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ORIGINAL CONTRIBUTIONS

Emotional Impact on Health Behavior Adherence After Bariatric Surgery: What About Positive Psychological Constructs?

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Abstract

Introduction Health behaviors are critical for weight loss maintenance after weight loss surgery (WLS), and emotional factors often play a role in adherence. Positive psychological constructs (e.g., optimism, positive affect) have predicted health outcomes in other medical populations but have been infrequently examined in post-WLS patients.

Methods This study measured optimism and positive affect in post-WLS patients recruited from online support groups. A hierarchical linear regression analysis tested their association with health behavior adherence, physical activity, and weight loss, controlling for demographic and weight-related covariates. It also tested depression and anxiety symptoms as moderators.

Results In 95 participants, positive affect was associated with better adherence ($b = 0.41$, $p < 0.01$) and greater moderate-to-vigorous physical activity ($b = 0.20$, $p < 0.001$) controlling for demographic/weight-related covariates, and independently with more weight loss ($b = 0.24$, $p < 0.05$). Optimism was independently associated with better adherence ($b = 0.32$, $p < 0.05$) and with greater moderate-to-vigorous physical activity controlling for demographic/weight-related covariates ($b = 0.16$, $p < 0.05$). These associations no longer reached statistical significance controlling for depression and anxiety symptoms. Anxiety symptoms moderated the relationship between positive affect and adherence ($b = 0.06$, $p < 0.01$), and depression ($b = 0.15$, $p < 0.01$) and anxiety ($b = 0.02$, $p < 0.05$) symptoms each moderated the relationship between optimism and walking, such that there was a stronger relationship between positive psychological constructs and health behaviors for those with higher anxiety or depression scores.

Conclusions Positive psychological states should be included when assessing emotional factors related to health behaviors in post-WLS patients. Interventions targeting health behaviors may be improved with inclusion of skills to boost positive psychological states.

Keywords Positive psychology · Health behaviors · Physical activity · Optimism · Emotion · Health psychology · Adherence

Introduction

While weight loss surgery (WLS) is the most effective and sustainable treatment available for severe obesity, weight regain is still common; about 25% of individuals who undergo WLS do not maintain the expected weight loss [1–5]. Adherence to important health behaviors, including a specific healthy diet and high levels of physical activity, is key for long-term weight loss maintenance [6–11]. Unfortunately, these behaviors can be difficult to maintain [12]. When objectively measured with an accelerometer, 89–97% of post-WLS patients do not meet recommended physical activity levels of 150 min of moderate-to-vigorous physical activity (MVPA) per week [13–16]. Further, dietary adherence tends to worsen over time after the surgery [17] which has been associated with less weight loss [18].

For many, emotional factors play a role in health behavior adherence. Psychological distress has predicted lower physical activity levels in post-WLS samples [19], and emotional eating, or using food to cope with negative emotions, is prevalent in this population and in some cases has been associated with poorer weight loss [12, 20, 21]. Individuals with depressive symptoms who undergo WLS tend to lose less weight

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overall and show lower adherence to health behaviors [19, 22]. On the other hand, positive psychological states have been largely excluded from research in the WLS population. Strong links between optimism and health outcomes have been shown in other medical populations [23–26], a relationship which may be mediated by health behavior engagement [27–32], although one study of WLS patients 15 days post-surgery found no relationship between optimism and health behavior adherence [33]. Additionally, positive affect seems to be particularly important in maintaining health behaviors [34, 35] and has been shown to increase after WLS [8].

Importantly, these positive psychological experiences are not simply the flip-side of depression; they seem to capture a unique construct that is not always explained by depressive symptoms. Only a moderate correlation between optimism and depressive symptoms has been found [36]. Further, optimism has predicted future health behaviors in longitudinal analyses controlling for depressive symptoms [31, 37–39], and positive affect and physical activity have been associated in cardiac patients, controlling for depressive symptoms [40].

Given the unique emotional factors that are often present in individuals with severe obesity, such as internalized weight stigma and shame about one's appearance [41–43], along with the often drastic emotional changes that patients experience after WLS in many areas of their lives, positive emotional states may be relevant in health behavior engagement and weight loss after surgery. The present study had three aims: (1) to measure positive psychological constructs, and how they vary based on time since the surgery, in a sample of post-WLS patients to compare those of the general population; (2) to examine relationships of positive emotional constructs with health behaviors and weight loss; and (3) to measure whether these relationships held while controlling for symptoms of depression and anxiety, and whether symptoms of depression or anxiety moderated the relationship between positive psychological constructs and health outcomes. A relationship between positive psychological characteristics and better health markers was hypothesized, that would weaken, but still hold, when controlling for symptoms of depression and anxiety. It was also hypothesized that symptoms of depression and anxiety would moderate the relationship, with a stronger relationship for those with low depression/anxiety symptoms than those with high, given that symptoms of depression and anxiety themselves are strongly related to health behaviors.

