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The impact of childhood trauma on change in depressive symptoms, eating pathology and weight following Roux-en-Y gastric bypass

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Abstract

Background: History of childhood trauma is associated with increased risk of mental disorders, eating pathology and obesity.

Objective: To examine associations between childhood trauma and changes in depressive symptoms, eating pathology and weight following Roux-en-Y Gastric Bypass (RYGB).

Setting: Three U.S. academic medical centers.

Method: Adults undergoing bariatric surgery (2007-2011) were enrolled in a cohort study. Participants (96 of 114; 86%) completed the Beck Depression Inventory-1 (BDI-1) to assess depressive symptomology, the interviewer-administered Eating Disorder Examination (EDE) to assess subthreshold eating pathology, and weight assessment before and 6 months and annually following RYGB for 7 years, and the Childhood Trauma Questionnaire (CTQ) once post-RYGB.

Results: Pre-surgery, median age was 46 years and median body mass index was 47 kg/m²; 79% were female. Data completeness across 7-year follow-up was 78-90%, 66-91% and 93-100% for

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the BDI-1, EDE and weight, respectively. Using mixed models, presence/severity of childhood emotional abuse, emotional neglect and physical neglect, but not sexual abuse or physical abuse, were significantly associated ($p < .05$) with change (i.e., less improvement/worsening) in the BDI-1 and EDE global scores, as were higher total CTQ score and more types of moderate-intensity trauma. All CTQ measures were associated ($p < .05$) with less improvement/worsening in the EDE eating concern and shape concern scores. CTQ measures were not significantly related to weight loss or regain.

Conclusions: Although childhood trauma did not impact weight outcomes following RYGB, those who experienced childhood trauma had less improvement in depressive symptomology and eating pathology, and therefore might benefit from clinical intervention.

Keywords

childhood trauma; depressive symptoms; eating pathology; weight; Roux-en-Y gastric bypass; bariatric surgery; childhood maltreatment; depression; mental disorders

Background

There is a higher prevalence of history of childhood emotional, physical and sexual abuse, and emotional and physical neglect, among adults who undergo bariatric surgery compared with the general population^(1,2). Children who experience trauma go on to develop mental disorders at higher rates compared with children who do not; this has been reported in the general population^(3,4), as well as among bariatric surgery patients^(1,2,5). For example, among a sample of 302 women, a subgroup of whom were enrolled in the Longitudinal Assessment of Bariatric Surgery-3 (LABS-3) Psychosocial Study, presence/greater severity of childhood physical or mental abuse and neglect were associated with higher risk of pre-surgery history of major depressive disorder, posttraumatic stress disorder (PTSD), other anxiety disorders, alcohol use disorder and binge eating disorder, as well as suicidal ideation or behavior and antidepressant use⁽¹⁾. These associations were independent of age, race, education, body mass index and childhood sexual abuse. In this same study, childhood sexual abuse was independently associated with pre-surgery history of PTSD, suicidal ideation or behavior and antidepressant use, but not other mental disorders⁽¹⁾.

There is also evidence that a history of childhood trauma increases risk of eating disorders in the general population⁽⁴⁾ and subclinical eating pathology, i.e., the psychological traits or constructs shown to be clinically relevant in individuals with eating disorders⁽⁶⁻⁹⁾. For example, in a sample of 192 females with binge eating disorder, bulimia nervosa or anorexia nervosa, childhood emotional abuse independently predicted higher eating, shape and weight concerns⁽⁶⁾. Childhood sexual and physical abuse also independently predicted higher eating concern⁽⁶⁾. In some populations (e.g., patients with eating disorders; college students; African American/low income/inner-city) depressive symptoms have been shown to mediate associations between childhood trauma and eating pathology.^(8,10-12) However, this has not been investigated among bariatric surgery patients.

