The BODY-Q: A Patient-Reported Outcome Instrument for Weight Loss and Body Contouring Treatments

Anne F. Klassen, DPhil,*
Stefan J. Cano, PhD,†
Amy Alderman, MD, MPH,‡
Mark Soldin, MB ChB,
FCS(SA) Plast Surg,
FRCS(Plast),§
Achilles Thoma, MD, MSC,
FRCS(C),¶
Sam Robson, MRCGP,‖
Manraj Kaur, PT, MSc
(Rehab),**
Athanasios Papas, MD, PhD,
FEBOPRAS,§
Nancy Van Laeken, MD,††
Valerie H. Taylor, MD, PhD,‡‡
Andrea L. Pusic, MD, MSc,§§

Background: Body contouring performed for cosmetic purposes, or after weight loss, has the potential to improve body image and health-related quality of life (HRQL). The BODY-Q is a new patient-reported outcome (PRO) instrument designed to measure patient perceptions of weight loss and/or body contouring. In this article, we describe the psychometric properties of the BODY-Q scales after an international field-test.

Methods: Weight loss and body contouring patients from Canada, United States, and United Kingdom were recruited between November 2013 and February 2015. Data were collected using an iPad directly into a web-based application or a questionnaire booklet. Rasch measurement theory analysis was used for item reduction and to examine reliability, validity, and ability to detect change.

Results: The sample included 403 weight loss and 331 body contouring patients. Most BODY-Q items had ordered thresholds (134/138) and good item fit. Scale reliability was acceptable, ie, Person separation index >0.70 for 16 scales, Cronbach α ≥0.90 for 18 of 18 scales, and Test–retest ≥0.87 for 17 of 18 scales. Appearance and HRQL scores were lower in participants with more obesity-related symptoms, higher body mass index, and more excess skin and in those pre- versus postoperative body contouring. The 134 weight loss patients who completed the BODY-Q twice, either 6 weeks (weight loss/nonsurgical body contouring program) or 6 months (bariatric program) later, improved significantly on 7 appearance and 4 HRQL scales.

Conclusion: The BODY-Q is a clinically meaningful and scientifically sound patient-reported outcome instrument that can be used to measure outcomes in patients who undergo weight loss and/or body contouring. *(Plast Reconstr Surg Glob Open 2016;4:e679; doi: 10.1097/GOX.0000000000000665; Published online 13 April 2016.)*

Body contouring procedures, such as liposuction and lifts to the upper arm, abdomen, thigh, and lower body, are increasingly popular forms of plastic surgery. The number of body contouring procedures in the United States was 694,318 in 2014, comprising 39.3% of all aesthetic procedures and up from 239,832 in 1997.[1] Although most of these procedures were performed for cosmetic reasons, many

*From the *Department of Pediatrics, McMaster University, Hamilton, ON, Canada; †Modus Outcome, Letchworth Garden City, UK; ‡Swan Center for Plastic Surgery, Alpharetta, Ga.; §Plastic and Reconstructive Department, St Georges Hospital NHS Trust, Tooting, London, United Kingdom; ¶Department of Surgery, McMaster University, Hamilton, ON, Canada; ‖Temple Medical, Aberdeen, Scotland; **School of Rehabilitation Sciences, Institute of Applied Health Sciences, Hamilton, ON, Canada; ††Division of Plastic and Reconstructive Surgery, University of British Columbia, Vancouver, BC, Canada; ‡‡Women's College Hospital, University of Toronto, Toronto, ON, Canada; and §§Department of Surgery, Memorial Sloan-Kettering Cancer Center, New York, N.Y.*

patients seek body contouring to remove excess skin after massive weight loss. Whether performed for cosmetic purposes or after weight loss, body contouring has the potential to improve a patient's body image and health-related quality of life (HRQL).[2–7]

In many countries, body contouring procedures are considered cosmetic and patients are expected to pay out-of-pocket for treatments. In some countries, body contouring to remove excess skin after massive weight loss is considered reconstructive and access to treatment is provided to patients who meet specified criteria.[8] Given the profound impact that excess skin after weight loss can have on appearance and HRQL, evidence-based information about patient-centered outcomes of body contouring after massive weight loss is needed. Patient-centered information is also needed to ensure that cosmetic body contouring procedures, including nonsurgical treatments, are safe and effective.

A limitation in the pursuit of such data is the lack of a rigorously developed patient-reported outcome (PRO) instrument designed to measure HRQL and other concerns common to both weight loss and body contouring patients.[9] Research into weight loss and body contouring that has used a PRO instrument has tended to use instruments that are generic (eg, SF-36[10]), obesity specific (eg, Moorehead-Ardelt Questionnaire[11]), or body contouring specific (eg, BREAST-Q reduction module[12–14]).

To address the lack of a PRO instrument for patients undergoing weight loss and body contouring, our team followed international recommendations[15–19] to develop the BODY-Q. We previously described the development of the BODY-Q conceptual framework

and set of scales, which involved a literature review, 63 patient interviews, 22 cognitive patient interviews, and input from 9 experts (phase 1).[20–22] The BODY-Q measures 3 domains (appearance, HRQL, and experience of healthcare) via 18 independently functioning scales. In this article, we describe the psychometric results for each scale based on an international field test.

METHODS

In Canada, research ethics approval was obtained at McMaster University (Hamilton Integrated Research Ethics Board) and the University of British Columbia (Behavioural Research Ethics Board). In the United States, ethics approval was obtained through the IRB Company Incorporated (Buena Park, Calif.). In the United Kingdom, National Health Service permission was obtained, with study sponsorship provided by the Royal Free London NHS Foundation Trust.

Sample
The following recruitment strategies were used.

St Joseph's Healthcare Bariatric Program, Hamilton (Canada)
Patients exploring or seeking bariatric surgery and post-bariatric surgery patients were recruited between November 2013 and July 2014. Data were collected using either a handheld tablet, with data entered directly into a secure web-based application (ie, Research Electronic Data Capture, REDCap[23]), or a questionnaire booklet. All participants completed the appearance and HRQL scales, and, to ensure some familiarity with clinic staff, only patients who were post-bariatric surgery were asked to complete the experience scales. Participants were also invited to provide an e-mail to participate in 2 additional study components as follows: a test–retest (TRT) survey sent after 1 week; and a 6-month follow-up. Those who agreed to either component were sent an e-mail at the appropriate time, with the URL link to access the survey via REDCap. Up to 2 e-mailed reminders, spaced by 2 weeks, were sent to nonrespondents. The 6-month follow-up group also received a phone call reminder.

St George's University Hospital, London (England)
Patients who had body contouring between February 2004 and May 2014 were sent an information letter and questionnaire booklet composed of the appearance and HRQL scales. The experience scales were excluded due to potential recall bias given the length of time elapsed since surgery for many patients. Nonrespondents were sent up to 2 postal reminders and 1 phone call as necessary. Excluded from the denominator were patients whose questionnaire was returned to sender, patients with a terminal illness, and patients who had deceased.

