When Mood Worsens after Gastric Bypass Surgery: Characterization of Bariatric Patients with Increases in Depressive Symptoms Following Surgery

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Abstract

Background Depression levels generally decrease substantially following bariatric surgery; however, little is known about bariatric patients who might experience increases in depression following surgery. We examined the frequency of bariatric patients who experienced discernible increases in depression levels following surgery and explored their correlates.

Methods Participants were 107 patients with extreme obesity who underwent gastric bypass surgery and were followed up at 6 and 12 months postsurgery. Participants completed self-report questionnaires about depression (BDI), eating disorder psychopathology (EDE-Q), self-esteem (RSES), and social functioning (SF-36) at baseline and again at 6 and 12 months postsurgery.

Results Fourteen (13.1 %) participants reported discernible increases (BDI-Increase), 14 (13.1 %) reported discernible decreases (BDI-Decrease), and 79 (73.8 %) did not report discernible changes (no change) in BDI scores from 6 to 12 months postsurgery. Presurgically, there were no differences between the three groups. By 12 months postsurgery, the BDI-Increase group had significantly higher depression scores and significantly lower self-esteem and SF-36 mental component scores than did the other groups. For the BDI-Increase group, BDI Change was significantly associated with body mass index, self-esteem, and SF-36 physical component scores.

Conclusions Findings highlight that a subgroup of individuals report discernible increases in depressive scores postsurgery and may differ in potentially clinically meaningful ways from those who do not report discernible increases in depressive symptoms. Future research is needed to better understand the long-term trajectory of patients with discernible worsening mood following gastric bypass surgery.

Keywords Bariatric surgery · Gastric bypass · Obesity · Depression · Mood

Introduction

Obesity is a global health concern associated with substantial economic costs [1] and various medical and psychiatric comorbidities, including depression [2, 3]. The relationship between obesity and depression is complex; a recent meta-analysis of longitudinal studies suggested a bidirectional link between depression and obesity [4]. Clinically, depression tends to improve following weight loss in patients receiving lifestyle modification [5] and undergoing bariatric surgery [6]. While these overall findings are encouraging, a subset of individuals with obesity may develop greater depressive symptoms following weight-loss treatments. For example, Faulconbridge et al. [5] found that 13.9 % of participants in a randomized controlled trial for weight loss reported discernible (or clinically significant) increases in depression. Furthermore, individuals with discernible increases in depressive scores experienced less weight loss and reported more psychiatric comorbidities relative to those without discernible increases in depressive scores [5].

Research with patients who undergo bariatric surgery has generally found that overall depressive levels tend to decrease substantially following surgery [6–9] during the short-term [8, 10–12] and longer-term [6, 7, 12–14]. The few studies that have examined the relationship between depression and post-surgical weight loss outcomes have yielded mixed findings. Some researchers found a relationship between presurgical depression and excess weight loss postsurgery [15], while others found that lower preoperative depression scores were related to weight regain postsurgery [16]. Another study reported that postoperative, but not preoperative, depression levels predicted less weight loss postoperatively [7].

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Additionally, greater decreases in depressive scores have been associated with greater percentage of excess weight loss [6].

While the nature of the relationship between depression and weight loss after bariatric surgery is mixed, even less is known about bariatric patients who might experience increases in depression following bariatric surgery. This is particularly important considering the increased risk of suicide following bariatric surgery [17]. The first study to examine increases in depression postsurgery found that 10.7 % of bariatric patients reported increases in depressive scores 1 year postsurgery, but only 3.8 % reported discernible increases in depressive scores [6]. The insufficient number of patients with discernible increases in depression in the Dixon et al. [6] study precluded any analyses, but the authors speculated about factors that may relate to increases in depression and highlighted the need for empirical research. A second small prospective study using structured clinical interviews reported that three participants (3.5 %) newly developed a clinical depressive disorder following surgery [7]. Except for these two preliminary studies, research has yet to examine discernible worsening in mood following bariatric surgery. Examining discernible differences in mood is important as this represents a clinically meaningful difference in mood (e.g., as defined previously as greater than half a standard deviation and half the range between mild and moderate symptoms of depression [5]).

