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Two-year trends in psychosocial functioning after adolescent Roux-en-Y gastric bypass

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Abstract

Background—Comprehensive studies of adolescent bariatric surgery outcomes are in their infancy and are critically needed. The present study examined the rate of change in the body mass index (BMI), health-related quality of life (HRQOL), depressive symptoms, and self-concept in adolescents undergoing Roux-en-Y gastric bypass (RYGB) during the first 24 postoperative months using a prospective longitudinal design at a pediatric medical center.

Methods—A total of 16 adolescents (mean age 16.2 yr; 62.5% female, mean BMI 59.9 kg/m²; 97% of eligible, consecutive patients) completed the Impact of Weight on Quality of Life-Kids, Pediatric Quality of Life Inventory, Beck Depression Inventory, Self-Perception Profile for Adolescents, and height and weight measurements at baseline and 6, 12, 18, and 24 months after RYGB. A total of 75% participated at all follow-up points.

Results—Before RYGB, global psychosocial impairments were documented. Hierarchical linear modeling was used to examine the growth trajectories. Several quadratic (nonlinear) trends were revealed. A substantial reduction in weight and depressive symptoms, as well as improved HRQOL and self-concept were identified across the first postoperative year, followed by decelerations in year 2, including weight regain ($P < .0001$) and slight increases in depressive symptoms ($P = .004$) and decreases in HRQOL (Social, $P = .002$; Body Esteem, $P = .0007$; Physical Comfort, $P < .0001$; and Total, $P < .0001$), and self-concept (Social, $P = .02$; Appearance, $P = .002$; and Close Friendship, $P = .008$).

Conclusion—During the first 24 months after RYGB, preliminary evidence suggests adolescents experience significant weight loss as well as psychosocial and HRQOL improvements. A deceleration in these gains occurred in the second postoperative year. Longer term follow-up with larger samples is critical to determine the weight and psychosocial trajectories, and what role psychosocial status plays in adolescents' weight change and maintenance.

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Disclosures

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Keywords

Adolescent; Roux-en-Y gastric bypass; Depression; Quality of life; Psychosocial

Prevalence estimates of extreme pediatric obesity range from 3.8% to 6.4% of today's youth [1,2]. Bariatric surgery, a viable intervention for adult extreme obesity, is now undergoing critical evaluation with adolescents. The initial outcome data support the safety and short-term efficacy of this intervention for adolescents [3–5], with associated improvements in psychosocial health (e.g., quality of life, depressive symptoms) [5–8]. However, with one recent exception [5], our understanding of the psychosocial outcomes of adolescent bariatric surgery has been limited to the first postoperative year and by study method (e.g., retrospective chart reviews, nonsystematic or significant attrition).

Our group [6] was the first to prospectively examine the psychosocial outcomes of adolescent Roux-en-Y gastric bypass (RYGB) and the rate of change in these outcomes across the first-postoperative year. In addition to substantial weight loss from before surgery/baseline to 12 months after RYGB ($n = 28$, mean change in body mass index [BMI] -24.1 kg/m^2 or 38%), adolescents reported a significant reduction in depressive symptoms and improved health-related quality of life (HRQOL), with evidence of a deceleration in the rate of change over time. The present study extended our previous work and used a prospective longitudinal design to examine the changes in BMI, depressive symptoms, HRQOL, and self-concept in the initial 16 adolescent participants during their first 24 postoperative months. From the published adult data [9,10], we hypothesized that adolescents would experience significant BMI loss and significant improvements in psychosocial status, including improved generic and weight-related HRQOL and self-concept, as well as a reduction in depressive symptoms during the first 24 postoperative months. However, we expected a deceleration in these improvements by the end of the first postoperative year.

Methods

The present data were a part of a prospective observational study examining change in the psychosocial functioning of adolescents with extreme obesity at 6 and 12 months after RYGB [6]. The present study focused on the initial 16 participants of the larger cohort for whom additional study visits had been completed at 18 and 24 months postoperatively. The local institutional review board approved the study.

Participants and procedures

Surgical candidacy was determined using the initial adolescent bariatric surgery patient selection guidelines (e.g., BMI $> 40 \text{ kg/m}^2$) [11]. The potential study participants were approached after obtaining clinical and insurance approval for surgery, which, for the study period, was exclusively RYGB. The adolescents underwent RYGB between May 2004 to September 2005. The study inclusion criteria required participants to be 14–17 years old with no developmental disability owing to the study's high reading demand. Of the 16 consecutive patients meeting the inclusion criteria, 100% agreed to complete the baseline

measures. Retention was high, with data obtained at all 5 time points for 75% of the sample and at 4 points for 94%. At 24 months, 88% (n = 14) of the participants completed the data collection.