Cosmetic Surgery Clinics, Hamilton, Vancouver, Mississauga (Canada), and Atlanta (United States)

Patients exploring or seeking body contouring surgery, and patients who had had body contouring, were recruited in clinics in Hamilton, Vancouver, and Atlanta between December 2013 and December 2014. Data were collected using either an iPad directly into RED-Cap, or using a questionnaire booklet. All participants completed the experience scales and the Body scale plus any appearance scale relevant to their body contouring procedure and/or areas of the body with excess skin (eg, Arms scale for brachioplasty patients and/or patients with excess skin on upper arms). Only patients who previously had bariatric surgery were asked to complete the Physical scale and Symptoms checklist. The remaining HRQL scales were completed by all participants.

The Atlanta and Mississauga clinics also invited former body contouring patients to participate. The Atlanta clinic staff sent an e-mail invitation with URL link to all patients treated in the previous three years. One reminder was sent 1 month later. For the Mississauga clinic, patients who participated in the earlier cognitive interview phase of the study[22] were sent an e-mail invitation with URL link. Two reminders were sent spaced by 1 week.

Private Medical Clinic, Aberdeen (Scotland)

Patients attending a weight loss program that included a collagen stimulation treatment (nonsurgical body contouring) were recruited between October 2014 and February 2015. Participants completed the body, abdomen, skin, body image, psychological and social scales. At the end of the survey, participants were invited to provide an e-mail address if they were willing to complete the experience scales (2-week follow-up). Those who complied with this request were invited to complete the initial set of scales again (6-week follow-up). For both follow-ups, 2 e-mail reminders were sent spaced by 1 week.

Analysis

We used Rasch Measurement Theory (RMT) analysis[24] to identify the subset of items for each scale that represented the best indicators of outcome. Decisions about which items to retain were based on the following set of statistical and graphical tests, explained in more detail elsewhere[25]:

1. Thresholds for item response options: For each scale, we examined thresholds between response options (eg, between very satisfied and somewhat satisfied) to determine if a scale's response categories scored with successive integer scores increased as intended.

2. Item fit statistics: We examined 3 indicators of fit to determine, for each scale, if the items worked together to map out a clinically important construct in the form of a hierarchy: (1) log residuals (item–person interaction); (2) χ^2 values (item–trait interaction); and (3) item characteristic curves. Fit residuals should be between –2.5 and +2.5, and χ^2 values should be nonsignificant after Bonferroni adjustment. We interpreted fit statistics together and in relation to clinical usefulness.

3. Dependency: Residual correlations between pairs of items were inspected to identify any that were 0.30 or higher as high residual correlations can artificially inflate reliability.[26]

4. Targeting: For each scale, we examined person and item locations to determine if items were evenly spread over a reasonable range that matched the range of the construct reported by the sample.

5. Stability: Differential item functioning (DIF) was examined to determine if items in a scale worked the same across subgroups within the sample. Subgroups that were examined included age group (<40, 40–49, 50–59, ≥60 years), sex, patient type (weight-loss and body contouring), country (Canada, United States, and United Kingdom), and method of data collection (online and paper). Chi-square values significant after Bonferroni adjustment were used to indicate items with potential DIF.

6. Person separation index (PSI): We computed the PSI for each scale. PSI measures error associated with the measurement of people in a sample and is comparable to Cronbach α.[27] Higher values indicate greater reliability.

In addition to the RMT analyses, for each scale, we computed Cronbach α[27] and, for the Test-retest (TRT) data, interclass correlation coefficients.[28] We also examined the proportion of participants with scale level missing data and with scores at the floor and ceiling. For the Symptom checklist, we computed the proportion of participants who chose each response option for the scale's 10 obesity-related symptoms.

The Rasch logit scores were transformed into 0 (worse) to 100 (best) scores. These scores were used to conduct the following tests of construct validity:

1. For each item on the obesity-specific Symptom checklist, mean body mass index (BMI) would be incrementally higher according to frequency of symptoms reported (eg, lowest for never, …, highest for all the time).

2. Scales measuring similar constructs (eg, appearance scales) would correlate more strongly with each other than with scales measuring dissimilar constructs. Correlations between BMI and number of symptoms experienced would be stronger with appearance and HRQL scales than with patient experience scales. Patient characteristics (age, sex, and ethnicity) would correlate weakly with BODY-Q scale scores.

3. BODY-Q scores for appearance and HRQL would vary across clinical groups in the sample. BODY-Q scores would be lowest (worse) for patients who had not started their weight loss journey (ie, prebariatric surgery) and would be highest (best) for cosmetic patients who had had body contouring surgery.

4. Scores for appearance and HRQL will be incrementally lower in participants who report having more versus less excess skin.

Finally, to examine responsiveness, paired *t* tests and effect sizes (ie, mean time 1 – mean time 2/standard deviation at time 1) were computed to determine statistical and clinical significance of change in scores for participants who completed BODY-Q scales on 2 occasions.

RESULTS

Table 1 shows details about the scales. Each scale has 10 or fewer items and Flesch-Kincaid grade levels under 6 (range, 0–5.3). The response rate (Table 2) varied by method of recruitment as follows: face-to-face, 94%; postal, 40%; and email, 14%. Table 3 shows sample characteristics. The 734 participants provided 965 assessments, with 616 (64%) of the assessments collected via REDCap.

The RMT analysis provided evidence of reliability and validity for the BODY-Q scales. Thresholds were ordered for 134 of 138 items. Four items in the Information scale evidenced disordered thresholds. For these items, we simplified the scoring by collapsing across 2 categories as follows, with subsequent RMT analysis using the rescored data: very dissatisfied, 0; somewhat dissatisfied, 0; somewhat satisfied, 1; very satisfied, 2.

Table 1. BODY-Q Scales Including Number of Items, Response Options, FK Grade Level

Name of Scale	Items	Example Item	Response Options	FK Grade
Body	10	How your body looks in a swimsuit?	Dissatisfied/satisfied	2.1 (0.5–3.7)
Abdomen	7	How your clothes fit your abdomen?	Dissatisfied/satisfied	3.1 (2.2–4.8)
Arms	7	How toned your upper arms look?	Dissatisfied/satisfied	1.4 (0.5–5.2)
Back	4	How your back looks when you are naked?	Dissatisfied/satisfied	0.0 (0.0–3.9)
Buttocks	5	The size of your buttocks?	Dissatisfied/satisfied	1.2 (0.5–3.6)
Hips and Outer Thighs	5	The shape of your hips and outer thighs?	Dissatisfied/satisfied	1.2 (0.8–2.3)
Inner thighs	4	How the skin on your inner thighs looks?	Dissatisfied/satisfied	0.6 (0.5–1.0)
Skin	7	People seeing your excess skin?	Not at all/extremely bothered	3.2 (0.5–6.7)
Scars*	10	How noticeable your scars are?	Not at all/extremely bothered	1.2 (0.0–5.2)
Body image	7	My body is not perfect but I like it.	Agree/disagree	2.5 (0.5–6.4)
Physical†	7	Bending over (e.g., to tie your shoes)?	All the time/never	2.7 (0.5–6.6)
Psychological	10	I feel confident.	Agree/disagree	3.5 (0.5–9.5)
Sexual	5	I am comfortable undressing in front of my partner.	Agree/disagree	5.3 (2.3–6.7)
Social	10	I take part in life instead of sitting back.	Agree/disagree	3.7 (1.0–8.3)
Symptoms†	10	Skin rash or infection?	All the time/never	2.8 (0.0–9.1)
Doctor	10	Talked to you in a way that was easy to understand?	Agree/disagree	4.2 (0.5–9.9)
Information	10	The amount of time it would take to heal and recover?	Dissatisfied/satisfied	5.0 (2.4–11.1)
Medical team	10	Worked together as a team?	Agree/disagree	3.6 (0.5–12.0)
Office staff	10	Welcomed you at the front desk?	Agree/disagree	3.9 (0.5–12.0)

*Scale specific to post body contouring patients.
†Scales/checklist specific to patients with obesity.
FK indicates Flesch-Kincaid grade level.