Considering that childhood trauma increases risk for obesity⁽¹³⁾, mental disorders and subclinical eating pathology, there is a dearth of research investigating its potential impact on

improvement in these domains following bariatric surgery. Four studies have evaluated the associations between history of childhood sexual abuse and short-term post-surgery weight loss, none of which reported a significant association^(5,14-16). One of these studies (N=424), which also examined history of childhood physical abuse and the Adverse Childhood Experience (ACE) score, reported no significant associations between these measures and weight loss⁽¹⁶⁾. In contrast, a study of 223 adults undergoing bariatric surgery found that participants with a high vs low ACE score, who had similar body mass index (BMI) at time of surgery, had higher BMI at 6-months post-surgery (36.9 vs. 33.4 kg/m²; p = 0.03). Despite what appeared to be a larger difference between groups at 12-months (34.5 vs. 30.5 kg/m²; p = 0.07), the association was no longer significant,⁽¹⁷⁾ perhaps due to attrition which may have lowered statistical power. Finally, a pilot study (N=17) reported a positive correlation between a history of childhood trauma, as measured by the Childhood Trauma Questionnaire (CTQ) total score, and weight loss 6 months following surgery⁽¹⁸⁾. However, the authors cautioned, “as a preliminary result derived from a relatively small sample, [the] finding may have been a result of chance rather than a true correlation.”

To our knowledge, no studies with long-term follow-up have evaluated the impact of childhood trauma on outcomes of bariatric surgery. Using validated measures, the LABS-3 Psychosocial Study recently reported on changes in mental disorders, eating pathology and weight with 7-year follow-up^(19,20). However, the impact of childhood trauma on post-surgery outcomes has not been evaluated. This study aims to add to the limited literature by assessing the potential impact of specific types of childhood trauma (emotional, physical and sexual abuse, as well as emotional and physical neglect) and their cumulative effects on changes in depressive symptoms, subclinical eating pathology and weight following Roux-en-Y gastric bypass (RYGB). A secondary aim was to assess whether depressive symptoms mediated associations between childhood trauma and eating pathology. We hypothesized that all domains of childhood trauma would be associated with less improvement in these outcomes, and that change in depressive symptoms mediated the association between childhood trauma and change in eating pathology.

Methods

Design and Participants

The LABS-3 Psychosocial study is part of the National Institutes of Health-funded LABS consortium of studies, which has been described in detail in prior reports⁽²¹⁾. Between 2007-2011 202 adults from three clinical centers (the Neuropsychiatric Research Institute, Fargo, ND; Columbia/Weill Cornell Medical Centers in New York, NY; and the University of Pittsburgh/Duquesne University in Pittsburgh, PA) were enrolled and underwent a bariatric surgical procedure. The Institutional Review Boards at each center approved the protocol and consent forms, and all participants provided written informed consent prior to data collection. Research assessments were conducted within 30 days prior to surgery (after approval for surgery), 6 months post-surgery and annually for 7 years following surgery. Measures were completed at all assessments unless otherwise noted. LABS-3 participants who underwent RYGB (N=114) and completed the CTQ and at least 1 follow-up (N=96; 84%) were included in this report.

Childhood Trauma

The CTQ is a 28-item, well-validated self-report questionnaire which is widely used for the retrospective assessment of traumatic experiences prior to age of 17⁽²²⁾. The CTQ assesses five domains of childhood trauma: ‘emotional abuse’ (i.e., verbal assaults on a child’s sense of worth or well-being, or any humiliating, demeaning or threatening behavior directed towards a child by an older person); ‘physical abuse’ (i.e., bodily assaults on a child by an older person that pose a risk of, or result in, injury); ‘sexual abuse’ (i.e., sexual contact or conduct between a child and older person; explicit coercion is a frequent but not essential feature of these experiences); ‘emotional neglect’ (i.e., failure of caretakers to provide a child’s basic psychological and emotional needs, such as love, encouragement, belonging and support); and ‘physical neglect’ (i.e., failure of caregivers to provide a child’s basic physical needs, including food, shelter, safety and supervision and health⁽⁸⁾). The CTQ was added to the study protocol after study initiation and administered at the year-4 or year-5 assessment. The CTQ asks respondents to rate their history of abuse or neglect across five sub-scales (emotional, physical and sexual abuse as well as physical and emotional neglect) using a 5-point Likert Scale with values ranging from ‘Never True’ to ‘Very Often True’. Each subscale has a score range from 5-25, with subscale-specific thresholds to indicate severity (i.e., none, mild, moderate or severe)⁽²³⁾. A total CTQ score is the sum of all subscale scores, with a range of 25-125. Cronbach’s alpha coefficients, reflecting internal consistency, for the CTQ subscales were: 0.85 for emotional abuse, 0.87 for physical abuse, 0.90 for sexual abuse, 0.86 for emotional neglect and 0.88 for physical neglect. The total CTQ scale was 0.82.