At each follow-up point, the adolescents and primary caregivers were administered measures independently by trained staff. The study visits were scheduled with the clinical visits for patient convenience. However, to minimize burden and maximize retention, the follow-up data were also collected by staff at the participants' homes or by mailing questionnaires the participant completed with the aid of staff by telephone. These strategies were useful at the 18-month (47% mail; 7% home visits) and 24-month follow-up visits (7% mail; 36% home visits). The participants were compensated for their participation.

Measures

The caregivers completed a questionnaire documenting information to determine the family's socioeconomic status using the Revised Duncan, an occupation-based measure of socioeconomic status [12,13]. For both adolescents and caregivers, height and weight measurements were obtained by the research assistant using a calibrated stadiometer and digital scale, with the participants in street clothing without shoes. For those participants who received the questionnaires by mail, self-reported measurements were used. These data were used to calculate BMI. The percentage of excess weight loss (%EWL) at 24 months was calculated as follows. Each participants' baseline ideal body weight (ideal body weight = height² × BMI at the 85th percentile for gender and age [14]) and baseline excess weight (excess weight = baseline weight – ideal body weight) were calculated. The percentage of excess weight loss was defined as the weight lost at 24 months divided by the excess weight multiplied by 100.

Adolescent depressive symptoms were assessed using the Beck Depression Inventory-II, a 21-item questionnaire for those 14 years old, with well-established psychometric properties [15]. Greater total raw scores reflect more depressive symptoms and correspond to ranges of symptom severity (minimal, 0–13; mild, 14–19; moderate, 20–28; and severe, ≥ 29). A total raw score of ≥ 17 is considered a conservative marker for clinically elevated depressive symptoms.

Adolescents completed the Self-Perception Profile for Adolescents [16], a 45-item instrument evaluating perceived competencies (e.g., self-concept) in 8 areas: scholastic, social acceptance, athletic, physical appearance, behavioral conduct, romantic appeal, job, and close friendship. The scale psychometrics were acceptable [16,17].

Adolescents completed the Pediatric Quality of Life Inventory [18], a psychometrically sound 23-item, generic HRQOL measure for youth aged 13–18. The Physical sub-scale and a Psychosocial Health summary score (mean score of the Emotional, Social, and School subscales) were used. Minimal clinically important difference scores (i.e., the smallest change in a score that the patients perceive as beneficial) for the Pediatric Quality of Life Inventory were 6.66 for Physical and 5.30 for Psychosocial Health [19]. The adolescents also completed the Impact of Weight on Quality of Life-Kids [20], a 27-item instrument for adolescents aged 11–19 years that assesses weight-related QOL. The subscales (Physical

Comfort, Body Esteem, Social Life, and Family Relations) and total score have strong psychometric properties. The minimal clinically important difference scores for the Impact of Weight on Quality of Life-Kids were 8.8 for Physical Comfort, 7.7 for Body Esteem, 8.1 for Social Life, 6.2 for Family Relations, and 4.8 for Total QOL [21].

Statistical analysis

Hierarchical linear modeling (HLM) [22] using SAS/MIXED was used to estimate the average growth trajectories of BMI and psychosocial factors arrayed over time. HLM is the most robust analytical procedure available for evaluating nonlinear growth trends over time. Although complete data were available for 75% of the sample, HLM uses maximum likelihood estimation methods to accommodate missing data such that any participant with multiple data points can be included in the analysis of the entire trajectory. Using Bayes' estimation, those with more data are given more weight in the calculation—a procedure preferred to using listwise or pairwise deletion in analyses in which portions of the developmental curve are represented by differing individuals or when any given portion of the curve is only sparingly represented [23]. Restricted maximum likelihood estimation with an estimated degrees of freedom procedure [24] was used to obtain valid parameter estimates under the assumption of ignorable missing data. When examining growth trajectories, there are considerable power gains to be expected with models using 4 points of data [25]. Even with these power gains, only large effect sizes that are upward of $\delta > .85$ will be detectable with a sample of 16 subjects [26].

Results

Participating adolescents (mean age 16.2 ± 1.4 years) were primarily girls (62.5%), non-Hispanic white (87.5%), and from a wide geographic area representing 7 states. The descriptive data for all response variables are listed in Table 1.