Table 2. Number of Patients by Method of Recruitment and Location of Center

	Face-to-Face				E-mail			Postal
Center	Atlanta	Hamilton Bariatric	Scotland	Vancouver	Atlanta	Mississauga	Hamilton Cosmetic	London
Sample	118	390	49	9	738	54	22	222
Respond	118	354	49	9	67	27	22	88
Response rate	100	91	100	100	9	50	100	40
	94				14			40

Table 3. Patient Characteristics by Country of Recruitment

	United States	Canada	United Kingdom	Total
Participants				
Age in years, N=705				
Mean (SD)	43.3 (9.8)	47.3 (10.4)	48.2 (9.4)	46.5 (10.2)
Range	20–72	22–75	18–72	18–75
Sex, N = 731				
Female	171 (94)	354 (85.9)	119 (86.9)	644 (88.1)
Male	11 (6)	58 (14.1)	18 (13.1)	87 (11.9)
Marital status, N = 729				
Married or living common law	136 (73.9)	269 (65.6)	93 (68.9)	498 (68.3)
Other	48 (26.1)	141 (34.4)	42 (31.1)	231 (31.7)
Ethnicity, N = 731				
White	129 (69.7)	364 (88.3)	116 (86.6)	609 (83.3)
Other	56 (30.3)	48 (11.7)	18 (13.4)	122 (16.7)
BMI at baseline, N = 713				
Mean (SD)	25.2 (3.6)	37.8 (10.7)	29.3 (5.8)	33.1 (10.3)
Range	17.8–37.8	18.0–75.8	19.8–57.1	17.8–75.8
BMI at baseline, N = 713				
Normal	98 (54.1)	43 (10.6)	30 (23.8)	171 (24.0)
Overweight	65 (35.9)	73 (18.0)	50 (39.7)	188 (26.4)
Obese class I	15 (8.3)	74 (18.2)	28 (22.2)	117 (16.4)
Obese class II	3 (1.7)	54 (13.3)	13 (10.3)	70 (9.8)
Obese class III	0 (0)	162 (39.9)	5 (4.0)	167 (23.4)
Type of patient, N (%)				
Weight loss	0 (0)	354 (85.9)	49 (35.8)	403 (54.9)
Body contouring	185 (100)	58 (14.1)	88 (64.2)	331 (45.1)
Assessments				
Number, N = 965				
1 assessments	185 (88.5)	412 (70.7)	137 (79.2)	734 (76.1)
2 assessments	24 (11.5)	123 (21.1)	23 (13.3)	170 (17.6)
3 assessments	—	48 (8.2)	13 (7.5)	61 (6.3)
Assessments for each scale, N				
Body	208 (22.3)	581 (62.3)	144 (15.4)	933 (100)
Abdomen	148 (17.3)	566 (66.0)	143 (16.7)	857 (100)
Arms	38 (5.8)	535 (82.2)	78 (12.0)	651 (100)
Back	52 (8.1)	515 (79.8)	78 (12.1)	645 (100)
Buttocks	27 (4.4)	513 (82.9)	79 (12.8)	619 (100)
Hips and outer thighs	44 (6.9)	517 (80.7)	80 (12.5)	641 (100)
Inner thighs	43 (6.6)	526 (81.2)	79 (12.2)	648 (100)
Skin	96 (16.7)	400 (69.4)	80 (13.9)	576 (100)
Scars	95 (41.1)	51 (22.1)	85 (36.8)	231 (100)
Body image	193 (21.6)	558 (62.6)	141 (15.8)	892 (100)
Physical	—	504 (86.2)	81 (13.8)	585 (100)
Psychological	191 (21.4)	557 (62.5)	143 (16.0)	891 (100)
Sexual	187 (22.9)	547 (66.9)	84 (10.3)	818 (100)
Social	190 (21.4)	555 (62.6)	142 (16.0)	887 (100)
Symptoms	—	504 (86.2)	81 (13.8)	585 (100)
Doctor	94 (18.1)	420 (80.9)	5 (1.0)	519 (100)
Information	93 (17.9)	426 (82.1)	—	519 (100)
Medical team	93 (17.4)	418 (78.4)	22 (4.1)	533 (100)
Office staff	91 (17.0)	421 (78.7)	23 (4.3)	535 (100)
Clinical groups, N = 965				
Prebariatric	—	119 (20.4)	—	119 (12.3)
Postbariatric	—	401 (68.8)	—	401 (41.6)
Pre-BC cosmetic	90 (43.1)	3 (1.0)	—	93 (9.6)
Post-BC WL	—	—	88 (100)	88 (9.1)
Post-BC cosmetic	119 (56.9)	60 (10.3)	—	179 (18.5)
WL Scotland	—	—	85 (100)	85 (8.8)
Excess skin, N = 545				
A little	45 (47.9)	84 (23.1)	34 (38.6)	163 (29.9)
A moderate amount	40 (42.6)	139 (38.3)	35 (39.8)	214 (39.3)
A lot	9 (9.6)	140 (38.6)	19 (21.6)	168 (30.8)

BC, body contouring; WL, weight loss.

Table 4 shows the item fit statistics for each scale organized by item location. Item fit was within −2.5 to +2.5 for 115 of 138 items, and all items had nonsignificant χ^2 *P* values after Bonferroni adjustment. The item residual correlations were above 0.30 for 8 pairs of items, with 1 pair above 0.40 (range, 0.31–0.47). In subtest analyses, the correlated items were found to have marginal

Table 4. Rasch Measurement Theory Statistical Indicators of Fit for Each BODY-Q Scale