Depressive Symptoms

The Beck Depression Inventory, version 1 (BDI-1) is a 21-item self-administered survey to assess presence/severity of psychological and physical symptoms of depression over the past week⁽²⁴⁾. It was administered at all assessments except year 6. Questions are assessed on a four-point scale ranging from 0 (symptom not present) to 3 (symptom very intense). The total score ranges from 0-63, with a higher score indicating greater depressive symptomology. Because many patients are advised to lose weight in preparation for surgery, no points were assigned to the BDI item, “I have lost more than 5 pounds,” for participants who indicated purposefully trying to lose weight. Cronbach’s alpha coefficient for the BDI score was 0.87 pre-surgery, and 0.90 1 year post-RYGB. Change in score was calculated as post-surgery score – pre-surgery score; thus, a negative value indicates improvement.

Eating Pathology

A modified version of the Eating Disorder Examination (EDE), a semi-structured interview to assess eating pathology⁽²⁵⁾, was administered at all assessments except the 6 month and 6 year assessment. The EDE-Bariatric Surgery Version⁽²⁶⁾ was adapted to discriminate responses related to eating psychopathology from those reflective of common surgery-related concerns, and includes the original EDE questions as well as additional questions of relevance to bariatric surgery patients. Participant responses regarding the past 28 days were used to score four subscales: restraint, eating concerns, shape concerns and weight concerns, each based on averaging 5 to 8 items on a six point scale (range 0-6). An EDE global score

represents the mean of the subscale scores. Higher scores indicate more frequency or severity of pathological eating behaviors and associated psychopathology. Cronbach's alpha coefficients for the EDE subscales were: 0.89 for restraint, 0.85 for eating concerns, 0.83 for shape concerns, 0.84 for weight concerns. For the EDE global score it was 0.79. Change in score was calculated as post-surgery score – pre-surgery score; thus, a negative value indicates improvement.

Weight

Assessment of body weight has been previously described⁽²⁷⁾. Change in weight from surgery was calculated as percentage of pre-surgery weight, i.e., $[100 * (\text{post-surgery weight} - \text{pre-surgery weight})] / \text{pre-surgery weight}$. Negative values indicate weight loss. Weight regain from post-surgery nadir weight was calculated as percentage of maximum weight lost, i.e., $[100 * (\text{post-nadir weight} - \text{nadir weight})] / (\text{pre-surgery weight} - \text{nadir weight})$ ⁽²⁷⁾. Positive values indicate weight regain.

Covariates

Height was measured at the pre-surgery assessment and BMI was calculated as weight in kilograms divided by height in meters squared. Birth date, race, ethnicity, education, income and smoking status were self-reported.

Analysis

Analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC, USA). Statistical significance was set at $p < .05$; tests were two-sided. Participants who were excluded from the analysis due to missing data were compared with those in the analysis sample using the Chi Square or Fisher's Exact test for categorical variables, Cochran-Armitage test for ordinal variables and the Wilcoxon rank sum test for continuous variables. Descriptive statistics (frequencies and percentages for categorical variables; medians, 25th-75th percentiles and ranges for continuous variables) were used to summarize pre-surgery characteristics and childhood trauma.

