Improving the Impact of BODY-Q Scores Through Minimal Important Differences in Body Contouring Surgery: An International Prospective Cohort Study

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Abstract

Background: The BODY-Q is a widely used patient-reported outcome measure for comprehensive assessment of treatment outcomes specific to patients undergoing body contouring surgery (BCS). However, for the BODY-Q to be meaningfully interpreted and used in clinical practice, minimal important difference (MID) scores are needed. A MID is defined as the smallest change in outcome measure score that patients perceive as important.

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Objectives: The aim of this study was to determine BODY-Q MID estimates for patients undergoing BCS to enhance the interpretability of the BODY-Q.
Methods: Data from an international, prospective cohort from Denmark, Finland, Germany, Italy, the Netherlands, and Poland were included. Two distribution-based methods were used to estimate MID: 0.2 standard deviations of mean baseline scores and the mean standardized response change of BODY-Q scores from baseline to 3 years postoperatively.
Results: A total of 12,554 assessments from 3237 participants (mean age 42.5 ± 9.3 years; BMI 28.9 ± 4.9 kg/m^2) were included. Baseline MID scores ranged from 1 to 5 on the health-related quality of life (HRQL) scales and 3 to 6 on the appearance scales. The estimated MID scores from baseline to 3-year follow-up ranged from 4 to 5 for HRQL and from 4 to 8 on the appearance scales.
Conclusions: The BODY-Q MID estimates from before BCS to 3 years postoperatively ranged from 4 to 8 and are recommended for interpretation of patients' BODY-Q scores, evaluation of treatment effects of different BCS procedures, and calculation of sample size for future studies.

Level of Evidence: 3

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It is estimated that between 70% and 90% of patients who undergo massive weight loss (MWL) develop varying degrees of excess skin, potentially affecting any area of the body, where subsequent body contouring surgery (BCS) may be needed.[1,2] BCS has the potential to improve or restore patients' body image and health-related quality of life (HRQL).[3] However, to assess the impact of BCS on HRQL, there is a need for valid and reliable patient-reported outcome measures (PROMs).[4] One such PROM is the BODY-Q, rigorously developed to measure patient-reported outcomes (PRO), specifically for patients undergoing BCS.[5] Recent studies have highlighted the BODY-Q as the PROM with the most robust psychometric properties for patients undergoing BCS.[6,7] As a result, it has had widespread uptake in the plastic and aesthetic surgical literature for exploration of the impact of BCS on patients' lives.[8-12] However, a gap exists in the interpretation of BODY-Q scores, limiting the utility of the BODY-Q in clinical care and research. Although efforts have been undertaken to generate normative BODY-Q scores from the general population for comparison with patient-reported scores, it is pivotal that clinicians and researchers are able to meaningfully interpret the BODY-Q scores in patients who have had BCS to estimate the impact of clinical interventions.[13,14]

The minimal important difference (MID) is a measure of the smallest detectable change in a scale of interest that is considered important by patients.[15,16] Two main methods exist to estimate the MID: the distribution-based method and the anchor-based method. The distribution-based method is based on the distribution of observed scores in a sample, examining score variability either through standard deviations (SD) or the change in SD that patients experience during a study period.[17,18] The anchor-based method employs an external, patient-centered reference to compare changes in PRO scores against this anchor.[19,20] The details of various anchor-based approaches have been described elsewhere.[17,18,21]

By determining MID for the BODY-Q to define a meaningful change or improvement, we can set more realistic expectations for outcomes, enabling clinicians to guide and advise patients more effectively.[22] MID scores can serve as reference values for the magnitude of change that patients perceive important in each BODY-Q scale, because a statistically significant difference may not necessarily constitute a meaningful change for the patients undergoing BCS.[23] Therefore, there is an imperative need for BODY-Q MID scores to provide a more accurate interpretation guide of changes in scores, to facilitate comparative effectiveness research and to assist patients in shared decision-making.[24] The aim of this study was to establish BODY-Q MID values for patients undergoing BCS in a multicenter European cohort with the distribution-based method.

METHODS

In this study, data were derived from an international, multicenter prospective cohort study (ClinicalTrials.gov, https://clinicaltrials.gov, NCT05272215) assessing the change of HRQL and appearance through the weight loss trajectory from prebariatric surgery to post-BCS. For this analysis, data from patients undergoing BCS were included. The study was conducted according to the Declaration of Helsinki principles and was approved by the local ethics committee from the respective sites before study commencement. Before data were merged at the coordinating center in Denmark (Odense University Hospital, Odense, Denmark) approval was obtained from the Danish Data Protection Agency. The study period ranged from June 2015 to February 2022.

