Psychiatric Diagnoses and Weight Loss Among Adolescents Receiving Sleeve Gastrectomy

Eleanor R. Mackey, PhD,[a,b] Jichuan Wang, PhD,[a,b] Chloe Harrington, BA,[b] Evan P. Nadler, MD[a,b]

abstract

BACKGROUND AND OBJECTIVES: Severe obesity is associated with higher risk of psychiatric difficulties. Bariatric surgery is the most effective treatment of severe obesity. Few guidelines exist regarding the association of psychiatric diagnoses in adolescents and outcomes after surgery because of the lack of longitudinal research. Our objective is to evaluate the rates of psychiatric diagnoses in adolescents undergoing surgery compared with those not receiving surgery and the association of preoperative psychiatric diagnoses with postsurgical weight loss outcomes.

METHODS: Adolescents (N = 222) referred for psychological evaluation at one institution for bariatric surgery (2009–2017) completed semistructured clinical interviews to assess the presence and number of psychiatric diagnoses. Comparison analyses were conducted between those who did not end up receiving surgery (N = 53) and those who did (N = 169). Using longitudinal modeling, we assessed the association of preoperative diagnoses with weight loss outcomes between 3 and 12 months after surgery.

RESULTS: Seventy-one percent of adolescents qualified for a psychiatric disorder. There were no differences in rates of specific disorders or numbers of diagnoses between those receiving surgery and those not receiving surgery. The presence or absence or number of diagnoses before surgery was not associated with weight loss outcomes after surgery.

CONCLUSIONS: Psychiatric diagnoses are prevalent among adolescents with severe obesity. These diagnoses are not associated with weight loss outcomes. The presurgical psychological evaluation serves as an opportunity to identify adolescents experiencing psychiatric problems and provide them with care but should not necessarily be considered a contraindication to surgery.

aCenter for Translational Science, Children's National Health System, Washington, District of Columbia; and bDepartment of Pediatrics, School of Medicine and Health Sciences, The George Washington University, Washington, District of Columbia

WHAT'S KNOWN ON THIS SUBJECT: Psychiatric diagnoses are prevalent in adolescents with severe obesity. Limited research on the association of these concerns with weight loss after bariatric surgery reveals variable effects of depression and eating disorders primarily in white adolescents.

WHAT THIS STUDY ADDS: We examine the association of psychiatric diagnoses with weight loss outcomes after laparoscopic sleeve gastrectomy in diverse adolescents, assessing multiple diagnoses, including anxiety and attention-deficit/hyperactivity disorder, as well as the level of comorbidity, which are unstudied.

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ARTICLE

Severe obesity, or a BMI >120% of the 95th percentile, is now estimated to affect 9.1% of adolescents.[1] This disease places adolescents at risk for significant morbidity and mortality, both concurrently and later in life.[2] Successful treatment in adolescence is critical to prevent maintenance of obesity into adulthood.[3] Bariatric surgery has emerged as the treatment with the most success in treating severe obesity.[4] However, as research begins to catch up to the clinical provision of surgery as a treatment of severe obesity in adolescence, there is still little information to guide clinical decision-making in regards to which adolescents are appropriate for surgery and what might constitute contraindications to treatment. Specifically, psychiatric diagnoses and the association with surgical outcomes are not well studied or understood.

Psychiatric diagnoses are a frequent comorbidity of severe obesity, and youth with severe obesity presenting for bariatric surgery have higher rates of psychiatric diagnoses compared with their healthy weight peers.[5–7] Psychiatric disorders like anxiety, depressive disorders, disorders of executive functioning, or eating disorders have demonstrated effects on adherence,[8] physical activity,[9,10] and eating behaviors[9,10] that could potentially affect postsurgical weight loss. Despite these comorbidities and the potential influence of these disorders on postsurgical weight loss outcomes, a recent systematic review of existing literature regarding pre- and postoperative mental health functioning in adolescents revealed that there is little literature in which the presence of specific psychiatric diagnoses is evaluated as a predictor of outcomes after bariatric surgery.[5] Existing data on depression and eating disorders reveal variable predictive ability for weight loss outcomes after surgery, and there is

literature suggesting that there may be some improvement in depressive symptoms after surgery.[5,11,12] However, other potentially highly relevant disorders to weight loss outcomes, including anxiety and attention-deficit/hyperactivity disorder (ADHD), are either understudied or unstudied.

