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Development of the Weight Management Skills Questionnaire in a Prebariatric Surgery Sample

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Abstract

Background—Weight loss after bariatric surgery is largely predicted by adherence to diet and lifestyle changes. There is no validated measure of self-reported adherence to a range of behaviors including self-monitoring, portion control, healthy food choice, and awareness of hunger and satiety.

Objectives—The goal of the present study was to develop and provide initial evidence for the validity of the Weight Management Skills Questionnaire, a measure of adherence to these changes, by identifying its factor structure and relating the total score and subscale scores to baseline BMI, weight change during a preoperative education program, dysregulated eating, and binge eating disorder (BED).

Setting—University hospital, USA.

Methods—Four hundred twenty-two bariatric surgery candidates responded the WMSQ and measures of eating behavior. Weight collected at the beginning, midpoint, and end of the presurgical program was used to compute percent total weight loss (%TWL) prior to surgery. Hierarchical factor analysis was used to explore the factor structure of the WMSQ while allowing the items to load onto a single general factor reflecting overall adherence to behavioral weight management.

Results—The WMSQ has three interpretable subfactors, with all items loading onto the general factor. All scales were unrelated to starting BMI; total score and subfactors measuring general and bariatric-specific weight management skills were associated with %TWL. The scale measuring hunger/satiety responsiveness was negatively related to dysregulated eating/BED.

Conclusions—The WMSQ may be a useful tool in future research exploring the key weight management skills associated with successful weight loss before and after bariatric surgery.

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Keywords

Sleeve gastrectomy; Roux-en-Y gastric bypass; Behavioral weight management; Binge eating; Emotional eating; External eating

Introduction

Successful weight loss and maintenance after bariatric surgery (i.e., gastric bypass and sleeve gastrectomy) is largely predicted by adherence to postoperative diet and lifestyle recommendations involving portion control, food choice, supplement adherence, and physical activity [1,2]. Most surgical programs require candidates to complete at least 3 to 6 months of preoperative education in order to learn and practice these behavioral changes before surgery and address barriers to postoperative adherence [3]. Although there are mixed findings [4], literature reviews have generally formed a consensus that patients who achieve modest preoperative weight loss as a result of behavioral weight management education are likely to have fewer postoperative complications, shorter operating times, and greater weight loss after bariatric surgery [5, 6]. Weight loss during presurgical education programs might be seen as a proxy for adherence to medically recommended weight loss interventions, and associations between preoperative weight loss and successful postoperative outcomes explained by this adherence. This has led to the recommendation that insurance-mandated preoperative education programs emphasize the development of specific skills associated with postoperative success [4].

A primary mechanism of successful weight loss is reduced caloric intake resulting in consistently negative energy balance, and behavioral modifications, such as portion control strategies and modifying the home food environment, are needed to maintain lower-calorie diets [7, 8]. Other behavioral skills, notably daily moderate exercise, self-monitoring of weight, exercise, and food intake, regular meal patterning/avoidance of meal skipping, and generally healthy eating, but particularly low-fat diets and diets that provide recommended daily protein intake, are implicated in successful weight loss maintenance over time in non-surgical studies [7, 9-13].

Less is known about specific behavioral predictors of weight loss and maintenance from bariatric surgery. Suboptimal weight loss and weight regain after bariatric surgery have been associated with lower levels of physical activity, subclinical disordered eating behavior, disinhibited eating and increases in food urges, drug and alcohol use, and dietary non-compliance [2, 14, 15]. Two studies have identified patient adherence to regular self-weighing, self-monitoring of weight and food intake, and adherence to postoperative dietary requirements as predictors of better weight loss outcomes [2, 16, 17]. These studies begin to shed light on the key behavioral components of successful weight loss maintenance after surgery, but they did not assess the same set of behaviors, limiting the ability to generalize from this body of literature. A recent literature review concluded there is little consensus on the associations between presurgical weight management and postoperative weight loss, which may be due to inconsistencies in study methodologies and presurgical education programs, many of which require patients to lose weight without providing instructions or

techniques for how to do so, or by recommending very low calorie diets and/or reliance meal replacement supplements [4]. Such strategies may be neither sustainable nor desirable in the long-term, and even these approaches may require other skills, such as food tracking, regular weighing, and attention to physiological hunger and satiety cues, to be successful even in the short term. The current lack of consensus underscores the importance of developing a standardized measure of weight management skills and behaviors specific to pre- and postoperative bariatric surgery patients in order to better understand the key ingredients in successful surgical weight management. Preoperative weight loss achieved through inappropriate means, like fasting, excessive caloric restriction, or “cleanses” and “detoxes” is inadvisable for many reasons, including psychosocial distress, health complications, and risk for the development of disordered eating. A measure of healthy, adaptive weight loss strategies would help to guide patients towards more appropriate adherence to recommendations that are intended to promote postoperative weight loss accompanied by good nutrition and psychosocial adjustment to surgery.