Body mass index

From before RYGB to 24 months postoperatively, the mean change in the adolescent BMI was a decrease of 21.1 kg/m^2 ($n = 13$), representing a mean BMI loss of 35% and a mean percentage of excess weight loss of $63\% \pm 13\%$ (range 41–84%). HLM revealed a significant quadratic effect over time [$t(1, 55) = 8.53$; $P < .0001$; Fig. 1]. Specifically, a substantial reduction occurred on average in adolescent BMI, with a deceleration by the end of the first postoperative year and evidence of weight regain in the second year. Most adolescents (92.3%; 12 of 13) at 24 months after RYGB remained obese (BMI 95th percentile for age and gender [27]), with 38.5% (5 of 13) maintaining a BMI in the extreme ($> 40 \text{ kg/m}^2$) range (BMI range 29.6–53.6 kg/m^2).

Psychosocial functioning

Before RYGB, 10 (62.5%) of the 16 adolescents reported clinically elevated depressive symptoms (Beck Depression Inventory-II total score > 17), with a mean total score (20.48 ± 12.67) in the moderate range of severity (Table 1). The mean levels of most self-concept domains were lower than mean ranges for normative adolescent samples [16], indicating a lower self-concept for the bariatric adolescents. Only the Scholastic Competence and Close

Friendship scores were within the normative ranges. The adolescent generic Pediatric Quality of Life Inventory and weight-related Impact of Weight on Quality of Life-Kids scores were markedly impaired compared with the instrument norms [18] and those of nonoverweight youth [20], with the exception of the weight-related Family Relations scale.

Longitudinally, HLM indicated a quadratic trend for depressive symptoms [$t(1, 15) = 3.38$; $P = .004$; Fig. 2]. Specifically, on average, a substantial reduction occurred in adolescent depressive symptoms over time, although a deceleration by the end of the first postoperative year and a slight increase in symptoms during the second year was evident. At 24 months after RYGB, only 2 (14.3%) of the 14 participants reported clinical range depressive symptoms (mean 7.71 ± 9.67), with most (78.6%) reporting minimal symptoms.

HLM indicated quadratic and linear trends for self-concept over time (Fig. 2). Quadratic trends were detected for Social Acceptance [$t(1, 69) = -2.42$; $P = .02$], Appearance [$t(1, 69) = -3.19$; $P = .002$], and Close Friendship [$t(1, 70) = -2.76$; $P = .008$]. Specifically, substantial improvement occurred in these domains over time, although a deceleration in the rate of improvement was evident by the end of the first postoperative year, with the second postoperative year marked by a decline. Linear trends were detected for Global Self-esteem [$t(1, 69) = 2.98$; $P = .004$], Athletic Competence [$t(1, 69) = 2.37$; $P = .02$], Job Competence [$t(1, 69) = 2.24$; $P = .03$], and Romantic Appeal [$t(1, 69) = 2.98$; $P = .004$], indicating continued improvement across 24 months postoperatively, with no evidence of deceleration. At 24 months, the mean levels of all domains of self-concept were within normative ranges [16], with the exception of Athletic Competence, which remained lower than the normative values.

HLM indicated quadratic trends over time for most domains of generic HRQOL [Physical Health, $t(1, 70) = -4.62$; $P < .0001$; Psychosocial Health, $t(1, 69) = -2.54$; $P = .013$] and Weight-related HRQOL [Social Life, $t(1, 60) = -3.20$; $P = .002$; Body Esteem, $t(1, 13) = -4.43$; $P = .0007$; Physical Comfort, $t(1, 59) = -6.25$; $P < .0001$; Total, $t(1, 60) = -5.13$; $P < .0001$]. On average, substantial improvement occurred in the HRQOL over time, with a deceleration in the rate of improvement by the end of the first postoperative year and evidence of a decline during the second postoperative year (Fig. 2). Clinically meaningful improvements were detected for the generic (Physical Health, Psychosocial) and weight-related (Social, Physical Comfort, Body Esteem) HRQOL scales from baseline to 6 months postoperatively and for the weight-related scales from 6 to 12 months after RYGB. No clinically meaningful improvements were perceived on any scale from 12 to 18 months or from 18 to 24 months after RYGB.

Discussion

We have provided the first prospective and preliminary data demonstrating that during the first 24 months after RYGB, and along with an impressive reduction in BMI (35%), adolescents experienced significant improvement in depressive symptoms, self-concept, and HRQOL. The effect sizes reported were very large, ranging from $\delta = 4.26$ for BMI change to $\delta = 1.62$ for Job Competence. The strengths of the present study included its prospective longitudinal design, high recruitment and retention rates, the use of measures designed

and/or validated for use with adolescents, and a robust analytical procedure for evaluating nonlinear growth trends over time. These preliminary data are compelling and need replication, currently ongoing with a significantly larger and multisite sample through the Teen-Longitudinal Assessment of Bariatric Surgery (Teen-LABS) consortium [28].

