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REVIEW ARTICLE

Body image assessment in oncology: an update review

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Abstract
Purpose Body image is a psychological dimension of the experience of cancer, which varies along the clinical features of the disease itself and in its phases, as well as its effects in terms of functioning and quality of life. In 2012, Supportive Care in Cancer published a review addressing the relevance, application, and instruments of body image assessment for oncological settings. Since then, many research papers have been published on this topic and new questionnaires for assessing body image in oncology are now available. This contribution aims to offer both researchers and clinicians an updated review of body image assessment tools.
Methods We searched PubMed, Psychology and Behavioral Sciences Collection, and Scopus databases, which allowed us to identify pertinent papers, classified according to the body image tool to which they refer. We then extracted the characteristics and the psychometric properties from each study.
Results From the 657 initial records, 23 papers met the selection criteria referring to 8 body image measurements. Although increasing in number and being the subject of a growing number of studies, these papers are still not exhaustive with respect to the verified psychometric properties. In particular, it is worth noting that their applicability to all types of cancer is limited and that a focus on women with breast cancer prevails.
Conclusion A complete validation (including a study of all types of validity and reliability) and an indication of the case results are not currently available for any of the eight instruments described. However, studies designed to apply body image assessment tools to patients other than those experiencing breast cancer as well to cultural contexts other than English-speaking countries, are increasing.

Keywords Body image · Cancer · Psychometrics · Reliability · Validity

Introduction

The body determines the space we occupy in the world, and mediates our interactions with the physical and social world. In addition, people interact with us, approaching our corporeality.

Cancer and anti-cancer treatments affect the body in various ways, directly or in the form of side effects [1–5]. In oncology, the physical damage may be temporary or permanent, sudden or gradual, and visible or not visible (e.g. regarding internal organs). It may include functional implications or disability. It may affect organs that have an important symbolic value and/or are connected, more than others, to personal identity (reproductive organs, for example). Sometimes, the damage may be for prophylactic reasons, as in the case of preventive bilateral mastectomy in the presence of mutations on the BRCA1/2 genes.

Body image is a psychological construct that captures the perceptions, emotions, and attitudes a person holds towards his/her own body [6, 7]. In oncology, body image relates to the subjective experience of having cancer, which varies according to the clinical features of the disease itself and its phases as well as the effects in terms of functioning and quality of life.

The first use of body image assessment was related to eating disorders, for which the perception of body size and its appreciation are the most important dimensions [6, 7]. In oncology, the assessment of body image is complicated because

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it must take into account the different objective impairments of the body caused by the disease and/or by treatment (amputation, scarring, functional damage, infertility, alopecia, edema, etc.); their possible variations over time; the possible functional implications, as well as the esthetics; and their subjective, social, and cultural significance [1–3].

This paper aims to review instruments that were specifically designed or adapted to investigate body image in cancer patients, describing their characteristics and their psychometric properties. It represents an update of a previous preliminary review [1], and it was stimulated by the increasing numbers of papers dealing with body image and body image assessment in oncology that have been published since that work.

Method

Data sources and search

A computer-based literature search was performed to identify articles about tools used in assessing body image in cancer patients that were published between January 2012 and August 2016, the period following the publication of one of our studies on the same subject issued in 2012 in Supportive Care in Cancer, Volume 20, Issue 5 [1]. PubMed, Psychology and Behavioral Sciences Collection, and Scopus databases were chosen for this search as they contain research publications across a wide range of health professions in the field of oncology, and they are a leading source for journals related to clinical and psychosocial cancer care. The search strategy cross-references cancer (or oncology, or neoplasm) and body image and assessment (or questionnaire, or scale, or inventory, or measure, or psychometrics).

After identifying and classifying the relevant publications, a database search by tool name was performed. Finally, a manual search of the reference lists of the selected papers was performed to identify any further relevant publications.

Data extraction

The papers we identified were categorized according to which instrument they refer to. For each instrument, we identified the aspects of the considered body image, the number of items, the response format, the enrolled sample, the type of tested validity (construct, convergent, discriminant, criterion, cross-cultural, linguistic equivalence, feasibility, and positive response proportion), the type of verified reliability (internal consistency, temporal stability), and tool availability.