Mixed models utilized all available data and controlled for factors related to missing follow-up data (i.e. site, age and pre-surgery smoking status) as fixed effects⁽¹⁹⁾. A series of linear mixed models with person-level random intercept were used to test and estimate associations between each of the five types of childhood trauma and change in depressive symptoms, as measured by the BDI-1 score, controlling for sex, race, pre-surgery BMI and the pre-surgery BDI-1 score, with time since surgery entered as a continuous fixed effect. Pre-surgery income and education were also considered as potential confounders and retained if $p < .10$. Due to the low number of participants reporting higher severity childhood trauma, the moderate and severe categories were collapsed. Due to collinearity between types of childhood trauma^(1,10), each type was evaluated in a separate model. However, the number of types of childhood trauma of at least moderate severity⁽⁶⁾ (i.e., 0, 1, 2, 3) and the total CTQ score⁽¹⁰⁾ were also evaluated as summary measures to account for the potential compounding impact of having experienced multiple types of trauma⁽⁷⁾. Thus there were 7 CTQ measures (5 types and 2 summary).

Modeling was repeated in a similar fashion for the EDE global score, as well as each of the EDE subscale scores. The change in the BDI-1 score was added to the model of change in the EDE global score as a time-dependent covariate to evaluate if depressive symptoms mediated the associations (i.e., explained some or all of the association) between history of childhood trauma and change in eating pathology.

Similar modeling was used to test and estimate associations between the 7 childhood trauma measures and change in weight and weight regain. However, for models of weight regain, time since surgery was replaced with times since nadir weight.

Results

Sample

Of 114 participants who underwent RYGB, 96 (84%) completed the required data components for this report (i.e., the CTQ and weight, BDI or EDE at 1 follow-up). There were no significant differences in sociodemographic characteristics, pre-surgery BMI or 1 year post-RYGB change in weight and depressive symptoms between participants who were excluded from the analysis sample due to missing data (N=18) vs those included (N=96) (supplemental material; sTable 1). Among the analysis sample, data completeness across follow-up assessments ranged from 78-90% for the BDI-1, 66-91% for the EDE and for 93-100% for weight (supplemental material; sTable 2).

Characteristics of the analysis sample prior to RYGB are reported in Table 1. Seventy-nine percent of participants were female; 94% were white. Pre-surgery, the median age was 46 (25th, 75th %ile: 36, 54) years, and 82% of participants had at least some college education. The median BMI was 47 (25th, 75th %ile: 43, 52) kg/m².

Childhood Trauma

History of childhood trauma is reported in Table 2. Among the five types of childhood trauma, emotional abuse was most common, reported at low severity by 42% of the sample, followed by emotional neglect (38%), sexual abuse (30%), physical neglect (29%) and physical abuse (25%). Forty-two percent of the sample reported at least one type of abuse or neglect, and 15% reported 3 or more types of abuse or neglect at moderate severity.

Outcomes

Change in the BDI-1, the EDE global score and weight by time since RYGB are provided in supplemental material (sTable 2). Across follow-up, mean (standard deviation) change in the BDI-1 and the EDE scores were $-2.6 (\pm 7.2)$ and $-0.9 (\pm 0.8)$, respectively. Mean (standard deviation) % weight change was $-31.2 (-10.3)$. In models of change in depressive symptoms and change in eating pathology, interactions between childhood trauma measures and time were not significant indicating the effect of childhood trauma did not differ across follow-up.

Depressive Symptoms

Associations between history of childhood trauma and pre- to post-surgery change in depressive symptoms, as measured by the BDI-1 score, and eating pathology, as measured by the EDE global score, are reported in Table 3. Presence/severity (i.e., mild severity and moderate severity vs none) of emotional abuse ($p=.04$), emotional neglect ($p=.008$) and physical neglect ($p=.01$) were significantly associated with less improvement in or worsening in depressive symptoms following RYGB, as were a higher CTQ total score ($p=.003$) and having experienced more types of childhood trauma of at least moderate intensity ($p=.03$). Associations with sexual abuse ($p=.18$) and physical abuse ($p=.07$) did not reach statistical significance but appeared to be in the same direction.