Although there is a measure of weight-related behaviors and skills validated for use in non-surgical weight management populations [18], there is currently no validated measure of behavioral weight management skills specific to preoperative or postoperative bariatric surgery patients. The Weight Management Skills Questionnaire (WMSQ) described in this manuscript will allow for a more systematic approach to examining pre- and postoperative skills use and its association with weight loss outcomes in bariatric surgery populations. A hierarchical factor analytic approach was selected specifically a priori, treating “behavioral weight management” as a latent construct with meaningful subgroups of specific skills. We will explore the relationship of the WMSQ total score and subfactors to body mass index (BMI) at the beginning of a presurgical lifestyle change program, as well as weight change during the program. In addition, we will explore the relationship of the WMSQ to disinhibited/disordered eating behaviors and previous weight loss efforts. We hypothesize that the measure will be related to weight loss, but not to starting weight. Analyses concerning disinhibited/disordered eating and previous weight loss efforts are exploratory.

Methods

Participants

Participants were 422 preoperative bariatric surgery candidates with severe obesity (BMI > 35). All participants were candidates for either sleeve gastrectomy or Roux-en-Y gastric bypass, in a mandatory preoperative behavioral weight management program at an academic medical center. See Table 1 for sample demographics.

Procedure

Depending on patients’ insurance requirements, the preoperative program consisted of four or six required individual and group classes scheduled over the course of 3 to 6 months. For all patients, one of the required classes is a behavioral weight management session that is scheduled at the “midpoint” of their presurgical program. Data on skills use were collected at the beginning of this midpoint session. Data on demographics and binge eating were collected during a single 2-h visit, usually taking place at the beginning or within the first

half of the presurgical program. Weight data were collected by program staff at the beginning of all sessions using the same scale. See Table 1 for average program length and program dropout. All participants provided informed consent for their clinical data, including the weight and questionnaire data used in the current study, to be added to a prospective research data registry. The institutional review board of Penn State College of Medicine/Milton S. Hershey Medical Center approved all study measures and procedures.

Measures

Weight Management Skills Questionnaire—The WMSQ assesses patients' self-reported frequency of use of behavioral weight loss skills taught in the presurgical program at Penn State College of Medicine/Milton S. Hershey Medical Center. A list of 28 items was developed based on the written program manual distributed to patients. The program manual includes standard of care guidelines and provides extensive evidence-based information about effective behavioral weight management including skills specifically relevant for bariatric surgery patients. Program staff, including psychologists, dietitians, nurses, and surgeons, reviewed the items and recommended changes and additions. The items were then piloted in a small sample of patients, who provided feedback on clarity and relevance [16]. The final item pool included items similar to those appearing on an existing general weight management scale [18], but also items specific to postbariatric weight maintenance (e.g., "I avoid drinking during meals" and "I eat slowly/chew thoroughly"). One item regarding selection of foods with fewer than 3 fat grams per 100 calories was dropped from the questionnaire and a priori from the factor analysis because it was no longer part of the preoperative curriculum. Another item ("I use less 'all or nothing' thinking") was dropped after exploration of missing data revealed that data on this item were missing from 7.8% of the sample, a rate of missingness greater than the recommended limit of 5% for imputation [19]. No other item exceeded 3% missingness. The final item pool therefore consisted of 26 items (Appendix).

Demographics—Patients self-reported their gender identity, race/ethnicity, age, and educational attainment (years of formal schooling) in the demographics section of the Weight and Lifestyle Inventory [20].

Percent Total Weight Loss—Participants were weighed at all presurgical clinic visits. Weight loss between program entry and the midpoint session as well as between the midpoint and the final session of the presurgical program was computed by subtracting midpoint weight from starting weight and final weight from midpoint weight, respectively. Weight change over the full presurgical program was also computed by subtracting each participant's final weight, which was recorded at the last presurgical clinic visit, from their starting weight upon entry to the presurgical program. The resulting change scores were then divided by starting weight to compute %TWL, or percentage of total weight lost during the presurgical program. Data on change from the midpoint to final session for 48 participants who dropped out and did not attend any sessions after the midpoint session were estimated using multiple imputation from available weight data.