Materials and Methods

Participants and Procedures

Participants were adults who self-reported undergoing WLS at least 1 month in the past. They were recruited primarily through online support groups (e.g., Facebook, Obesityhelp.com) with permission from website moderators. A subset of participants was recruited through a WLS clinic at an academic medical center for a different study that included completion of the survey. Informed consent was obtained from all individual participants included in the study, and the study was approved by the Institutional Review Board.

This survey was completed using the REDCap, a HIPAA-compliant online data management tool. Participants were asked for demographic information, surgery-related weight history, and self-report measures which included the following.

Psychological Measures

The Life Orientation Test–Revised (LOT-R) measures dispositional optimism, the generalized outcome expectancy that good things, rather than bad things, will happen in the future, using a ten-item scale including six active and four filler items (range 6–24). Sample active items include "In uncertain times, I usually expect the best," and "If something can go wrong for me, it will," answered on a five-point Likert scale ranging from "I agree a lot" to "I disagree a lot." It has been shown to have adequate predictive and discriminant validity and good test-retest reliability [44] and has been studied in post-WLS patients [33].

The Positive and Negative Affect Scale (PANAS) positive affect subscale is a ten-item mood scale with a range of 10–50, which asks participants to rate their experience of ten types of positive affect in general (e.g., interested, excited, proud, enthusiastic) on a five-point Likert scale ranging from "very slightly or not at all" to "extremely." The scale demonstrates high internal consistency ($\alpha = 0.86$) [45, 46] and has been used in medical populations previously [40, 47, 48], including WLS patients [8].

The Hospital Anxiety and Depression Scale (HADS) has been shown to be effective at measuring depression and anxiety in patients with medical illness. The scale consists of seven items for depression (HADS-D) and seven items for anxiety (HADS-A), both of which have a range of scores from 0 to 21. The HADS-D and HADS-A have both been shown to have good internal consistency ($\alpha = 0.82$ and 0.83, respectively), and a score of 8 or above on either subscale reflects a likely diagnosis of a depressive or anxiety disorder [49].

Health-Related Measures

The International Physical Activity Questionnaire (IPAQ) Short Form includes seven questions about the individual's last seven days of physical activity and inactivity. Scoring guidelines recommend truncating time spent on each level of physical activity (walking, moderate, and vigorous) at 180 min per day to avoid reporting errors. Totals are calculated

in terms of metabolic equivalents (METs), by assigning a multiplier to activity based on its intensity. METs were calculated for MVPA as well as walking, to capture both higher and lower intensity activity. The IPAQ has acceptable measurement properties and high reliability ($\alpha = 0.80$) [50].

The Bariatric Surgery Self-Management Questionnaire (BSSMQ) asks about adherence to seven behavioral domains following bariatric surgery: eating behaviors (eight items), physical activity (three items), dumping syndrome management (four items), and intake of fluids (eight items), supplements (four items), fruits/vegetables/whole grains (three items), and protein (three items), with a total score ranging from 0 (low adherence) to 66 (high adherence). The BSSMQ has demonstrated high construct validity and internal reliability ($\alpha = 0.83$) [51].

Height, weight, and surgery date were self-reported. Participants reported their weight at the start of the surgery process, at the time of the surgery, and at the time that they took the survey. Body mass index (BMI) change was calculated as the difference between current BMI and BMI at the start of the surgery process.

Data Analysis

All analyses were completed with Stata 15. Spearman's rho analyses tested the relationship between psychological, behavioral, and surgery-related variables. The hierarchical linear regression analyses tested the relationships between positive psychological predictor variables (optimism, positive affect) and behavioral and weight-related outcome variables (overall adherence, MVPA, walking, BMI change). Block 1 tested the independent relationship between the predictor and outcome. In block 2, demographic covariates were added (age, gender); in block 3, weight-related covariates were included (time since surgery, BMI at the start of the surgical process); in block 4, psychological covariates were added (depression symptoms, anxiety symptoms); and in block 5, the interaction terms were tested. To meet assumptions of regression analyses, natural log-transformations were used to adjust for skew in several variables: time since surgery, depressive symptoms, MVPA, and walking.

Results

Descriptive Statistics

Participants were 95 adults (90.5% female, 95.8% white) ranging in age from 24 to 73 ($M = 49.9$ years, SD = 11.8). All were post-surgery, with a wide variation in time since surgery, from 32 days to 24 years ($M = 3.5$ years, SD = 4.7). On average, participants reported a current BMI in the obese range ($M = 31.2$, SD = 7.3). Most participants (64.2%) were college graduates. The majority had either gastric bypass surgery (44.2%) or a sleeve gastrectomy (45.3%), with the remainder reporting lap band, duodenal switch, or another surgery. See Table 1 for summary statistics of all measures.

