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Additional Information

Possible substantive improvements in the structure of the Quality of Life in Adult Cancer Survivors (QLACS) scale? A study based on its Spanish version

Abstract

Purpose Quality of Life in Adult Cancer Survivors (QLACS) scale is one of the most commonly used and validated measures to assess the Health Related Quality of Life (HRQoL) in this population.

However, there are some aspects related to its structure that still deserve consideration. The aim of this study was to test the substantive improvement over the original QLACS structure resulting from several proposals reflected in the literature.

Method Using a cross-sectional design and Confirmatory Factorial Analysis, we explored those proposals. Reliability, convergent validity, and factor invariance across three cancer survivorships phases (re-entry, early, and long-term) were also analysed. 1.862 post-treatment survivors of diverse cancer types completed the Spanish versions of QLACS, Brief Symptom Inventory-18 (BSI-18), and Subjective Happiness Scale (SHS).

Results The original model with twelve domains, grouped (with the exception of benefits) into a single total score, versus two subtotal (Generic and Cancer-specific) obtained a good fit. The values of Cronbach's alpha, Composite reliability, Average Variance Extracted indexes and Pearson correlations supported the internal consistency and temporal stability (interval of 2-3 weeks) of the QLACS. Results also showed its adequate convergent validity and an invariant factor structure across survival periods (re-entry survivorship, early survivorship, long-term survivorship).

Conclusion In its original structure, albeit the replacement of the scores on the two subscales by a total score, our results support QLACS as a valid and useful tool for the assessment of HRQoL in post-treatment cancer survivors throughout the different survival phases.

Keywords Quality of Life in Adult Cancer Survivors (QLACS), post-treatment cancer survival, cancer survivorship phases, psychometric properties, assessment

Introduction

The adaptive tasks or challenges of cancer survivorship can span nearly every facet of the lives of people living with the diagnosis. They include physical and medical health domains, psychological

consequences, practical concerns, interpersonal relationships, and existential issues [1-6]. Consequently, with enhanced cancer survival [7], the improvement of HRQoL in cancer survivors is an increasingly important outcome [8-9]. The increasing awareness that patient-reported outcomes (PROs) are an important aspect of cancer survivorship [10] makes the availability of validated PRO instruments an imperative. The information provided will enable better management of the different symptoms and challenges of cancer survivorship by facilitating to inform the planning, targeting and evaluation of the implemented services and interventions [11-12].

The instruments developed to assess the HRQoL of cancer patients -e.g., EORTC QLQ-C30 [13] and General (FACT-G) [14]- do not adequately address the experiences of post-treatment disease-free cancer survivors. While they explore aspects that are no longer relevant in this period (e.g., acute symptoms related to disease and treatments), they fail to consider other specific topics of this cancer phase (reassuming family, work, and social roles, fear of recurrence, benefits of the cancer experience, etc.). Between other PRO instruments [e.g., 15-17] and in response to these issues, Quality of Life in Adult Cancer Survivors (QLACS) scale was developed by Avis et al. [18]. The QLACS scale is based on the multidimensional cancer-related QoL model of Gotay et al. [19] which takes into account both functioning and patient satisfaction with functioning, includes some areas not commonly comprised in other instruments such as psychosocial and financial concern [10], and is one of the QoL measures most commonly used and validated [10, 20-22]. The scale assesses 12 HRQoL domains, seven of which are generic (negative feelings, positive feelings, cognitive problems, physical pain, sexual problems, fatigue, and social avoidance) and five cancer-specific (financial problems, distress-family, appearance concerns, distress-recurrence, and benefits of cancer). In addition to the score in each of the twelve domains, it is possible to obtain Generic and Cancer-specific summary scores.