Scale	Full Item	Item Location	SE	Fit Residual	Chi-square	DF	P
Body	...looks when dressed	−1.67	0.07	−1.98	9.91	9	0.358
	...how clothes fit	−1.11	0.07	1.07	11.81	9	0.224
	...size	−0.68	0.07	1.65	7.98	9	0.536
	...shape	−0.54	0.07	−3.46	12.89	9	0.168
	...looks in photos	−0.15	0.06	−0.93	3.89	9	0.918
	...looks from behind	−0.04	0.07	2.22	11.83	9	0.223
	...looks from the side	0.10	0.06	−2.95	9.25	9	0.415
	...looks in summer clothes	0.58	0.07	−1.60	3.90	9	0.918
	...looks in a swimsuit	1.65	0.07	−0.97	6.40	9	0.700
	...looks in mirror unclothed	1.86	0.07	0.04	12.07	9	0.210
Abdomen	...how clothes fit	−1.48	0.09	0.56	21.89	9	0.009
	...size	−0.86	0.09	−1.13	10.68	9	0.299
	...looks from the side	0.49	0.09	−3.33	15.87	9	0.070
	...shape	0.36	0.09	−2.16	14.20	9	0.115
	...looks in a swimsuit	0.60	0.09	−0.08	0.60	9	0.414
	...how toned	1.06	0.09	1.72	8.35	8	0.400
	...looks when naked	1.53	0.09	−0.99	13.51	9	0.141
Arms	...size	−1.20	0.09	1.71	19.50	9	0.021
	...how smooth	−0.78	0.09	0.95	17.24	9	0.045
	...shape	−0.61	0.09	−3.07	12.89	9	0.167
	...how skin looks	−0.13	0.09	−0.25	7.20	9	0.616
	...how toned	0.87	0.09	−1.69	12.84	9	0.170
	...look when lifted up	0.87	0.09	0.34	7.81	9	0.553
	...look when not covered	0.99	0.09	−2.81	17.69	9	0.039
Back	...how smooth	−0.65	0.11	−2.97	18.75	7	0.009
	...looks from different angles	−0.32	0.12	−3.37	8.93	7	0.258
	...how toned	0.32	0.11	−1.32	10.57	7	0.159
	...looks when naked	0.64	0.10	−3.21	7.91	7	0.340
Buttocks	...size	−0.76	0.09	−1.45	21.97	7	0.003
	...look from the side	−0.24	0.09	−1.73	2.84	7	0.900
	...shape	−0.09	0.10	−2.68	7.91	7	0.340
	...how smooth	0.47	0.09	−1.63	18.19	7	0.011
	...how skin looks	0.63	0.09	−1.67	9.28	7	0.233
Hips and outer thighs	...size	−0.41	0.10	−3.51	7.65	7	0.365
	...shape	−0.34	0.10	−4.36	7.44	7	0.385
	...how skin looks	−0.11	0.10	−4.60	2.00	7	0.960
	...how smooth	0.22	0.10	−2.81	7.08	7	0.421
	...look from behind	0.64	0.10	−2.81	12.18	6	0.058
Inner Thighs	...how smooth	−0.61	0.12	−2.07	11.47	4	0.022
	...how skin looks	−0.61	0.12	−2.98	7.98	4	0.092
	...how toned	0.52	0.13	−1.32	6.20	4	0.185
	...look when naked	0.71	0.12	−1.99	8.41	4	0.078
Skin	...look bigger than you are	−0.52	0.09	0.81	2.00	7	0.960
	...dress in a way to hide	−0.43	0.09	−0.71	6.76	7	0.454
	...not able to wear certain clothes	−0.16	0.08	−0.19	12.06	7	0.099
	...how much it hangs	−0.10	0.09	−0.70	10.16	7	0.180
	...amount of skin	0.20	0.10	−0.95	17.53	7	0.014
	...people seeing	0.33	0.09	1.39	3.34	7	0.852
	...looks when naked	0.69	0.09	−1.41	18.18	7	0.011
Scars	...dress in way to hide	−1.18	0.15	−0.77	1.76	2	0.414
	...how wide	−0.36	0.13	−2.05	2.05	2	0.359
	...location	−0.33	0.13	−0.14	0.20	2	0.904
	...length	0.05	0.14	−0.18	1.69	2	0.430
	...noticeable	0.10	0.13	−1.91	5.42	2	0.066
	...color	0.11	0.13	0.93	2.37	2	0.305
	...how thick	0.15	0.13	−0.12	0.51	2	0.774
	...looking crooked	0.16	0.12	1.01	1.70	2	0.428
	...people seeing	0.44	0.12	2.33	5.24	2	0.073
	...look when not covered	0.88	0.12	−1.89	4.49	2	0.106
Body Image	...positive towards my body	−1.88	0.08	−1.78	16.11	9	0.065
	...not perfect but I like it	−1.76	0.08	−0.46	14.84	9	0.095
	...happy with my body	−0.53	0.08	−2.09	16.54	9	0.056
	...proud of my body	−0.31	0.07	−2.31	16.33	9	0.060
	...think body is attractive	0.70	0.08	−0.81	14.70	9	0.010
	...feel good when naked	1.82	0.08	−0.18	10.14	9	0.339
	...have body I want	1.96	0.08	2.10	10.51	9	0.311

(Continued)

Table 4. (*Continued*)

Scale	Full Item	Item Location	SE	Fit Residual	Chi-square	DF	P
Physical	…getting up from a bed	−0.91	0.10	0.79	9.69	5	0.085
	…bending from side to side	−0.73	0.10	1.26	5.42	5	0.367
	…walking or moving around	−0.18	0.09	−3.77	13.78	5	0.017
	…bending over	0.04	0.09	0.25	3.32	5	0.651
	…moderate exercise	0.39	0.09	−0.64	9.20	5	0.101
	…walking stairs	0.44	0.09	−0.45	7.49	5	0.187
	…standing for a long time	0.95	0.09	0.03	12.66	5	0.027
Psychological	…believe in myself	−0.94	0.07	−3.10	11.20	9	0.262
	…proud of myself	−0.60	0.07	−1.72	7.63	9	0.572
	…happy	−0.29	0.07	−2.62	5.83	9	0.757
	…like myself	−0.19	0.07	−1.86	7.27	9	0.609
	…emotionally strong	−0.19	0.06	3.22	20.60	9	0.015
	…in control of my life	−0.02	0.07	1.64	11.36	9	0.252
	…confident	0.20	0.07	−0.54	4.92	9	0.841
	…accepting of myself	0.28	0.07	0.46	9.51	9	0.392
	…comfortable with myself	0.68	0.06	0.91	15.18	9	0.086
	…feel great about myself	1.07	0.07	−2.05	10.78	9	0.291
Sexual	…fulfilling	−0.66	0.06	1.36	5.28	9	0.809
	…comfortable undressing	−0.43	0.06	−0.46	13.39	9	0.146
	…satisfied with sex life	−0.23	0.06	2.45	6.72	9	0.667
	…comfortable having lights on	0.23	0.06	−1.22	12.86	9	0.169
	…feel sexually attractive naked	1.08	0.06	−2.44	22.41	9	0.008
Social	…gatherings with people I know	−1.11	0.07	1.01	5.70	8	0.681
	…people listen to what I say	−0.95	0.07	2.00	11.35	8	0.183
	…accepted by people	−0.85	0.07	2.12	11.09	8	0.197
	…included in social situations	−0.80	0.07	−0.38	4.49	8	0.810
	…make good first impression	0.12	0.07	0.45	5.91	8	0.657
	…take part in life	0.24	0.06	−0.45	4.15	8	0.844
	…easy to make new friends	0.36	0.06	0.64	4.43	8	0.816
	…confident in group situations	0.39	0.06	−3.00	14.42	8	0.071
	…people I don't know well.	1.12	0.07	−3.64	14.30	8	0.074
	…confident walking into a room	1.47	0.06	−1.80	15.11	8	0.057
Doctor	…professional manner	−1.14	0.16	0.22	2.15	3	0.542
	…easy to understand	−1.00	0.16	−1.68	3.11	3	0.375
	…answered all your questions	−0.68	0.15	−1.39	3.16	3	0.368
	…treated you with respect	−0.63	0.15	−0.27	1.34	3	0.719
	…made you feel comfortable	−0.58	0.15	−1.33	2.63	3	0.453
	…involved you in decisions	0.35	0.13	−0.02	3.04	3	0.386
	…understood your concerns	0.44	0.13	−1.70	4.82	3	0.186
	…helped you figure out what's best	0.82	0.12	−1.20	5.71	3	0.127
	…available when you had concerns	1.11	0.12	1.46	4.44	3	0.218
	…spent enough time with you	1.30	0.12	1.55	1.63	3	0.653
Information	…questions were answered	−0.74	0.12	−0.79	4.07	4	0.397
	…written information	−0.58	0.12	−0.33	4.49	4	0.344
	…activities to avoid in recovery*	−0.44	0.13	−2.98	13.71	4	0.008
	…how the surgery would be done	−0.42	0.11	0.97	1.60	4	0.810
	…time to heal and recover	−0.28	0.11	−3.01	10.58	4	0.032
	…how surgery could be done*	0.00	0.12	1.23	5.18	4	0.269
	…possible complications*	0.33	0.12	−0.05	1.15	4	0.886
	…what other patients experience	0.64	0.10	1.54	10.24	4	0.037
	…how long to feel yourself again	0.66	0.09	−0.39	3.37	4	0.497
	…pain you might feel*	0.83	0.11	−1.90	7.52	4	0.111
Medical Team	…protected your privacy	−0.86	0.19	1.54	1.65	2	0.439
	…friendly and kind	−0.35	0.17	−0.80	0.54	2	0.762
	…treated you with respect	−0.29	0.17	−1.94	5.49	2	0.064
	…answered all your questions	−0.02	0.16	−0.44	1.90	2	0.388
	…easy to talk to	0.13	0.16	−1.13	1.17	2	0.557
	…attentive to your needs	0.13	0.16	−2.16	4.05	2	0.132
	…thorough	0.17	0.16	−1.65	2.66	2	0.265
	…worked together as a team	0.19	0.15	0.62	2.55	2	0.280
	…knowledgeable	0.29	0.16	0.11	0.74	2	0.693
	…available when you had concerns	0.60	0.15	2.28	2.47	2	0.291