Given the high prevalence of psychiatric diagnoses among youth with severe obesity, experts have considered how to address these comorbidities in the context of referral for bariatric surgery in adolescents. Initially, recommendations indicated that significant mood or cognitive difficulties should be considered as contraindications to surgery because there were almost no data with which to evaluate the association of these concerns with outcomes after surgery.[13,14] However, as more data have emerged, current recommendations emphasize the importance of screening for psychiatric diagnoses before surgery. Specifically, guidelines state that mental or behavioral health conditions that may impact adherence to pre- and postsurgical requirements must be screened for and treated before surgery and may indicate a contraindication depending on the severity of the concern.[15–17] Still lacking are standardized criteria defining what severity or stability of these psychiatric diagnoses should prevent or delay surgery. For example, because the limited existing literature in adults described above indicates that there is not a clear association between certain psychiatric diagnoses (such as depression) and weight loss outcomes, current best practices guidelines state that the presence of a depressive or eating disorder needs not be in and of itself a contraindication for surgery in adolescents.[18] However, to be cautious given the lack of research in this area, some recommendations

include the importance of treatment and history of stable functioning before consideration of surgery.[16]

Because the original guidelines were more conservative with regards to referrals for bariatric surgery in the presence of psychiatric disorders and more complex patients may not make it through the intensive presurgical process,[19] participant samples in published research to date are likely biased in favor of higher functioning adolescents with potentially less psychiatric comorbidities. However, there is no research in which those adolescents who go on to receive bariatric surgery are compared with those who do not. Additionally, the majority of research in adolescent bariatric surgery has been conducted primarily on white adolescents. Hispanic adolescents or adolescents of color may experience differing prevalence of some types of psychiatric diagnoses[20] and may be less likely to have access to care for these difficulties.[21] It is important, therefore, to determine if findings to date can be generalized to Hispanic adolescents or adolescents of color.

Therefore, in the current study, we aim to address these critical gaps in the literature concerning adolescents pursuing laparoscopic sleeve gastrectomy (LSG). First, we characterized the adolescents receiving LSG in the current study by evaluating (1) if those who went on to receive surgery had higher rates of psychiatric diagnoses and a higher number of diagnoses (as an indicator of comorbidity) than those who were evaluated but did not receive LSG and (2) if the presence of common categories of psychiatric diagnoses and the number of all diagnoses predict weight loss outcomes in adolescents receiving LSG. As a secondary aim, we evaluated whether sex, age, and ethnicity were associated with the presence and number of psychiatric disorders. We hypothesized (1) that there would be no group differences

in rates of psychiatric diagnoses between those receiving LSG given the selection criteria for surgery in the study institution and (2) that there would be no association of psychiatric diagnoses by category or number with weight loss outcomes after LSG on the basis of the adult literature.[22] With regards to age, sex, and ethnicity, we hypothesized that the rates of diagnoses would vary by sex, with more girls having diagnoses of mood and anxiety disorders and boys having higher rates of ADHD. We also hypothesized that there would be some increase in the rates of psychiatric diagnoses with age and for patients of color.[20]

METHODS

Procedure

The study was approved by the relevant institutional review board. Signed informed consent was completed during the first 2 years of data collection. In subsequent years, as requested by the institutional review board, signed informed consent was waived. Informed consent was acquired at the clinic visit. In lieu of a signed consent form, an information sheet was provided with the option to request that a patient not be included in the study. This method was used because a signed consent form would be the only document linking a name to the database, serving only to increase the risk of breach of confidentiality. No patients have opted out of the study to date. Four families were unable to provide informed consent because the parents did not speak English and did not have a translator available at the time of consent and were therefore not included in the study.

Adolescents completed the presurgical psychological evaluation before bariatric surgery. These evaluations are scheduled after an adolescent initially qualifies for bariatric surgery on the basis of a BMI of ≥35, with a medical comorbidity or a BMI ≥40. The evaluation is conducted by a clinical psychologist (E.R.M.) with both the adolescent and a parent present and typically occurs 1 to 4 months before potential surgery. The purpose of the evaluation is to determine the adolescent's capacity to consent to surgery and identify any diagnoses or psychosocial difficulties that may decrease likelihood of success after surgery. The process results in a formal psychiatric diagnosis, if one exists. On the basis of the current guidelines,[15,16,18] the presence of psychiatric diagnoses does not disqualify a patient from surgery in the program from which patients are recruited. Rather, if the severity or type of psychiatric diagnosis appears to confer additional risk for pre- and postoperative surgical functioning for a particular patient, that patient is referred to care, and treatment is mandated before surgery. For other patients, treatment is encouraged, and families are referred to care, but the surgery is not predicated on the receipt of treatment or delayed so the patient may receive mental health treatment.

