2000, 2003, 2006, and 2009) of the Healthcare Cost and Utilization Project Kids' Inpatient Database (KID). Sponsored by the Agency for Healthcare Research and Quality, the KID is released every 3 years and captures inpatient hospital information for patients younger than 21 years. The KID is created from a stratified, random sample of discharges from all community, nonrehabilitation hospitals in states participating in the Healthcare Cost and Utilization Project (ranging from 27 states in 2000 to 44 states in 2009); each sampled discharge record includes information on patient demographics, diagnosis and procedure codes, and hospital characteristics.[32]

We defined *adolescents* as individuals aged 10 to 19 years old, consistent with the World Health Organization definition and previous publications on obesity and bariatric surgery.[7,23,33] To identify adolescents undergoing bariatric surgery, we used *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) principal procedure codes (44.31, 44.39, 44.38, 44.95, and 44.69) with a confirmative *ICD-9-CM* principal diagnosis code for obesity (278.0, 278.01, 278.00, 278.8, or 278.1). We further classified surgery type into the following 4 categories: open RYGB (codes 44.31 and 44.39), laparoscopic RYGB (code 44.38), LAGB (code 44.95), and gastroplasty (code 44.69).[29] We identified major postoperative complications that occurred during the same hospital stay using *ICD-9-CM* codes[23] and applied publicly available software by Elixhauser et al[34] as a severity measure (Comorbidity Software version 3.7; Agency for Healthcare Research and Quality[35]). The software by Elixhauser et al defines comorbidities as secondary diagnoses associated with increases in length of stay, hospital charges, or mortality.

### DATA ANALYSIS

Our primary outcome was the national population-based inpatient bariatric procedure rate. The secondary outcome measures were trends in procedure rate and type, demographics, hospital characteristics and charges, length of stay, and in-hospital postoperative complication rates. We used income quartiles by patients' zip code of residence (ranging from the lowest [quartile 1] to the highest [quartile 4]) as a proxy measure of socioeconomic status.[36] We also reported hospital charges and the expected primary type of insurance (eg, private insurance, Medicaid, or other government payer). Charges reflected the amount billed for each admission, excluding professional fees.

Using sample weights provided by the KID, along with US national and regional census estimates for each sample year, we calculated nationally representative point estimates and population-based rates of bariatric surgery.[37] Point estimates, variances, and *P* values accounted for the complex sampling design of the KID database. We performed 2-sample *z* tests to assess for statistical differences between data from 2000 and 2003. Because of the small sample size in 2000, we chose 2003 as the reference year for pairwise comparisons to 2006 and 2009.

Analyses were performed using statistical procedures designed for complex survey data (SAS software version 9.2; SAS Institute, Inc). In compliance with the Healthcare Cost and Utilization Project Data Use Agreement, we did not report data when the tabulated cell size was 10 or fewer or the estimates had an SE of zero or a relative SE (weighted estimate divided by SE of estimate) of 0.30 or higher.[38] Differences between estimates were considered statistically significant at $P \leq .05$.

## RESULTS

Over 10 years, the number of adolescent inpatient bariatric procedures increased from 328 (95% CI, 239-417) in 2000 to 1009 (95% CI, 850-1168) in 2009 ($P < .001$) (**Table 1**). The largest increase occurred from 2000 to 2003, with the rate increasing from 0.8 to 2.3 per 100 000 adolescents. Despite the continued rise of obesity among adolescents, the rate of surgery remained constant after 2003. Similar trends in procedure volume and rate were observed when dividing the cohort by age (10-17 years vs 18-19 years). Roux-en-Y gastric bypass was most commonly performed (67.6% in 2009); however, the operative approach changed from open procedures at the beginning of the decade to almost entirely laparoscopic by 2009. In addition, the in-