(*Continued*)

Table 4. (*Continued*)

Scale	Full Item	Item Location	SE	Fit Residual	Chi-square	DF	*P*
Office Staff	...treated you with respect	−1.07	0.17	−2.07	9.57	2	0.008
	...made you feel comfortable	−0.72	0.16	−2.15	5.15	2	0.076
	...knowledgeable	−0.23	0.16	−1.37	1.38	2	0.503
	...attentive to your needs	−0.04	0.15	−1.43	4.17	2	0.124
	...thorough	0.04	0.15	−1.38	0.27	2	0.874
	...worked together as a team	0.16	0.15	−1.26	2.77	2	0.250
	...welcomed you at the front desk	0.19	0.14	0.59	1.17	2	0.558
	...caring	0.20	0.15	1.31	1.27	2	0.531
	...answered all your questions	0.26	0.15	−2.00	3.38	2	0.184
	...available when you had concerns	1.22	0.14	2.50	10.01	2	0.007

*Items were rescored because of disordered thresholds.

impact on scale reliability (≤0.02 difference in PSI value). The targeting of person measurements and the distribution of item locations defined a continuum of measurement for each scale. DIF was detected for 17 items on one or more variable (exception age group). When items were split on each variable with DIF and the new person locations were correlated with the original person locations, DIF had a negligible impact (Pearson correlations ≥ 0.97).

The reliability statistics and other statistics of scale performance are shown in Table 5. PSI values were above 0.70 for 16 of 18 scales with extremes included and all 18 scales with extremes excluded. Cronbach α values were 0.90 and higher for all 18 scales. For the TRT, 170 of 354 participants recruited from the Hamilton bariatric clinic provided an e-mail and agreed to participate and 44 complied (12% response rate). The respondents did not differ from the 310 nonrespondents by age, sex, ethnicity, BMI, number of obesity-specific symptoms, and BODY-Q scale

scores. The TRT value was 0.87 or higher for 16 of the 17 scales and was 0.65 for the Physical scale. Scale-wise missing data were up to 5%. The proportion of participants to score at the floor and ceiling were more than 50% for 3 of the experience scales (exception Information).

The Symptom checklist (Table 6) was completed by 431 weight loss participants of whom 110 completed it again 6 months later, providing a total of 541 assessments. The most common symptom was feeling tired during the day followed by back and joint pain. For all 10 symptoms, the mean BMI was lowest for the group of participants who never experienced the symptom and was highest for 7 symptoms for the group of participants who experienced the symptom all the time.

Correlations between scales (Table 7) tended to be higher, as predicted, for scales measuring similar constructs, with the exception of Body Image and Physical where correlations were stronger with appearance over HRQL scales. Higher BMI and more obesity-specific symptoms correlated with

Table 5. Reliability Statistics and Other Indicators of Scale Performance

Scale	PSI with Extremes	PSI No Extremes	Cronbach α	TRT	F/C, %	Missing Data, %
Body	0.94	0.93	0.96	0.94	8/4	5
Abdomen	0.94	0.94	0.98	0.92	25/6	2
Arms	0.92	0.91	0.95	0.92	12/3	3
Back	0.92	0.83	0.96	0.90	16/8	2
Buttocks	0.87	0.85	0.95	0.87	18/4	<1
Hips and outer thighs	0.89	0.84	0.97	0.90	21/6	1
Inner thighs	0.92	0.83	0.96	0.93	43/3	1
Skin	0.88	0.88	0.95	0.92	26/2	2
Scars	0.85	0.86	0.95	—	2/32	3
Body image	0.94	0.93	0.96	0.95	16/4	1
Physical	0.86	0.86	0.95	0.65	2/23	2
Psychological	0.90	0.90	0.95	0.93	1/16	<1
Sexual	0.82	0.74	0.90	0.94	11/11	4
Social	0.91	0.91	0.95	0.97	0/15	<1
Doctor	0.71	0.86	0.95	0.88	0/57	<1
Information	0.68	0.75	0.92	0.89	0/39	2
Medical team	0.61	0.87	0.97	0.92	0/70	1
Office staff	0.74	0.89	0.97	0.94	1/64	2

F/C indicates percent to score at floor and ceiling.

Table 6. Number (%) of Participants to Endorse Each Response Category of the Symptom Checklist and the Mean (SD) Value for BMI for Each Category and 1-way ANOVA P Value

No.	Symptom	All the Time		Often		Sometimes		Never		P
		N (%)	Mean (SD)	N (%)	Mean (SD)	N (%)	Mean (SD)	N (%)	Mean (SD)	
1	Feeling tired during the day	78 (14.4)	39.9 (11.5)	131 (24.2)	37.9 (10.4)	266 (49.2)	36.6 (9.3)	65 (12.0)	34.0 (8.3)	0.004
2	Back pain	84 (15.5)	40.0 (10.2)	97 (17.9)	40.9 (11.5)	226 (41.8)	36.4 (9.4)	133 (24.6)	33.6 (7.8)	<0.001
3	Joint pain	99 (18.3)	42.5 (10.6)	105 (19.4)	40.3 (10.8)	189 (34.9)	36.0 (8.9)	147 (27.2)	32.7 (7.5)	<0.001
4	Leg pain or discomfort	80 (14.8)	42.7 (10.3)	91 (16.8)	42.4 (10.9)	187 (34.6)	36.0 (9.0)	183 (33.8)	33.1 (7.7)	<0.001
5	Feeling off balance	21 (3.9)	39.1 (9.4)	75 (13.9)	39.4 (10.3)	250 (46.2)	38.3 (10.3)	194 (35.9)	34.4 (8.8)	<0.001
6	Feeling weak	41 (7.6)	37.6 (11.1)	52 (9.6)	40.2 (12.5)	239 (44.2)	37.9 (9.5)	208 (38.4)	35.3 (9.2)	0.004
7	Short of breath with mild exercise	48 (8.9)	45.6 (10.7)	66 (12.2)	43.3 (11.0)	215 (39.7)	38.0 (9.1)	210 (38.8)	32.2 (7.1)	<0.001
8	Swollen feet	34 (6.3)	46.6 (12.3)	41 (7.6)	44.6 (10.4)	173 (32.0)	38.5 (9.7)	292 (54.0)	34.1 (8.2)	<0.001
9	Skin rash or infection	31 (5.7)	41.7 (10.2)	60 (11.1)	39.2 (11.7)	149 (27.5)	38.8 (9.7)	299 (55.3)	35.4 (9.3)	<0.001
10	Too much perspiration	26 (4.8)	45.0 (11.4)	40 (7.4)	41.7 (11.2)	149 (27.5)	39.3 (10.5)	325 (60.1)	34.9 (8.6)	<0.001