Previous Weight Loss Attempts—To explore the relationship between participants' reported skills use during the presurgical program and previous weight loss efforts, a proxy variable was created using Section E of the Weight and Lifestyle Inventory [20], which asks patients to report their past attempts to lose weight. A count variable was created, ranging from 0 to 10, for the number of previous weight loss efforts reported.

Dysregulated Eating Behaviors—Two subscales of Section H of the WALI, which assesses obesity-related eating behaviors, were used to explore dysregulated eating. These subscales measure the degree to which participants report engaging in Emotional over-eating (EoE), eating in response to negative affect, and External Eating (ExE), eating in response to the sight of food or reminders of food. EoE and ExE are associated with binge eating and reduced postsurgical weight loss in bariatric samples, and Section H of the WALI has been validated for use in bariatric populations [21].

Questionnaire on Weight and Eating Patterns—The Questionnaire on Weight and Eating Patterns (QWEP) is a self-report measure of binge eating disorder symptoms, corresponding to DSM-5 diagnostic criteria for binge eating disorder. The QWEP is embedded within the WALI and has been widely used and validated in prebariatric populations [22]. Participants' responses to the QWEP are scored according to DSM-5 criteria to identify probable cases of binge eating disorder (BED) [23].

Data Analysis

The “scree,” “fa.parallel,” “vss,” and “omega” functions from the psych package for RStudio version 3.4.3 were used to generate a scree plot and conduct very simple structure (VSS), and parallel with minimum average parcel (MAP) analyses estimating number of components with eigenvalue ≥ 1 , and to fit hierarchical exploratory factor analysis (HFA) with a weighted least squares estimator and oblimin rotation [24, 25]. Hierarchical factor analysis is used when all items are believed to measure the same latent construct, but may also have an underlying second-order structure [26]. The “mice” package was used to generate five imputed datasets to account for missing skill items and to predict weight loss for participants who dropped out of the program after the midpoint session. For HFA, test statistics and factor loadings were pooled across samples [25]. Scree and parallel plots and VSS were examined to identify the appropriate number of group factors. χ^2 , RMSEA, and BIC for the hierarchical model with general and group factors were compared with that of a model with only a general factor. Adequacy of the factor solution was also explored by examining ω_h , a measure of the loading of each subfactor on the general factor, and ω_T , reflecting the strength of item loadings onto their subfactors [27, 28]. SPSS version 25 was used for correlational convergent validity analyses with demographic variables, baseline BMI, weight loss, WALI ExE/EoE, and BED. Partial correlations controlling for time between weight collections, as well as for gender and binge eating disorder were used to explore associations between the WMSQ and weight loss from the beginning to midpoint, midpoint to end, and across all session.

Results

Sample Descriptives

The sample was predominantly female and White, see Table 1 for sample descriptives.

Factor Structure

Scree, VSS, and parallel analyses suggested five subfactors (Table 2). For a hierarchical model with five group factors, $\chi^2(205) = 402.14$, $\chi^2/df = 1.96$, RMSEA = .06 [.05, .064], and BIC = -749.23, whereas a solution with only a general factor yielded $\chi^2(299) = 854.09$, $\chi^2/df = 3.66$, $p < .001$, RMSEA = .08 [.074, .084] and BIC = -714.87. $\omega_h = .71$ and $\omega_t = .92$. See Table 3 for ω_h of each group factor. One subfactor had a single item (I limit alcohol). Because a one-item factor is not stable or interpretable, we did not interpret this subfactor. Another item (I drink more water) did not load onto any subfactor. All 26 items loaded strongly onto the general factor. Three subfactors were interpretable and appeared distinct from one another, reflecting general weight loss skills (General), bariatric-specific weight loss skills (Bariatric), and responsiveness to physiological hunger and satiety (Physiological). Three additional items that appear to reflect general weight loss skills nevertheless loaded onto their own factor (see Table 2). Because these items were reflected in the total score, we chose not to validate the subfactor onto which they loaded. The total score therefore included all 26 skill items, and the three subfactors that were entered into convergent/predictive validity analyses were Bariatric, General, and Physiological weight loss skills.