Comparing Positive Psychological Constructs with the General Population and Testing Change with Time Since Surgery

The present sample had a lower mean optimism score (LOT-R; 15.1) than did two large adult general population samples in Europe; the first was 9711 German adults who completed the LOT-R with a mean score of 16.2 (SD = 3.8) [52]. The second was a representative sample of 1792 Norwegian adults with a mean score of 17.2 (SD = 3.0) [53]. As for positive affect, in a sample of 1003 adults in the UK, the mean positive affect score was 31.3 (SD = 7.65), which is lower than the mean of 35.6 in the present sample [45]. Neither positive affect nor optimism was associated with time since surgery in the present sample. In fact, of all the variables, only BMI change (increase over time, $p < 0.001$) was significantly associated with time since surgery, while overall adherence showed a trend toward a negative association with time since surgery ($p = 0.059$; see Table 2).

Associations Between Positive Psychological Predictors and Health-Related Measures

When tested independently (Model 1), optimism and positive affect were each associated with better overall adherence and higher MVPA, and positive affect was associated with a larger

Table 1 Characteristics of participants

Variable (possible range)	Mean (SD)
Optimism (6–24)[a]	15.1 (5.58)
Positive affect (10–50)[b]	35.62 (6.84)
Anxiety (0–21)[c]	6.25 (4.62)
Depression (0–21)[c]	3.45 (3.94)
Adherence (0–66)[d]	43.86 (8.33)
MVPA[e]	2219.62 (2626.00)
Walking[e]	1179.66 (1176.81)
BMI change	15.88 (7.43)

[a] Measured with the Life Orientation Test–Revised [44]

[b] Measured with the Positive and Negative Affect Scale positive affect subscale [46]

[c] Measured with the Hospital Anxiety and Depression Scale [49]

[d] Measured with the Bariatric Surgery Self-Management Questionnaire [51]

[e] Moderate-to-vigorous physical activity and walking (METs) per week, measured with the International Physical Activity Questionnaire Short Form [50]. MVPA measured in met/minutes, walking time measured in minutes

Table 2 Spearman's correlations between variables

	1	2	3	4	5	6	7	8
1. Optimism[a]								
2. Positive affect[b]	0.48							
3. Anxiety[c]	− 0.44	− 0.42						
4. Depression[c]	− 0.34	− 0.58	0.46					
5. Adherence[d]	0.16	0.30	− 0.25	− 0.35				
6. MVPA[e]	0.16	0.37	− 0.31	− 0.46	0.45			
7. Walking[e]	− 0.04	0.18	− 0.01	− 0.23	0.40	0.19		
8. BMI change	0.11	0.24	0.08	− 0.21	0.11	0.16	− 0.01	
9. Time since surgery	0.14	0.09	0.02	− 0.03	− 0.19	− 0.01	− 0.05	0.55

[a] Measured with the Life Orientation Test–Revised [44]

[b] Measured with the Positive and Negative Affect Scale positive affect subscale [45]

[c] Measured with the Hospital Anxiety and Depression Scale [49]

[d] Measured with the Bariatric Surgery Self-Management Questionnaire [51]

[e] Moderate-to-vigorous physical activity and walking (METs) per week, measured with the International Physical Activity Questionnaire Short Form [50]

BMI change. Positive psychological states were not associated with walking. In models controlling for demographic covariates (Model 2) and weight-related covariates (Model 3), positive affect remained a significant predictor of

Table 3 Associations between psychological predictors and health-related outcomes

Outcome	Model	Optimism[g]		Positive affect[h]	
		b	95% CI	*b*	95% CI
Adherence[e]	1[a]	0.32*	0.02, 0.62	0.51***	0.28, 0.74
	2[b]	0.27^	− 0.02, 0.57	0.46***	0.23, 0.69
	3[c]	0.27^	− 0.01, 0.55	0.41**	0.18, 0.63
	4[d]	0.06	− 0.25, 0.37	0.22	− 0.05, 0.50
MVPA[f]	1	0.16*	0.03, 0.29	0.21***	0.10, 0.31
	2	0.15*	0.02, 0.29	0.20***	0.09, 0.30
	3	0.16*	0.02, 0.29	0.20***	0.09, 0.31
	4	0.05	− 0.09, 0.20	0.07	− 0.06, 0.20
Walking[f]	1	− 0.00	− 0.09, 0.09	0.05	− 0.02, 0.13
	2	− 0.01	− 0.10, 0.08	0.04	− 0.03, 0.12
	3	− 0.01	− 0.10, 0.08	0.04	− 0.03, 0.12
	4	− 0.02	− 0.12, 0.09	0.00	− 0.09, 0.10
BMI change	1	0.13	− 0.14, 0.41	0.24*	0.02, 0.46
	2	0.09	− 0.02, 0.24	0.21^	− 0.02, 0.43
	3	− 0.03	− 0.23, 0.17	0.08	− 0.09, 0.24
	4	0.02	− 0.20, 0.24	0.05	− 0.15, 0.25