scale scores for appearance and HRQL. Patient characteristics correlated only weakly with BODY-Q scale scores.

Figures 1 and 2 show the mean scores for appearance and HRQL scales by clinical group, respectively. Mean scores differed significantly across patient group for all appearance and HRQL scales ($P \leq 0.003$). The lowest (worst) scores were for participants waiting for bariatric surgery, all of whom were obese (BMI ≥ 38), and the highest (best) scores were for cosmetic surgery patients who had had body contouring. For all scales, participants with a lot of excess skin reported the lowest mean scores, whereas participants who reported having a little excess skin reported the highest mean scores (Table 8).

E-mails for the 6-month follow-up were provided by 299 of 354 participants from the Hamilton bariatric clinic (121 complied; 34% response) and from 42 of 49 weight loss participants from Aberdeen (13 complied; 31% response). The 134 respondents did not differ from the 269 nonrespondents in terms of age, sex, ethnicity, or BMI, but on the BODY-Q scales, they did report higher (better) scores on the Doctor scale ($P = 0.03$ on Mann–Whitney U Test). Most participants (N = 100) had lost weight since the initial assessment. Participants from Hamilton lost more weight on average than the Scottish patients (31.1 versus 15.2 pounds, $P = 0.001$ on independent sample t test). Table 9 shows results for paired t tests. Significant improvement was reported on 7 of the 8 appearance scales (exception Skin) and 4 of the 5 HRQL scales (exception sexual), and significant worsening was reported for 2 (doctor, office staff) experience scales. Effect sizes were small to moderate in size.

DISCUSSION

The BODY-Q is a comprehensive PRO instrument designed for weight loss and/or body contouring patients. The BODY-Q scales were reliability and validity in a large international sample of patients, and the ability to detect change after weight loss. BODY-Q scales worked the same (without bias) across patients who varied by age, sex, country, patient type, and use of paper versus electronic data collection. The BODY-Q revealed that satisfaction with appearance, and HRQL is lower for patients who report more obesity-related symptoms, higher BMI, and more excess skin, and being pre- versus postoperative body contouring.

BODY-Q experience scales measure issues identified as important to weight loss and body
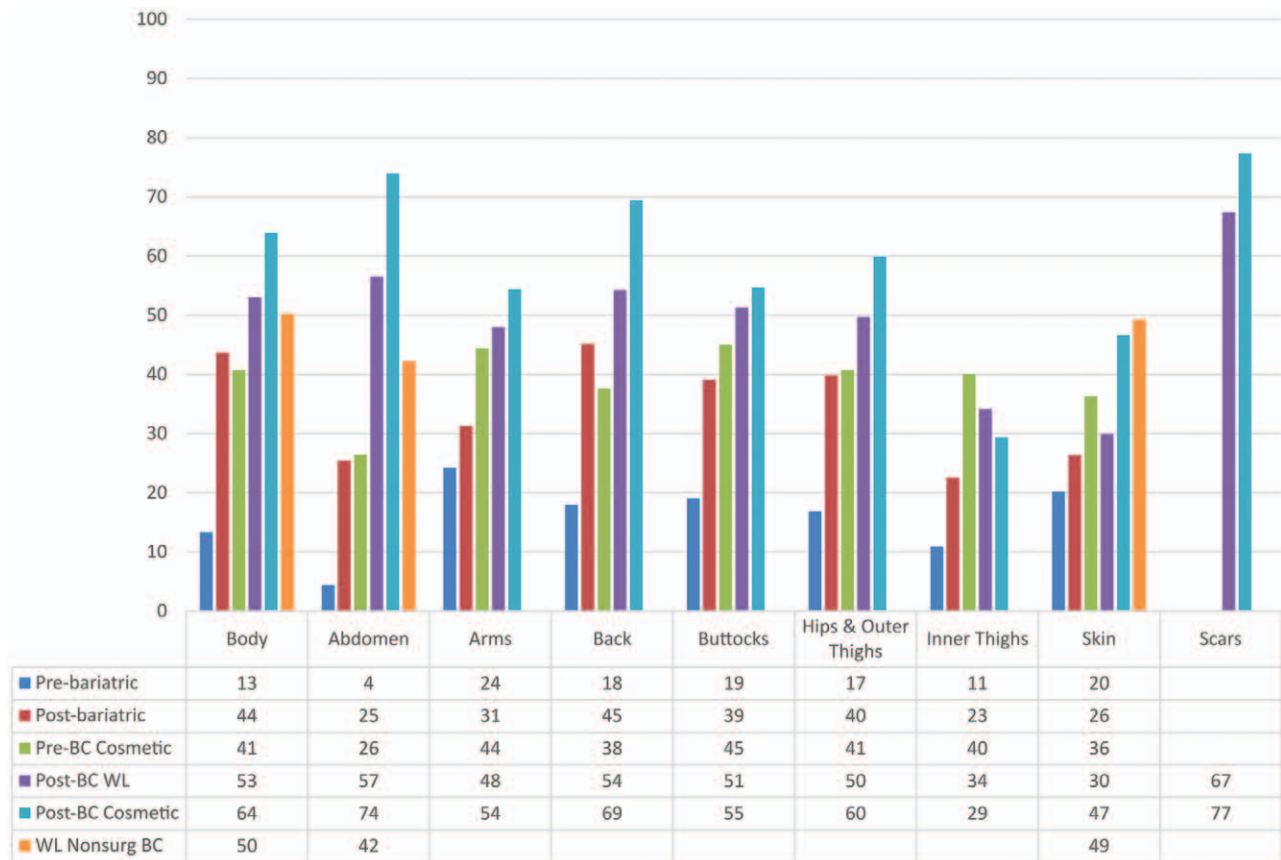
Table 7. Correlations Between BODY-Q Scales, Patient Characteristics and Number of Symptoms