Convergent Validity

The WMSQ scales were moderately to strongly intercorrelated (Table 3) and differed in their relationships with weight loss during the presurgical program, number of previous weight loss attempts, and current dysregulated/disordered eating (Table 4). None of the scales were related to BMI at program entry. In a partial correlation analysis controlling for days between sessions, Total score, General Weight Loss Skills, and Bariatric Weight Loss Skills were each modestly related to %TWL from program entry to the session where WMSQ was completed and to %TWL from the beginning of the presurgical program to the end (%TWL Pre-, %TWL Total). There was a negligible partial correlation between Physiological skills and any weight loss variable. Participants' reported number of previous weight loss attempts was not significantly associated with any of the WMSQ scales. Physiological was inversely and moderately related to WALI Section H ExE and EoE, and was uniquely negatively related to BED. The total score and other subfactors had small negative relationships with ExE and EoE, and were not related to BED (Table 4).

Discussion

The aim of the current study was to describe the development of a new measure of behavioral weight management skills for bariatric patients. Twenty-six items, developed with input from bariatric patients and clinicians, loaded strongly onto a single higher order factor with excellent internal consistency, offering support for using the WMSQ total score to capture patients' overall adherence to weight management interventions. Three subfactors

showed slightly different relationships with convergent validity variables. Most notably, a factor measuring internal awareness of and responsiveness to hunger and satiety cues was associated with disinhibited/disordered eating behaviors, whereas the total score and subfactors assessing general and bariatric-specific weight loss skills were associated with %TWL during the presurgical program.

It should be noted that although HFA suggested a five-factor solution, only three interpretable factors were identified. One factor assessed general weight loss skills and showed the strongest relationship to the total score. The other two subfactors may assess more specific skills related to bariatric surgery. To our knowledge, the Bariatric skill subfactor is the first scale that incorporates skills specific to successful weight management after bariatric surgery, such as thorough chewing and avoiding drinking during meals. Other skills that loaded onto this factor may be those associated more with successful weight maintenance than weight loss (e.g., regular exercise). Future research should address whether these skills show greater predictive validity with postbariatric weight loss and/or longer-term weight maintenance.

Three items are loaded onto a factor assessing responsiveness to hunger and satiety cues. Learning to recognize and respond appropriately to physical satiety cues, while also learning to distinguish hunger cues from urges to eat in response to environmental or emotional triggers, is a target of new weight management and binge eating treatments [e.g., 29]. In the current sample, the Physiological skills scale showed divergent validity from the total score and other subfactors in its strong negative relationship with external eating, and moderate negative relationships with emotional eating and binge eating. The Physiological skill subscale may be useful as an outcome measure in future efficacy research [29]. Given the limited interpretability of the subfactor structure and the preliminary nature of the validity analyses, we recommend using the total score of the WMSQ to explore overall use of weight management skills, and encourage further exploration of the Bariatric and Physiological subscales as measures of bariatric-specific weight management skills and selfregulation of physiological cues, respectively.

Findings from the present study suggested that participants' number of past dieting attempts was not associated with a greater use of total, general, or bariatric weight loss skills while in the presurgical program. The majority of participants reported a history of weight loss attempts, but it was unclear if these attempts involved the use of weight management skills as opposed to inappropriate restriction, compensatory behavior, or meal replacement programs. Indeed, many of our patients enter the presurgical program at their highest ever adult weight and report they have been unsuccessful in their past dieting attempts.

Dysregulated eating (e.g., eating in response to affect or food cues in the environment) and disordered eating (e.g., binge eating disorder) are associated with poor postsurgical outcomes. Patients' self-reported use of skills associated with eating in response to hunger and satiety cues was more strongly associated with scores on WALI Section H Emotional and External eating scales, and was the only subfactor inversely associated with meeting binge eating disorder criteria, suggesting that these skills might be uniquely protective against dysregulated and disordered eating.

The WMSQ was not associated with baseline BMI, suggesting that it measured skills either learned or increasingly practiced during a weight management education program. Although the associations between the WMSQ total score and subscales suggest that the measure captures adherence to skills that are associated with more successful behavioral weight management, alternate explanations are possible. It could be the case that, because participants were usually weighed before they completed the WMSQ, this biased responding, with participants reporting higher use of weight management skills when they knew they had been more successful with weight loss. Participants were only told their current weight; they did not know their starting weight unless they asked the clinic staff or unless they were already tracking their weight loss independently. Therefore, not all participants would have known whether they had lost or gained weight, or by how much.