[a] Independent relationship

[b] Adjustment for age and gender

[c] Additional adjustment for time since surgery and BMI at the start of the surgery process

[d] Additional adjustment for depression and anxiety

[e] Measured with the Bariatric Surgery Self-Management Questionnaire [51]

[f] Moderate-to-vigorous physical activity and walking (METs) per week, measured with the International Physical Activity Questionnaire Short Form [50]

[g] Measured with the Life Orientation Test–Revised [44]

[h] Measured with the Positive and Negative Affect Scale positive affect subscale [46]

^$p < 0.10$, *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$

Table 4 Fully adjusted models with interaction term

Outcome	Interaction	Optimism[c]		Positive affect[d]	
		b	95% CI	*b*	95% CI
Adherence[a]	Depression	0.17	−0.16, 0.50	0.19^	−0.03, 0.42
	Anxiety	0.04	−0.01, 0.10	0.06**	0.02, 0.10
MVPA[b]	Depression	0.06	−0.10, 0.21	0.05	−0.06, 0.15
	Anxiety	0.00	−0.02, 0.03	0.01	−0.01, 0.03
Walking[b]	Depression	0.15**	0.04, 0.26	0.06	−0.01, 0.14
	Anxiety	0.02*	0.00, 0.04	0.01	−0.00, 0.03
BMI change	Depression	0.03	−0.20, 0.27	0.02	−0.15, 0.18
	Anxiety	−0.01	−0.05, 0.03	−0.01	−0.04, 0.02

[a] Measured with the Bariatric Surgery Self-Management Questionnaire [51]

[b] Moderate-to-vigorous physical activity and walking (METs) per week, measured with the International Physical Activity Questionnaire Short Form [50]

[c] Measured with the Life Orientation Test–Revised [44]

[d] Measured with the Positive and Negative Affect Scale positive affect subscale [46]

^$p < 0.10$, *$p < 0.05$, **$p < 0.01$

adherence and MVPA, while optimism remained significantly associated with MVPA, but not adherence. See Table 3 for detailed results.

Associations Between Positive Psychological Predictors and Health-Related Measures, Controlling for Depression and Anxiety and with Depression and Anxiety as Moderators

In the fully adjusted models (Model 4), optimism and positive affect were no longer significantly associated with adherence, MVPA, or BMI change (see Table 3). When the moderating effects of depression and anxiety symptoms were tested, three significant relationships were found: anxiety symptoms significantly moderated the relationship between positive affect and overall adherence, such that those with higher anxiety scores showed a stronger positive relationship between positive affect and adherence. Additionally, both depressive and anxiety symptoms moderated the relationship between optimism and walking in the same direction; there was a stronger positive relationship between optimism and walking for those with higher depressive and higher anxiety symptoms. See Table 4 and Figs. 1, 2, and 3 for details.

Discussion

This study is aimed at better understanding positive psychological constructs in the post-WLS population, as these constructs have been shown to be important for health and well-being in other groups but have minimally been examined after WLS. Levels of optimism were slightly lower in the present sample than those in the two European general population samples [52, 53]. The present sample showed higher