Assessing the construct validity consists of determining the underlying factorial structure of the tool. Convergent validity refers to the correspondence of the instrument to other already validated measures that assess the same construct. Discriminant validity consists of the tool's ability to discriminate between different participants groups. Criterion validity refers to the tool's ability to distinguish cases from non-cases. Cross-cultural validity evaluates the application of the tool to other cultural/linguistic contexts, whereas linguistic equivalence focuses on the equivalent value of the tool's version in a language other than the original one. Feasibility considers the tool's acceptance by compilers. Proportion of positive responses indicates the tool's ability to capture the presence of all the aspects of the construct being considered. Internal consistency measures the items' homogeneity, determining whether the scale consists of a single underlying construct. Temporal stability indicates whether the obtained scores remain constant over time.

For each tool, the available psychometric data were subsequently summarized by means of a code: "adequate"; "partial" (if available data were inconsistent and/or they were incomplete: for example, construct validity was tested only by exploratory factor analysis or was not tested for the original version but only for other linguistic versions, and internal consistency was provided for the total score only and not for each identified factor); or "non-available". Cross-cultural validity was assessed as adequate when it was assessed for at least one additional cultural context other than the original one.

Results and discussion

The initial search (including manually retrieved articles) yielded 657 records. After excluding articles on the basis of the abovementioned criteria and due to duplication, we considered 23 articles [8–30] dealing with eight different tools: Appearance Schemas Inventory-Revised (ASI-R; [8]); Body Image after Breast Cancer Questionnaire (including its Chinese version; BIBCQ/BIBCQ-C; [9, 10]); Body Image and Relationship Scale (including its Swedish version; BIRS/BIRS-S [11–13]); Body Image Scale (BIS; [14–21]); Body Image Screener for Cancer Reconstruction (BICR; [22]); Breast-Impact of Treatment Scale (including its Malay version; BITS/MBITS [23–25]); Measure of Body Apperception (MBA; [26–28]); and Sexual Adjustment and Body Image Scale (including its gynecologic version; SABIS/SABIS-g [28–30]).

Table 1 shows the characteristics and the tested psychometric properties for the identified body image tools as deducible by each selected paper. Table 2 summarizes the psychometric data available for each tool.

Of the eight identified instruments, only one (ASI-R) was borrowed from other populations (i.e. college students, [31, 32]); the remaining tools have been created specifically for oncology.

For all eight tools, validation studies reported involving breast cancer patients (at different stages of the experience of

Table 1 Tools for assessing body image in cancer patients: characteristics and psychometric properties

Tool	Assessed aspect(s)	Number of items	Response options	Enrolled sample	Validity	Reliability	Notes
ASI-R [8]	Body image investment (i.e. value or importance placed on appearance and physical attributes)	20	5-point Likert scale from 1 "strongly disagree" to 5 "strongly agree"	356 breast cancer patients undergoing mastectomy and breast reconstruction	Construct: 3 moderately/lowly correlated factors (appearance self-evaluation, appearance power/control, appearance standards and behaviors consisting of 8, 5 and 7 items, respectively) established by EFA (oblique promax rotation) and confirmed by CFA	Internal consistency: $A > 0.71$ for each factor	This was the first study that assess the tool [31, 32] psychometric properties in an oncological population
BIBCQ [9]	6 independent domains of body image: vulnerability (feelings of susceptibility of the body to illness and cancer); body stigma (feelings of a need to keep the body hidden); limitations (feelings about competence and ability); body concerns (satisfaction with body shape and appearance); transparency (concerns about the obviousness of cancer-related changes to appearance); arm concerns (concerns about arm symptoms and appearance)	45 common items, 6 optional items specific to women with 2 breasts, 2 optional items specific to women missing 1 or 2 breast(s)	5-point Likert scale from 1 "strongly disagree" to 5 "strongly agree"; 5-point frequent scale from 1 "never/almost never" to 5 "always/almost always"	164 Canadian breast cancer outpatients 3+ months after diagnosis; 116 Canadian women without a history of breast cancer (control group)	Convergent: moderate correlations of BIBCQ subscales with scales assessing depression, self-esteem, QoL, sexual functioning; no correlations with social desirability measure Discriminant: differences in scores between patients and controls; differences in scores according to undergone treatments	Internal consistency: $A > 0.77$ in each subscale Temporal stability: ICC > 0.77 (2 weeks) in each subscale	Items have a grade 5 Flesch-Kincaid reading level. The median completion time is 7.5 min, with 85% of participants completing the questionnaire within 10 min. Not all scales need be administered or analyzed. Both the tool and its scoring key are presented in appendixes
BIBCQ-C [10]	6 independent domains of body image: vulnerability (feelings of susceptibility of the body to illness and cancer); body stigma (feelings of a need to keep the body hidden); limitations (feelings about competence and ability); body concerns (satisfaction with body shape and appearance); transparency (concerns about the obviousness of cancer-related changes to	45 common items, 6 optional items specific to women with 2 breasts, 2 optional items specific to women missing 1 or 2 breast(s)	5-point Likert scale from 1 "strongly disagree" to 5 "strongly agree"; 5-point frequent scale from 1 "never/almost never" to 5 "always/almost always"	545 Chinese breast cancer patients	Construct: 6 factors confirmed by CFA Convergent: correlations with depressive and anxious states measures	Internal consistency: $A > 0.61$ for each subscale Temporal stability: ICC > 0.60 for each subscale (4 weeks)	It is the Chinese version of BIBCQ The paper is in Chinese Information was extrapolated by the abstract only