Eating Pathology

Mirroring the associations between childhood trauma and change in depressive symptomology, presence/severity of emotional abuse ($p<.001$), emotional neglect ($p=.02$) and physical neglect ($p<.001$), but not sexual abuse ($p=.053$) or physical abuse ($p=.25$), were significantly associated with less improvement or worsening in eating pathology, measured by the EDE global score. For emotional abuse and emotional neglect, but not physical neglect, a history of at least moderate severity appeared to have a larger impact than mild severity, however, 95% CI for effect estimates were wide and overlapped. Higher CTQ total score ($p<.0001$) and having experienced more types of childhood trauma of at least moderate intensity ($p=.04$) were also significantly associated with less improvement or worsening in the EDE global score (Table 3).

Estimated associations between history of childhood trauma and change in eating pathology were similar with additional control for change in the BDI-1 score (Table 3), indicating that the association between childhood trauma and eating pathology was not explained by depressive symptomology. However, the number of types of trauma of at least moderate severity was no longer significantly related to change in the EDE global score.

Associations between childhood trauma measures and change in the EDE subscale scores are reported in Table 4. Of the five types of trauma, emotional abuse had the strongest and most consistent associations with change in each of the EDE subscale scores. In contrast to the EDE global score, sexual abuse and physical abuse were significantly related to less improvement in eating concern ($p=.02$ and $p=.009$, respectively) and shape concern ($p=.03$ and $p=.04$, respectively) as were the other forms and summary measures (i.e., the number of types of childhood trauma of at least moderate severity and the total CTQ score) of childhood trauma (p for all $<.05$).

Weight

None of the measures of childhood trauma were significantly related to pre- to post-RYGB change in weight, or weight regain from weight nadir (supplemental material, sTable 3).

Discussion

To our knowledge, this is the first study to evaluate the impact of childhood trauma on changes in depressive symptoms and eating pathology following bariatric surgery. This study demonstrates that history of childhood trauma has a negative impact on both short- and long-term changes in depressive symptoms and eating pathology following RYGB. However, change in depressive symptoms does not appear to mediate the association between childhood trauma and change in eating pathology. Despite being related to aspects of eating pathology, childhood trauma was not related to post-surgery weight loss or regain, which the literature suggests are affected by numerous biopsychosocial factors^(28,29).

Studies of childhood trauma are often limited to evaluating abuse⁽⁶⁾ or only sexual abuse⁽⁷⁾. However, in the current study, five types of trauma, including emotional and physical neglect, were evaluated. Childhood emotional abuse, emotional neglect and physical neglect were all related to change in depressive symptoms, as was the cumulative effect of the five different types of childhood trauma. For example, the change in BDI-1 score was approximately 2.4 points higher (i.e., worse), on average, for every 25 CTQ points higher, an effect similar in magnitude but in the opposite direction as bariatric surgery (given the mean change in the BDI-1 score across time points was -2.6). In addition, there was a dose-response relationship between the number of types of childhood trauma of at least moderate intensity and change in the BDI-1 score such that those who experienced at least two types of trauma had less improvement than those who experienced one type, who had less improvement than those who experienced none), suggesting the various types of trauma had at least partially independent effects (i.e. a cumulative impact).

All five types of childhood trauma and their cumulative effect were related to less improvement/worsening in the EDE shape concern and eating concern scores. Emotional abuse, emotional neglect and physical neglect were also related to less improvement/worsening in the EDE weight concern and eating restraint scores, although the magnitude of the associations was smaller compared to shape concern. For example, moderate/severe emotional abuse was associated with a change of 0.59 for the EDE eating restraint score vs. 1.37 for the shape concern score (i.e., over twice the impact). However, at least some types of childhood trauma had a clinically meaningful effect⁽¹⁹⁾ on all four types of eating pathology that we examined.

Of the five types of trauma, emotional abuse had the strongest and most consistent associations with change in the EDE scores. This finding is consistent with a review of childhood trauma and eating pathology which concluded that emotional abuse may have a relationship with a broader range of eating symptoms than sexual and physical abuse⁽⁷⁾, as well as a more recent study of females with eating disorders, in which emotional abuse had an association with more types of pathological eating compared with sexual abuse and physical abuse⁽⁶⁾. While it was outside of the scope of the current study to evaluate the content of emotional abuse, abuse that is specific to weight may have a particularly strong impact on later eating pathology^(30,31). Given the proportion of bariatric surgery patients with a history of childhood obesity⁽³²⁾, future studies should examine this construct.

