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A Revision of the Quality of Life-Breast Cancer Survivors (QOL-BCS) Instrument

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Abstract

The importance of quality of life (QOL) measurement among breast cancer survivors (BCS) is well-recognized by researchers and clinicians. With data from 427 rural BCS, the authors used a combination of clinical expertise and statistical analysis to revise a 48-item measure of QOL specific for BCS. The revised 15-item model shows adequate psychometric properties and provides the basis for a brief yet comprehensive multidimensional measure of QOL applicable to most BCS. Future work includes fine-tuning the measurement model and examining its generalizability among non-rural BCS.

Keywords

Quality of Life; Breast Cancer; Breast Cancer Survivors; Instrument Development; Psychometric Analysis

Breast cancer is the most common cancer among women in the United States. It is the second leading cause of cancer death in women, after lung cancer (American Cancer Society, 2012). It is estimated that for 2012 there will be 226,870 new cases of invasive breast cancer diagnosed among women in the United States, and that 39,510 women will die of the disease. However, the chances of dying from breast cancer have decreased in the past decade, which is likely the result of improvements in detection, treatment, and supportive care. Currently, there are about 2.5 million breast cancer survivors (BCS) in the United States. Although providing primary treatment remains the priority for clinicians, maintaining survivors' quality of life (QOL) after treatment is also a principal objective. Because of the increasingly large number of BCS, the importance of QOL in breast cancer survivorship is well-recognized by clinicians and researchers. Common treatments such as surgery, chemotherapy, radiation therapy, or hormonal therapy may result in long-term physical side effects. Furthermore, due to the long natural history of the disease, BCS may experience additional QOL problems and concerns related to social, work, and family changes during

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survivorship, as well as psychological distress related to cancer surveillance and fear of recurrence.

In addition to generic QOL measures, at least 13 cancer-specific measures of QOL have been used over the last two decades in breast-cancer survivorship studies (Chopra & Kamal, 2012; Gordon & Siminoff, 2010). A pioneer among such measures is the Quality of Life-Cancer Survivors scale (QOL-CS), a 41-item instrument originally developed by nursing researchers (Dow, Ferrell, Leigh, Ly, & Gulasekaram, 1996; Ferrell, Dow, & Grant, 1995; Ferrell, Dow, Leigh, Ly, & Gulasekaram, 1995), who based their instrument on a model of QOL that contains four interrelated dimensions: physical, psychological, social, and spiritual well-being. Over the past 20 years, the QOL-CS and its adaptations for different types of cancer have been used in several published studies, with at least 4,260 research participants having completed the original QOL-CS measure or an adaptation of it (Ahles et al., 2005; Burhansstipanov et al., 2010; Burris & Andrykowski, 2010; Lehmann, Oerlemans, van de Poll-Franse, Vingerhoets, & Mols, 2011; K. D. Meneses et al., 2007; Meyers et al., 2011; Nagarajan, Mogil, Neglia, Robison, & Ness, 2009; Robert, Ottaviani, Huh, Palla, & Jaffe, 2010; Sun et al., 2007). Additionally, the QOL-CS and its conceptual model have been cited in at least three systematic reviews (Chopra & Kamal, 2012; Leak, Mayer, & Smith, 2011; Mols, Vingerhoets, Coebergh, & van de Poll-Franse, 2005). Here we focus on the development of an adaptation of the QOL-CS specific to BCS, the Quality of Life-Breast Cancer Survivors instrument (QOL-BCS). The initial 50-item version of the QOL-BCS was developed in 2005 and tested on a sample of 256 BCS (K. D. Meneses, et al., 2007). An analysis of those data indicated problems with the spiritual domain subscale (which was unaltered from the QOL-CS), including lack of directionality of some items due to ambiguity in their wording and low internal consistency. These problems were also noted in separate studies (Avis, Ip, & Foley, 2006; Lehmann, et al., 2011). In 2008, a second experimental 48-item version of the QOL-BCS was developed focusing on the physical, psychological, and social well-being domains and excluding the spiritual domain items. The domains and item topics for the original QOL-CS, and the 2005 and 2008 versions of the QOL-BCS are shown in Table 1. Item scores consist of ratings for each specific topic on a 0 to 10 ordinal scale. For most items lower scores indicate fewer problems and therefore better quality of life. Due to wording, a few items require reverse-coding prior to analysis.