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**Table 1. Volume and Description of Adolescent (10-19 Years) Inpatient Bariatric Surgical Procedures Performed in the United States From 2000 Through 2009 Based on Data From the Kids' Inpatient Database**

| Variable | 2000 Value | 2000 *P* Value | 2003 Reference Year | 2006 Value | 2006 *P* Value | 2009 Value | 2009 *P* Value |
|---|---|---|---|---|---|---|---|
| No. of records, unweighted | 186 | | 615 | 583 | | 700 | |
| Estimated No. (95% CI) of bariatric procedures in age category, y | | | | | | | |
| 10-17 | 102 (66-138) | <.001 | 288 (224-351) | 223 (141-305) | .26 | 228 (129-327) | .44 |
| 18-19 | 226 (154-298) | <.001 | 699 (588-809) | 702 (599-806) | .67 | 781 (680-881) | .47 |
| Total 10-19 | **328** (239-417) | <.001 | **987** (839-1135) | **925** (769-1081) | .47 | **1009** (850-1168) | .75 |
| Estimated procedure rate per 100 000 adolescents in age category, y, % | | | | | | | |
| 10-17 | 0.3 | | 0.9 | 0.7 | | 0.7 | |
| 18-19 | 2.8 | | 8.5 | 8.4 | | 8.8 | |
| Total 10-19 | 0.8 | | 2.3 | 2.2 | | 2.4 | |
| Procedure type, % | | | | | | | |
| Open RYGB | 90.6 | .86 | 89.9 | 15.7 | <.001 | 7.0 | <.001 |
| Laparoscopic RYGB | 0.0 | NA | 0.0 | 62.1 | NA | 60.6 | NA |
| LAGB | 0.0 | NA | 0.0 | 20.6 | NA | 32.1 | NA |
| Gastroplasty | NR | NR | 10.1 | NR | NR | NR | NR |
| Hospital type, % | | | | | | | |
| Adult unit in general hospital | 85.2 | .99 | 86.0 | 74.9 | .07 | 76.3 | .11 |
| Children's unit in general hospital | 14.8 | .84 | 14.0 | 22.6 | .16 | 19.8 | .30 |
| Freestanding children's hospital | 0.0 | NA | 0.0 | NR | NA | NR | NA |
| Hospital location, % (rate per 100 000 adolescents)[a] | | | | | | | |
| Northeast | 16.4 (0.7) | .64 | 18.5 (2.4) | 29.5 (3.6) | .04 | 31.0 (4.3) | .01 |
| South | 35.6 (0.8) | .29 | 43.2 (2.9) | 30.0 (1.8) | .01 | 38.1 (2.5) | .34 |
| Midwest | NR | NR | 19.6 (2.0) | 19.7 (1.9) | .98 | 13.8 (1.5) | .15 |
| West | 30.6 (1.1) | .09 | 18.7 (1.9) | 20.8 (1.9) | .63 | 17.1 (1.8) | .68 |
| Hospital charges, $ (95% CI)[b] | 29 977 (25 376-34 578) | .04 | 35 943 (32 706-39 180) | 38 689 (34 229-43 149) | .33 | 36 658 (35 088-42 228) | .27 |
| Length of stay, mean (95% CI), d | 3.6 (3.2-4.0) | .001 | 2.8 (2.7-2.9) | 2.3 (2.0-2.6) | .002 | 1.9 (1.7-2.1) | <.001 |
| In-hospital postoperative complication rate, % (95% CI) | NR | NR | 2.9 (1.5-4.3) | 2.6 (1.3-3.9) | .76 | NR | NR |
| Mortality, % | 0.0 | NA | NR | NR | NR | 0.0 | NA |

Abbreviations: LAGB, laparoscopic adjustable gastric banding; NA, not applicable; NR, not reported because the tabulated cell size was 10 or fewer or the estimate had a standard error of zero or a relative standard error (weighted estimate per standard error of estimate) of 0.30 or higher; RYGB, Roux-en-Y gastric bypass.

[a] Rate based on regional population data for the given year.

[b] Adjusted for inflation (2009 US dollars).

troduction of LAGB led to a decrease in the proportion of RYGB procedures after 2003. The use of LAGB could not be captured in hospital administrative data files before 2004 because *ICD-9-CM* procedure codes were not assigned to this procedure. By 2009, LAGB comprised 32.1% of all procedures reported.

Adolescent bariatric procedures were most often performed in adult hospital units (74.9%-85.2%) in urban locations (94.8%-97.9%), with approximately half occurring at teaching institutions (46.4%-57.4%). The rate of procedures varied by region: the Northeast experienced a steady increase between each reported year, whereas other regions saw an overall decline after 2003.