Studies among adults with obesity have documented less weight loss in conventional weight loss programs among those with a history of sexual abuse in childhood or adulthood versus without^(33,34). The hypothesized explanation has been that those with a history of sexual abuse worry that body attractiveness through weight loss may increase vulnerability to future attack; thus excess weight is maintained as a defense^(33,35). However, as noted earlier, four previous studies failed to find an association between history of childhood sexual abuse and short-term surgically-induced weight loss^(5,14-16). In addition, although not specific to childhood exposure, a recent study of over 4000 patients from the Ontario Bariatric Registry⁽³⁶⁾ failed to find a significant association between history of sexual abuse or “any type of abuse” and weight loss through 1 year post-surgery. Our study provides further support for a lack of association and extends the knowledge base by providing evidence that long-term weight loss, and specifically weight regain, is not affected.

Strengths of the present study include inclusion of patients from 3 geographically diverse clinical centers, well-validated assessments of childhood trauma, depressive symptoms and eating pathology; serial assessments for 7 years following surgery; and high retention relative to the bariatric literature. In addition, the assessment method (i.e., self-report) and timing of the assessment (i.e., post-surgery) for childhood trauma may have led to more accurate reporting (vs. interviewer-administered and pre-surgery)⁽³⁷⁾. A notable limitation is that although we utilized analytic techniques that made use of all available data, due to the initial sample size, loss to follow-up, and the low frequency of mental disorders²³ (including eating disorders) and specific types of pathological eating behaviors⁽¹⁹⁾ (e.g., loss of control eating), statistical power was limited for some analyses (e.g., differentiating the effect by severity) and precluded other analyses of interest. Still, analyses allowed for the evaluation of individual types of childhood trauma, which have differential effects, and the cumulative effect of experiencing multiple types of trauma, as well as different types of eating pathology. Additionally, this sample had very low representation of black race and Hispanic ethnicity, which are associated with higher prevalence of childhood trauma⁽³⁸⁾.

Conclusion

In summary, this study demonstrates that although childhood trauma does not appear to impact weight outcomes following RYGB, those with a history of childhood trauma have less improvement in depressive symptomology and subclinical eating pathology. While associations varied by type of childhood trauma, all 5 types were related to negative outcomes. Although childhood trauma should not be considered a contraindication to bariatric surgery, additional research should evaluate whether those with such history would benefit from clinical intervention either prior to or following surgery, such as referral to a mental health professional with expertise in childhood trauma⁽³⁵⁾.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Childhood trauma was related to less improvement in depressive symptoms post-RYGB
- Childhood trauma was related to less improvement in eating pathology post-RYGB
- Associations varied by type and severity of childhood trauma
- Childhood trauma did not impact weight loss or weight regain following RYGB

Table 1.

Characteristics of adults prior to Roux-en-Y gastric bypass

	Total (N=96^a) No. (%)^b
Age, years	
Median (25th –75th %-ile)	45.5 (36, 53.5)
Range	24-68
Race	
White	90 (93.8)
Black	6 (6.3)
Hispanic ethnicity	
No	91 (94.8)
Yes	5 (5.2)
Education	(N=92)
High school or less	17 (17.7)
Some college	45 (46.9)
College degree	30 (31.3)
Household income, US \$	(N=91)
Less than 25,000	18 (18.8)
25,000-49,999	33 (34.4)
50,000-74,999	22 (22.9)
75,000-99,999	10 (10.4)
>100,000	8 (8.3)
Smoking Status	
No	74 (77.1)
Yes	22 (22.9)
Body mass index, kg/m ²	
Median (25th –75th %-ile)	47.2 (43.1, 51.6)
Range	36.1-71.3

^aUnless otherwise indicated due to missing data.^bUnless otherwise indicated.

Table 2.