This paper presents the results of a psychometric evaluation of the 2008 QOL-BCS instrument on a sample of 427 BCS. The steps taken in the evaluation included: 1) content analysis by an expert nurse researcher and clinician, 2) statistical item analysis combining classical psychometric methods and Item Response Theory (IRT) methods, and 3) an examination of convergent validity using a common measure of health-related QOL.

Methods

Sample

Responses for the 2008 QOL-BCS instrument from 427 rural BCS were obtained from baseline data of the Rural Breast Cancer Survivor Intervention (RBCS). Briefly, the RBCS is a population-based randomized clinical trial with the endgoal of determining the effectiveness of a telephone-delivered education and support intervention for rural BCS. Rural breast cancer survivors were recruited through the Florida Department of Health and the Florida Cancer Data System who provided a population-based sample of women with the first diagnosis of breast cancer. Inclusion criteria included: at least 21 years of age, diagnosed with histologically confirmed Stage I-III breast cancer within the past 3 years of study entry, no evidence of recurrent or metastatic disease, and may be on hormonal therapy (i.e., aromatase inhibitor or tamoxifen) at study entry. The RBCS Principal Investigator received institutional review board approval to conduct the primary study.

Descriptive statistics for participant demographic and cancer treatment characteristics were tabulated.

Content Analysis

Because the domains in the QOL-BCS measure multiple constructs (e.g., Social well-being includes family distress, sexuality, and financial burden) a content analysis was conducted by an expert oncology nurse researcher with over 20 years of experience in breast-cancer survivorship studies, and who participated in the development of the original QOL-CS. The purpose of the content analysis was to select the items applicable to most BCS regardless of age or treatment received, and to organize these items into clinically meaningful dimensions.

Item Analysis

A combination of classical psychometric methods and Item Response Theory (IRT) methods was used for item selection and for testing the instrument structure resulting from the content analysis. Combining these two analytical paradigms offers advantages in terms of quality of the resulting instruments: the classical psychometric analysis focuses on estimating and testing the dimensional structure of the items, while the IRT methods also focus on the performance of the items in classifying subjects along an underlying latent continuum (Kelly, Kallen, & Suarez-Almazor, 2007; Kyngdon, 2004; Waugh & Chapman, 2005). The item analysis strategy used in this study consisted of preliminary item selection conducted with exploratory factor analyses and separately with IRT methods, and then a confirmatory factor analysis with the items selected by either of the preliminary selection procedures. The analyses were conducted using SAS (version 9.3) and R (version 2.15.0) software packages.

Item selection with Exploratory Factor Analysis (EFA)—Within each of the dimensions resulting from the content analysis, sequential principal component EFA's were conducted beginning with all the items in the dimension and then removing one-at-a-time the items with the lowest final communality estimate. The sequential procedure stopped when the final communalities for all remaining items within a dimension were equal or greater than 0.55 (i.e. the factor solution explained at least 55% of each remaining item's variability). A final oblique-rotated EFA was conducted with all the items selected by the dimension-specific EFA's.

Item selection with IRT methods—Within each of the dimensions resulting from the content analysis, the item selection consisted of two steps. First, a Mokken Scalability Analysis for Polytomous Items (van der Ark, 2007) was conducted in order to identify the items that were unidimensional (i.e. measuring the same latent trait). This clustering procedure selected items based on a measure of unidimensionality called the scalability coefficient, ranging from 0 to 1, where higher values signify that the items belong in a single scale. A cutoff value of 0.5 was used for the scalability coefficient, which indicates a strong suggestion of unidimensionality (Mokken, 1971). Details and examples of Mokken scale analysis using the R package mokken can be found in the reference by van der Ark. Once unidimensionality was established, the second step consisted of a polytomous ordinal item response analysis using two alternative modeling techniques: Unconstrained Graded Response Model (UGRM), and Unconstrained Partial Credit Model (UPCM). Details on these models and their implementation in the R package ltm can be found in the reference by Rizopoulos (2006). The best fitting model between UGRM and UPCM was established using the Akaike Information Criterion (the smaller, the better fitting). With the final model selected, the total scale information measure was estimated as well as the percent of the total information contributed by each item. The percent of the total information indicate the relative ability of an item to discriminate among contiguous trait scores at various locations

along the trait continuum. Items whose percent information accounted for less than 15% of the total scale information were removed.