Bariatric surgical procedures were performed in patients as young as 12 years (**Table 2**); however, they were increasingly performed in adolescents older than 17 years (70.8% in 2003 and 77.5% in 2009; $P = .03$). Most patients were female (74.0%-77.9%), a finding that did not change significantly during the study period. The percentage of patients with 2 or more comorbid conditions increased from 18.3% in 2003 to 25.2% in 2009 ($P = .005$), while those without any comorbid diagnoses decreased in the same time period (50.7% vs 41.4%; $P = .002$). The types of comorbid conditions remained similar, with chronic pulmonary disease, hypertension, diabetes, depression, liver disease, and hypothyroidism remaining the most common secondary diagnoses.

Most adolescents undergoing surgery in 2000 were from higher-income areas, with only 7.6% of patients residing in the lowest-income zip codes compared with



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**Table 2. Characteristics of Adolescents (10-19 Years) Undergoing Inpatient Bariatric Surgical Procedures From 2000 Through 2009 Based on Data From the Kids' Inpatient Database**

| Variable | 2000 Value | 2000 *P* Value | 2003 Reference Year | 2006 Value | 2006 *P* Value | 2009 Value | 2009 *P* Value |
|---|---|---|---|---|---|---|---|
| Age, mean (95% CI), y | 17.8 (17.5-18.1) | | 17.9 (17.8-18.0) | 17.9 (17.7-18.1) | | 18.0 (17.8-18.2) | |
| Age category, y, % | | | | | | | |
| <12 | 0.0 | .11 | 0.0 | 0.0 | .007 | 0.0 | .03 |
| 12-15 | 8.1 | | 5.6 | 5.9 | | 4.5 | |
| 16 | 12.6 | | 8.0 | 8.3 | | 9.4 | |
| 17 | 10.4 | | 15.5 | 9.9 | | 8.8 | |
| 18 | 28.7 | | 25.5 | 36.5 | | 31.4 | |
| 19 | 40.2 | | 45.3 | 39.5 | | 46.1 | |
| Female sex, % | 77.9 | .59 | 76.1 | 76.8 | .80 | 74.0 | .39 |
| Zip code income quartile, median, % | | | | | | | |
| 1, Lowest | 7.6 | <.001 | 23.0 | 21.7 | .76 | 24.1 | .65 |
| 2 | 24.6 | .31 | 20.8 | 20.1 | .90 | 22.5 | .46 |
| 3 | 24.4 | .31 | 29.7 | 25.4 | .16 | 26.1 | .23 |
| 4, Highest | 43.4 | .001 | 26.5 | 32.8 | .05 | 27.3 | .72 |
| Type of insurance, % | | | | | | | |
| Private | 79.0 | .54 | 81.2 | 67.9 | <.001 | 68.3 | <.001 |
| Medicaid | 7.8 | .97 | 7.7 | 9.9 | .26 | 17.2 | <.001 |
| Other government payer | 13.2 | .50 | 11.1 | 22.1 | <.001 | 14.6 | .16 |
| No. of comorbid conditions, % | | | | | | | |
| 0 | 53.8 | .51 | 50.7 | 42.8 | .008 | 41.4 | .002 |
| 1 | 30.6 | .92 | 31.0 | 37.0 | .03 | 33.4 | .34 |
| >2 | 15.6 | .44 | 18.3 | 20.2 | .43 | 25.2 | .005 |

43.4% in the highest. By 2003, patients were more evenly distributed among the 4 income quartiles. Private insurance remained the primary payer source throughout the study period; however, Medicaid use increased from 7.7% in 2003 to 17.2% in 2009 ($P < .001$).

No in-hospital deaths occurred among adolescent patients undergoing bariatric surgery, and the in-hospital complication rate remained less than 3% (Table 1). The mean length of stay decreased by almost 1 day from 2003 through 2009 (2.8 days vs 1.9 days, $P < .001$). After adjusting for inflation, the mean hospital charge remained about $35 000 (2009 US dollars).