History of childhood trauma among adults who underwent Roux-en-Y gastric bypass

	Total (N=96) No. (%)^a
Total CTQ Score	
Median (25th –75th %-ile)	34 (28, 51.5)
Range	25-84
Number of types of moderate severity trauma	
None	56 (58.3)
One	16 (16.7)
Two	10 (10.4)
Three	6 (6.3)
Four	6 (6.3)
Five	2 (2.1)
Emotional Abuse	
None	56 (58.3)
Low	25 (26.0)
Moderate	7 (7.3)
Severe	8 (8.3)
Physical Abuse	
None	72 (75.0)
Low	7 (7.3)
Moderate	7 (7.3)
Severe	10 (10.4)
Emotional Neglect	
None	59 (61.5)
Low	19 (19.8)
Moderate	12 (12.5)
Severe	6 (6.3)
Physical Neglect	
None	68 (70.8)
Low	15 (15.6)
Moderate	8 (8.3)
Severe	5 (5.2)
Sexual Abuse	
None	67 (69.8)
Low	4 (4.2)
Moderate	9 (9.4)
Severe	16 (16.7)

Abbreviations: CTQ, Childhood Trauma Questionnaire.

^aUnless otherwise indicated.

Table 3.

Associations between measures of childhood trauma with change in depressive symptoms and eating pathology following RYGB.

Childhood trauma	Change in BDI-1 Score ^b (N=89)			Change in EDE Global score ^c (N=94)			Change in EDE Global score with additional control for change in the BDI-1 (n=88)		
	B ^b	(95% CI)	P	B ^c	(95% CI)	P	B ^c	(95% CI)	P
CTQ Total Score ^a , per 25 points	2.43	(0.85-4.02)	0.003	0.32	(0.14-0.51)	<0.001	0.27	(0.08-0.47)	0.007
No. moderate types (ref=none)			0.03			0.04			0.10
One	1.72	(-1.01-4.44)		0.17	(-0.15-0.49)		0.04	(-0.31-0.39)	
Two	3.88	(0.53-7.23)		0.47	(0.09-0.85)		0.45	(0.03-0.87)	
Three or more	3.40	(0.37-6.42)		0.37	(0.01-0.73)		0.32	(-0.07-0.70)	
Emotional Abuse (ref=none)			0.04			<0.001			<0.001
Low	1.55	(-0.70-3.79)		0.26	(0.02-0.50)		0.22	(-0.03-0.47)	
Moderate/Severe	3.93	(0.85-7.02)		0.79	(0.44-1.14)		0.80	(0.45-1.15)	
Physical Abuse (ref=none)			0.07			0.25			0.25
Low	2.70	(-1.40-6.80)		0.29	(-0.20-0.78)		0.32	(-0.17-0.81)	
Moderate/Severe	2.85	(0.26-5.44)		0.21	(-0.09-0.52)		0.20	(-0.11-0.52)	
Emotional Neglect (ref=none)			0.008			0.02			0.04
Low	1.21	(-1.24-3.66)		0.27	(-0.01-0.54)		0.28	(-0.01-0.57)	
Moderate/Severe	4.07	(1.53-6.61)		0.45	(0.13-0.77)		0.37	(0.04-0.70)	
Physical Neglect (ref=none)			0.01			<0.001			0.002
Low	3.79	(1.28-6.30)		0.64	(0.35-0.93)		0.56	(0.26-0.85)	
Moderate/Severe	0.58	(-2.37-3.53)		0.08	(-0.23-0.39)		0.07	(-0.28-0.41)	
Sexual Abuse (ref=none)			0.18			0.053			0.26
Low	2.67	(-2.22-7.56)		0.42	(-0.15-0.99)		0.39	(-0.18-0.97)	
Moderate/Severe	2.06	(0.39-4.50)		0.30	(0.02-0.57)		0.16	(-0.14-0.47)	

Abbreviations: CTQ, Childhood Trauma Questionnaire; No, Number; RYGB, Roux-en-Y gastric bypass.