Model Testing With Confirmatory Factor Analysis (CFA)—The instrument structure resulting from the content analysis but only including items selected by either EFA or IRT methods was tested in an initial structural equation model fitted with Maximum Likelihood but using the Satorra-Bentler scaled test statistic and robust standard errors (Rosseel, 2012) in order to adjust for nonnormality if present. Goodness of fit was assessed with the ratio of the χ^2 statistic by its degrees of freedom (χ^2/df) as well as other commonly used indices such as CFI (comparative fit index), RMSEA (root mean square error of approximation), and SRMR (standardized root mean square residual). Typically, values of χ^2/df smaller than two, CFI values greater than 0.95, RMSEA values smaller than 0.06, and SRMR values smaller than 0.08 are all indicative of good fit (Tabachnick & Fidell, 2007). Initial fit of the model was improved by removing a few ill-fitting items until an acceptable overall fit was achieved. The final model was inspected by the content expert for validity from a conceptual standpoint.

Examination of Convergent Validity

Convergent validity assesses the degree to which two methods of measuring a construct are similar, i.e. converge (Polit & Beck, 2012). To this end, the associations between the revised model's domain scores and two summary scores of a widely-used generic instrument for measuring health-related QOL, the SF-36 (Ware & Sherbourne, 1992), were estimated and tested using common Pearson correlations. The two SF-36 summary scores, the Physical Component and Mental Component Summaries, measure physical and mental functioning, respectively. The domain scores of the revised QOL-BCS model, computed by averaging the items scores within each domain, were reversed so that they were in the same direction of the SF-36 summary measures (higher values indicating better health-related QOL).

Results

Participant Characteristics

A total of 427 BCS were included in the present analyses. Table 2 shows participants' socio-demographic and treatment characteristics. The modal participant was Caucasian, between 46-65 years of age, married or with a partner, having less than college education, working or retired, and with a family income of less than \$50,000. The majority of survivors were within three years after end of treatment, received combined lumpectomy and radiation therapy as primary treatment, and adjuvant chemotherapy. Over 66% of survivors were on hormonal therapy.

Content Analysis

The results of the content analysis are shown in Table 3. Out of the initial pool of 48 items, the content expert selected 38 and organized them into eight clinically meaningful dimensions: 1) Physical well-being, 2) Short-term psychological well-being, 3) Long-term psychological well-being, 4) Distress, 5) Anxiety/Depression, 6) Cancer fear, 7) Social well-being; and 8) Financial/material concerns. Items related to fertility, sexuality, menstrual changes, concerns for daughters, radiation therapy, chemotherapy, and employment were removed from the instrument as they were considered not applicable to all BCS. Cronbach's alpha for the selected 38 items was estimated at 0.95. With the exception of Distress, the dimensions showed adequate internal consistency, as indicated by Cronbach's alpha statistics of at least 0.79. Internal consistency could not be estimated for Financial/material concerns as this dimension was composed of a single item. However, a number of items

showed low corrected item-dimension correlations (i.e. < 0.5), suggesting that these items were not sufficiently related to their dimensions.

Item Analysis

Exploratory Factor Analysis—The results of the final oblique-rotated EFA with all the items selected by the dimension-specific EFA's are shown in Table 4. The procedure selected 18 items within the instrument structure specified by the content analysis. The factors were correlated among each other as suggested by an average inter-factor correlation of 0.42 (SD=0.17, Min.=0.12, Max.=0.68) among the 21 inter-factor correlations. The Financial/material concerns dimension was not included in the EFA analysis, as this single-item dimension was not factorable; instead it was directly tested as a component of the overall model in the CFA.

IRT methods—The results of the IRT procedures are shown in Table 5. Within the instrument structure specified by the content analysis (not including the single-item Financial/material concerns dimension), the scalability step identified 24 items that were considered undimensional. Next, the polytomous ordinal item response analysis step resulted in the selection of 19 items as most informative. The selected items accounted for at least 89% of the information within each dimension.

Confirmatory Factor Analysis—The initial CFA model included 22 items: 16 items selected by both EFA and IRT procedures, two items selected by EFA only, three items selected by IRT only, and the single item for the Financial/material concerns dimension. The final CFA model (Table 6) included 15 items, 13 of which had been selected by both EFA and IRT procedures. The model provided adequate fit to the data, as indicated by the χ^2/df ratio and the other three fit indices. The dimensions were correlated among each other as suggested by an average inter-factor correlation of 0.43 (SD=0.18, Min.=0.17, Max.=0.77). Cronbach's alpha for all 15 items included in the final model was estimated at 0.89, indicating adequate internal consistency. Alpha coefficients and corrected item-dimension correlations for the final model are shown on Table 7 (left panel), all of which indicated adequate internal consistency. After inspection, the final model was approved by the content expert.