The aim of this study was to examine the frequency of bariatric patients who experience discernible increases in depressive symptoms following bariatric surgery and to explore their correlates. If individuals with discernible worsening depressive symptoms differ in meaningful ways from those who exhibit no changes or improvements in depression, prevention and intervention efforts may help facilitate more positive postoperative outcomes for this subset of patients.

Method

Participants were 107 patients with extreme obesity who all underwent gastric bypass surgery and were followed up at 6 and 12 months following surgery. Of the 107 participants, 94 were women and 13 were men, 73 were White (18 identified as Black, 15 as Hispanic, and 1 as Asian), and 24 completed college. Presurgically, participant mean age was 42.7 (SD=10.5) years and mean BMI was 51.7 (SD=7.8).

Procedures

All participants provided informed consent, and the study was IRB-approved. Participants were informed that their responses to the research study would not influence the surgical process and findings were only shared with the treatment team if participants so desired and also provided consent. Prior to

gastric bypass surgery, height and weight were measured and participants completed a battery of questionnaires. Weight measurements and self-report questionnaires were repeated 6 and 12 months postsurgery.

Measures

Body Mass Index BMI was calculated using measured height and weight values (weight [kg] divided by height [m²]).

Beck Depression Inventory BDI [18] is a 21-item self-report measure that assesses current depressive symptoms. The BDI, a well-established measure of depressive symptoms in the mental health and obesity fields [19], is used widely in clinical evaluations of bariatric surgery patients [20, 21] and in research studies examining depression before and after obesity treatment [19] and bariatric surgery [11, 22]. The BDI is a psychometrically sound measure with excellent reliability and validity [23, 24]. Higher scores indicate greater depressive symptomatology. Generally, scores of 0–9 reflect minimal symptoms, 10–18 reflect mild symptoms, 19–29 reflect moderate, and >29 reflect severe depression symptoms [23]; studies with bariatric patients have employed these BDI cut-points [22].

Eating Disorder Examination-Questionnaire EDE-Q [25] is a self-report version of the EDE semi-structured interview [26] that assesses eating disorder psychopathology. The EDE-Q yields a global score (the mean of four subscales) which is indicative of overall general eating disorder psychopathology severity. The EDE-Q has shown good test-retest reliability in diverse patient groups with obesity [27]. Higher scores are indicative of greater severity.

Rosenberg Self-Esteem Scale RSES [28] is a widely used and well-established 10-item self-report measure of global self-esteem. Items are rated on a scale from 1 (strongly agree) to 4 (strongly disagree). Higher scores are indicative of higher self-esteem.

Medical Outcomes Study Short Form-36 Health Survey SF-36 [29] is a 36-item self-report measure that assesses social functioning. This measure has well-documented reliability and validity [30, 31]. The current study utilized two scores from the SF-36: the physical component summary and the mental component summary [32]. For these summary scores, means are 50 (SD=10) for the US population. Higher scores reflect better functioning.

Data Analyses

A BDI change ≥ 5 is considered a discernible change in depression [5]. Three groups were created: (1) BDI-Increase

group (discernible, or ≥ 5 , increase in BDI scores, (2) BDI-Decrease group (discernible, or ≥ 5 , decrease in BDI scores), and (3) no change group (< 5 increase or decrease in BDI scores). The groups were established based on BDI changes that occurred between 6 and 12 months postsurgery. We examined the frequency of these three study groups and their BDI scores at the three assessment points. A series of ANCOVAs controlling for weight were conducted to examine differences across the three groups at each time point (preoperatively and 6 and 12 months postoperatively). BDI Change between 6 and 12 months was calculated by subtracting 6 month BDI scores from 12 month BDI scores. BDI changes were correlated with the clinical variables.

Results

The three groups did not differ on sex, race, or education. While age was significantly different between groups, post-hoc analyses did not reveal significant between-group differences (Table 1). Age was not significantly correlated with depression change ($p=0.298$) and was not used as a covariate; a series of ANCOVAs controlling for age yielded similar findings to those reported here.