^a Possible range: 25-125. Actual range: 25-84. Higher values indicate more childhood trauma.^b Possible range: -63 to 63. Actual range: -26.0 to 25.0. Positive values indicate less improvement/worsening since pre-surgery. Estimates are adjusted for site, sex, race, pre-surgery values of age, body mass index, smoking status, and time since surgery.

Possible range: -3.9 to 6. Actual range: -9 to 6. Positive values indicate less improvement/worsening. Estimates are adjusted for site, sex, race, pre-surgery values of age, body mass index, smoking status and the global EDE score, and time since surgery.

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Table 4.
Associations between type and severity of childhood trauma with change in eating pathology following RYGB.

Childhood trauma	Pre- to post-surgery change in EDE scores ^a (N=94)											
	Restraint			Eating Concern			Shape Concern			Weight Concern		
	B ^b	(95% CI)	P	B ^b	(95% CI)	P	B ^b	(95% CI)	P	B ^b	(95% CI)	P
CTQ Total Score, per 25 points	0.14	(-0.08-0.37)	0.20	0.26	(0.15-0.37)	<0.001	0.62	(0.34-0.91)	<0.001	0.38	(0.11-0.65)	0.007
No. moderate types (ref=none)			0.45			<0.001			0.008			0.26
One	0.27	(-0.13-0.66)		0.04	(-0.16-0.24)		0.34	(-0.18-0.85)		0.18	(-0.31-0.66)	
Two	0.26	(-0.20-0.72)		0.31	(0.08-0.54)		0.84	(0.23-1.45)		0.49	(-0.09-1.07)	
Three or more	0.08	(-0.35-0.51)		0.42	(0.20-0.64)		0.77	(0.20-1.33)		0.37	(-0.18-0.91)	
Emotional Abuse (ref=none)			0.02			<0.001			<0.001			0.03
Low	0.17	(-0.13-0.48)		0.10	(-0.05-0.24)		0.54	(0.17-0.92)		0.37	(-0.01-0.75)	
Moderate/Severe	0.59	(0.17-1.01)		0.65	(0.45-0.86)		1.37	(0.83-1.91)		0.66	(0.09-1.22)	
Physical Abuse (ref=none)			0.04			0.009			0.04			0.87
Low	0.72	(0.16-1.27)		-0.11	(-0.43-0.20)		0.72	(-0.05-1.49)		0.17	(-0.56-0.89)	
Moderate/Severe	-0.01	(-0.36-0.34)		0.28	(0.09-0.46)		0.53	(0.05-1.02)		0.08	(-0.38-0.54)	
Emotional Neglect (ref=none)			0.04			0.004			0.005			0.03
Low	0.43	(0.10-0.76)		0.09	(-0.08-0.27)		0.47	(0.04-0.91)		0.31	(-0.09-0.71)	
Moderate/Severe	0.22	(-0.15-0.59)		0.35	(0.15-0.55)		0.82	(0.31-1.34)		0.60	(0.13-1.08)	
Physical Neglect (ref=none)			0.16			0.03			<0.001			<0.001
Low	0.35	(-0.01-0.71)		0.28	(0.08-0.48)		1.05	(0.58-1.52)		0.94	(0.51-1.37)	
Moderate/Severe	0.01	(-0.38-0.40)		0.05	(-0.17-0.26)		0.20	(-0.31-0.71)		0.21	(-0.25-0.67)	
Sexual Abuse (ref=none)			0.25			0.02			0.03			0.08
Low	0.57	(-0.12-1.26)		-0.08	(-0.45-0.29)		0.38	(-0.54-1.30)		0.74	(-0.10-1.58)	
Moderate/Severe	0.07	(-0.26-0.40)		0.25	(0.07-0.43)		0.60	(0.16-1.04)		0.33	(-0.07-0.74)	

Abbreviations: CTQ, Childhood Trauma Questionnaire; No, Number;

^aPossible range: -6 to 6.

^bPositive values indicate less improvement/worsening. Estimates are adjusted for site, sex, race, pre-surgery values of age, body mass index, smoking status and the corresponding EDE score, and time since surgery entered as a continuous fixed effect.