Convergent Validity

The examination of the association between the revised QOL-BCS model and the SF-36 summary measures is shown in Table 7 (right panel). The observed relationships indicated adequate convergent validity. Physical well-being was the dimension most strongly associated to the SF-36 Physical Component, with a large-size relationship ($r=0.7$). Medium-size relationships were observed between the SF-36 Physical Component and the Social ($r=0.37$), Short-term psychological ($r=0.35$) and Long-term psychological ($r=0.31$) well-being dimensions. Large-size relationships indicated that the SF-36 Mental Component was strongly associated to Anxiety/Depression ($r=0.74$), Long-term psychological ($r=0.63$), and Social ($r=0.60$) well-being dimensions. Medium-to-large-size relationships were observed between the SF-36 Mental Component and the Short-term psychological ($r=0.47$) and Physical ($r=0.42$) well-being dimensions.

Discussion

The revision of the QOL-BCS instrument presented here resulted in a brief yet comprehensive basis for a multidimensional measure of QOL for BCS irrespective of age or treatment received. The brevity of a revised instrument translates into reduced participant burden. For instance, it is expected that completing the 15 items in the final model will take

an average of six to seven minutes, based on the 22-minute average completion time for the 48-item 2008 QOL-BCS.

Examination of the topics for the selected 15 items suggests that these topics may be relevant to other cancers and not just breast cancer. However, the revision presented here was conducted with data collected on a sample of BCS only; therefore the results cannot be generalized to survivors of other cancers.

Although a fully data driven approach could have been used to conduct the revision, a combination of clinical expertise along with statistical analyses was preferred. This combined approach provided advantages such as allowing the inclusion of a dimension measuring financial/material concerns which, on the basis of statistical criteria alone, should have been removed solely on the fact that the dimension was measured by the single item related to financial burden. A scalability analysis would have dropped that single item by labeling it as non-scalable. However, recent studies have found associations between QOL, economic burden, and financial distress among BCS (K. Meneses, Azuero, Hassey, McNees, & Pisu, 2012). Therefore, including a financial/material concerns dimension in the QOL model may help provide a more holistic view of QOL beyond the classical health-related QOL model.

When the 15 items composing the final model were compared to a widely-used generic measure of health-related QOL such as the SF-36, a strong suggestion of convergent validity was observed, as indicated by high correlations between the SF-36 summary physical and mental functioning measures and comparable dimensions of the revised model. But in addition to providing measures of physical and psychological well-being, the revised model measures aspects specific to cancer, such as cancer fear and distress.

This study does not present a final version of the QOL-BCS instrument, as issues regarding the Spiritual well-being dimension, a component of the original QOL-CS model, are yet to be resolved. These issues include whether a Spiritual well-being dimension should be included in a QOL model, and if so, an item set would need to be developed and tested to measure such dimension, as the original items have not shown to be adequate. Also, a potential problem is that two dimensions in the revised model, Social well-being and Financial/material concerns, are measured by single items. Traditionally, multi-item measures are considered more reliable and less volatile than single-item measures. Therefore, the development of a few items that strengthen the measurement of these two dimensions may be necessary.

The present study is not without limitations. Because of the cross-sectional nature of the data used, the stability of the revised dimensions over time was not examined. Also, data for the present instrument revision was provided by a sample of mostly rural BCS. Generalizability of the measurement model needs to be examined among non-rural BCS. Finally, this study does not provide a comparison of the different QOL measures that have been used in the past 20 years in breast cancer survivorship studies, as it is beyond the scope of the revision presented here. However, references are provided that review several of these instruments (Chopra & Kamal, 2012; Mols, et al., 2005).

Conclusion

The revision of the 48-item QOL-BCS instrument provided the basis for a brief yet comprehensive multidimensional model of QOL applicable to most BCS. Directions for future research include fine-tuning the measurement model by examining additional items to strengthen the measures of Social well-being and Financial/material concerns, the inclusion of a revised Spiritual well-being dimension, and generalizability among non-rural BCS.