These initial adolescent findings indicate critical areas for additional exploration. First, at 2 years postoperatively, adolescent psychosocial functioning was at levels more typical of nonclinical or nonoverweight adolescent samples [16,18,20,29]. This suggests not only improved, but more normative, psychosocial status, intriguing given that the overwhelming majority of adolescents remained obese at 2 years postoperatively. Some precedence has been set for these phenomena within the adult bariatric data in which normative-range HRQOL [30] and body image concerns have been reported despite continued overweight/obese status [31] at 12 months after RYGB. Within the published HRQOL data, it has been suggested that a change in health status might “recalibrate” a person’s conceptualization, values, and internal standards for self-evaluation; a construct referred to as “response shift” [32]. Thus, experiencing a significant *change* in weight (e.g., loss) or health status (e.g., resolution of co-morbid conditions) might be more important to adolescent psychosocial status than the actual weight status during the first 2 postoperative years.

Second, HLM detected a deceleration in the rate of change and a slight decline in functioning for most psychosocial domains, in parallel with weight regain, during the second postoperative year. Moreover, although clinically meaningful improvements were detected for the generic (Physical Health, Psychosocial) and weight-related (Social, Physical Comfort, Body Esteem) HRQOL scales from baseline to 6 months postoperatively, as well as for the weight-related scales from 6 to 12 months after RYGB, no clinically meaningful improvements were perceived on any scale from 12 months after RYGB onward. Thus, as the rate of improvement in HRQOL scores began to decelerate during the 6–12-month postoperative period, patients also did not perceive meaningful improvements during this time. Arguably, these initial adolescent findings are consistent with adult RYGB outcomes, suggesting psychosocial changes parallel weight change and stability [9,33].

Conclusion

The initial data from the first prospective study examining psychosocial functioning before and after RYGB suggest net gains across all psychosocial domains at 2 years. The replication of these findings with a larger, multisite sample is critical. Finally, only larger sample studies that are longer term (e.g., 5–10 yr) and that include a nonoperative comparison group of extremely obese adolescents will provide sufficient evidence of the durability of weight loss over time and a context to evaluate the relative effect of bariatric surgery on the long-term psychosocial well-being of extremely obese adolescents as they transition to young adulthood.

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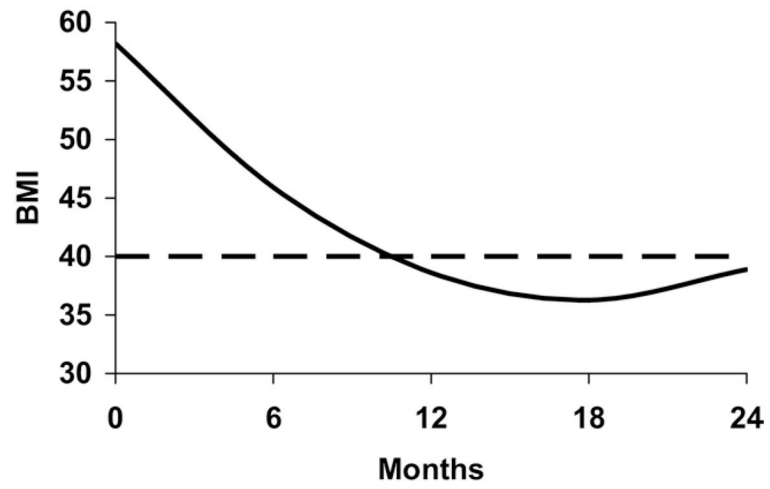


Fig. 1.
HLM of adolescent BMI from before to 24 months after RYGB.