## COMMENT

Bariatric surgical procedures are an effective treatment for severe adolescent obesity and its associated comorbidities, providing significant and sustained weight loss.[9,12] Our study confirms the previously reported growth in bariatric procedures from 2000 to 2003 among adolescents.[23,26] Despite the suggestion that adolescent bariatric surgery has increased in popularity and continued to grow exponentially,[28] inpatient surgery use leveled off from 2003 through 2009, reaching a plateau of about 1000 procedures annually. Previous studies[29,30,39] documented similar plateaus in adult bariatric surgery around 2003 to 2004. While the rate of adolescent inpatient procedures did not increase from 2003 through 2009, the preferred type of operative approach changed from open to laparoscopic, further mirroring the trends in adults.[29,30] Laparoscopic RYGB almost completely replaced open RYGB, and the use of LAGB increased after its approval for adults in 2001.

The plateau of inpatient adolescent bariatric procedures in the face of the ever-growing obesity epidemic suggests a gap between adolescents eligible for surgery and those actually undergoing weight loss procedures. Some have speculated that adult bariatric surgery has reached a saturation point in terms of patient demand, physician referrals, and the number of certified bariatric surgeons.[30,39] Alternatively, Nguyen and colleagues[29] postulate that the plateau in adult procedures is due to limited health care access, related to both the limited number of bariatric facilities designated as centers of excellence and the lack of insurance coverage for bariatric procedures. Although adolescents' attitudes toward bariatric surgery are unknown, the number of adolescents who qualify for surgery based on BMI continues to grow, making a reduced patient demand an unlikely explanation. Furthermore, surgeon membership in the American Society for Metabolic and Bariatric Surgery is increasing,[29] and many members are planning adolescent bariatric surgery centers.[40] These trends argue against surgeon supply as a factor influencing procedure volume among adolescents.

The demographic differences of those undergoing surgery vs the population with obesity suggest the existence of societal barriers in adolescent bariatric surgery. The prevalence of obesity among adolescent boys and girls was comparable in 2000 (14.8% each) but has been increasing at a higher rate from 2000 to 2008 among male adolescents.[41] Despite this disparity, almost 75% of the US adolescent bariatric surgical procedures in 2009 were



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performed on female patients. A 2010 study[27] in California revealed that female patients accounted for 78% of adolescent bariatric procedures, while girls comprise only 43% of the state's adolescent population with obesity.

Disparities in bariatric surgery use are also suggested by differences in socioeconomic status and regional demographics. A large proportion of adolescents with obesity come from households of lower socioeconomic status, with an increased likelihood of obesity seen as both household income and highest educational level decrease.[42-44] Despite the concentrated burden of obesity in lower-income households, the rate of bariatric procedures is similar across low-income and high-income areas. This distribution is an improvement from 2000 but represents a persistent discrepancy between the use of bariatric procedures among income groups, with the lowest rate of use among those with the highest need. From a geographical perspective, adolescents in the South and Midwest have a higher prevalence of obesity, yet the rate of surgery is greatest in the Northeast, indicating a further disparity.[43,45]

Insurance coverage also limits those who can undergo surgery.[46] The Early and Periodic Screening, Diagnostic and Treatment program by Medicaid provides comprehensive obesity-related coverage for children whose families rely on public insurance to pay for medical care.[47] However, few states require Medicaid coverage for weight loss surgery, and some explicitly deny payment for bariatric procedures.[46,48] States that provide coverage often have unclear policies about which interventions are included.[46,48] Although a rise in the percentage of cases covered by Medicaid was observed during the decade studied herein, the overall proportion of procedures paid for by public insurance remained low. Most patients had private insurance, yet adolescents with obesity are more likely to be covered by Medicaid or to be uninsured.[49]

Physicians may also limit access to bariatric surgery. The increase in adolescent bariatric procedures from 2000 to 2003 led to a series of regulations and recommendations issued by experts in childhood obesity.[19,50] Although meant to protect adolescents, these recommendations may have led to more cautious referrals, reducing the proportion of eligible adolescents offered weight loss procedures in subsequent years. Many physicians also remain skeptical of the usefulness of bariatric surgery in the management of adolescent obesity. A 2009 regional survey showed that physicians were reluctant to refer adolescents for surgery, despite dissatisfaction with nonsurgical weight loss interventions.[51] A similar national survey of physicians found that almost half would never refer an adolescent for a bariatric procedure; most believed that individuals should be at least 18 years old, have severe comorbidities, and have attempted alternative weight loss methods for more than a year before undergoing a bariatric procedure, with its attendant risks.[52] These beliefs may be reflected in our data because most patients undergoing surgery were closer to the upper end of adolescence (18-19 years) and increasing proportions had 2 or more comorbidities at the time of surgery. Several factors may be influencing this trend, including improvements in diagnosis coding and increased referrals for treatment of obesity-related comorbidities; however, it may also be evidence that adolescents are referred for surgery later in the course of their disease. These potentially delayed referrals can contribute to worsened outcomes, with higher posttreatment BMIs, fewer adolescents reaching a nonobese weight after surgery, and increased cardiovascular risk.[19,20,53,54]