The majority of those evaluated go on to receive surgery, with those not going on to surgery (*N* = 53) (1) being denied by insurance because of age, procedure not covered, or requiring a facility to perform the procedure other than the study institution (64%); (2) electing not to move forward with the procedure (17%); or (3) being nonadherent to presurgical requirements (ie, becoming pregnant or not attending required medical visits; 19%). All patients, regardless of whether they remain on the surgery track or do not receive surgery, continue care in the outpatient lifestyle management clinic, consisting of monthly visits with a medical provider and dietician as well as referrals to other specialists as needed.

Participants

The 222 participants were mostly female (72%) and Hispanic or of color (82% Hispanic or of color; 59% African American, 17% Hispanic, 6% other) pediatric patients with severe obesity (BMI mean = 50.1; SD = 8.7; range: 35–87) between the ages of 10 and 23 (mean = 16.4; SD = 2.1). Out of the 222 participants evaluated, 53 did not receive surgery (see Table 1 for demographic information by group). Although no direct measure of socioeconomic status was collected, ∼50% of the patients in the program were on Medicaid.

Measures

All data were gathered either at the preoperative psychological evaluation or the pre- and postsurgical appointments (within the month before surgery, and 3, 6, 9, and 12 months postsurgery) with the surgeon, during which their anthropometric measures were assessed.

Demographic Variables

Sex (coded as 0 = female, 1 = male), race and/or ethnicity, and age were all abstracted from the medical record. These are self-reported at the time of the first visit to the hospital, when a record is created for the patient. Only 6 patients were not classified as African American, white, or Hispanic. These individuals were primarily multiracial or Asian, but the group was too small to be considered as a separate group. Therefore, these were excluded from final analyses.

Psychiatric Diagnoses

As a structured method of diagnosing current and lifetime experience of a psychiatric diagnosis, the Kiddie Schedule for Affective Disorders and Schizophrenia, Present and Lifetime version screener[23] was used. The Kiddie Schedule for Affective Disorders and Schizophrenia, Present and Lifetime version screener is a semistructured clinical interview

TABLE 1 Descriptive Data by Group

	Surgery (N = 169)	Nonsurgery (N = 53)	Total (N = 222)	Difference Between Groups, P
Sex (female)	74%	62%	71%	.12
Race and/or ethnicity				.43
African American	60%	55%	59%	
Hispanic or Latino	17%	18%	17%	
White	19%	16%	18%	
Other	4%	12%	6%	
Age	16.4 (2.0)[a]	16.2 (2.2)[a]	16.4 (2.1)[a]	.50
Preoperation baseline BMI	50.6 (8.7)[a]	48.5 (8.7)[a]	50.1 (8.7)[a]	.13
Anxiety diagnosed	25%	28%	26%	.72
Depression diagnosed	42%	37%	41%	.63
ADHD diagnosed	21%	22%	21%	.99
Eating disorder diagnosed	6%	14%	8%	.13
No. diagnoses	1.2 (1.1)[a]	1.4 (1.2)[a]	1.3 (1.1)[a]	.27
%EBMIL at 3 mo (N = 141)	37% (16%)[a]	—	—	—
%EBMIL at 6 mo (N = 95)	48% (18%)[a]	—	—	—
%EBMIL at 9 mo (N = 67)	51% (21%)[a]	—	—	—
%EBMIL at 12 mo (N = 78)	55% (22%)[a]	—	—	—

—, not applicable.
[a] Mean (SD).