Table 1 (continued)

Tool	Assessed aspect(s)	Number of items	Response options	Enrolled sample	Validity	Reliability	Notes
	appearance); arm concerns (concerns about arm symptoms and appearance)						
BIRS [11]	Issues related to appearance, health, physical strength, sexuality, relationships, and social functioning that are unique to women diagnosed with, and treated for, breast cancer	32	5-point bipolar rating scale, anchored 1 "disagree strongly" and 5 "agree strongly"	95 female long-term breast cancer survivors reporting being disease free	Construct: 3 correlated factors (health and strength, social barriers, appearance and sexuality composed of 12, 9, and 11 items, respectively) established by EFA (principal axis factoring with varimax rotation) Convergent: correlations of tool subscales with measures of other related psychological dimensions	Internal consistency: $A = 0.94$ (total score) Temporal stability: Rho > 0.40 in each item (2 weeks)	Tool items are listed in the table
BIRS [12]	Issues related to appearance, health, physical strength, sexuality, relationships, and social functioning that are unique to women diagnosed with, and treated for, breast cancer	28	5-point bipolar rating scale, anchored 1 "disagree strongly" and 5 "agree strongly"	139 Brazilian female breast cancer survivors	Construct: 3 factors (strength and health, social barriers, appearance and sexuality composed of 10, 10, and 8 items, respectively) established by EFA (principal axis factoring, varimax rotation) not overlapping those of the original version	Internal consistency: $A = 0.92$ (total score)	The paper described the adaptation of BIBCQ for Brazilian users. The paper is in Portuguese
BIRS-S [13]	Issues related to appearance, health, physical strength, sexuality, relationships, and social functioning that are unique to women diagnosed with, and treated for, breast cancer	41	5-point bipolar rating scale, anchored 1 "disagree strongly" and 5 "agree strongly"	100 Swedish breast cancer survivors diagnosed with breast cancer 20–42 months prior to the study	Convergent: correlations with mental and physical functioning scales; linguistic equivalence: ICC > 0.97 between the original BIRS and the BIRS-S in all 3 subscales	Internal consistency: $A > 0.86$ for each subscale; $A = 0.96$ for total score Temporal stability: ICC > 0.87 for each subscale (2–3 weeks)	It is an adapted version of the original instrument including 9 additional items addressing specific areas of importance for Swedish breast cancer survivors
BIS [14]	Body image symptoms/distress	10	4-point rating scale anchored 0 "not at all" to 3 "very much"	682 British breast cancer patients enrolled in different recruitments	Construct: 1 factor established by EFA (general least squares analysis) Discriminant: score differences between patients undergone mastectomy vs. conservative surgery	Internal consistency: $A > 0.84$ in each subgroup; $A = 0.93$ for the total sample	It is the refinement of a previous tool version. The tool was provided in appendix
BIS [15]	Body image symptoms/distress	10	4-point rating scale anchored 0 "not at	173 Portuguese post-operative	Construct: 1 factor established by PCA	Internal consistency: $A > 0.91$ in both	It is the Portuguese version of BIS and it was provided in the appendix