Table 1. Participant Characteristics

Characteristics	Total	Netherlands	Denmark	Italy	Germany	Poland	Finland
Patients, *n* (%)	3237	712 (22.0)	1782 (55.1)	420 (13.0)	192 (16.9)	68 (2.1)	63 (1.9)
Assessments, *n* (%)	12,554	5938 (47.3)	3372 (26.9)	1750 (13.9)	384 (3.1)	565 (4.5)	545 (4.3)
Gender, *n* (%)	2912	712	1782	95	192	68	63
Female	2536 (87.1)	638 (89.6)	1504 (84.4)	84 ()	192 (100)	63 (92.6)	55 (87.5)
Male	375 (12.9)	73 (10.3)	278 (15.6)	11 ()	0 ()	5 (7.4)	8 (12.5)
Other	0 (0)	0 (0)	0 (0)	0 (0)	0 ()	0 (0)	0 (0)
Age	2597	477	1782	90	145	57	46
Mean (SD)	42.5 (9.31)	44.7 (11.4)	44.9 (10.4)	42.3 (8.54)	38.0 (9.62)	39.8 (6.00)	45.3 (9.90)
Minimum, maximum	18.9, 75.4	22.4, 68.1	18.9, 75.4	20.1, 58.0	20.9,62.9	26.6, 60.6	26.1, 68.8
Age group, *n* (%)	2597	477	1782	90	145	57	46
17-29	223 (8.6)	40 (8.4)	138 (7.7)	9 (10.0)	30 (20.7)	4 (7.0)	2 (4.3)
30-39	665 (25.6)	77 (16.1)	474 (26.6)	19 (21.1)	56 (38.6)	25 (43.9)	14 (30.4)
40-49	866 (33.3)	152 (31.9)	589 (33.1)	43 (47.8)	39 (26.9)	27 (47.4)	16 (34.8)
50-59	678 (26.1)	171 (35.8)	460 (25.8)	19 (21.1)	17 (11.7)	0 (0)	11 (23.9)
>60	165 (6.4)	37 (7.8)	121 (6.8)	0 (0)	3 (2.1)	1 (1.8)	3 (6.5)
Missing	640	235	0	330	47	11	17
BMI	2568	484	1773	95	109	57	50
Mean (SD)	28.9 (4.94)	29.7 (6.81)	28.7 (4.7)	25.6 (2.81)	32.6 (7.50)	27.6 (4.11)	29.0 (3.72)
Minimum, maximum	19.0, 64.5	19.0, 64.5	22.7, 55.6	19.5, 32.9	20.5,57.1	19.8, 41.5	18.0, 40.9
BMI groups, *n* (%)	2567	484	1773	95	109	57	49
<18.49	2 (0.01)	0 (0)	2 (0.1)	0 (0)	0 (0)	0 (0)	0 (0)
18.5-24.9	826 (32.2)	97 (20.0)	637 (35.9)	59 (62.1)	15 (13.8)	13 (22.8)	5 (10.2)
25-29.9	1296 (50.5)	226 (46.7)	951 (53.6)	30 (31.6)	30 (27.5)	31 (54.4)	28 (57.1)
30-34.9	305 (11.9)	91 (18.8)	152 (8.6)	6 (6.3)	31 (28.4)	11 (19.3)	14 (28.6)
35-39.9	55 (2.1)	20 (4.1)	17 (1.0)	0 (0)	17 (15.6)	0 (0)	1 (2.0)
>40	83 (3.2)	50 (10.3)	14 (0.7)	0 (0)	16 (14.7)	2 (3.5)	1 (2.0)
Missing	670	228	9	325	83	11	14
Comorbidities *n* (%)	2708	711	1782	84	—	68	63
Diabetes	169 (6.2)	62 (8.7)	99 (5.5)	0 (0)	—	1 (1.5)	7 (11.1)
Hypertension	209 (7.7)	124 (17.4)	65 (3.6)	8 (9.5)	—	4 (5.9)	8 (12.7)
Hyperlipidemia	18 (0.7)	6 (0.8)	12 (0.7)	0 (0)	—	0 (0)	0 (0)
Obstructive sleep apnea	99 (3.7)	84 (11.8)	9 (0.5)	0 (0)	—	0 (0)	6 (9.5)
Osteoarthritic disease	227 (8.4)	132 (18.6)	81 (4.5)	7 (8.3)	—	3 (4.4)	4 (6.3)

Table 1. Continued

Characteristics	Total	Netherlands	Denmark	Italy	Germany	Poland	Finland
Cardiovascular or coagulation disease	85 (3.1)	55 (7.7)	23 (1.3)	4 (4.8)	—	2 (2.9)	1 (1.6)
Psychiatric	191 (7.1)	95 (13.4)	83 (4.7)	9 (10.7)	—	1 (1.5)	3 (4.8)
Reflux disease	129 (4.8)	103 (14.5)	—	12 (14.3)	—	9 (13.2)	5 (7.9)
No medical condition	1905 (70.3)	365 (51.3)	1441 (80.1)	28 (33.3)	—	54 (79.4)	17 (27.0)
Missing	337	1	0	336	—	0	0
Type of weight loss surgery *n* (%)	2111	552	1452	20	—	54	33
LRYGB (gastric bypass)	1554 (73.6)	341 (61.7)	1.141 (78.5)	5 (6.0)	—	37 (68.5)	30 (90.9)
LSG (gastric sleeve)	507 (24.0)	198 (35.8)	292 (20.1)	7 (8.3)	—	7 (13.0)	3 (0.9)
Gastric banding	41 (1.9)	12 (2.2)	17 (1.2)	2 (2.4)	—	10 (18.5)	0 (0)
Other	9 (0.4)	1 (0.1)	2 (0.1)	6 (7.1)	—	0 (0)	0 (0)
No surgery	25 (1.2)	1 (0.1)	—	11 (13.1)	—	2 (3.7)	11 (33.3)
Area of body contouring surgery *n* (%)							
Abdomen	1532 (51.2)	345 (48.6)	755 (49.1)	180 (42.8)	192 (100)	31 (45.3)	29 (46.2)
Breast	459 (15.3)	165 (23.2)	189 (12.3)	85 (20.2)	—	6 (9.3)	14 (22.0)
Back	270 (9.0)	67 (9.4)	180 (11.7)	15 (3.6)	—	5 (6.8)	3 (4.1)
Arms	297 (9.9)	106 (14.9)	129 (8.41)	45 (10.7)	—	10 (14.0)	7 (11.8)
Inner thighs	346 (11.6)	146 (20.6)	162 (10.5)	30 (7.1)	—	5 (8.0)	3 (4.1)
Hips and outer thighs	182 (6.1)	102 (14.3)	28 (1.80)	40 (9.5)	—	7 (10.3)	5 (7.9)
Buttocks	231 (7.7)	106 (14.8)	94 (6.1)	25 (6.0)	—	4 (6.4)	2 (2.7)