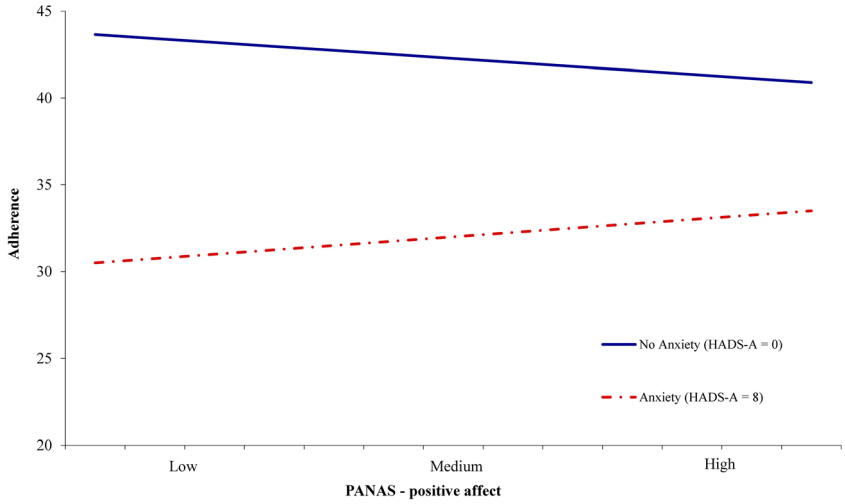

Fig. 1 The interaction between positive affect and anxiety on adherence

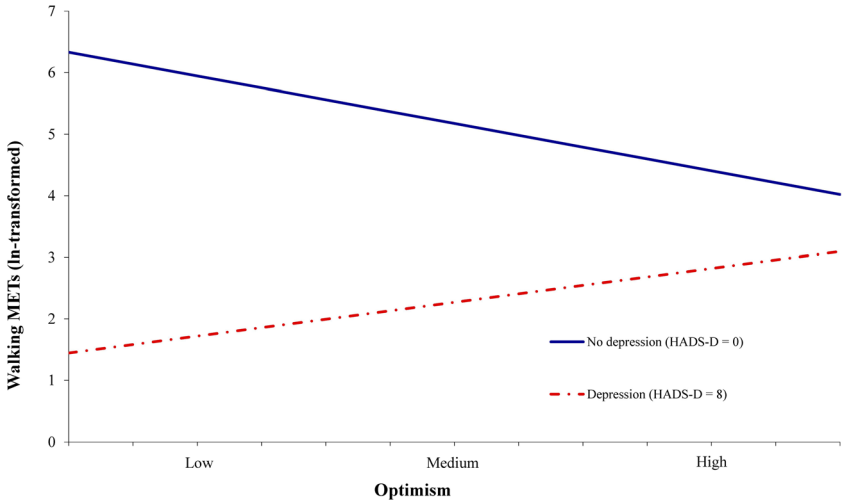

Fig. 2 The interaction between optimism and depression on walking

levels of positive affect than did a large sample of adults in the UK [45]; however, the present study asked about affect in general, whereas the UK study asked about the past week specifically [45]. In their original validation study of the PANAS, Watson and colleagues found that positive affect scores tended to increase as the time frame widened [46]. Therefore, it is possible that the question's time frame, rather than the sample, explains this difference. No associations between positive psychological constructs and time since surgery were found in this cross-sectional sample.

Regarding associations with health behaviors and weight loss, hypotheses about the relevance of optimism and positive affect were partially supported. Positive affect was consistently positively associated with both overall adherence and MVPA, even when controlling for demographic and weight-related variables. It was also independently associated with larger BMI change. This relationship did not hold for walking. Optimism was also positively associated with MVPA controlling for demographic and weight-related variables, and independently with adherence. However, once symptoms of depression and anxiety were included in the models, these positive psychological constructs were no longer significant predictors of any health behaviors. These findings are inconsistent with studies in other populations that have shown an independent relationship of optimism with physical activity and diet, controlling for depressive symptoms [31, 37–39]. They are also inconsistent with the previously found significant cross-sectional relationship between positive affect and health behaviors, controlling for depressive symptoms [40]. It may be that the smaller sample size in the present study, especially compared with prior epidemiological studies with more than 10,000 participants, is simply insufficient to see such effects. It is also possible that a longitudinal relationship between positive psychological well-being and health behaviors may exist that is not captured by this cross-sectional dataset. It also could be that, in the post-WLS population, symptoms of depression or anxiety explain the relationship seen between positive affect and optimism with health behaviors.