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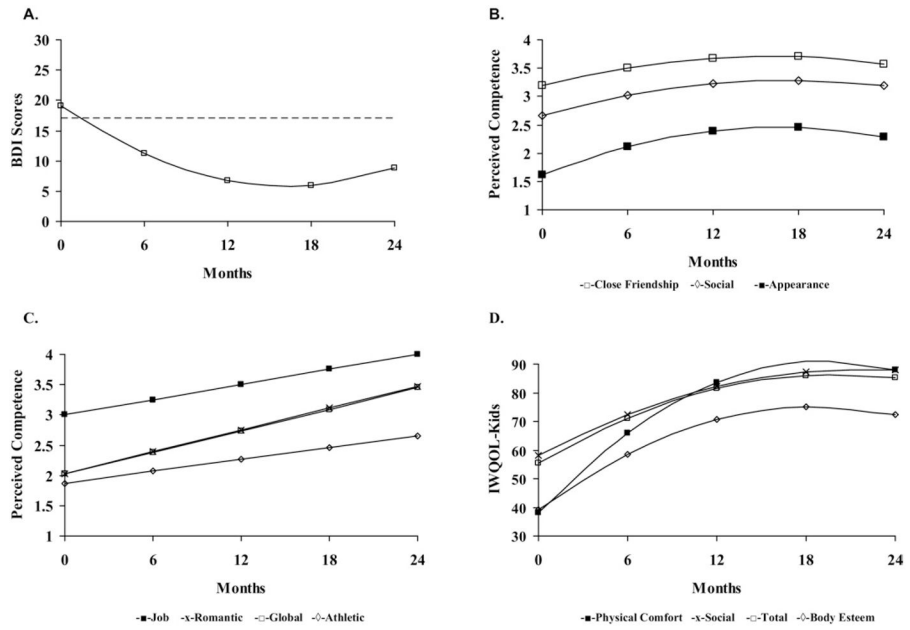


Fig. 2. HLM of adolescent (A) depressive symptoms, (B,C) perceived competence, and (D) weight-related HRQOL from before to 24 months after RYGB.

Table 1

Adolescent BMI and self-report of psychosocial status

Variable	Before RYGB (baseline; n = 16)	6-mo Follow-up (n = 13-14)	12-mo Follow-up (n = 14-15)	18-mo Follow-up (n = 15)	24-mo Follow-up (n = 14)
Adolescent BMI (kg/m ²)	59.91 ± 8.71	42.21 ± 7.80	36.94 ± 4.94	35.17 ± 5.14	38.40 ± 7.53
BDI total score	20.48 ± 12.67	8.61 ± 11.48	6.16 ± 5.00	9.27 ± 8.02	7.71 ± 9.67
SPPA					
Global self-esteem	2.34 ± .82	2.85 ± .84	3.14 ± .70	2.88 ± .79	3.13 ± .64
Scholastic	2.84 ± .98	2.85 ± .83	3.04 ± .74	3.16 ± .84	3.16 ± .68
Social	2.56 ± .88	3.03 ± .88	3.27 ± .78	3.11 ± .80	3.24 ± .59
Athletic	1.84 ± .82	2.11 ± 1.01	2.14 ± .96	2.45 ± 1.05	2.39 ± .86
Appearance	1.51 ± .44	2.26 ± .88	2.41 ± .72	2.27 ± .70	2.51 ± .83
Job	2.96 ± .65	3.26 ± .52	3.41 ± .39	3.39 ± .66	3.50 ± .44
Romantic	2.03 ± .64	2.35 ± .52	2.57 ± .77	2.87 ± .93	2.86 ± .79
Behavior	2.98 ± .66	3.02 ± .66	3.20 ± .56	3.24 ± .81	3.27 ± .60
Close friendship	3.18 ± .88	3.35 ± .78	3.80 ± .22	3.45 ± .70	3.50 ± .76
PedsQL					
Physical health	48.83 ± 18.40	81.97 ± 15.79	80.36 ± 17.74	85.00 ± 12.46	86.61 ± 16.83
Psychosocial health	48.85 ± 19.96	65.71 ± 22.67	72.68 ± 15.64	77.11 ± 16.96	78.39 ± 17.20
Total	48.98 ± 17.86	71.73 ± 19.18	75.19 ± 15.27	79.73 ± 14.36	81.27 ± 15.99
IWQOL-Kids					
Total	53.21 ± 21.69	73.88 ± 26.75	84.88 ± 18.36	85.41 ± 19.90	86.12 ± 18.09
Physical comfort	33.33 ± 23.72	72.62 ± 24.17	88.89 ± 15.96	89.44 ± 15.74	90.77 ± 15.69
Body esteem	36.63 ± 31.92	63.10 ± 35.99	75.91 ± 29.45	74.31 ± 34.22	74.11 ± 30.25
Social life	56.25 ± 34.63	75.30 ± 32.83	85.83 ± 20.94	86.67 ± 20.90	88.93 ± 19.83
Family life	93.23 ± 13.17	89.88 ± 23.27	96.94 ± 7.46	95.83 ± 16.14	96.13 ± 13.32

BMI = body mass index; BDI = Beck Depression Inventory II; SPPA = Self-Perception Profile for Adolescents; PedsQL = Pediatric Quality of Life Inventory; IWQOL-Kids = Impact of Weight on Quality of Life-Kids.

Data presented as mean ± standard deviation.