BMI, body mass index; SD, standard deviation.

Data Collection

The cohort included the following countries and hospitals: Denmark (Odense University Hospital, Hospital of Southwest Jutland, and Printzlau Private Hospital); Finland (Tampere University Hospital); Germany (Johanniter-Krankenhaus und Waldkrankenhaus, Bonn); Italy (Universita Campus Bio-Medico Hospital, Rome); the Netherlands (OLVG West Hospital, Amsterdam, Catharina Hospital, Eindhoven, and St. Antonius Hospital, Nieuwegein); and Poland (Marciniaka Specialized Hospital, Wroclaw). Patients ages 18 years or older undergoing BCS were included. Patients with limited proficiency in the language of the study site (ie, Danish, Finnish, German, Italian, Dutch, or Polish) and patients with cognitive impairments were excluded.

The BODY-Q

The BODY-Q was developed and validated in accordance with the Rasch measurement theory; the development of the BODY-Q has been previously published.[5] The BODY-Q consists of 32 independently functioning scales measuring HRQL, appearance, eating-related concerns, and experience of care.[5,25-28] This study included 5 HRQL scales (physical function, body image, psychological, sexual, and social) and 11 appearance scales (abdomen, body, arms, back, buttocks, hips and outer thighs, inner thighs, chest, nipples, stretch marks, and scars). The chest and nipple scales were only developed for patients seeking masculinizing chest surgery. Each of the BODY-Q scale contained 4 to 10 items, rated on a Likert scale of 1 (very dissatisfied) to 4 (very satisfied). The raw scores from each item in a scale were summed and subsequently transformed by the Rasch conversion tables into a score ranging from 0 to 100, such that a higher score signified greater satisfaction or improved quality of life.

Administration of the BODY-Q

The BODY-Q was administered preoperatively (baseline) and postoperatively at the following time points: 3 to 6

Table 2. Baseline Minimal Important Difference Values

Appearance	*n*	SD	0.2 SD	MID estimate
Appearance				
Body	2382	15.30	3.06	3
Abdomen	2408	27.21	5.44	5
Back	2389	29.82	5.96	6
Buttocks	2369	26.33	5.27	5
Arms	2391	27.29	5.46	5
Inner thighs	2355	26.82	5.36	5
Hips and outer thighs	2358	29.95	5.99	6
Chest	261	23.29	4.66	5
Nipples	259	28.75	5.75	6
Stretch marks	2066	28.48	5.70	6
Skin	2341	18.24	3.65	4
Scars	66	25.16	5.03	5
Health-related quality of life				
Psychological	1998	7.83	1.57	2
Social	1997	6.14	1.22	1
Sexual	1980	7.39	1.47	2
Physical	1235	11.89	2.38	2
Body image	2001	8.61	1.72	2

MID, minimal important difference; SD, standard deviation.

months, 1 year, 2 years, and 3 years after surgery. In Denmark, patients were included from June 2015 to November 2021. A direct link was sent to the questionnaire through the research electronic data capture (REDCap) hosted by the Open Patient Data Explorative Network (OPEN), Odense University Hospital, through their secure electronic mailbox. Additionally, patients were able to fill out the questionnaire at their hospital appointments with an iPad (Apple, Cupertino, CA). In Finland, Italy, the Netherlands, and Poland participants were included directly in Castor EDC (Amsterdam, the Netherlands), in a secure web-based application by a URL link. This included Finnish participants from February 2019 to November 2021, Italian participants from February 2019 to November 2021, Dutch participants from December 2017 to November 2021, and Polish participants from May 2018 to February 2022. German participants were recruited for June 2018 to May 2021. Additionally, patients were asked to provide information regarding their age, weight, weight loss, height, marital status, educational level, type of weight loss treatment, area of BCS, and comorbidities.

Determination of the Minimal Important Difference

With the distribution-based method, a reasonable effect size must be determined.[29] An effect size of 0.2 is considered an appropriate measure for MID based on a review by Samsa et al.[30] Two distribution-based analyses were performed to estimate the MID. First, the baseline SD was the measure of sample variation. Second, the 0.2 standardized response mean (SRM) was employed to estimate a mean MID from baseline to 3 years postoperatively.[21,22,31] Additionally, the MID was stratified based on body mass index (BMI) groups (<18.49, 18.5-24.9, 25.0-29.9, 30-34.9, 35-39.9, >40 kg/m^2), gender (male and female), and age groups (18-29, 30-39, 40-49, 50-59, >60 years).