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Table 1

Domains and item topics included in the QOL-CS and QOL-BCS instruments

Dimensions and item topics	Instrument Version (year)		
	QOL-CS (1995)	QOL-BCS (2005)	QOL-BCS (2008)
Physical well-being			
Fatigue	X	X	X
Appetite	X	X	X
Aches/pain	X	X	X
Physical strength			X
Shortness of breath		X	X
Lymphedema		X	X
Sleep	X	X	X
Weight gain		X	X
Vaginal dryness		X	X
Menstrual chg/fertility	X		
Menstrual changes		X	X
Hot flashes		X	X
Fertility		X	X
Overall physical health	X	X	X
Constipation	X		
Nausea	X		
Psychological well-being			
Coping	X		
Coping as result of disease		X	X
Coping as result of tx		X	X
Overall QOL single Item	X	X	X
Happiness	X	X	X
Manage situations			X
Enjoy things			X
Satisfaction	X	X	X
Focus on well-being			X
Concentration/memory	X	X	X
Usefulness	X	X	X
Appearance	X	X	X
Self-concept	X	X	X
Diagnosis distress	X	X	X
Cancer tx distress	X		
Distress from tx: Surgery		X	X
Distress from tx: Radiation tx		X	X
Distress from tx: Chemotherapy		X	X

Dimensions and item topics	Instrument Version (year)		
	QOL-CS (1995)	QOL-BCS (2005)	QOL-BCS (2008)
Distress from tx: Completion of tx		X	
Distress since tx ended	X		X
Anxiety	X	X	X
Depression	X	X	X
Overall psychological well-being			X
Fear future tests	X	X	X
Fear new cancer	X	X	X
Fear recurrent cancer	X	X	X
Fear spread cancer	X	X	X
Control	X	X	
Life back to normal		X	X
Social well-being			
Family distress	X	X	X
Support/others	X	X	X
Personal relationships	X	X	X
Sexuality	X	X	X
Employment	X	X	X
Home activities	X	X	X
Isolation	X	X	X
Concern for daughter/fem. relatives		X	X
Financial burden	X	X	X
Overall social well-being			X
Spiritual well-being			
Import. relig. activ.	X	X	
Import. spiritual activ.	X	X	
Spiritual change	X	X	
Life purpose	X	X	
Positive change	X	X	
Uncertainty	X	X	
Hopefulness	X	X	
Total number of items used	41	50	48

Table 2

Participants' socio-demographic and treatment characteristics

Characteristic	N=427	
	n	(%)
Caucasian	402	94.15
Age groups		
35-45	19	4.45
46-65	236	55.27
66-90	172	40.28
Married or partnered	312	73.07
College educated	164	38.41
Employment status		
Full or part time	169	39.58
Retired	194	45.43
Other	64	14.99
Family income *		
\$50,000	207	48.59
>\$50,000	158	37.09
Declined to answer	61	14.32
Time since end of treatment *		
12 months or less	95	22.78
13-36 months	309	74.1
37-48 months	13	3.12
Surgery received		
Lumpectomy	242	56.67
Mastectomy	128	29.98
Bilateral mastectomy	57	13.35
Radiation	302	70.73
Chemotherapy	248	58.08
Hormonal therapy	286	66.98

* Counts <427 due to missing data

Table 3

Content analysis results (N=427)