	Body	Abdomen	Arms	Back	Buttocks	Hips and Outer Thighs	Inner Thighs	Skin	Scars	Body Image	Physical	Psychological	Sexual	Social	Doctor	Information	Medical Team	Office Staff
Body	1.00																	
Abdomen	0.80†	1.00																
Arms	0.49†	0.51†	1.00															
Back	0.69†	0.63†	0.59†	1.00														
Buttocks	0.64†	0.54†	0.53†	0.63†	1.00													
Hip and outer thighs	0.69†	0.57†	0.56†	0.66†	0.74†	1.00												
Inner thighs	0.49†	0.42†	0.59†	0.50†	0.59†	0.64†	1.00											
Skin	0.50†	0.53†	0.45†	0.47†	0.44†	0.46†	0.45†	1.00										
Scars	0.33†	0.37†	0.28†	0.46†	0.34†	0.43†	0.28†	0.32†	1.00									
Body image	0.85†	0.77†	0.52†	0.67†	0.60†	0.66†	0.49†	0.58†	0.45†	1.00								
Physical	0.54†	0.41†	0.32†	0.42†	0.41†	0.45†	0.26†	0.27†	0.31†	0.48†	1.00							
Psychological	0.57†	0.51†	0.39†	0.46†	0.42†	0.48†	0.30†	0.47†	0.35†	0.70†	0.33†	1.00						
Sexual	0.54†	0.53†	0.40†	0.41†	0.43†	0.44†	0.39†	0.48†	0.37†	0.65†	0.23†	0.62†	1.00					
Social	0.51†	0.49†	0.33†	0.43†	0.41†	0.46†	0.32†	0.40†	0.31†	0.60†	0.33†	0.76†	0.56†	1.00				
Doctor	0.23†	0.24†	0.11*	0.13*	0.06	0.15†	0.09	0.10	0.34†	0.29†	0.17*	0.26†	0.28†	0.33†	1.00			
Information	0.25†	0.20†	0.19†	0.18†	0.16†	0.18†	0.13*	0.15†	0.35†	0.27†	0.15†	0.29†	0.26†	0.31†	0.57†	1.00		
Medical team	0.22†	0.23†	0.06	0.13*	0.13*	0.16†	0.07	0.11*	0.19*	0.24†	0.11*	0.25†	0.22†	0.26†	0.61†	0.45†	1.00	
Office staff	0.16†	0.19†	0.08	0.09	0.12*	0.14†	0.04	0.08	0.23*	0.21†	0.07	0.22†	0.24†	0.27†	0.54†	0.46†	0.60†	1.00
BMI	−0.60†	−0.56†	−0.29†	−0.47†	−0.39†	−0.45†	−0.27†	−0.22†	−0.10	−0.55†	−0.51†	−0.33†	−0.29†	−0.16†	−0.12*	−0.07	−0.14†	−0.13†
Age	−0.08*	−0.07*	−0.09*	−0.01	−0.06	−0.07	−0.04	−0.04	−0.17*	−0.13†	−0.13†	−0.05	−0.16†	−0.02	−0.02	−0.03	−0.01	0.07
Sex	−0.07*	−0.09*	0.26†	0.06	0.10*	0.09*	0.19†	0.12†	−0.09	−0.09*	0.02	−0.04	0.03	−0.01	−0.08*	0.01	−0.03	−0.02
Ethnicity	−0.18†	−0.15†	−0.04	−0.05	0.04	−0.03	−0.02	−0.11*	−0.10	−0.20†	0.08	−0.18†	−0.16†	−0.17†	−0.08	−0.04	−0.01	−0.05
Symptoms	−0.53†	−0.43†	−0.40†	−0.47†	−0.46†	−0.49†	−0.33†	−0.45†	−0.29†	−0.53†	−0.70†	−0.44†	−0.36†	−0.43†	−0.11*	−0.17†	−0.11	−0.04

Patient characteristics: BMI and Age = continuous variables; Sex and Ethnicity (Caucasian versus other) = dichotomous variables. Pearson correlations except for doctor, medical team, office staff used Spearman's rho due to skewed data.

*Correlation is significant at the 0.05 level (2-tailed).

†Correlation is significant at the 0.01 level (2-tailed).

Fig. 1. Mean scores for BODY-Q appearance scale scores by clinical group.

	Body	Abdomen	Arms	Back	Buttocks	Hips & Outer Thighs	Inner Thighs	Skin	Scars
Pre-bariatric	13	4	24	18	19	17	11	20	
Post-bariatric	44	25	31	45	39	40	23	26	
Pre-BC Cosmetic	41	26	44	38	45	41	40	36	
Post-BC WL	53	57	48	54	51	50	34	30	67
Post-BC Cosmetic	64	74	54	69	55	60	29	47	77
WL Nonsurg BC	50	42						49	

contouring patients. These 4 scales provide specific versus generic[29,30] indicators of quality. BODY-Q experience and outcome scales could be used to provide patient-centered information for quality improvement purposes, similar to the use of the BREAST-Q.[12,13] For example, the BREAST-Q was used in a national audit of close to 8000 breast reconstruction and mastectomy patients treated in NHS and independent hospitals in England, Wales, and Scotland[31] and was included in the American Society of Plastic Surgeons Tracking Operations and Outcomes for Plastic Surgeons (TOPS) program launched in 2002 as a Health Insurance Portability and Accountability Act compliant, secure and confidential national database of plastic surgery procedures and outcomes.[32]

The BODY-Q addresses the lack of rigorously designed PRO instruments for use in cosmetic body contouring. In a U.K. Department of Health literature review of PRO instruments for cosmetic surgery, only 3 met international recommendations for PRO instrument development and validation, ie, BREAST-Q,[12,13] FACE-Q,[33] and Skindex.[34] Recently, the Body-QoL,[35] a PRO instrument devel-

oped in Chile was published. Compared with the BODY-Q, Body-QoL is more limited in scope as its focus is on body contouring patients only, and it contains a limited number of scales that measure satisfaction with body (ie, the abdomen), sex life, self-esteem and social performance, and physical symptoms.