Statistical Analyses

All analyses were conducted with StataBE Version 17 (College Station, TX). Demographic data of the patients were summarized with descriptive statistics, which included mean, standard deviation (SD), and 95% CI for continuous variables, whereas proportions were utilized for categorical variables. The summed raw scores from each BODY-Q were transformed to Rasch converted scores, ranging from 0 to 100, with the Rasch converted scoring tables. For each scale, the median and interquartile range (consisting of the 25th percentile and 75th percentile) of the patient's scores were applied to devise a score interpretation tool.

RESULTS

Patient Demographics

The sample consisted of 12,554 assessments from 3237 patients. See Table 1 for participant characteristics, and Supplemental Table 1, available online at www.aestheticsurgeryjournal.com, for patients' educational levels and marital status. The cohort consisted of 2536 (87.1%) females and 375 (12.9%) males, with a mean age of 42.5 ± 9.3 years (ranging from 18.9 to 75.4) and a baseline BMI of 28.9 ± 4.9 kg/m^2. The mean follow-up was 37.0 months overall, with a mean follow-up of 30.6 months in Denmark, 49.0 months in Finland, 12.0 months in Germany, 64.9 months in Italy, 16.7 months in the Netherlands, and 49.4 months in Poland.

The Minimal Important Difference

BODY-Q baseline 0.2 SD MID scores are presented in Table 2. The MID estimate was between 1 and 5 in the

Table 3. Mean Minimal Important Difference Values From Baseline to 3 Years Follow-up on Health-related Quality of Life Scales

BODY-Q BCS	Psychological			Social			Sexual			Physical			Body image		
Time point	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate
6 months post-BCS	543	4.12	4	541	3.51	4	531	5.02	5	343	4.47	4	546	4.80	5
1 year post-BCS	389	4.18	4	385	3.51	4	378	5.04	5	290	4.88	5	386	5.00	5
2 years post-BCS	121	4.67	5	119	3.38	3	119	5.35	5	88	4.24	4	123	5.52	6
3 years post-BCS	31	4.57	5	31	3.77	4	31	5.71	6	20	6.65	7	31	5.46	5
Mean			4			3			4			4			5

BCS, body contouring surgery; MID, minimal important difference; SRM, standardized response mean.

Table 4. Mean Minimal Important Difference Values From Baseline to 3 Years Follow-up on Appearance Scales, Part 1

BODY-Q BCS	Body			Abdomen			Back			Buttocks			Arms			Inner thighs			Hips and outer thighs		
Time point	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate
6 months post-BCS	552	3.87	4	552	8.01	8	548	6.24	6	542	5.75	6	552	5.29	5	543	5.33	5	542	6.45	6
1 year post-BCS	402	4.25	4	402	7.72	8	396	6.43	6	391	4.91	5	400	5.95	6	390	6.42	6	392	6.44	6
2 years post-BCS	120	4.42	4	123	7.88	8	119	7.01	7	117	5.74	6	120	6.98	7	118	6.64	7	117	7.34	7
3 years post-BCS	31	3.82	4	31	8.21	8	30	9.01	9	31	6.23	6	36	7.04	7	31	7.99	8	31	5.58	6
Mean			4			7			6			5			5			6			5

BCS, body contouring surgery; MID, minimal important difference; SRM, standardized response mean.

HRQL domain and between 3 and 6 in the appearance domain. The MID baseline estimate was 2 for psychological, 1 for social, 2 for sexual, 2 for physical function, and 2 for body image on the HRQL scales. On the appearance scales, the MID estimates were 3 for body, 5 for abdomen, 6 for back, 5 for buttocks, 5 for arms, 5 for inner thighs, 6 for hips and outer thighs, 6 for nipples, 5 for chest, 6 for stretch marks, 4 for skin, and 5 for scars.

The 0.2 SRMs from baseline to 3 years postoperatively for the HRQL and appearance domains are presented in Tables 3-5. The MID estimates based on change from baseline to 3 years postoperatively were between 4 and 8. On the Rasch transformed 0 to 100 scale, the MID estimate based on change from baseline was 4 for psychological, 3 for social, 4 for sexual, 4 for physical function, and 5 for body image on the HRQL scales. On the appearance scales, the MID estimates were 4 for body, 7 for abdomen, 6 for back, 5 for buttocks, 5 for arms, 6 for inner thighs, 5 for hips and outer thighs, 5 for nipples, 4 for chest, 4 for stretch marks, 5 for skin, and 3 for scars. This meant, for each surgical site, BODY-Q scores equal to or above the MID estimate represented a meaningful change in scores.

Proportion of Patients Achieving Minimal Important Difference Scores

The median BODY-Q scores for each HRQL and appearance domain are presented in Figures 1 and 2, and in Supplemental Table 2 available online at www.aestheticsurgeryjournal.com, displaying the total number of patients on each scale and percentage of patients who achieved the estimated mean MID. All patients on average scored higher after BCS. The only exception was the nipple scale, for which the score declined 2 years after BCS.