Mean Depression Scores and Increases in Depression Scores Postsurgically

Overall, the mean BDI score was an average of 13.1 (SD=7.8) prior to bariatric surgery and decreased to an average of 5.43 (SD=5.32) and 5.0 (SD=5.5) 6 and 12 months postsurgery, respectively. From presurgery to 6 months postsurgery, no (0) participants reported discernible increases in BDI scores. From presurgery to 12 months postsurgery, 4

(3.7 %) reported discernible increases in BDI scores. From 6 to 12 months postsurgery, 14 (13.1 %) reported discernible increases in BDI scores. The four participants with discernible BDI increases from presurgery to 12 months postsurgery also had discernible increases from 6 to 12 months postsurgery. Therefore, all participants with any discernible increases were captured in the 6 to 12 month time frame. The majority ($n=79$, 73.8 %) met criteria for the no change group, while 13.1 % ($n=14$) met criteria for the BDI-Increase group and 13.1 % ($n=14$) met criteria for the BDI-Decrease group.

Depression Group Differences Presurgically and 6 and 12 Months Postsurgically

Presurgically, the three groups did not differ on BDI, EDE-Q, RSES, SF-36 mental component, or SF-36 physical component scores (Table 2). At 6 months postsurgery, the groups did not differ on EDE-Q, SF-36 mental component, or SF-36 physical component scores, but differed on BDI and RSES scores. Specifically, the BDI-Decrease group had significantly higher BDI scores than did the no change and BDI-Increase groups. RSES differences did not produce significantly different post-hoc tests. At 12 months postsurgery, the groups differed on BDI, RSES, and SF-36 mental component scores. Specifically, the BDI-Increase group had significantly higher BDI scores and significantly lower RSES and mental component scores than did both the no change and BDI-Decrease groups; however, no significant differences emerged for BMI, EDE-Q, and SF-36 physical component scores among groups. Figure 1 illustrates BDI scores from presurgery to 6 and 12 months postbariatric surgery for each group. Although BMI did not significantly differ by group, the BDI-Decrease group lost an average of 99.3 (SD=26.4) lb, the no change

Table 1 Demographic characteristics for three BDI groups: BDI-Increase, no change, and BDI-Decrease

Variable	BDI-Increase ≥ 5 ($n=14$)	No change ($n=79$)	BDI-Decrease ≥ 5 ($n=14$)	Test statistic	<i>p</i> value
Age, mean (SD)	37.4 (10.8)	44.1 (9.7)	39.8 (12.5)	$F(2, 104)=3.20$	0.045
Female, no (%)	12 (85.7 %)	68 (86.1)	14 (100.0)	$\chi^2(2)=2.23$	0.328
Race/ethnicity, no (%) ^a				$\chi^2(2)=3.89$	0.143
White	9 (64.3)	57 (72.2)	7 (50.0)		
Black	4 (28.6)	10 (12.7)	4 (28.6)		
Hispanic	1 (7.1)	12 (15.2)	2 (14.3)		
Asian	0 (0.0)	0 (0.0)	1 (7.1)		
Education, No (%) ^a				$\chi^2(2)=0.49$	0.782
Less than college degree	11 (84.7)	60 (75.9)	11 (78.5)		
Completed college	2 (15.4)	19 (24.1)	3 (21.4)		

Test statistic=chi-square for categorical variables and ANOVAs for dimensional variables. *p* values are for two-tailed tests

SD standard deviation, No number

^a Denotes that chi-square was performed for two collapsed categories given low frequencies of some variables (i.e., White versus non-White and college graduate versus less than college degree)

Table 2 Descriptive statistics of clinical variables and ANCOVA's comparing study groups at baseline and 6 and 12 months postgastric bypass surgery controlling for weight

