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Original article

Health Disparities in Adolescent Bariatric Surgery: Nationwide Outcomes and Utilization

Omar Nunez Lopez, M.D. [a,*], Daniel C. Jupiter, Ph.D. [b], Fredrick J. Bohanon, M.D. [a], Ravi S. Radhakrishnan, M.D. [a,c], and Kanika A. Bowen-Jallow, M.D. [a,*]

[a] *Department of Surgery, University of Texas Medical Branch, Galveston, Texas*
[b] *Department of Preventive Medicine and Community Health, University of Texas Medical Branch, Galveston, Texas*
[c] *Department of Pediatrics, University of Texas Medical Branch, Galveston, Texas*

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A B S T R A C T

Purpose: Bariatric surgery represents an appropriate treatment for adolescent severe obesity, but its utilization remains low in this patient population. We studied the impact of race and sex on preoperative characteristics, outcomes, and utilization of adolescent bariatric surgery.
Methods: Retrospective analysis (2007–2014) of adolescent bariatric surgery using the Bariatric Outcomes Longitudinal Database, a national database that collects bariatric surgical care data. We assessed the relationships between baseline characteristics and outcomes (weight loss and remission of obesity-related conditions [ORCs]). Using the National Health and Nutrition Examination Survey and U.S. census data, we calculated the ratio of severe obesity and bariatric procedures among races and determined the ratio of ratios to assess for disparities.
Results: About 1,539 adolescents underwent bariatric surgery. Males had higher preoperative body mass index (BMI; 51.8 ± 10.5 vs. 47.1 ± 8.7, $p < .001$) and higher rates of obstructive sleep apnea and dyslipidemia. Blacks had higher preoperative BMI (52.4 ± 10.6 vs. 47.3 ± 8.3; 48.7 ± 8.8; 48.2 ± 12.1 kg/m^2; whites, Hispanics, and others, respectively $p < .001$) and higher rates of hypertension, obstructive sleep apnea, and asthma. Weight loss and ORCs remission rates did not differ between sexes or races after accounting for the rate of severe obesity in each racial group. White adolescents underwent bariatric surgery at a higher proportion than blacks and Hispanics (2.5 and 2.3 times higher, respectively).
Conclusions: Preoperative characteristics vary according to race and sex. Race and sex do not impact 12-month weight loss or ORC's remission rates. Minority adolescents undergo bariatric surgery at lower-than-expected rates.

IMPLICATIONS AND CONTRIBUTION

Minority adolescent severe obesity rates have disproportionally increased over the last years. Bariatric surgery is an effective treatment for adolescents with severe obesity but its utilization remains low. This nationwide study demonstrates lower-than-expected rates of bariatric surgery in minority adolescents and the impact of race and sex on outcomes.

Despite substantial efforts to prevent and treat childhood obesity, pediatric obesity rates continue to rise with more notable increases in the prevalence of severe obesity in adolescents [1]. Examination of the National Health and Nutrition Examination Survey (NHANES) demonstrated that 33% of children

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* Address correspondence to: Omar Nunez Lopez, M.D.,and Kanika A. Bowen-Jallow, M.D., Department of Surgery, University of Texas Medical Branch, 301 University Boulevard, Galveston, TX 77555-0353.
E-mail addresses: oanunezl@utmb.edu (O. Nunez Lopez); kabowen@utmb.edu (K.A. Bowen-Jallow).

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met criteria for being overweight, including 9% meeting criteria for severe obesity, defined as age- and sex-specific body mass index (BMI) ≥120% of the 95th percentile, or BMI ≥ 35 kg/m^2 [1,2]. This represents approximately 4.5 million children and adolescents with severe obesity in the United States that require intensive obesity treatment [3].

Obesity in childhood and adolescence is associated with serious obesity-related conditions (ORCs), such as type 2 diabetes mellitus, hypertension, obstructive sleep apnea (OSA), gastroesophageal reflux disease (GERD), cholelithiasis, nonalcoholic fatty liver disease, dyslipidemia, pseudotumor cerebri, and musculoskeletal pathologies [4,5]. Obese children are likely to carry obesity to adulthood and to have increased morbidity and mortality risk [6,7]. Specifically, Freedman et al. [8] demonstrated that 88% of adolescents with a BMI ≥ 99th percentile develop adult obesity, suggesting the need for more aggressive treatment in this subgroup of patients.