that enables the diagnosis of psychiatric disorders across the various types of diagnoses. The screener is the core component of the interview that assesses primary symptoms across all diagnoses but does not include the supplemental questions available for each diagnosis because of time constraints. This screener was conducted with the adolescent alone. As part of the larger clinical assessment, parent report was also gathered, including existing diagnoses received by another mental health provider, and adolescent report was corroborated. Either a licensed clinical psychologist (E.R.M.) or a psychology doctoral graduate student or intern under the direct supervision of the psychologist administered the interview. For the purposes of the current study, the presence or absence of a class of diagnosis was calculated for any depressive disorder, anxiety disorder, type of ADHD, or eating disorder. Present, in partial remission, and recent past diagnoses were included in these tallies. Additionally, the number of overall diagnoses (which includes diagnoses other than depressive disorders, anxiety disorders, ADHD,

or eating disorders) was computed as an index of comorbidity. The number of diagnoses was skewed. Instead of treating it as a continuous variable, the number of diagnoses was coded as a 3-level categorical measure (0, 1, or 2 or more diagnoses), and category 0 was treated as the reference group in modeling.

Weight Loss

As a measure of weight loss after surgery, the percentage of excess BMI lost (%EBMIL) was calculated. This is done by assuming a goal BMI of 25 and is a standard calculation for assessing weight loss postsurgery.[24] Specifically, a BMI of 25 is subtracted from the preoperative BMI to calculate the excess BMI. BMI at subsequent time points is then used in reference to excess BMI to calculate the %EBMIL. Because of loss to follow-up, 85% of participants had weight loss data at 3 months postsurgery, 60% at 6 months postsurgery, and 54% at 12 months postsurgery.

Data Analytic Plan

Descriptive data were first calculated to characterize the sample with regards to age, sex, race and/or

ethnicity, and baseline BMI. Next, to examine differences in rates of diagnoses in the 4 primary diagnostic categories (depressive, anxiety, ADHD, and eating) between those adolescents who received surgery and those who did not, χ^2 tests were calculated. Independent sample t tests were conducted to evaluate the between-group differences in the number of diagnoses at the preoperative psychological evaluation. Finally, the growth trajectory of change in %EBMIL was examined by using a nonlinear latent growth model (LGM).[25–28]

In the LGM, outcome measures are %EBMIL at 3, 6, 9, and 12 months postsurgery. There are 2 latent growth factors, representing the initial 3-month average %EBMIL and the rate of change in %EBMIL every 3 months between 3 and 9 months postsurgery. The measure of %EBMIL at the 12-month follow-up was treated as a distal outcome. The preoperative psychiatric diagnoses (eg, presence of anxiety, depression, ADHD, or eating disorders and the number of diagnoses) were included as predictors in the model to predict (1) the rate of weight loss between 3 and 9 months postsurgery and (2) the amount of weight loss at 12 months postsurgery, controlling for demographics (ie, age, sex, and race and/or ethnicity).

The Bayesian approach was applied for model estimation because it has superior performance in small samples without reliance on asymptotic and data normality assumptions and is also more robust for handling missing data.[29–31] The Bayesian approach is a full-information estimator in which all of the available data under a missing-at-random (MAR) assumption are used. Such a full-information approach is superior to the traditional approaches and similar response pattern imputations, especially in the context of longitudinal studies.[32–34] Different from the missing

completely at random assumption in the traditional statistical methods, MAR allows missingness to be related to observed covariates and/or outcome measures.[29,31,35] That is, any association between missing data and the observed covariates (eg, sociodemographics or intervention assignment) or observed outcomes (eg, outcome measures at baseline) does not violate the MAR assumption. The LGM was estimated by using Mplus 8.0.[36] Nonetheless, data were first examined to determine the association of any demographic variables with whether any follow-up data were missing. By using χ^2 analyses, there was no significant association with sex ($\chi_2{}^2 = 0.4$; $P = .81$) or race and/or ethnicity ($\chi_2^2 = 2.4$; $P = .31$). By using t tests, no significant difference was found with age ($t_{166} = 0.1$; $P = .92$) or preoperative BMI ($t_{166} = -0.8$; $P = .46$).