Dimensions and item topics	Descriptive Statistics		(Cronbach's alpha), Corrected item-dimension correlation*
	Mean (SD)	Median (Minimum-Maximum)	
Physical well-being			(0.85)
Fatigue	4.1 (2.88)	4 (0-10)	0.76
Appetite	1.93 (2.64)	0 (0-10)	0.63
Aches/pain	4.31 (3)	4 (0-10)	0.68
Physical strength	4.01 (2.86)	4 (0-10)	0.71
Shortness of breath	2.1 (2.71)	1 (0-10)	0.49
Sleep	3.41 (3.33)	2 (0-10)	0.57
Weight gain	2.13 (3.07)	0 (0-10)	0.34
Concentration/memory	3.52 (2.54)	3 (0-10)	0.44
Overall physical health	3.23 (2.2)	3 (0-10)	0.49
Short-term psychological well-being			(0.80)
Coping as result of disease	1.94 (2.48)	1 (0-10)	0.62
Coping as result of tx	2.14 (2.68)	1 (0-10)	0.64
Manage situations	1.98 (2.22)	1 (0-10)	0.60
Enjoy things	1.93 (2.6)	1 (0-10)	0.31
Focus on well-being	2.08 (2.63)	1 (0-10)	0.37
Appearance	4.77 (3.83)	5 (0-10)	0.47
Self-concept	2.93 (3.45)	1 (0-10)	0.60
Life back to normal	2.82 (2.72)	2 (0-10)	0.63
Long-term psychological well-being			(0.90)
Happiness	2.24 (2.37)	2 (0-10)	0.85
Satisfaction	1.99 (2.24)	1 (0-10)	0.80
Usefulness	2.28 (2.31)	2 (0-10)	0.71
Overall psychological well-being	2.49 (2.27)	2 (0-10)	0.60
Overall QOL single Item	2.01 (2.15)	1 (0-10)	0.78
Distress			(0.64)
Diagnosis distress	7.4 (3.07)	9 (0-10)	0.56
Distress from tx: Surgery	5.79 (3.47)	6 (0-10)	0.55
Distress since tx ended	3.17 (3.01)	2 (0-10)	0.36
Family distress	5.92 (3.21)	7 (0-10)	0.25
Anxiety/Depression			(0.85)
Anxiety	3.75 (3.04)	3 (0-10)	0.75
Depression	2.79 (2.98)	2 (0-10)	0.75
Cancer fear			(0.95)
Fear future tests	4.67 (3.48)	5 (0-10)	0.81
Fear new cancer	5.11 (3.47)	5 (0-10)	0.93

Dimensions and item topics	Descriptive Statistics		(Cronbach's alpha), Corrected item-dimension correlation*
	Mean (SD)	Median (Minimum-Maximum)	
Fear recurrent cancer	5.04 (3.5)	5 (0-10)	0.91
Fear spread cancer	4.77 (3.65)	5 (0-10)	0.85
Social well-being			(0.79)
Support/others	1.53 (2.35)	0 (0-10)	0.44
Personal relationships	1.44 (2.54)	0 (0-10)	0.46
Home activities	2.74 (2.97)	2 (0-10)	0.60
Isolation	1.7 (2.78)	0 (0-10)	0.69
Overall social well-being	2.19 (2.14)	2 (0-10)	0.69
Financial/material concerns			(N/A)
Financial burden	4.41 (3.68)	4 (0-10)	N/A

* Correlation after removing item

N/A: Not Applicable

Overall Cronbach's alpha=0.95

Table 4

Results of final exploratory factor analysis (N=427)

Dimension	Rotated Factor Pattern (Standardized Regression Coefficients *)							Communality
	Item topic	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7
Physical	Fatigue		0.64					0.64
	Aches/pain		0.87					0.71
	Physical strength		0.83					0.73
Short-term psychological	Coping as result of disease				0.62			0.60
	Coping as result of tx				0.91			0.79
Long-term psychological	Happiness			0.85				0.86
	Satisfaction			0.71				0.73
	Overall QOL single item			0.79				0.77
Distress	Diagnosis distress				1.04			1.00
	Distress from tx: Surgery				0.53			0.43
Anxiety/Depression	Anxiety					0.66		0.72
	Depression					0.81		0.83
Cancer fear	Fear future tests	0.83						0.70
	Fear new cancer	0.96						0.92
	Fear recurrent cancer	0.94						0.90
	Fear spread cancer	0.88						0.79
Social	Isolation				0.31		0.36	0.50
	Overall social well-being						0.93	1.00

* Only standardized coefficients greater than 0.3 in absolute value are shown

Inter-factor correlation mean= 0.42 (SD=0.17, Min.=0.12, Max.=0.68)

Table 5

Item selection by item response theory procedures (N=427)