Bariatric surgery is a treatment option for adolescents with severe obesity who have failed to lose weight after 6 months of behavioral and medical interventions [9]. It has been performed since the 1980s, gaining widespread utilization in the early 2000s [10]. In 2004, a panel of experts recommended bariatric surgery for adolescents with BMI ≥ 40 kg/m^2 and ORCs or BMI ≥ 50 kg/m^2 regardless of ORCs [9]. Concerns for worsened outcomes due to strict BMI requirements and growing evidence regarding the safety and efficacy of bariatric surgery led to modification of the qualifying criteria [11,12]. Currently, adolescents with BMI ≥ 35 kg/m^2 and major comorbidities or BMI ≥ 40 kg/m^2 with minor comorbidities are candidates for bariatric surgery [13].

The rates of bariatric surgery utilization in adolescents has plateaued since 2003 and still remains low despite the increasing rates of adolescent obesity and increased prevalence of ORCs over the same period of time [14]. Patient-, provider-, and system-level factors may be associated with this trend. Notably, insurance coverage and the authorization process are more complex in adolescents than in adults; insurance coverage is not easily predictable even for patients meeting all the defined criteria. Inge et al. [15] reported that less than half of adolescents received approval for bariatric surgery on the first request.

Racial disparities in childhood obesity have been recognized extensively. In 2013–2014, the obesity rate in white children was 16%, compared with 19% in blacks and 22% in Hispanics [16]. In this study, we analyzed the impact of race on the preoperative characteristics and postoperative outcomes of bariatric surgery in adolescents. Furthermore, we studied whether the utilization rate of bariatric surgery is lower in nonwhite adolescents despite the higher prevalence of obesity in minority groups.

Methods

Participants and materials

Adolescents with age ≥12 to <19 years who underwent bariatric surgery were identified using the Bariatric Outcomes Longitudinal Database (BOLD), years 2007–2014. The BOLD, created by the Surgical Review Corporation, is a repository from the American Society for Metabolic and Bariatric Surgery–Bariatric Surgery Center of Excellence (BSCOE) participants [17]. BSCOE participants (563 centers, during the study period, distributed across the nation) entered prospective data for bariatric surgery patients during all phases of care. Each patient was followed over time, including preoperative visits, hospital stay, and postoperative visits [17]. Verification of the data occurs through site inspections and data reconciliation [17]. With the Surgical Review Corporation's approval, the data from subjects who agreed to allow their information to be used for research can be deidentified and used for aggregate data analysis.

Demographic characteristics included age, sex, and race (as classified by the BOLD; the racial group "others" included Asians, Native Americans, and Pacific Islanders). Baseline clinical characteristics included preoperative BMI (lowest BMI before surgery), and ORCs. The primary outcome was weight loss, measured by absolute changes (BMI units and net weight loss in kilograms) and relative changes (percent of total weight loss [%TWL]). Secondary outcomes were the remission rate of ORCs, calculated as the proportion of subjects whose preoperatively identified ORCs resolved after surgery.

The NHANES database and U.S. census population data from the years 2013 to 2014 were used to calculate the estimated number of adolescents with severe obesity, stratified by sex and race. The NHANES is a continuous survey that uses a stratified, multistage, clustered probability sample design to acquire a representative sample of the U.S. population. More information about its methodology can be found on the NHANES Web site (http://www.cdc.gov/nchs/nhanes/). Deidentified data was used for this study, and it was exempt from the institutional review board approval by the University of Texas Medical Branch.

Obesity-related conditions

ORCs included hypertension, diabetes, OSA, GERD, asthma, hyperlipidemia, and depression. ORCs were defined as follows. Hypertension was defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 100 mmHg at two separate clinical evaluations or high blood pressure controlled with the use of antihypertensive medications. Diabetes was defined as fasting blood glucose >125 mg/dl or pre-existing diagnosis of diabetes mellitus treated with diabetes medications and/or insulin. OSA was defined as the presence of sleep apnea symptoms and a diagnosis confirmed by sleep study (regardless of use of continuous positive airway pressure therapy). GERD was defined as intermittent or chronic symptoms of reflux requiring treatment (proton pump inhibitors or H2 blockers). Asthma was defined as intermittent or variable symptoms of asthma requiring pharmacologic treatment. Hyperlipidemia was defined as elevated levels of triglycerides and/or total cholesterol.

Subjects identified to have ORCs preoperatively were assessed for remission 12 months after surgery. We defined remission of ORCs as follows. Remission of hypertension was defined as measurements of systolic blood pressure <120 mmHg and diastolic blood pressure <80 mmHg without antihypertensive medications. Remission of diabetes was defined by fasting blood glucose < 100 mg/dl without the use of diabetes medications or insulin. Remission of OSA was defined as the absence of sleep apnea symptoms and no requirement of continuous positive airway pressure therapy. Remission of GERD was defined by the resolution of reflux symptoms without proton pump inhibitors or H2 blockers. Remission of asthma was defined as the absence of symptoms and no requirement of pharmacologic treatment. Remission of hyperlipidemia was defined by the normalization of triglycerides and total cholesterol levels.