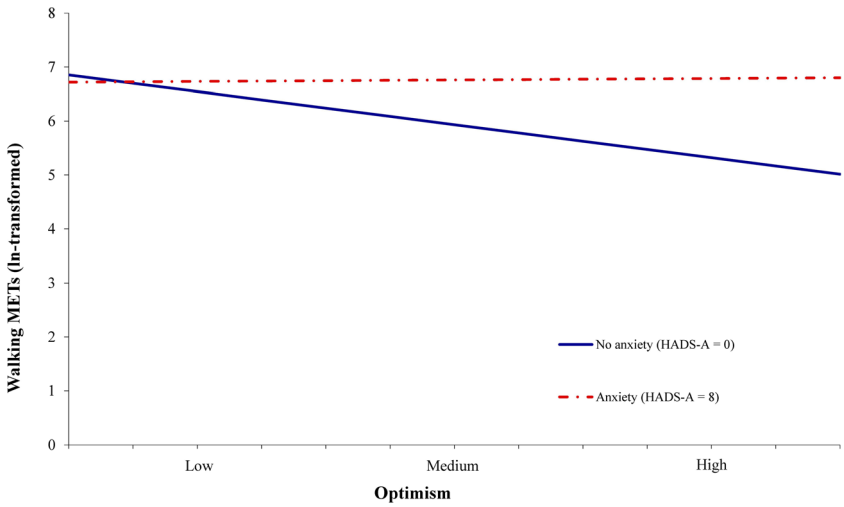

Fig. 3 The interaction between optimism and anxiety on walking

While anxiety symptoms moderated the relationship between positive affect and adherence and both depressive and anxiety symptoms moderated the relationship between optimism and walking, the direction of these interactions was unexpected. A stronger effect of positive affect and optimism on health behaviors was hypothesized for those with lower symptoms of depression and anxiety, given that depression and anxiety symptoms themselves are strong predictors of health behaviors that may overpower the effects of positive constructs. However, results showed the opposite trend. When the interaction was significant, there was a stronger positive relationship between the positive construct and health behavior for those with higher symptoms of anxiety or depression.

This interaction could be unique to the context of post-WLS patients. As opposed to the general population or those with chronic medical conditions, those undergoing WLS have extensive and specific recommendations for maintaining weight loss after surgery. Perhaps in this context, for those without a mental disorder, adherence is relatively high regardless of one's affect or level of optimism. However, for those struggling with symptoms of anxiety or depression, positive psychological constructs may buffer the detrimental effects that the mental condition can exert on health behaviors. This logic is consistent with the interaction found in a prior study of patients with acute coronary syndrome, another group in whom intensive behavioral recommendations follow a specific event. Here, depressive symptoms only predicted poorer health outcomes for those low in optimism, suggesting that high optimism buffered the detrimental effects of depressive symptoms on health [39]. Further research is needed to better clarify how negative and positive psychological states may interact to affect health and health behaviors.

These results suggest that emotional states are an important factor in one's ability to adhere to critical behavioral recommendations after WLS. While mental health symptoms related to depression and anxiety are clearly integral to monitor and address after surgery [19, 22], positive psychological constructs such as optimism and positive affect may also be useful targets to assess. Teaching patients skills to boost these positive states may help them to adhere to health behaviors and to achieve their desired weight loss outcomes. Positive psychological interventions have been effective in increasing optimism and positive affect in healthy populations and some medical groups [54–56]. These interventions use specific activities (e.g., keeping a gratitude journal, identifying and using personal strengths, clarifying one's best possible self and the steps needed to move toward it) designed to increase such positive assets. Such interventions may also lead to improvements in health behaviors [47, 48] and could potentially be applied to the post-WLS population.

This study had several limitations. Participants in this study were mainly recruited from the online support groups, which have become an increasingly popular way for those undergoing WLS to interact with others to share information and support [57]. This recruitment source provided diversity in terms of time since surgery and geographic region, although the participants may not be representative of all WLS patients, as not all are active on such websites. Further, the cross-sectional nature of the data limits the ability to determine causality in any of these relationships, and all health and behavioral information was collected via self-report, which can be prone to bias. It is also possible that the present sample size was too small to identify relationships that may exist and that were found in much larger epidemiological datasets.

In conclusion, positive psychological states such as positive affect and optimism may be relevant in the health and well-being of post-WLS patients, although they did not have an impact independent of depression and anxiety symptoms on health behaviors in the present study. Further assessment of psychological states and their relationship to physical and mental health outcomes after surgery is warranted. Skills to boost positive psychological states may enhance effects of interventions targeting improved behavioral adherence after WLS.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

References

1. Clapp B, Wynn M, Martyn C, et al. Long term (7 or more years) outcomes of the sleeve gastrectomy: a meta-analysis. Surg Obes Relat Dis. Elsevier Inc. 2018;14:741–7.
2. Courcoulas AP, Christian NJ, Belle SH, et al. Weight change and health outcomes at 3 years after bariatric surgery among individuals with severe obesity. JAMA. 2013;310:2416–25.
3. Maciejewski ML, Arterburn DE, Van Scoyoc L, et al. Bariatric surgery and long-term durability of weight loss. JAMA Surg. 2016;151:1046–55.
4. Karlsson J, Taft C, Rydén 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;31:1248–61.
5. Adams TD, Davidson LE, Litwin SE, et al. Weight and metabolic outcomes 12 years after gastric bypass. N Engl J Med. 2017;377:1143–55.
6. Egberts K, Brown WA, Brennan L, et al. Does exercise improve weight loss after bariatric surgery? A systematic review. Obes Surg. 2012;22:335–41.
7. Livhits M, Mercado C, Yermilov I, et al. Exercise following bariatric surgery: systematic review. Obes Surg. 2010;20:657–65.
8. Sarwer DB, Wadden TA, Moore RH, et al. Preoperative eating behavior, postoperative dietary adherence, and weight loss after gastric bypass surgery. Surg Obes Relat Dis. 2008;4:640–6.
9. Wakayama L, Nameth K, Adler S, Safer DL. Replication and extension of dietary adherence as a predictor of suboptimal weight loss outcomes in post-bariatric patients. Surg Obes Relat Dis Elsevier Inc; 2019. https://doi.org/10.1016/j.soard.2018.10.029.