Table 1 (continued)

Tool	Assessed aspect(s)	Number of items	Response options	Enrolled sample	Validity	Reliability	Notes
			all" to 3 "very much"	breast cancer patients	Convergent: score correlations with other body image measures and QoL measures Discriminant: score differences between women underwent mastectomy vs. conservative surgery	total sample and subsamples	
BIS [16]	Body image symptoms/distress	10	4-point rating scale anchored 0 "not at all" to 3 "very much"	155 Korean post-operative breast cancer patients	Construct: 1 factor established by general least squares factor analysis Convergent: correlation with other body image measures and with anxious state, depressive state and QoL measures Discriminant: score differences between women underwent mastectomy vs. oncoplastic surgery	Internal consistency: $A = 0.94$ Temporal stability: $r = 0.67$ (6 months)	It is the Korean BIS version. It was provided in supplement
BIS [17]	Body image symptoms/distress	9	4-point rating scale anchored 0 "not at all" to 3 "very much"	242 Thai breast cancer patients who had surgery and had completed chemo-radiation for 1+ year	Construct: 1 factor established Discriminant: score differences between women underwent mastectomy vs. breast conserving surgery	Internal consistency: $A > 0.8$ Temporal stability: >0.70	It is the Thai BIS version. Information was extrapolated by the abstract only
BIS [18]	Body image symptoms/distress	10	4-point rating scale anchored 0 "not at all" to 3 "very much"	209 Dutch breast cancer female patients	Discriminant: score differences between participants undergone mastectomy vs. breast conserving treatments Feasibility: 0.2% missing answers Positive response prevalence (criterion ≥ 30%): 9/10 items	Internal consistency: $A > 0.90$ Temporal stability: Rho = 0.92 (2 weeks)	It is the Dutch BIS version and it was provided in the table
BIS [19]	Body image symptoms/distress	10	4-point rating scale anchored 0 "not at all" to 3 "very much"	100 women who had undergone radical surgery for breast ($n = 50$) or gynecological ($N = 50$) cancer	Construct: 1 factor established by EFA (unweighed least squares) Convergent: correlations with depression, anxiety, self-esteem, QoL measures	Internal consistency: $A = 0.96$	It is the Spanish BIS version. It was provided in the appendix

Table 1 (continued)

Tool	Assessed aspect(s)	Number of items	Response options	Enrolled sample	Validity	Reliability	Notes
BIS [20]	Body image symptoms/distress	10	4-point rating scale anchored 0 "not at all" to 3 "very much"	100 Turkish patients with ostomy lasting for at least 2 months	Construct: 1 factor established by PCA (varimax rotation) and CFA	Internal consistency: $A = 0.94$ Temporal stability: $r = 0.85$ (2 weeks)	It is the Turkish BIS version
BIS [21]	Body image symptoms/distress	9 + 1	4-point rating scale anchored 0 "not at all" to 3 "very much"	82 British patients undergoing surgery for colorectal cancer	Construct: 1 factor (added with a single item specifically focusing upon dissatisfaction with scar) established by multi-trait scaling and EFA Convergent: weak correlation with emotional functioning measure Discriminant: score differences between patients with a stoma vs. patients undergoing simple resection	Internal consistency: $A = 0.90$ Temporal stability: ICC = 0.89 (2 weeks)	–
BICR [22]	Body image concerns	4	4-point answer scale anchored 0 "not at all/none of the time" to 3 "very much/most of the time"	248 cancer patients undergoing reconstructive surgery	Criterion: obtained by means of simple and multinomial regression models: a score of 3 on any single item could reasonably be used to identify a patient who may benefit from a referral for specialized psychosocial care to treat body image concerns; concern about future appearance changes was the single best predictor of counseling enrollment	–	Tool provided in the table
BITS [23]	Body change stress (i.e. subjective psychological stress that accompanies women's negative and distressing feelings and emotions, thoughts, and behaviors resultant from breast cancer and/or breast surgeries)	13	4-point rating scale: 0 "not at all", 1 "rarely", 3 "sometimes", 5 "often"	194 stage II/III post-surgery breast cancer patients prior to beginning adjuvant therapy	Construct: 1 factor established by EFA (Maximum Wishart Likelihood discrepancy function, with direct quartimin [oblique] rotation) Convergent: correlations with stress, mood disturbance, sexuality, and body satisfaction measures Discriminant: score differences between women receiving segmental	Internal consistency: $A = 0.91$ Temporal stability: $r = 0.70$ (12 months)	Tool items were provided in the table