Table 5. Mean Minimal Important Difference Values From Baseline to 3 Years Follow-up on Appearance Scales, Part 2

BODY-Q BCS	Nipples			Chest			Stretch marks			Skin			Scars		
Time point	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate	*n*	0.2 SRM	MID estimate
6 months post-BCS	46	5.97	6	46	5.64	6	475	5.03	5	530	5.73	6	7	4.43	4
1 year post-BCS	28	4.80	5	30	5.56	6	272	4.93	5	354	5.74	6	45	4.54	5
2 years post-BCS	7	11.6	12	8	6.30	6	100	4.73	5	116	5.84	6	2	8.34	8
3 years post-BCS	1	—	—	1	—	—	29	4.92	5	31	5.71	6	0	—	—
Mean			5			4			4			5			3

BCS, body contouring surgery; MID, minimal important difference; SRM, standardized response mean.

BMI, Gender, and Age Stratified Minimal Important Difference

The 0.2 SDs from baseline stratified by age, gender, and BMI groups are presented in Supplemental Table 3, available online at www.aestheticsurgeryjournal.com. On all scales, age group 50 to 59 years had higher MID scores than younger and older age groups. Overall, there were no differences in BMI groups or between male and female participants.

DISCUSSION

In this study, BODY-Q MID scores were estimated based on 3237 patients undergoing BCS with the distribution-based method. At baseline, the MID estimates ranged from 1 to 5 on the HRQL scale and from 3 to 6 on the appearance scale. The mean change of MID from baseline to 3-year follow-up ranged from 4 to 5 on HRQL and from 4 to 8 on the appearance scale. BMI and gender stratified MIDs showed no differences, and the age group of 50 to 59 years scored higher MID scores than younger and older patients.

For all scales, the median BODY-Q scores improved and stabilized after BCS, except for the nipple scale, for which the median score declined 2 years postoperatively. This decline was probably due to the small sample size in the 2-year postoperative group, because only 10 patients were included at that time. The BODY-Q chest and nipple scales were relevant only for male participants. In a recent multinational longitudinal study of up to 10-year follow-up on patients undergoing bariatric surgery with or without subsequent BCS, all patients scored higher on all BODY-Q scales after BCS.[32] However, surgery around the areola may disrupt normal appearance, cause asymmetry, or altered sensation, which may be undesirable for these participants. It is also known that post-MWL breast surgery is difficult to perform with long-lasting results due to skin quality.[33]

The distribution-based method was utilized to estimate the MID scores. Overall, there is no consensus regarding a "best-practice" approach for estimating a MID.[24] The US Food and Drug Administration (FDA) recommends either the anchor-based method exclusively or in a combination with the distribution-based method, because the change in patient scores are linked to a meaningful external anchor, and so incorporate the patient's perspective.[34] Because anchor-based approaches prioritize the patient's perspective, this recommendation is often made for an optimal estimation of MIDs.[21,35] However, the anchor-based method is limited by the selection of appropriate anchors, because the subjective choice of individual patients may not be generalizable.[36] Although the distribution-based method depends on the variability of the sample, it might not necessarily reflect the patient's perspective.[36,37] Due to this limitation, the mean SRM was estimated, which is not dependent on the sample's baseline heterogeneity.[21,38] For clinical care and research, assessing individuals or a larger group of patients undergoing BCS, we recommend the mean SRM as a MID reference value, because the mean change of scores is more representative than baseline values.[21,36,37] Additionally, the outcomes of multiple centers from 6 European countries were combined in this study to increase the generalizability of the MID estimates. No other BCS-specific PROMs exist with established MID scores. In the plastic surgical literature, MIDs have been established for the BREAST-Q with the distribution-based method, as in our study.[22,31,39] Similar to this study, they found MIDs ranging from 3 to 5 points.[22,31]

Without an established MID, it can be difficult to determine if a significant change in score represents a clinically