Relationships with prospective %TWL were attenuated compared with %TWL prior to data collection and %TWL across the full program. There could be several potential reasons for this finding. As surgery nears, the focus of our preoperative educational program shifts from weight management to preparation for the surgical procedure, although providers continue to emphasize the use of WMSQ skills. In cases where participants were observed to be struggling to make lifestyle changes, individual sessions focused on increasing skills use. Based on the current study, where WMSQ skills were only measured once, and there was limited evidence of a prospective relationship with weight loss, we are not able to provide predictive validity evidence. Future studies should use designs that directly test whether increased skill use is associated with weight loss over time. We are now administering the WMSQ at baseline, mid-treatment, and the end of our program in order to address this question in future validation studies.

Conclusions

Given the importance of behavioral weight management for the maintenance of healthy weight loss following bariatric surgery, there is a need for a psychometrically sound instrument to allow researchers to assess adherence to weight management skills and to empirically derived subgroups of skills. In addition, there is limited research on what kind of preoperative education is associated with successful postoperative outcomes, but two recent systematic reviews of patient education practices in weight loss surgery have each included recommendations that such programs should emphasize lifestyle changes, habits, and practice of skills use in adopting new routines preoperatively that will promote safe, healthy, and sustained postoperative weight loss [3, 4]. A tool measuring the degree to which patients adopt and use bariatric-specific weight management skills may be useful in efficacy research on prebariatric education programs.

The WMSQ appears to be an internally consistent instrument for assessing weight management skills and was associated with weight loss and dysregulated eating in this sample of prebariatric patients. Initial evidence from this measure development study indicates that the skills most associated with dysregulated eating are different from those most associated with weight loss in the context of a prebariatric, weight management-focused lifestyle intervention. Consistent with prior evidence, the constellation of skills most strongly associated with behavioral weight loss involved self-monitoring, planning, goal-

setting, and physical exercise [8, 16]. Future research is needed to address the relationship of weight management skills use to postoperative weight loss.

In addition to its potential as a research tool, a validated measure of skills use would also have clinical utility. Assessing patients' use of weight management skills throughout prebariatric programs and during postsurgical follow-up might also allow clinicians to tailor interventions to the needs of individual patients. The WMSQ may be used as a tool to promote discussion and reflection on behavioral preparation for surgery while also yielding potentially clinically relevant information for patients and clinicians throughout their preoperative program and at postoperative follow-up intervals.

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Appendix

Weight Management Skills Questionnaire (WMSQ)

The following statements relate to your eating habits and behaviors. For each question you should select the response from the list below which **best describes you and your behaviors in the past week**.

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
I write in my food journal most days	1	2	3	4	5
I use portion control	1	2	3	4	5
I exercise at least 3 days/week for 30 minutes	1	2	3	4	5
I choose zero calorie drinks	1	2	3	4	5
I keep high risk foods out of my home	1	2	3	4	5
I limit going out to eat/ordering out	1	2	3	4	5
I/we prepare meals at home	1	2	3	4	5
I avoid unplanned snacking	1	2	3	4	5
I buy more fresh, unprepared foods	1	2	3	4	5
I eat at least 3 meals/day & snack as needed	1	2	3	4	5
I write down goals regularly	1	2	3	4	5
I know when I am hungry	1	2	3	4	5
I know when I am full	1	2	3	4	5
I stop eating when I am full	1	2	3	4	5

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
I limit high fat/fried foods	1	2	3	4	5
I limit sweets	1	2	3	4	5
I measure foods	1	2	3	4	5
I avoid drinking during meals	1	2	3	4	5
I use the plate method	1	2	3	4	5
I limit alcohol	1	2	3	4	5
I drink more water	1	2	3	4	5
I use mindful eating	1	2	3	4	5
I eat fruits/vegetables daily	1	2	3	4	5
I eat slowly/chew thoroughly	1	2	3	4	5
I use a smaller plate & fork	1	2	3	4	5
I weigh myself regularly (1x/week)	1	2	3	4	5