Table 1 (continued)

Tool	Assessed aspect(s)	Number of items	Response options	Enrolled sample	Validity	Reliability	Notes
					mastectomy versus mastectomy		
MBITS [24]	Body change stress (i.e. subjective psychological stress that accompanies women's negative and distressing feelings and emotions, thoughts, and behaviors resultant from breast cancer and/or breast surgeries)	13	4-point rating scale: 0 "not at all", 1 "rarely", 3 "sometimes", 5 "often"	70 Malay female breast cancer patients undergoing chemotherapy	Construct: 2 factors (intrusion and avoidance composed of 8 and 5 items, respectively) established by PCA (varimax rotation) Convergent: subscales correlations with anxious and depressive state measures Linguistic equivalence: Rho = 0.93 between MBITS and BITS (English version)	Internal consistency: $A = 0.94$ (total score); $A > 0.87$ for each subscale Temporal stability: ICC = 0.84 (3 weeks) (total score)	It is the Malay version of BITS
MBA [25]	Personal investment in (or concern on) one's body image (i.e. extent to which compilers have invested in this aspect of self as a source of self-acceptance)	8	4-point answer scale anchored 1 "disagree" to 4 "agree"	66 female pre-surgery stage I/II breast cancer patients	–	Internal consistency: $A = 0.78$ and 0.53 for its 2 factors, respectively Temporal stability: ICC = 0.67 and 0.39 (1 year) for the 2 factors, respectively	Tool items were provided in table. The tool was described as bi-factorial (concern about appearance and concern about body integrity)as a results of PCA on data previously collected in college students
MBA [26]	Personal investment in (or concern on) one's body image (i.e. extent to which compilers have invested in this aspect of self as a source of self-acceptance)	8	4-point answer scale anchored 1 "disagree" to 4 "agree"	60 Hispanic early-stage breast cancer patients	Linguistic equivalence: differences between respondents in English and respondents in Spanish in concern about physical appearance subscale but not in concerns about body integrity; substantial association between depression measure and the concern about appearance scale in English respondents whereas this correlation was smaller in Spanish respondents	–	It is the Spanish (neutral Spanish) version of MBA. The Spanish tool translation was found convergent to the English version in a sample of college students
MBA [27]	Personal investment in (or concern on) one's body image (i.e. extent to which compilers have invested in	7	4-point answer scale anchored 1 "disagree" to 4 "agree"	122 English fluent head and neck cancer patients who had completed	Construct: 1 factor established by PCA Convergent: correlations with anxious and depressive state measures and with	Internal consistency: $A = 0.77$	Original MBA items were reworded for being administered to both genders

Table 1 (continued)

Tool	Assessed aspect(s)	Number of items	Response options	Enrolled sample	Validity	Reliability	Notes
	this aspect of self as a source of self-acceptance)			treatments 12+ months prior	observer rating of disfigurement		
SABIS, Body Image Scale [28]	Disturbances in body image that are unique to breast cancer patients	6	–	353 female primary breast cancer patients that had completed initial surgical treatment	Convergent: the 2 subscales correlated with mood disturbance, and subjective distress measures Discriminant: differences in post body image subscale scores between participants treated with mastectomy vs. lumpectomy	Internal consistency: $A > 0.79$ in each subscale Temporal stability: Rho > 0.69 in each subscale (3 months)	The Body Image Scale was described as consisting of 2 subscale: prior body image; post body image. The tool along with scoring instructions may be accessed by contacting the corresponding author
SABIS [29]	Disturbances in body image and sexuality that are unique to breast cancer patients	14	–	169 Turkish women who had undergone initial surgical treatment for primary breast cancer	Construct: 4 factors (impact of sexual functioning; prior sexuality and prior body image; post body image; sexual importance of breasts consisted of 4, 5, 3, and 2 items, respectively) established by PCA (varimax rotation) Convergent: subscales correlated with body satisfaction e mood states measures	Internal consistency: $A = 0.71$ (all items)	It is the Turkish adaptation of SABIS [28]. The tool was described as not covering all dimensions representing Turkish patients' sexuality and body image
SABIS-G, Body Image Scale [30]	Disturbances in body image of gynecologic cancer patients	3	–	294 Canadian gynecologic cancer patients	Construct: 1 factor (changes in a woman's body image which was correlated to the other SABIS factor named "sexuality") established by EFA (maximum-likelihood analysis with Promax [oblique] rotation) and confirmed by CFA Convergent and discriminant validity was assessed for overall SABIS-G score	Internal consistency: $A = 0.88$ Temporal stability: ICC = 0.89 (4 weeks)	It is an adaptation of SABIS [28] for patients diagnosed and treated for gynecologic cancers. Adaptation process started from 9 SABIS items (items about breasts had been removed) Tool items were provided in table whereas scoring was described in the text