Hesitancy to refer adolescents may have been warranted in the early development of bariatric surgery; however, increasing evidence suggests that weight loss procedures are as safe and effective in adolescents as they are in adults.[9-15] In this study, we observed a low complication rate and no in-hospital deaths, despite the increasing prevalence of comorbidities among those undergoing surgery. Laparoscopic techniques were increasingly used, with LAGB contributing to one-third of the procedures in 2009. Studies[9-12,14,15] of LAGB in adolescents have shown substantial weight loss and equivalent resolution of comorbidities compared with RYGB. Although LAGB often requires surgical adjustments, with reoperation rates as high as 28% in adolescent trials,[11] the overall early complication rate is low and generally less severe than that observed with gastric bypass.[9,12] Despite the reversibility and lower severity complication profile of LAGB, it remains approved by the Food and Drug Administration only for use in older individuals (≥18 years). Other surgical techniques such as laparoscopic sleeve gastrectomy are being adapted to adolescent patients, with early reports of safety and efficacy.[55] Studies[56,57] of laparoscopic sleeve gastrectomy in adults document weight loss almost equivalent to that of RYGB but with fewer complications. This favorable risk-benefit profile, without the need for device approval, may make laparoscopic sleeve gastrectomy an appealing option for adolescents. Long-term data on complications and outcomes are needed to determine which procedure is safest and most effective in adolescents.

Our study has several limitations, mostly related to the use of administrative data. First, administrative databases do not include preoperative clinical data (such as BMI and severity of comorbid diseases) or postdischarge outcomes. Therefore, we were unable to evaluate postoperative weight loss or resolution of comorbid diseases. Each year of the KID also includes a different sample of discharges, preventing us from following up adolescents longitudinally and determining rates of late complications, readmissions, or surgical revisions after initial hospitalization. Second, while the KID is useful for studying rare pediatric events, we encountered small cell sizes when reporting trends by age and procedure subtype for each outcome measure. Third, administrative databases rely on medical billing practices, with changes in coding schemes often lagging behind changes in medical procedures. For example, evidence exists that LAGB has been performed since 2001 in adolescents.[14] However, our data could not capture laparoscopic procedures before 2006 because *ICD-9-CM* billing codes for these procedures were not created until 2004. Similarly, *ICD-9-CM* codes for laparoscopic sleeve gastrectomy were not available until 2011, preventing unique identification of these procedures during our study period. Our data can detect the overall trend toward laparoscopic procedures, but the increases depicted



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likely started earlier and occurred more gradually than suggested by our findings.

Fourth, the KID includes only hospital discharges and will not capture the increasing trend of performing LAGB at outpatient or ambulatory surgical centers. Therefore, our findings relate only to inpatient use of bariatric surgery among adolescents. An adult study[30] estimated that more than 20 000 LAGB procedures are performed at ambulatory centers each year, representing almost 20% of weight loss procedures. Of those younger than 21 years, 46% of LAGB procedures in California were performed at outpatient centers.[27] The addition of data from these surgical facilities may have led to increased overall procedure volume and proportion of LAGB procedures performed annually. With the lack of Food and Drug Administration approval for LAGB in those younger than 18 years, these additions would not likely have altered the general plateau in volume depicted by our inpatient data.

Our study provides insight into recent national trends in inpatient adolescent bariatric surgery. The data show that adolescent bariatric surgery trends mirror those observed in the adult population, with a plateau in volume during the mid-2000s and a shift toward less invasive procedures. They also point to low use of this potentially life-altering treatment in adolescent boys and groups of lower socioeconomic status. As prospective databases are developed,[2] we will be able to assess the trends and outcomes of adolescent bariatric surgery more accurately. Efforts to address barriers in access to care among adolescent populations with the largest obesity burden are needed to bridge the gap between those who qualify for and those who actually undergo weight loss procedures.

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