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Table 1

Sample descriptives

	<i>N</i>	Range	Mean (SD)
Age	422	18–74	43.91 (12.22)
Starting BMI	422	35.03–85.98	48.55 (8.72)
Percent weight change (%TWL) from beginning to midpoint session (pre), midpoint to final session(dropout (post) and from beginning to final session (total)			
%TWL pre	422	– 9.38–6.27	– 1.09 (2.28)
%TWL post	422	– 10.80–6.95	– 0.93 (2.35)
%TWL total	422	– 16.94–6.72	– 1.91 (3.35)
Total days in program	422	23–248	110.60 (41.97)
Previous weight loss efforts (WALI section E, item 1)	422	0–10	2.68 (2.18)
WALI Section H external eating *	345	1–5	2.32 (0.98)
WALI Section H emotional eating *	345	1–5	2.82 (0.86)
<i>N</i> (%)			
Female gender	322 (75.3%)		
Race/ethnicity			
White	314(74.1%)		
African American/Black	44 (10.4%)		
Hispanic	29(6.8%)		
Multiracial	12 (2.8%)		
Asian	1 (0.2%)		
Other/not reported	24 (5.7%)		
Education attainment			
Less than high school	30 (7.6%)		
High school	162 (38.2%)		
Some college/associate's degree	131 (30.9%)		
College degree	45 (15.1%)		
Graduate degree	24 (8.1%)		
Not reported	4 (1.09%)		
Binge eating disorder criteria			
Meets criteria	51 (12.0%)		

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	Mean (SD)	Range	N
Missing data			27 (6.4%)
Dropout			48 (11.1%)
Dropout at midpoint session			18(4.2%)
Dropout after midpoint session			30 (7.1%)

* WALLI section H subscale scores are missing for 77 consecutive participants due to changes in data collection

Table 2

Hierarchical factor analysis: higher order and second-order Schmid Leiman factor loadings

Item text	g-loading	Subfactor loading
No loading/subfactor not interpreted		
I choose zero calorie drinks.	.34	.21
I eat at least 3 meals/day and snack as needed.	.39	.20
I weigh myself regularly (1 × week)	.31	.74
I limit alcohol. *	.30	.85
I drink more water.	.43	NA
General weight loss skills		
I write in my food journal most days.	.42	.27
I use portion control.	.60	.24
I keep high risk foods out of my home.	.33	.20
I limit going out to eat/ordering out.	.50	.39
I/we prepare meals at home.	.56	.48
I avoid unplanned snacking.	.49	.26
I buy more fresh, unprepared foods.	.57	.47
I limit high fat/fried foods.	.57	.30
I limit sweets.	.54	.24
I use mindful eating.	.63	.24
I eat fruits/vegetables daily.	.50	.28
Bariatric weight loss skills		
I exercise at least 3 days/week for 30 min.	.36	.20
I write down goals regularly.	.46	.38
I measure foods.	.57	.29
I avoid drinking during meals.	.39	.26
I use the plate method.	.57	.44
I eat slowly/chew thoroughly.	.43	.20
I use a smaller plate and fork.	.46	.32
Physiological weight loss skills		
I know when I am hungry.	.35	.51
I know when I am full.	.34	.86
I stop eating when I am full.	.37	.58

* This item loaded onto a single-item factor

Table 3

Scale reliability (factor saturation), means, intercorrelations

	ω	M (SD) range = 1–5	General	Bariatric	Physiological
Total score	.92	3.77 (.57)	.92***	.86***	.54***
General skills	.80	3.90 (.64)	1		
Bariatric skills	.79	3.23 (.77)	.68***	1	
Physiological skills	.80	4.10 (.79)	.40***	.35***	1

 $p < .001$
**
 $p < .01$
*
 $p < .05$

Table 4

Convergent validity with demographics, starting weight, %TWL, and dysregulated/disordered eating

	Age	Gender [†]	Baseline BMI	%TWL ^{††} pre	%TWL ^{††} post	Total %TWL ^{††}	Previous weight loss efforts	WALI section H external	WALI section H emotional	Binge eating [†]
Total score	-.02	-.09	-.001	-.16**	-.01	-.12*	.05	-.19***	-.16**	-.09
General skills	-.01	-.08	.04	-.15**	-.08	-.12*	.03	-.15**	-.13*	-.07
Bariatric skills	.02	-.14***	-.01	-.14**	-.08	-.11*	-.08	-.17**	-.13*	-.06
Physiological skills	.02	.04	-.01	-.04	.01	-.01	-.11*	-.33***	-.23***	-.20***

 $p < .001$

**
 $p < .01$

*
 $p < .05$

[†] Point biserial correlation; female = 0, male = 1; no BED = 0; BED = 1

^{††} Partial correlation between skills use and percent weight change, controlling for days between measurements