ASI-R Appearance Schemas Inventory-Revised, *EFA* exploratory factor analysis, *CFA* confirmatory factor analysis, *A* Cronbach's alpha, *BIBCQ* Body Image after Breast Cancer Questionnaire, *ICC* intraclass correlation coefficient, *BIBCQ-C* BIBCQ, Chinese version, *BIRS* Body Image and Relationship Scale, *Rho* Spearman's correlation coefficient, *BIRS-S* Body Image and Relationship Scale, Swedish version, *BIS* Body Image scale, *PCA* principal component analysis, *r* Pearson's correlation coefficient, *BICR* Body Image Screener for Cancer Reconstruction, *BITS* Breast-Impact of Treatment Scale, *MBIT* Breast-Impact of Treatment Scale, Malay Version, *MBA* Measure of Body Apperception, *SABIS* Sexual Adjustment and Body Image Scale, SABIS-G Sexual Adjustment and Body Image Scale, Gynecological

Table 2 Assessment tools for body image in cancer patients: summary of the tested psychometric properties

Property	ASI-R	BIBCQ/BIBCQ-C	BIRS/BIRS-S	BIS	BICR	BITS/MBITS	MBA	SABIS/SABIS-G
Validity								
Construct	A	+/−	+/−	+/−	\	+/−	+/−	+/−
Convergent	\	A	A	A	\	A	A	A
Discriminant	\	A	\	A	\	A	\	A
Criterion	\	\	\	\	A	\	\	\
Cross-cultural	\	A	A	A	\	A	A	A
Linguistic equivalence	\	\	A	\	\	A	A	\
Feasibility	\	A	\	A	\	\	\	\
Positive response proportion	\	\	\	A	\	\	\	\
Reliability								
Internal consistency	A	A	+/−	A	\	A	A	A
Temporal stability	\	A	+/−	A	\	A	\	A
Additional information								
Tool availability	\	A	A	A	A	A	A	+/−
Administration time	\	A	\	\	\	\	\	\

ASI-R Appearance Schemas Inventory-Revised, *BIBCQ* Body Image after Breast Cancer Questionnaire, *BIBCQ-C* BIBCQ Chinese version, *BIRS* Body Image and Relationship Scale, *BIRS-S* Body Image and Relationship Scale, Swedish version, *BIS* Body Image scale, *BICR* Body Image Screener for Cancer Reconstruction, *BITS* Breast-Impact of Treatment Scale, *MBIT* Breast-Impact of Treatment Scale, Malay Version, *MBA* Measure of Body Apperception, *SABIS* Sexual Adjustment and Body Image Scale, *SABIS-G* Sexual Adjustment and Body Image Scale, Gynecological, *a* adeguate, \ non-available, +/− partial data

illness). A preliminary study of the BIS (see [14]) had involved a heterogeneous sample for the diagnosis of cancer patients, and in the literature, validation studies on ostomy patients [20] and patients undergoing surgery for colorectal cancer are available [21]. For the MBA, a study of the adaptation of the instrument to patients of both genders with head or neck cancer has been conducted [27]. Finally, for the SABIS, there exists an adaptation for gynecological oncological patients [30].