The goodness of fit of the model was assessed by posterior predictive checking.[37] If the model fits the data well, the 95% confidence interval of the difference between the observed and replicated χ^2 values should center around 0, and the posterior predictive P value should be >.05.[30,37] Statistical inferences were made by examining the range of parameter estimates that captures 95% of the posterior probability distribution (ie, 95% Bayesian credibility interval [CI]). If the 95% CI of a path coefficient estimate does not cover 0, then the path coefficient is statistically significant at α = .05 level.[31,37]

RESULTS

Participants presented with a range of 0 to 5 mental health diagnoses (mean = 1.3; SD = 1.1). Seventy-one percent of participants had at least 1 diagnosis, and 34% had 2 or more diagnoses. Across the diagnostic categories, there were high rates of anxiety (26%), depression (42%), ADHD (22%), and eating disorder

(8%) diagnoses across both groups (see Table 1). When comorbid conditions were present, the most frequent comorbidity was between anxiety and depressive disorders (accounting for 49% of those who had comorbid diagnoses). There were small numbers of other disorders that were not examined separately in analyses but accounted for in overall number of diagnoses, including oppositional defiant disorder ($n = 5$), bipolar disorder ($n = 4$), autism spectrum disorder ($n = 2$), substance abuse ($n = 2$), intermittent explosive disorder ($n = 2$), schizophrenia ($n = 1$), and conduct disorder ($n = 1$). χ^2 analyses (see Table 1) indicated that there was no difference in the rates of diagnoses or the number of diagnoses between groups (all $P > .05$). Likewise, race and/or ethnicity and sex were not associated with whether an adolescent received surgery or not (all $P > .05$). Independent samples t tests indicated that BMI at baseline was not associated with whether an adolescent received surgery ($t_{219} = -1.53$; $P = .13$).

With regards to the association of demographic variables with mental health diagnoses, white participants were more likely to have an anxiety diagnosis ($\chi^2 = 4.07$; $P = .04$) and an eating disorder diagnosis ($\chi^2 = 4.31$; $P = .04$), but race and/or ethnicity (white participants as compared with Hispanic participants or participants of color) was not associated with ADHD, depression, or the number of diagnoses (all $P > .05$). Bivariate correlations indicated that age was not associated with rates or the number of diagnoses ($P > .05$). Boys were more likely to have ADHD diagnoses ($\chi^2 = 11.36$; $P = .001$), but sex was not associated with anxiety, depression, eating disorders, or the number of diagnoses ($P > .05$).

The model fit the data well (posterior predictive checking 95% confidence interval = −30.81 to 31.35; posterior predictive $P = .495$). Our model results reveal that the change in

%EBMIL over time was nonlinear. From presurgery to 3-month follow-up, the average change in BMI was a decrease of 37.0% excess BMI (95% CI: 34.1% to 39.5%). %EBMIL was 45.9% (95% CI: 41.7% to 51.3%) at 6-month follow-up, 50.8% (95% CI: 44.6% to 59.9%) at 9-month follow-up, and 52.9% (95% CI: 45.9% to 63.1%) at 12 months postsurgery, respectively. %EBMIL from presurgery to 3-month follow-up as well as the rate of change in %EBMIL over time between 3 and 9 months postsurgery had a significant positive effect on %EBMIL at 12-month follow-up (β = .76 [95% CI: 0.23 to 1.02] and β = 2.10 [95% CI: 1.60 to 2.95]). In other words, the amount of %EBMIL at 3 months and the rate of change in %EBMIL over time after 3 months postsurgery both predicted the %EBMIL at 12 months. However, none of the psychiatric diagnoses, the number of diagnoses, or the demographics had a significant effect on the %EBMIL at 12 months postsurgery.

DISCUSSION

In the current study, we found that in a diverse sample of adolescents, there were no differences in types or number of psychiatric diagnoses for those adolescents who go on to receive LSG and those who do not in the study institution. Additionally, there were no differences in demographic or weight status characteristics of those who received surgery compared with those who did not. These results indicate that adolescents receiving surgery at this institution do not have fewer psychiatric disorders and are not from differing backgrounds than those who do not. Therefore, the results regarding associations of psychiatric diagnoses with weight loss outcomes from the current study are essential to provide outcome data for what is likely to be more typical of programs in recent years and moving

forward, given the newer guidelines on managing psychiatric diagnoses in the context of bariatric surgery.[15,16,18]