Dimensions and item topics	Scalability coefficient *	Information		
		Total	%	Cumulative % **
Physical well-being		41.07	100%	
Physical strength	0.72	14.85	36%	36%
Fatigue	0.68	11.26	27%	63%
Aches/pain	0.72	10.52	26%	89%
Appetite	0.64	4.44	11%	
Short-term psychological well-being		35.92	100%	
Coping as result of disease	0.68	13.4	37%	37%
Coping as result of tx	0.68	13.01	36%	73%
Life back to normal	0.58	5.4	15%	88%
Self-concept	0.53	4.11	11%	
Long-term psychological well-being		66.76	100%	
Happiness	0.81	22.59	34%	34%
Satisfaction	0.78	17.35	26%	60%
Overall QOL single Item	0.81	14.33	21%	81%
Usefulness	0.72	7.13	11%	92%
Overall psychological well-being	0.65	5.36	8%	
Distress		34.19	100%	
Diagnosis distress	0.63	30.75	90%	90%
Distress from tx: Surgery	0.63	3.44	10%	
Anxiety/Depression		23.97	100%	
Anxiety	0.77	12.8	53%	53%
Depression	0.77	11.17	47%	100%
Cancer fear		69.5	100%	
Fear new cancer	0.91	28.01	40%	40%
Fear recurrent cancer	0.91	23.53	34%	74%
Fear spread cancer	0.88	10.77	15%	89%
Fear future tests	0.83	7.19	10%	
Social well-being		26.72	100%	
Isolation	0.66	10.43	39%	39%
Overall social well-being	0.66	9.55	36%	75%
Home activities	0.61	6.74	25%	100%

* Items with scalability coefficients <0.5 not shown

** Items selected for CFA based on % information of at least 15%

Table 6

Final confirmatory factor analysis model (N=427)

Factors and items	Path coefficients		R ²
	Estimate (SE) [*]	Standardized	
Physical well-being[†]			
Aches/pain	2.39 (0.13)	0.8	0.64
Physical strength	2.55 (0.12)	0.89	0.79
Short-term psychological well-being[†]			
Coping as result of disease	2.06 (0.13)	0.83	0.69
Coping as result of tx	2.17 (0.13)	0.81	0.66
Long-term psychological well-being[†]			
Happiness	2.15 (0.09)	0.91	0.82
Satisfaction	1.94 (0.11)	0.87	0.75
Distress[†]			
Diagnosis distress	2.42 (0.15)	0.79	0.63
Distress from tx: Surgery	2.63 (0.16)	0.76	0.58
Anxiety/Depression[†]			
Anxiety	2.6 (0.1)	0.86	0.73
Depression	2.6 (0.11)	0.87	0.76
Cancer fear[†]			
Fear new cancer	3.26 (0.09)	0.94	0.88
Fear recurrent cancer	3.38 (0.08)	0.97	0.93
Fear spread cancer	3.25 (0.09)	0.89	0.8
Social well-being[†]			
Overall social well-being	2.14 (0.09)	1	1
Financial/material concerns[†]			
Financial burden	3.68 (0.07)	1	1
Model fit:			
² (64 df)= 88.266, p=0.024; ² /df =1.379			
RMSEA (90% CI) =0.03 (0.014, 0.043)			

Factors and items	Path coefficients		
	Estimate (SE) [*]	Standardized	R ²
	CFI=0.993		
	SRMR = 0.029		

[†]Inter-factor correlations: Mean=0.43, SD=0.18, Min.=0.17, Max.=0.77

^{*}p<.001 for all path coefficient estimates

Table 7

Measures of internal consistency for the final model and correlations with SF-36 summary measures (N=427)

Dimensions and item topics	(Cronbach's alpha), Corrected item-dimension correlation [†]	Correlation with SF-36 Summary Measures	
		Physical Component	Mental Component
Physical well-being	(0.83)	0.70 ***	0.42 ***
Aches/pain	0.71		
Physical strength	0.71		
Short-term psychological well-being	(0.80)	0.35 ***	0.47 ***
Coping as result of disease	0.67		
Coping as result of tx	0.67		
Long-term psychological well-being	(0.88)	0.31 ***	0.63 ***
Happiness	0.79		
Satisfaction	0.79		
Distress	(0.75)	0.02	0.20 ***
Diagnosis distress	0.60		
Distress from tx: Surgery	0.60		
Anxiety/Depression	(0.85)	0.24 ***	0.74 ***
Anxiety	0.75		
Depression	0.75		
Cancer fear	(0.95)	0.12 *	0.25 ***
Fear new cancer	0.90		
Fear recurrent cancer	0.92		
Fear spread cancer	0.87		
Social well-being	(N/A)	0.37 ***	0.60 ***
Overall social well-being	N/A		
Financial/material concerns	(N/A)	0.10 *	0.26 ***
Financial burden	N/A		
Total Score	(0.89)[‡]	.37 ***	.61 ***

[†]Correlation after removing item

*
p<.05;

**
p<.01;

p<.001

N/A: Not applicable

[†]Overall Cronbach's alpha