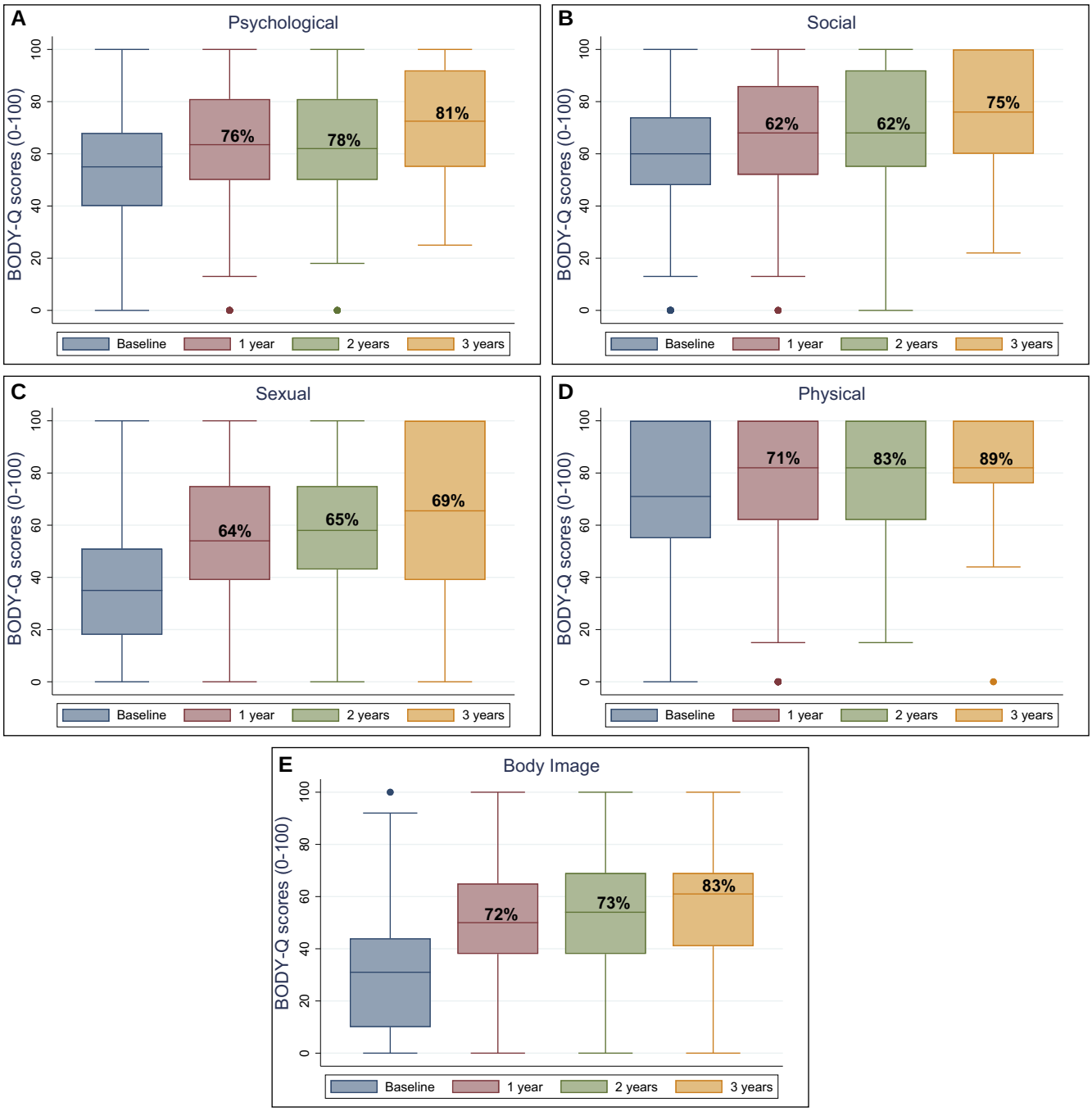

Figure 1. BODY-Q health-related quality of life scale scores (A-E) from baseline to 3 years after body contouring surgery.

meaningful change. Therefore clinicians can more accurately assess whether or not a treatment has resulted in a clinically meaningful improvement in a patient's HRQL and satisfaction with appearance with BODY-Q MIDs.[21] The MIDs also enable exploration of results from previous and future BODY-Q studies. As an example, in a previous BODY-Q study by Poulsen et al, patients who underwent BCS had a score difference of 9.3 between preoperative and postoperative scores on the physical scale. Because our MID score based on the mean 0.2 SRM is 5, this change constitutes a meaningful change for the patients and not only a statistical significant difference.[3] Or, in the opposite case, if a study shows a nonsignificant difference between preoperative and postoperative BODY-Q scores on an individual scale, for example, the physical scale, but the change in scores is above the 5, the mean MID for physical based on