Overall, there were high rates of psychiatric diagnoses in this population (71% had at least 1 diagnosis), consistent with previous literature that revealed higher susceptibility to mental illness in adolescents with severe obesity.[5–7] However, there were limited associations between demographic characteristics and psychiatric diagnoses even in the current sample, which is much more racially and ethnically diverse than previously published studies. Specifically, white adolescents were more likely than Hispanic adolescents or adolescents of color to experience anxiety or eating disorders. This finding regarding anxiety is in contrast to some existing literature in the general adolescent population that revealed higher rates of anxiety disorders in non-Hispanic African American adolescents[20] but is consistent with other literature that revealed similar rates across demographic groups, including higher rates of some types of anxiety in white adolescents.[38] Therefore, differences in rates of anxiety disorders by race may be more specific to adolescents with severe obesity because there may be more acceptance of larger body shapes among Hispanic communities or communities of color; therefore, anxiety about social functioning may be higher in white adolescents who may not experience the same level of acceptance as their peers from Hispanic or other racial backgrounds.[39] Boys were more likely to have a diagnosis of ADHD than girls. This is consistent with the literature that revealed a threefold increase in diagnoses of ADHD for boys compared with girls.[20]

Consistent with hypotheses, there was no association of psychiatric

diagnoses or number of diagnoses with weight loss trajectories after surgery. This adds to the literature that revealed no association of depression[5,11] with weight loss outcomes as well as findings in adult populations regarding the lack of association with ADHD and weight loss outcomes after surgery.[40] In our previous work, we have found that the subclinical experience of loss of control eating[41] and executive dysfunction[42] may contribute to variability in postoperative outcomes, so it may be more important to evaluate subclinical symptoms rather than disorders that meet full criteria for categorization. Even then, however, the contribution of loss of control eating, found in ours as well as other studies,[11] accounts for only a small percentage of long-term weight loss. It is possible that a different assessment for severity of psychiatric disorders aside from a frequency count or accounting for treatment of psychiatric disorders may have revealed an impact on weight loss outcomes after LSG. Authors of future work should examine these potential factors, with regards to association with weight loss after LSG as well as follow-up periods longer than 12 months postsurgery.

In the current study, we provide an important examination of the association of psychiatric disorders with weight loss outcomes after LSG. However, there are a few important limitations to consider. First, there are significant missing follow-up weight loss data that may affect the findings of the study because those who did not return for appointments may have lost less weight than those who attended follow-up appointments. Second, a more precise assessment of the severity of psychiatric disorders, including whether a patient was currently receiving treatment, may be associated with weight loss

outcomes rather than the number of diagnoses assessed in the current study. Assessing more distal weight loss outcomes longer than 12 months postsurgery may also reveal more effects of psychiatric diagnoses. Finally, weight loss, although a primary desired outcome after bariatric surgery, is not the only outcome important to evaluate. Psychiatric outcomes should also be examined in future research.

CONCLUSIONS AND FUTURE DIRECTIONS

The results of the current study reveal that even when programs adhere to the less stringent guidelines regarding psychiatric diagnoses and appropriateness for bariatric surgery, the types of psychiatric diagnoses and the number of diagnoses before surgery do not predict weight loss outcomes. Therefore, it may be beneficial for the preoperative evaluation to be focused less on the appropriateness of surgery in the presence of psychiatric diagnoses but rather, as others have suggested,[16,22] that the psychological preoperative evaluation is recognized as valuable for identifying adolescents at high risk for psychiatric problems. Bariatric surgery represents a turning point in health and well-being. Therefore, the presurgical time period presents a unique opportunity for adolescents who may be particularly motivated during this phase to receive treatment to improve their mental health status independent of their receipt of bariatric surgery.

Recent work suggests that psychiatric diagnoses and maladaptive eating behaviors in adults during the postoperative period may be more important for predicting weight loss outcomes.[43–47] Therefore, future research should be focused more on the postoperative period in ethnically diverse adolescents to determine the source of variability in outcomes to

apply appropriate interventions. This research may be challenging given difficulties of retention to follow-up after bariatric surgery.[48] Therefore, the use of innovative strategies to monitor remotely and then refer for treatment (eg, online questionnaires, telehealth, computerized, home-based interventions) may be essential for both research and clinical care after surgery. Authors should also examine changes in psychiatric diagnoses after surgery in diverse groups of adolescents in future research because an assumption that mental health will improve by virtue of weight loss may not be applicable in all populations and may still merit referral for treatment. Additionally, the risk for postsurgical development of psychiatric diagnoses and suicidal ideation cannot be overlooked.[49]

ABBREVIATIONS

ADHD: attention-deficit/ hyperactivity disorder
CI: credibility interval
LGM: latent growth model
LSG: laparoscopic sleeve gastrectomy
MAR: missing-at-random
%EBMIL: percentage of excess BMI lost

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