Baseline	Group 1 BDI-Increase ≥ 5 ($n=14$)	Group 2 No change ($n=79$)	Group 3 BDI-Decrease ≥ 5 ($n=14$)	Test statistic (F, p); Sig. Post-hocs
BMI	52.71 (7.20)	51.79 (7.98)	49.85 (7.78)	0.13, $p=0.878$
BDI	15.36 (9.87)	12.35 (7.34)	15.00 (7.91)	1.32, $p=0.272$
EDE-Q	3.12 (0.79)	3.26 (1.07)	3.10 (0.83)	0.36, $p=0.701$
RSES	28.59 (5.94)	30.06 (5.30)	29.43 (5.57)	0.47, $p=0.624$
SF-36 Mental component	45.48 (14.07)	48.22 (10.38)	47.88 (12.31)	0.55, $p=0.582$
SF-36 Physical component	34.54 (11.21)	31.77 (10.29)	32.07 (9.66)	0.52, $p=0.597$
6th month				
BMI	37.38 (6.42)	37.36 (6.60)	36.62 (6.73)	0.39, $p=0.680$
BDI	4.71 (3.79)	4.80 (4.89)	9.71 (7.09)	6.17, $p=0.003$; 3>1**, 3>2*
EDE-Q	2.16 (0.90)	1.63(0.97)	1.70 (1.19)	1.73, $p=0.182$
RSES	34.86 (4.33)	36.61 (3.89)	34.02 (5.34)	3.49, $p=0.034$
SF-36 Mental component	52.29 (6.93)	56.26 (7.72)	53.81 (11.24)	1.71, $p=0.185$
SF-36 Physical component	49.14 (10.10)	49.87 (9.34)	48.54 (9.14)	0.21, $p=0.815$
12th month				
BMI	32.36 (5.26)	33.47 (6.05)	32.74 (6.27)	0.44, $p=0.648$
BDI	11.86 (5.05)	4.10 (4.85)	3.29 (4.89)	16.50, $p=0.000$; 1>2***, 1>3***
EDE-Q	1.80 (1.10)	1.64 (1.03)	1.72 (1.03)	0.26, $p=0.770$
RSES	32.00 (5.26)	37.04 (3.82)	36.21 (4.25)	9.06, $p=0.000$; 1<2***, 1<3*
SF-36 Mental component	46.12 (11.02)	55.52 (9.19)	55.12 (7.33)	6.07, $p=0.003$; 1<2**, 1<3*
SF-36 Physical component	46.82 (13.07)	51.88 (8.19)	50.15 (11.37)	2.72, $p=0.071$

BMI body mass index, EDE-Q eating disorder examination-questionnaire, RSES Rosenberg self-esteem scale, SF-36 medical outcomes study short form-36 health survey

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$

group lost an average of 109.5 (33.7) lb, and the BDI-Increase group lost an average of 109.8 (32.3) lb from baseline to 12 months. Figure 2 illustrates average weights from presurgery to 6 and 12 months postsurgery for each group.

Associations of Clinical Variables with Changes in Depression Scores

Table 3 summarizes the correlates of BDI Change with 12-month BMI, EDE-Q, RSES, and SF-36 mental and physical component scores. For the overall group, RSES scores were significantly and negatively related to BDI Change. For the

BDI-Increase group, BDI Change was significantly and positively associated with 12-month BMI, and significantly and negatively correlated with RSES and physical component scores. For the BDI-Decrease group, RSES, and mental component scores were significantly and positively associated with BDI Change.

Suicide Level (BDI) from Presurgery to 6 and 12 Months Postsurgery

Inspection of the BDI item used to assess suicidal ideation revealed that 95 (88.8 %) participants did not report any

Fig. 1 Beck Depression Inventory (BDI) mean scores presurgically and 6 and 12 months shown separately for the BDI-Increase ($n=14$), no change ($n=79$), and BDI-Decrease ($n=14$) groups

Fig. 2 Weight mean scores presurgically and 6 and 12 months shown separately for the BDI-Increase ($n=14$), no change ($n=79$), and BDI-Decrease ($n=14$) groups

Table 3 Bivariate correlations of clinical variables with BDI Change (Pearson's *r* correlations between clinical variables and participants' BDI Change from 6 to 12 months postoperatively)

	Overall (<i>n</i> =107)	BDI-Increase ≥ 5 (<i>n</i> =14)	No change (<i>n</i> =79)	BDI-Decrease ≥ 5 (<i>n</i> =14)
12-month BMI	-0.002	0.676**	-0.052	-0.020
EDE-Q	-0.010	0.008	-0.041	-0.224
RSES	-0.248**	-0.668**	-0.064	0.702**
SF-36 Mental component	-0.210*	-0.449	0.051	0.563*
SF-36 Physical component	-0.121	-0.715**	0.100	0.112

BMI body mass index, *EDE-Q* eating disorder examination-questionnaire, *RSES* Rosenberg self-esteem scale, *SF-36* medical outcomes study short form-36 health survey

* $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$

suicidal ideation at baseline, 6 months, or 12 months postsurgery. Twelve (11.2 %) participants reported suicidal ideation and the majority (9 or 75 %) of those who reported any suicidal ideation did so only at baseline. Three participants (25 % of the group endorsing any suicidal ideation or 2.8 % of the overall group) reported an increase in suicidal ideation at 12 months postsurgery. Two of the three participants with reported increases in suicidal ideation were in the BDI-Increase group, and one was in the no change group. Of note, in all cases, participants who reported suicidal ideation endorsed the following item: "I have thoughts of killing myself, but I would not carry them out." Therefore, these participants endorsed passive suicidal thoughts, but did not endorse active suicidal plans or intent.