10. Mitchell JE, Christian NJ, Flum DR, et al. Postoperative behavioral variables and weight change 3 years after bariatric surgery. JAMA Surg. 2016;151:752–7.
11. Thomas JG, Bond DS, Phelan S, et al. Weight-loss maintenance for 10 years in the National Weight Control Registry. Am J Prev Med. 2014;46:17–23.
12. Sherf Dagan S, Keidar A, Raziel A, et al. Do bariatric patients follow dietary and lifestyle recommendations during the first post-operative year? Obes Surg. 2017;27:2258–71.
13. King WC, Chen JY, Bond DS, et al. Objective assessment of changes in physical activity and sedentary behavior: pre- through 3 years post-bariatric surgery. Obesity. 2015;23:1143–50.
14. Bond DS, Jakicic JM, Unick JL, et al. Pre- to postoperative physical activity changes in bariatric surgery patients: self report vs. objective measures. Obesity. 2010;18:2395–7.
15. King WC, Hsu JY, Belle SH, et al. Pre- to postoperative changes in physical activity: report from the longitudinal assessment of bariatric surgery-2 (LABS-2). Surg Obes Relat Dis. 2012;8:522–32.
16. Mechanick JI, Youdim A, Jones DB, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient-2013 update. Obesity. 2013;9:159–91.
17. Sjöström L, Lindroos AK, Peltonen M, et al. Lifestyle, diabetes, and cardiovascular risk factors 10 years after bariatric surgery. N Engl J Med. 2004;351:2683–93.
18. Karmali S, Brar B, Shi X, et al. Weight recidivism post-bariatric surgery: a systematic review. Obes Surg. 2013;32:1922–33.
19. Rosenberger PH, Henderson KE, White MA, et al. Physical activity in gastric bypass patients: associations with weight loss and psychosocial functioning at 12-month follow-up. Obes Surg. 2011;21:1564–9.
20. Colles SL, Dixon JB, O'Brien PE. Grazing and loss of control related to eating: two high-risk factors following bariatric surgery. Obesity. 2008;16:615–22.
21. Castellini G, Godini L, Amedei SG, et al. Psychological effects and outcome predictors of three bariatric surgery interventions: a 1-year follow-up study. Eat Weight Disord. 2014;19:217–24.
22. Mitchell JE, King WC, Chen JY, et al. Course of depressive symptoms and treatment in the longitudinal assessment of bariatric surgery (LABS-2) study. Obesity. 2014;22:1799–806.
23. Tindle HA, Chang Y-F, Kuller LH, et al. Optimism, cynical hostility, and incident coronary heart disease and mortality in the Women's Health Initiative. Circulation. 2009;120:656–62.
24. Kubzansky LD, Thurston RC. Emotional vitality and incident coronary heart disease: benefits of healthy psychological functioning. Arch Gen Psychiatry. 2007;64:1393–401.
25. Rasmussen HN, Scheier MF, Greenhouse JB. Optimism and physical health: a meta-analytic review. Ann Behav Med. 2009;37:239–56.
26. Chida Y, Steptoe A. Positive psychological well-being and mortality: a quantitative review of prospective observational studies. Psychosom Med. 2008;70:741–56.
27. Steptoe A, Wright C, Kunz-Ebrecht SR, et al. Dispositional optimism and health behaviour in community-dwelling older people: associations with healthy ageing. Br J Health Psychol. 2006;11:71–84.
28. Giltay EJ, Geleijnse JM, Zitman FG, et al. Lifestyle and dietary correlates of dispositional optimism in men: the Zutphen elderly study. J Psychosom Res. 2007;63:483–90.
29. Browning C, Sims J, Kendig H, et al. Predictors of physical activity behavior in older community-dwelling adults. J Allied Health. 2009;38:8–17.
30. Kim ES, Kubzansky LD, Soo J, et al. Maintaining healthy behavior: a prospective study of psychological well-being and physical activity. Ann Behav Med. 2017;51:337–47.
31. Huffman JC, Beale EE, Celano CM, et al. Effects of optimism and gratitude on physical activity, biomarkers, and readmissions after an acute coronary syndrome: the gratitude research in acute coronary events study. Circ Cardiovasc Qual Outcomes. 2016;9:55–63.
32. Boehm JK, Chen Y, Koga H, et al. Is optimism associated with healthier cardiovascular-related behavior? Circ Res. 2018;122:1119–34.
33. Ghorpade K, Abhyankar S. Some positive personality correlates of adherence to treatment among post bariatric surgery patients. Indian J Posit Psychol. 2014;4:51–4.
34. Van Cappellen P, Rice EL, Catalino LI, et al. Positive affective processes underlie positive health behaviour change. Psychol Health. 2018;33:77–97.
35. Ekkekakis P, Lind E, Vazou S. Affective responses to increasing levels of exercise intensity in normal-weight, overweight, and obese middle-aged women. Obesity. 2010;18:79–85.
36. DuBois CM, Beach SR, Kashdan TB, et al. Positive psychological attributes and cardiac outcomes: associations, mechanisms, and interventions. Psychosomatics. 2012;53:303–18.
37. Progovac AM, Donohue JM, Matthews KA, et al. Optimism predicts sustained vigorous physical activity in postmenopausal women. Prev Med Rep. 2017;8:286–93.
38. Hingle MD, Wertheim BC, Tindle HA, et al. Optimism and diet quality in the Women's Health Initiative. J Acad Nutr Diet. 2014;114:1036–45.
39. Ronaldson A, Molloy GJ, Wikman A, et al. Optimism and recovery after acute coronary syndrome: a clinical cohort study. Psychosom Med. 2015;77:311–8.
40. Sin NL, Moskowitz JT, Whooley MA. Positive affect and health behaviors across 5 years in patients with coronary heart disease: the heart and soul study. Psychosom Med. 2015;77:1058–66.
41. Han SY, Agostini G, Brewis AA, et al. Avoiding exercise mediates the effects of internalized and experienced weight stigma on physical activity in the years following bariatric surgery. BMC Obes. 2018;5:18.
42. Ball K, Crawford D, Owen N. Too fat to exercise? Obesity as a barrier to physical activity. Aust N Z J Public Health. 2000;24:331–3.
43. Raves DM, Brewis A, Trainer S, et al. Bariatric surgery patients' perceptions of weight-related stigma in healthcare settings impair post-surgery dietary adherence. Front Psychol. 2016;7:1497.
44. Scheier MF, Carver CS, Bridges MW. Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a reevaluation of the life orientation test. J Pers Soc Psychol. 1994;67:1063–78.
45. Crawford JR, Henry JD. The Positive and Negative Affect Schedule (PANAS): construct validity, measurement properties and normative data in a large non-clinical sample. Br J Clin Psychol. 2004;43:245–65.
46. Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect: the PANAS scales. J Pers Soc Psychol. 1988;54:1063–70.
47. Celano CM, Albanese AM, Millstein RA, et al. Optimizing a positive psychology intervention to promote health behaviors following an acute coronary syndrome: the positive emotions after acute coronary events-III (PEACE-III) randomized factorial trial. Psychosom Med. 2018;80:526–34.
48. Celano CM, Gianangelo TA, Millstein RA, et al. A positive psychology–motivational interviewing intervention for patients with type 2 diabetes: proof-of-concept trial. Int J Psychiatry Med. 2018:009121741879144.
49. Bjelland I, Dahl A, Haug TT, et al. The validity of the hospital anxiety and depression scale. An updated literature review. J Psychosom Res. 2002;52:69–77.

50. Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003;35:1381–95.
51. Welch G, Wesolowski C, Piepul B, et al. Physical activity predicts weight loss following gastric bypass surgery: findings from a support group survey. Obes Surg. 2008;18:517–24.
52. Hinz A, Sander C, Glaesmer H, et al. Optimism and pessimism in the general population: psychometric properties of the Life Orientation Test (LOT-R). Int J Clin Heal Psychol. 2017;17:161–70.
53. Schou-Bredal I, Heir T, Skogstad L, et al. Population-based norms of the life orientation test-revised (LOT-R). Int J Clin Heal Psychol. 2017;17:216–24.
54. Seligman MEPP, Steen TA, Park N, et al. Positive psychology progress: empirical validation of interventions. Am Psychol. 2005;60:410–21.
55. Sin NL, Lyubomirsky S. Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: a practice-friendly meta-analysis. J Clin Psychol. 2009;65:467–87.
56. Moskowitz JT, Carrico AW, Duncan LG, et al. Randomized controlled trial of a positive affect intervention for people newly diagnosed with HIV. J Consult Clin Psychol. 2017;85:409–23.
57. Koball AM, Jester DJ, Domoff SE, et al. Examination of bariatric surgery Facebook support groups: a content analysis. Surg Obes Relat Dis. 2017;13:1369–75.