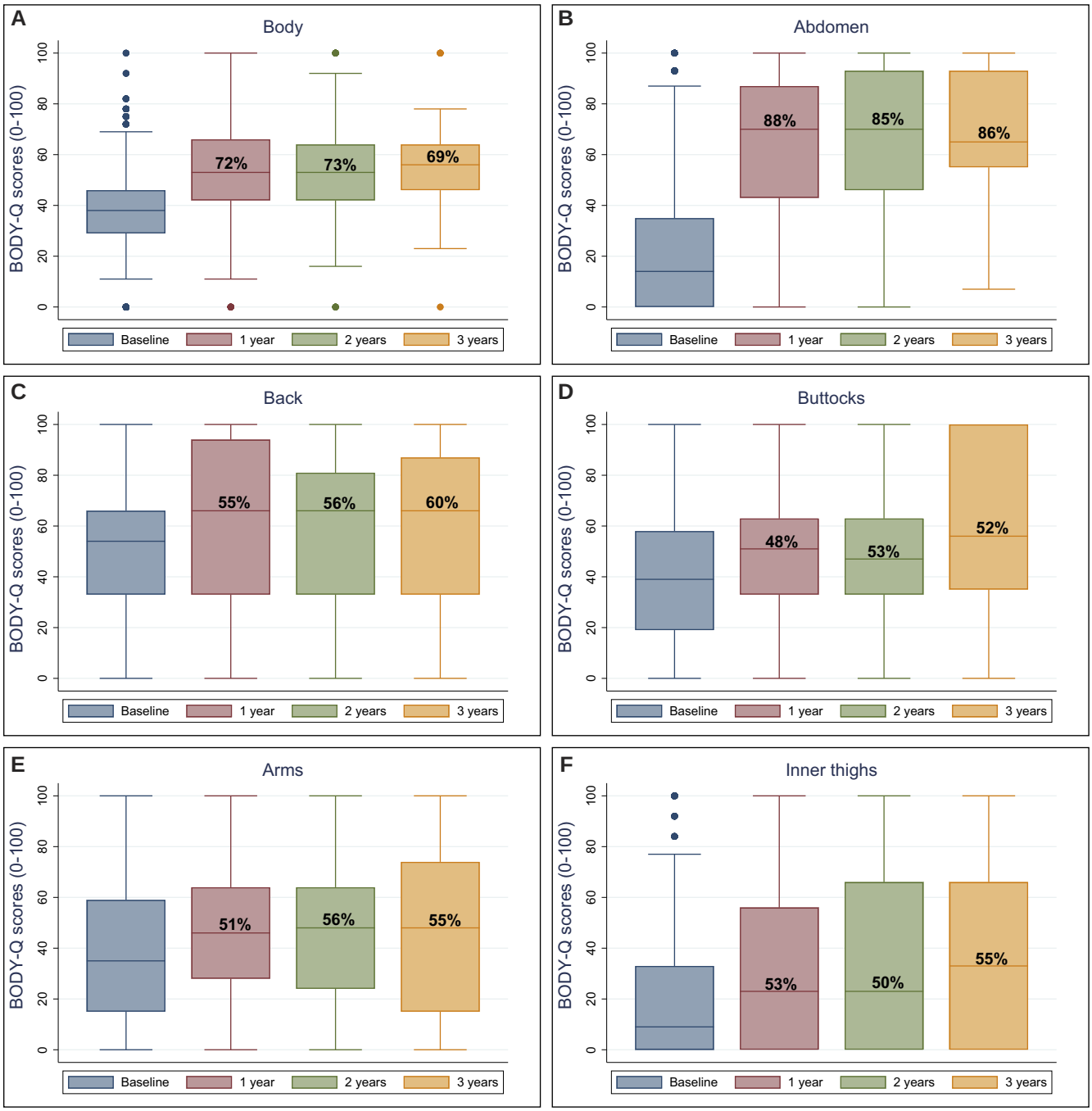

Figure 2. BODY-Q appearance scale scores (A-L) from baseline to 3 years after body contouring surgery.

these results, the change can be interpreted as meaningful for the patients irrespective of the statistical significance.[23]

Previous research has demonstrated the negative impact of excess skin following MWL.[40] Although this significantly improves after BCS, the healthcare budget remains limited for the reimbursement of BCS following MWL.[3,32,41] This limitation is particularly notable when considering the reimbursement of BCS as an indispensable part of postbariatric surgical care.[42] In this study, abdominal BCS was the most frequently performed procedure (51.2% of all BCS), with 86% of patients achieving the estimated MID for the BODY-Q abdomen scale postoperatively. Furthermore, between 69% and 89% of patients achieved the estimated MID across all HRQL scales. These results underscore the particular importance of abdominal BCS in improving HRQL and patient satisfaction with