Discussion

To our knowledge, this is the first study to examine patients with worsening depressive symptoms 6 and 12 months following gastric bypass surgery. The primary aim was to investigate the frequency of discernible increases in depressive scores (BDI increases ≥ 5) and their correlates postsurgery. Consistent with previous research [6–9], we observed overall substantial mean reductions in depression levels, reaching scores reflective of normal mood by 6 and 12 months postsurgery. Despite these overall mean improvements, a subgroup of patients reported discernible worsening in mood postoperatively. From baseline to 6 months postsurgery, no participants reported discernible worsening in mood; yet, 3.7 % reported discernible worsening in mood from presurgery to 12 months postsurgery, and 13.1 % reported discernible worsening in mood from 6 to 12 months postsurgery. Thus, the majority of patients with discernible worsening in mood experienced these mood changes between 6 and 12 months postsurgery, suggesting this may be a critical period for early detection and intervention as needed.

Two recent bariatric studies discussed increases in depression following surgery [6, 7], but only one examined

discernible increases in depressive symptoms [6], while the other examined a categorical diagnosis of depression [7]. Consistent with the present findings, Dixon et al. [6] found that 3.8 % of participants reported discernible increases in BDI scores one year post-lap band surgery; however, discernible differences in BDI scores between 6 and 12 months were not examined. When investigating discernible increases in BDI-II scores at 12 months following a non-surgical weight loss treatment, the frequency (13.9 %) was much higher [5]. It is unknown whether bariatric or non-bariatric treatments yield differences in discernible worsening mood; however, one study comparing bariatric to lifestyle modification among patients with obesity and binge eating disorder found similar changes in depressive symptoms between groups at 12 months, even when controlling for binge eating [33]. Importantly, however, the lifestyle modification group reported mean increases in depressive scores from 6 to 12 months (6.3 to 11.7, respectively) despite weight stabilization during that time. Thus, converging lines of research from both surgical and nonsurgical weight loss treatments suggest that 6 to 12 months posttreatment may be a key period to assess for depression.

This study also compared three groups of patients: those with discernible worsening in mood (BDI-Increase), no discernible changes in mood (no change), and discernible improvements in mood (BDI-Decrease) following gastric bypass surgery. While the three groups did not differ on demographic or clinical variables presurgically, at the 6-month assessment, the BDI-Decrease group reported higher depression scores than both the BDI-Increase and no change groups. In contrast, 12 months postoperatively, the BDI-Increase group reported significantly higher depression scores and lower self-esteem and mental components of social functioning than did the remaining two groups. It is noteworthy that BDI Change from 6 to 12 months postsurgery was significantly associated with 12-month BMI and negatively associated with physical components of social functioning and self-esteem only within the BDI-Increase group. Given that all three groups did not differ in BMI, it is interesting that BMI was related to changes in

depressive scores for only patients with worsening depressive symptoms. In a non-surgical weight loss treatment study, those with discernible worsening mood 1 year posttreatment lost less weight 18 and 52 weeks posttreatment; however, this was not the case in this bariatric group. We speculate that significantly lower self-esteem among the BDI-Increase group may contribute to this finding (12-month BMI and 12-month self-esteem correlation, $r=-0.61$).

Finally, the majority of gastric bypass patients did not endorse suicidal ideation at any assessment period; however, a few patients reported new passive suicidal ideation postsurgery. Active suicidal ideation was not endorsed by any of the patients in the present study. Although recent research indicates that bariatric patients may be at increased risk for suicide than the general population [17, 34], risk for suicide may occur later than 1 year postsurgery. Perhaps, increases in suicidal ideation in this group would have been captured later as weight loss ceases and/or weight becomes more stable. In fact, one study found that 30 % of suicides occurred during the first two years postsurgery but nearly 70 % occurred during the first three years postsurgery [17].