Our study has some limitations. First, 7% of online participants opted out of the survey before reaching the end, which could be due to the length of the survey and/or the fact that REDCap does not include a feature to let respondents know how far they have progressed. Second, although there are advantages to internet surveys, the response rate to e-mailed invitations was much lower than postal and face-to-face recruitment. Third, TRT reliability for the Scar scale is needed from patients who are post body contouring. Fourth, some participants (mainly obesity class III) scored at the floor on some appearance scales. Finally, our sample was primarily cross-sectional, which was suitable for PRO instrument development. Longitudinal studies of weight loss and cosmetic patients are now needed to measure change in satisfaction with appearance and HRQL with weight
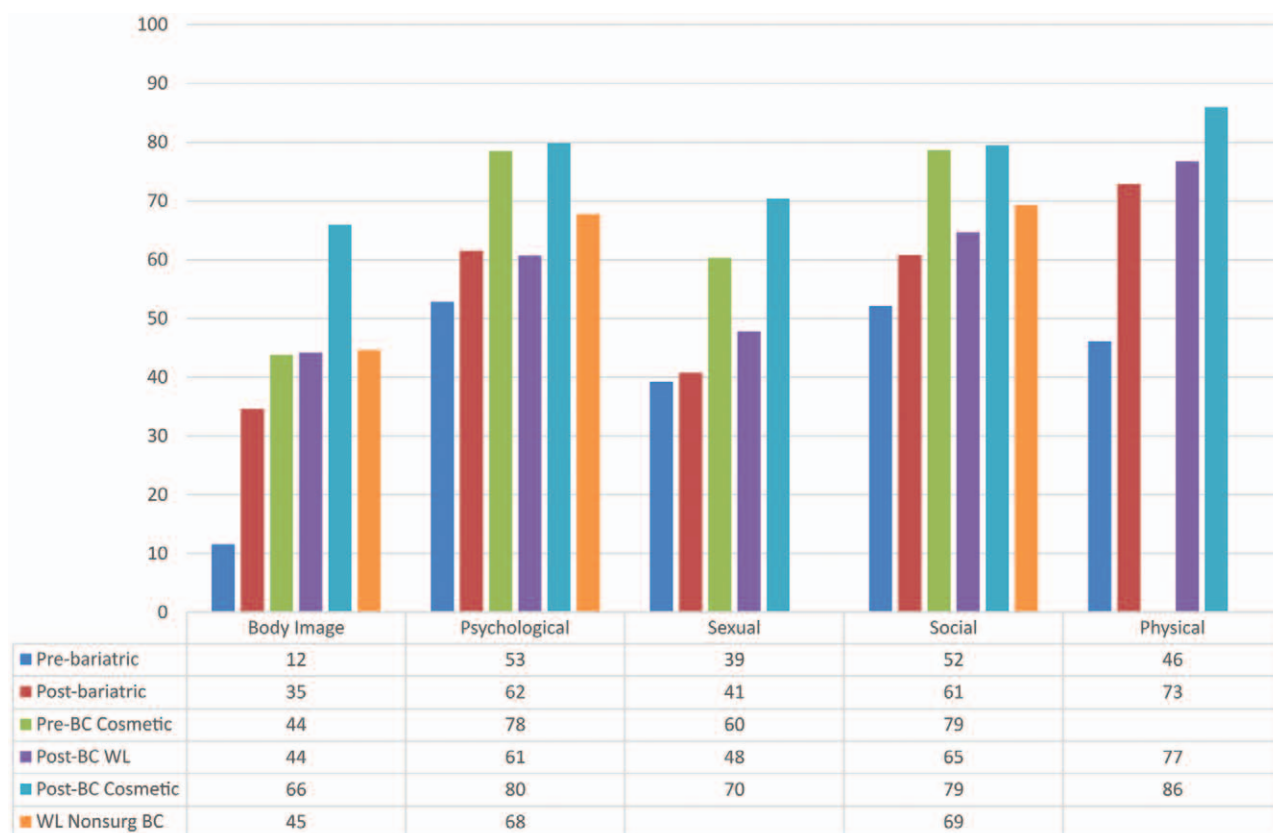
Fig. 2. Mean scores for BODY-Q HRQL scale scores by clinical group.

Table 8. Mean Scores for BODY-Q Scales by Amount of Excess Skin and *P* value for ANOVA

Scale	A little	A Moderate Amount	A Lot	*P*
Body	53.4 (22.0)	44.7 (18.4)	37.9 (16.4)	<0.001
Abdomen	46.5 (30.4)	31.9 (27.1)	20.8 (22.3)	<0.001
Arms	46.5 (27.1)	31.6 (20.6)	23.4 (20.9)	<0.001
Back	58.0 (29.5)	44.3 (27.9)	36.3 (25.1)	<0.001
Buttocks	49.5 (24.1)	38.9 (24.8)	32.7 (22.4)	<0.001
Hips and outer thighs	51.5 (24.6)	38.7 (26.9)	33.8 (25.6)	<0.001
Inner thighs	35.2 (27.2)	20.3 (25.3)	15.0 (23.5)	<0.001
Skin	52.6 (23.1)	29.3 (22.2)	11.0 (14.7)	<0.001
Scars	74.5 (22.4)	65.2 (28.8)	57.4 (26.5)	0.041
Body image	50.7 (26.0)	37.2 (22.4)	26.8 (19.9)	<0.001
Physical	77.9 (24.6)	73.9 (25.7)	66.0 (25.1)	0.001
Psychological	73.4 (20.6)	65.5 (20.1)	56.2 (21.4)	<0.001
Sexual	58.1 (25.5)	45.5 (25.3)	35.8 (24.6)	<0.001
Social	72.7 (20.0)	64.7 (21.0)	58.7 (19.8)	0.001
Doctor	90.1 (16.2)	84.4 (23.2)	86.7 (16.8)	0.124
Information	84.4 (17.0)	81.2 (19.8)	79.6 (19.8)	0.203
Medical team	95.2 (10.5)	87.9 (22.6)	88.9 (17.4)	0.015
Office staff	90.5 (15.5)	86.3 (24.3)	87.6 (19.0)	0.354

loss, the development of excess skin, and body contouring.

To conclude, the BODY-Q provides a means to collect evidence-based outcomes data from the patient perspective. As with the BREAST-Q[12–14] and FACE-Q,[36,37] the BODY-Q is available free-of-charge to nonprofit users. We encourage the plastic surgery community to use these PRO instruments. Such data are needed to inform patient selection and education, comparative effectiveness research, and healthcare policy decisions.

Table 9. Mean Scores for BODY-Q Scales on Repeated Administration, *P* Value for Paired *t* Test and Effect Size

Scale	N	Mean (SD)	Mean (SD)	Mean Difference (SD)	*P* Value	Effect Size
Body	134	35.4 (22.1)	47.8 (18.5)	−12.4 (19.6)	<0.001	−0.56
Abdomen	130	20.1 (22.1)	32.2 (24.7)	−12.1 (21.0)	<0.001	−0.55
Arms	120	27.4 (21.1)	35.0 (23.8)	−7.5 (17.5)	<0.001	−0.36
Back	114	37.6 (27.2)	50.6 (26.1)	−13.0 (24.3)	<0.001	−0.48
Buttocks	117	31.8 (23.7)	42.0 (22.6)	−10.1 (22.3)	<0.001	−0.43
Hips and outer thighs	115	33.4 (27.2)	42.9 (26.5)	−9.5 (24.3)	<0.001	−0.35
Inner thighs	116	18.7 (23.9)	23.0 (28.0)	−4.2 (20.6)	0.03	−0.18
Skin	74	26.4 (25.0)	26.7 (23.7)	−0.2 (18.7)	0.911	−0.01
Body image	124	29.2 (21.9)	39.1 (22.9)	−9.9 (19.4)	<0.001	−0.45
Physical	107	68.1 (24.4)	73.6 (23.6)	−5.4 (17.4)	0.002	−0.22
Psychological	124	59.5 (19.8)	63.0 (21.7)	−3.5 (18.8)	0.04	−0.18
Sexual	104	40.0 (22.8)	40.5 (25.0)	−0.5 (17.0)	0.779	−0.02
Social	122	56.6 (18.8)	61.0 (19.0)	−4.4 (13.6)	0.001	−0.23
Doctor	70	89.9 (15.3)	84.0 (18.9)	5.9 (15.7)	0.005*	0.39
Information	75	82.7 (17.6)	80.7 (20.0)	2.0 (18.8)	0.361	0.11
Medical team	66	91.4 (15.6)	86.4 (20.9)	5.0 (18.2)	0.057*	0.32
Office staff	72	89.0 (17.9)	83.0 (22.5)	6.0 (16.3)	0.003*	0.34

*Wilcoxon Signed Rank Test as data not normally distributed

Anne F. Klassen, DPhil
McMaster University
3N27, 1200 Main Street W
Hamilton, ON, Canada L8N 3Z5
E-mail: aklass@mcmaster.ca

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