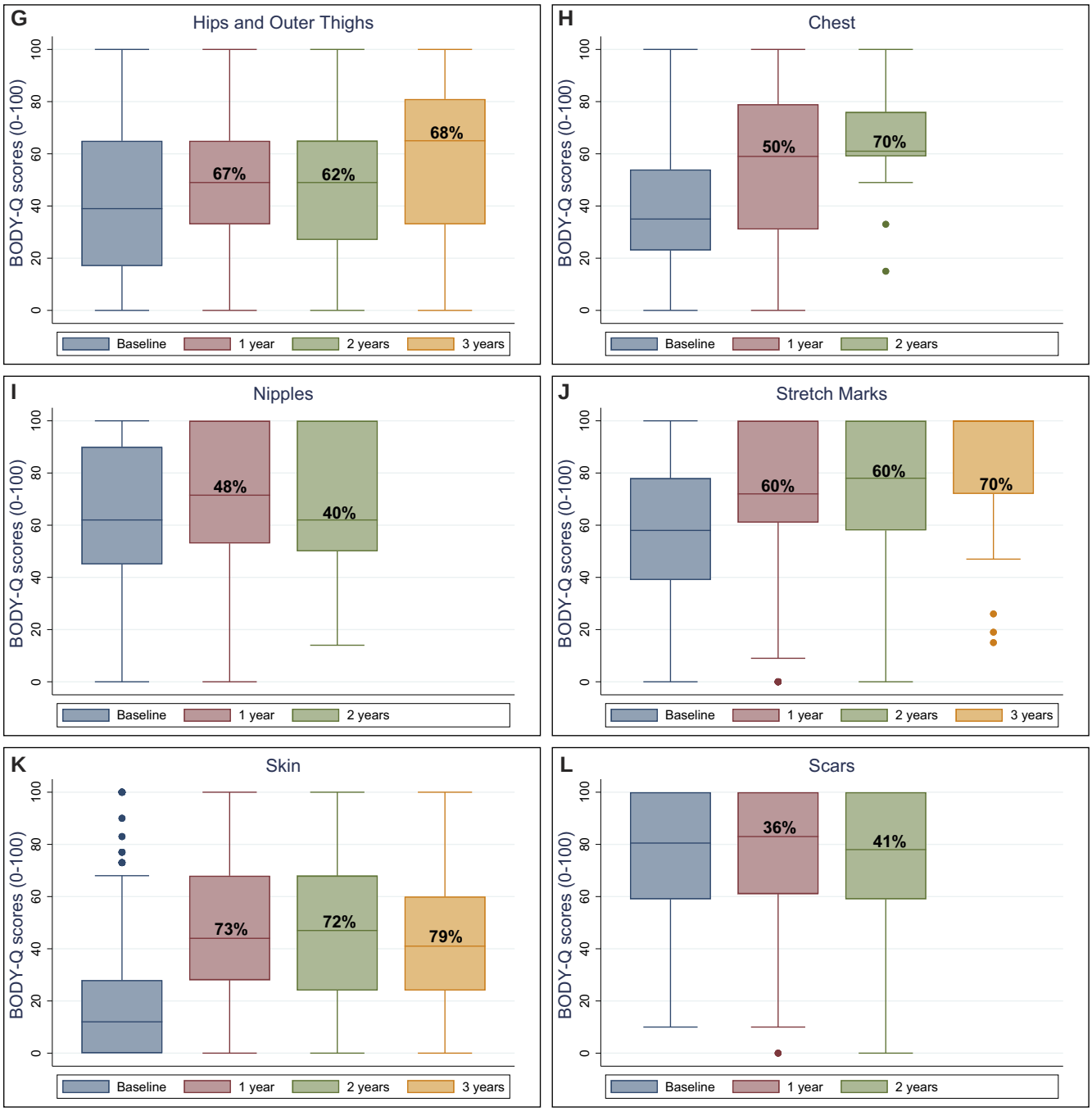

Figure 2. Continued

appearance during the post–weight loss period. These findings advocate for the incorporation of such procedures in holistic patient care following MWL and for the reimbursement of BCS by healthcare systems.

In a retrospective follow-up, Altieri et al demonstrated that only 6% of patients who had bariatric surgery subsequently underwent BCS, although 70% to 90% of patients following MWL report significant excess skin.[1,2,43] The discrepancy between the number of patients desiring BCS and the uptake of BCS after bariatric surgery may be due to limited insurance coverage and income, which can influence the decision to undergo BCS, particularly in countries where BCS is not publicly funded.[44,45] In the included countries in this study, BCS was either available through the public health system within specified criteria (Denmark and Finland), through insurance companies (the Netherlands, Germany,

Italy), or a national healthcare insurer (Poland).[46-50] However, in many countries, BCS is considered cosmetic surgery, and therefore is not reimbursed by insurance companies or national health systems.[51] Utilizing the estimated MIDs in future BODY-Q BCS studies is crucial for demonstrating the positive impact that BCS has on patients' HRQL following MWL and underscoring the need to include BCS as a reimbursed component of postbariatric surgery care.

To the best of our knowledge, this study is the first effort to establish BODY-Q MIDs for patients undergoing BCS. Strengths of this study included the large, multicenter cohort of BCS patients from 6 European countries gathered to estimate the MIDs. The relatively large sample size of 2253 patients should not influence the magnitude of the MIDs because it is expressed as an average variation around a mean value, but it is expected to improve the precision of the MIDs.[21] In addition, we adjusted for potential clinical differences such as BMI, gender, and age by conducting subgroup analyses. These analyses confirmed that BMI and gender did not influence the MID estimates. Only the age group between 50-59 years was associated with higher MID scores when compared to younger and older patients.

These MID scores will enable sample size calculation when designing clinical research to obtain an adequately powered study to answer a research question.[52] The MID is an essential component of estimating a required sample size and should be part of the design of future studies that incorporate the BODY-Q.

This study had several limitations. All data were solely patient reported; therefore, we were unable to characterize the specific BCS technique, number of previous BCSs, or complications during or after surgery. The sample sizes varied across countries, with the majority of participants from Denmark (55.1%) and the Netherlands (22.0%).

We only had baseline characteristics from Finland, Germany, Italy, and Poland. Therefore, we lacked follow-up data regarding patient characteristics such as BMI and change of BMI during the study period. Another limitation may be the use of the distribution-based method to estimate the MID. This method exclusively depends on statistical indicators, which might not reflect the clinical relevance of variations in the PRO sufficiently. This might yield MID estimates that lack sufficient relevance for patients. Furthermore, multiple approaches are described for the distribution-based method, including different effect sizes and SRM values.[17,53] In this study, we chose a conservative approach (0.2 SD) for the BODY-Q MID scores in a BCS population, based on a review by Samsa et al.[21,30,52,53] In the future, a combined approach with the distribution-based and anchor-based methods should be applied due to the limitations of each method. Therefore we acknowledge that future studies may report different MID values for patients undergoing BCS.[36] However, until these values obtained with the anchor-based method become available, the estimates presented in this study are recommended for clinical and research use.

CONCLUSIONS

In this study, the estimated MID for the BODY-Q from baseline to 3 years postoperatively ranged from 4 to 5 on the HRQL scales and from 4 to 8 on the appearance scales. These findings provide meaningful insights and guidance for the interpretation of the BODY-Q scores in previous and future studies, improving the clinical and research utility of this PROM for understanding the impact of BCS on patients' lives. In the future, a combined methodology comprising the distribution-based and anchor-based methods is recommended for the estimation of BODY MID scores.

Supplemental Material

This article contains supplemental material located online at www.aestheticsurgeryjournal.com.

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Disclosures

The BODY-Q is developed by Drs Klassen, Pusic, and Cano, and they all receive a share of any license revenues based on institutions' inventor sharing policy. Dr Klassen is the owner of EVENTUM Research, which provides consulting services to the pharmaceutical industry. Dr Cano is CSO of Modus Outcomes, a Division of Thread (Cary, NC). The other authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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