Our findings should be interpreted within the context of several study limitations. First, participants underwent gastric bypass surgery and findings may not generalize to other types of bariatric surgeries or to different developmental eras. Future research should replicate this study with adolescents undergoing bariatric surgery [35]. Second, given that a small subset of participants met criteria for the BDI-Increase and BDI-Decrease groups, larger sample sizes would yield greater power to detect between-group differences of smaller effect sizes; we note, however, that even with the small groups, we did detect meaningful differences. Third, follow-up assessments were limited to the period through 12 months postsurgery and longer-term follow-up is needed to better understand the trajectory and severity of discernible worsening mood over time. Fourth, use of antidepressant therapy or other forms of mental health treatment were not assessed during the postoperative period. Thus, we are unable to correlate changes in depression levels with changes in any ongoing treatments. One study with post-RYGB patients reported that 40 % of patients experienced no changes in antidepressant use post-RYGB; while others may have increased or decreased use [36]. Similarly, predictors of depressive changes were not assessed. Lastly, it is important to keep in mind that BDI scores decreased over time for the overall group and mean depressive scores for the BDI-Increase group were indicative of only *subthreshold or mild* mood disturbances; these increases may not warrant clinical intervention. Future research with larger samples and longer-term follow-ups are needed to allow for more sophisticated analyses, including for example, exploration of potential mediational effects of weight changes on depression levels.

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Conflict of Interest Drs. Ivezaj and Grilo declare no conflicts of interest. All provided ICMJE Conflict of Interest Forms.

References

1. Wang YC, McPherson K, Marsh T, et al. Health and economic burden of the projected obesity trends in the USA and the UK. *Lancet*. 2011;378(9793):815–25.
2. Dave DM, Tennant J, Colman G. Isolating the effect of major depression on obesity: role of selection bias. *J Ment Health Policy Econ*. 2011;14(4):165–86.
3. Moreira RO, Marca KF, Appolinario JC, et al. Increased waist circumference is associated with an increased prevalence of mood disorders and depressive symptoms in obese women. *Eat Weight Disord*. 2007;12(1):35–40.
4. Luppino FS, de Wit LM, Bouvy PF, et al. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Arch Gen Psychiatry*. 2010;67:220–9.
5. Faulconbridge LF, Wadden TA, Berkowitz RI, et al. Changes in symptoms of depression with weight loss: results of a randomized trial. *Obesity*. 2009;17(5):1009–16.
6. Dixon JB, Dixon ME, O'Brien PE. Depression in association with severe obesity. *Arch Intern Med*. 2003;163(17):2058–65.
7. de Zwaan M, Enderle J, Wagner S, et al. Anxiety and depression in bariatric surgery patients: a prospective follow-up study using structured clinical interviews. *J Affect Disord*. 2011;133:61–8.
8. Leombruni P, Pierò A, Dosio D, et al. Psychological predictors of outcome in vertical banded gastroplasty: a 6 months prospective pilot study. *Obes Surg*. 2007;17:941–8.
9. Sarwer DB, Wadden TA, Moore RH, et al. Preoperative eating behaviour, postoperative dietary adherence and weight loss following gastric bypass surgery. *Surg Obes Relat Dis*. 2008;4:640–6.
10. Emery CF, Fondow MDM, Schneider CM, et al. Gastric bypass surgery is associated with reduced inflammation and less depression: a preliminary investigation. *Obes Surg*. 2007;17:759–63.
11. Hayden MJ, Dixon JB, Dixon ME, et al. Characterization of the improvement in depressive symptoms following bariatric surgery. *Obes Surg*. 2011;21(3):328–35.
12. Velcu LM, Adolphine R, Mourelle R, et al. Weight loss, quality of life and employment status after Roux-en-Y gastric bypass. 5-year analysis. *Surg Obes Relat Dis*. 2005;1:413–7.
13. Karlsson J, Taft C, Ryden A, et al. Ten-year trends in health-related quality of life after surgical and conventional treatment for severe obesity: the SOS intervention study. *Int J Obes*. 2007;31(8):1248–61.
14. Schowalter M, Benecke A, Lager C, et al. Changes in depression following gastric banding: a 5- to 7-year prospective study. *Obes Surg*. 2008;18:314–20.
15. Averbukh Y, Heshka S, El-Shoreya H, et al. Depression score predicts weight loss following Roux-en-Y gastric bypass. *Obes Surg*. 2003;13(6):833–6.
16. Odom J, Zalesin KC, Washington TL, et al. Behavioral predictors of weight regain after bariatric surgery. *Obes Surg*. 2010;20(3):349–56.
17. Tindle HA, Omalu B, Courcoulas A, et al. Risk of suicide after long-term follow-up from bariatric surgery. *Am J Med*. 2010;123(11):1036–42.
18. Beck AT, Steer R. Manual for revised Beck Depression Inventory. New York: Psychological Corporation; 1987.