The body image aspects investigated by the eight tools are as follows: the investment in the body (two instruments: ASI-R, MBA); distress/stress/disturbance (three tools: BIS, BITS/MBITS, SABIS); and the concerns or issues (three instruments: BIBCQ/BIBCQ-C, BIRS/BIRS-S, BICR).

Half of the tools (BIS, BICR, MBA, SABIS) have a number of items not exceeding 10, and 2 instruments (ASI-R, BITS/MBITS) include a number of items between 11 and 20, whereas the remaining 2 tools (BIBCQ/BIBCQ-C, BIRS/BIRS-S) have more than 30 items.

The tools were made available in the selected publications. The only exceptions were the ASI-R, designed for other contexts and then validated for oncology, and SABIS that is available from the authors [28] (although the items and delivery of SABIS-G can be found in the relative publication [30]).

In none of the three articles relating to SABIS identified [28–30] were there indications about the scale of the response to the item.

Finally, the compilation time is only reported for the BIBCQ/BIBCQ-C.

Validity of the selected tools

Construct validity was assessed in seven of the eight instruments. In one case (ASI-R), authors recurred to a confirmatory factor analysis. In the remaining cases, the analysis was exploratory and sometimes (as in the case of BIRS, BIS, BITS/MBITS, SABIS) led to different results between studies. A confirmatory factor analysis was even conducted for BIBCQ-C, although in the original article on the BIBCQ [9] the instrument was described as multifactorial and this analysis was not reported.

Convergent validity was studied in six of the instruments (not shown for the ASI-R and BICR). In general, this was tested through correlations with similar psychological construct measures (including other measures of body image) and it documented its peculiarities.

For four instruments (BIBCQ/BIBCQ-C, BIS, BITS/MBITS, SABIS/SABIS-G), the discriminant validity was documented by verifying the ability to distinguish subsamples (usually stratified by type of treatment received, more or less invasive, and therefore impacting on the studied construct).

Only for the BICR are the data on the criterion validity available: in fact, for this tool a cutoff score was able to differentiate cases from non-cases.

The cross-cultural validity was verified for six of the instruments. Exceptions are the ASI-R (it must be remembered that this is the adaptation of a tool which is already in use for other populations) and the BICR. To date, the BIS is the tool about which we have the greatest number of cross-cultural studies available (it should be noted that 8 of the 23 selected studies address this instrument). In addition to data on cross-cultural validity, here the linguistic equivalence data were reported as verified for the BIRS/BIRS-S (English vs. Sweden), the BITS/MBITS (Malaysian vs. English), and the MBA (Spanish vs. English).

Information about the feasibility tool is available for BIBCQ/BIBCQ-C and the BIS, whereas the data for the positive response proportion are available only for the BIS.

Reliability of the selected tools

Internal consistency was verified in seven of the eight tools considered and it was satisfactory for all of them. An exception was BIRS/BIRS-S since in two of the three related papers internal consistency was verified for the entire questionnaire rather than for each subscale.

Temporal stability was adequate for BIBCQ/BIBCQ-C, BIS, BITS/MBITS, and SABIS/SABIS-G, but was tested only for the total score in BIRS/BIRS-S and was not tested in ASI-R and BICR.

Conclusions

In 2012, Supportive Care in Cancer published a review addressing relevance, application, and instruments of body image assessment for oncological settings. In that review, six different tools were presented, although a validation process (also if preliminary) had only been described for four of these. Today we have identified 23 papers related to the validation of eight different tools.

Although it cannot be argued that the validation process is exhaustive for any of the identified tools (future studies should be particularly directed to the definition of the criterion validity of these instruments), both the growing attention to the issue of the assessment of body image in oncology (which is very much deducible from the increased number of published instruments and the various works on cross-cultural validation) and the growing attention to the methodological aspects of evaluation (as seen in the different aspects of validity and reliability considered) must be acknowledged.

This review is intended to be of assistance as a rapid clinical method of assessing the instruments available in one's own country. However, for researchers it shows the aspects that require further study, in particular (in addition to the already mentioned issue of criterion validity), the adaptation and use with other cancer populations as compared to breast cancer patients.

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Compliance with ethical standards

Conflicts of interest The authors declare that they have no conflicts of interest.

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