19. Look AHEAD Research Group. Impact of intensive lifestyle intervention on depression and health-related quality of life in Type-II diabetes: the Look AHEAD trial. *Diabetes Care*. 2014;37:1544–53.
20. Bauchowitz AU, Gonder-Frederick LA, Olbrisch ME, et al. Psychosocial evaluation of bariatric surgery candidates: a survey of present practices. *Psychosom Med*. 2005;67:825–32.
21. Walfish S, Vance D, Fabricatore AN. Psychological evaluation of bariatric surgery applicants: procedures and reasons for delay or denial of surgery. *Obes Surg*. 2007;17(12):1578–83.
22. Mitchell JE, King WC, Chen J-Y, et al. Course of depressive symptoms and treatment in the Longitudinal Assessment of Bariatric Surgery (LABS-2) study. *Obesity*. 2014. doi:10.1002/oby.20738.
23. Beck A, Steer RA, Garbin MG. Psychometric properties of the Beck Depressive Inventory 25 years of evaluation. *Clin Psychol Rev*. 1988;8:77–100.
24. Krukowski RA, Friedman KE, Applegate KL. The utility of the Beck Depression Inventory in a bariatric surgery population. *Obes Surg*. 2010;20(4):426–31.
25. Fairburn CG, Beglin SJ. Assessment of eating disorders: interview or self-report questionnaire? *Int J Eat Disord*. 1994;16:363–70.
26. Fairburn CG, Cooper Z. The eating disorder examination (12th ed.). In: Fairburn CG, Wilson GT, editors. *Binge eating: nature, assessment, and treatment*. New York: Guilford Press; 1993. p. 317–60.
27. Reas DL, Grilo CM, Masheb RM. Reliability of the Eating Disorder Examination-Questionnaire in patients with binge eating disorder. *Behav Res Ther*. 2006;44(1):43–51.
28. Rosenberg M. *Conceiving the self*. New York, NY: Basic Books; 1979.
29. Ware Jr JE, Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I Conceptual framework and item selection. *Med Care*. 1992;30(6):473–83.
30. McHorney CA, Ware Jr JE, Lu JF, et al. The MOS 36-item Short-Form Health Survey (SF-36): III. Tests of data quality, scaling assumptions, and reliability across diverse patient groups. *Med Care*. 1994;32(1):40–66.
31. McHorney CA, Ware Jr JE, Raczek AE. The MOS 36-Item Short-Form Health Survey (SF-36): II Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Med Care*. 1993;31(3):247–63.
32. Ware Jr JE, Kosinski M, Keller SD. *SF-36 physical and mental health summary scales—a user's manual*. Boston: New England Medical Center, The Health Institute; 1994.
33. Faulconbridge LF, Wadden TA, Thomas JG. Changes in depression and quality of life in obese individuals with binge eating disorder: bariatric surgery versus lifestyle modification. *Surg Obes Relat Dis*. 2013;9(5):790–6.
34. Adams TD, Gress RE, Smith SC, et al. Long-term mortality after gastric bypass surgery. *N Engl J Med*. 2007;357(8):753–61.
35. Zeller MH, Modi AC, Noll JG, et al. Psychosocial functioning improves following adolescent bariatric surgery. *Obesity*. 2009;17(5):985–90.
36. Cunningham JL, Merrell CC, Sarr M, et al. Investigation of antidepressant medication usage after bariatric surgery. *Obes Surg*. 2012;22(4):530–5.