While the QLACS was originally developed for long-term (5 years) cancer survivors [18, 23], subsequent studies have also evaluated its use for short-term cancer survivors [11, 24-25]. In both cases, the QLACS scale has shown good psychometric properties. However, there are some aspects related to its structure that deserve future consideration. As early as their first exploratory factor analysis to test the scale structure in a sample of long-term survivors, the authors of the instrument [18] found that the sexual problems domain was divided into two correlated factors: *interest* and *functioning*. However, attending to the criteria-based approach, they considered maintain a single domain. In a subsequent study with also

long-term breast cancer survivors, the results obtained by Avis et al. [23] supported the validity of the previous QLACS dimensional structure.

Years later, Ashley et al. [11] conducted a study to examine the dimensional structure of QLACS in a sample of shorter-term cancer survivors using Rasch analysis. The results demonstrated the unidimensionality for the Cancer-specific subscale and the cancer benefit domain. However, despite the elimination of several misfitting items (all sexual problem items, two pain items, and one social avoidance item), the results did not support the validity of computing a Generic summary score. In contrast, the Generic scale would be subdivided, according to the authors' results, into two factors of positive and negative loading items interpreted as emotional (positive feelings, negative feelings and social avoidance domains) and physical (fatigue, pain and cognitive domains) aspects. Analyzed separately, the items of the sexual subscale were again divided into the two factors related to *interest* and *function* like Avis et al. [18].

Finally, the validation of the Spanish version of the QLACS scale [24] explored the QLACS factor-structure also in a sample of shorter-term cancer survivors through two different approaches: Confirmatory Factor Analysis (CFA) and Rasch analysis. The results of the second-order CFA for the original model hypothesized by Avis et al. [18] provided satisfactory fit indices. On the other hand, after excluding misfitting items (all sexual problems items, all financial problems items, two positive feelings items, and two social avoidance items), the model based on the Rasch analysis supported the one-dimensionality of both Generic and Cancer Specific summary subscales. The data also supported the one-dimensionality of domains of cancer benefits, sexual problems (although local dependence was detected) and financial problems (although with differential item functioning in two cases). The second-order CFA for model based on these results provided again satisfactory fit indices and almost identical to those obtained for the Avis et al. [18].

In light of the above, there are several issues regarding the structure of QLACS scale that still need some consideration. Is the sexual problem domain one-dimensional or two-dimensional? Should it be included in the Generic subscale or considered separately? Should economic problems domain be part of the Cancer-specific subscale or considered as a separate domain? Would it be better to consider the Generic subscale as one- or two-dimensional? Therefore, the main objective of this study was to analyze, using Confirmatory Factor Analysis, the possible significant improvements in the original structure of the QLACS scale implied by the aforementioned questions. Moreover, the feasibility of providing QLACS

with a total score to facilitate comparison of the results obtained in different subgroups (type of cancer, cancer survival stage, etc.) of people with cancer was a final structural proposal under consideration. Lastly, we explored the internal consistency, temporal stability and convergent validity of the QLACS structural proposal resulting from our previous analysis.

Secondly, it has been suggested that there should be three, rather than two, phases to differentiate in the often-lengthy period following primary treatment given the different challenges involved [26-27]. This suggestion is specific to differentiate cancer survivors who are in the first year after completion of primary treatment. This first or re-entry phase involves the transition from patient to survivor. It is characterized by the loss of the active treatment safety net, as well as frequent medical appointments, resumption or revision of major life roles, diminished interpersonal support, and experience of lingering or emergent effects of diagnosis and treatment [6]. Consequently, a final aim of the present study was to test the factorial invariance and differential validity of the QLACS scale over survival time, distinguishing one more phase with respect to the traditional differentiation between short and long survivorship.

Materials and methods

Procedure and Participants

This cross-sectional study is part of a research project on QoL and unmet psychosocial needs in adult oncology survivors approved by the Ethic Committee of the different participating medical institutions and cancer patient associations. A total of 2.271 cancer survivors were approached and those who (i) were aged 18 years or older at the time of diagnosis, (ii) disease-free (no evidence of disease), (iii) had completed treatment with curative-intent (with the exception of maintenance treatment) at least 1 month were invited to participate. Of 2.271 approached people, 1.862 (82%) were eligible and provided their conformed written consent. The assessment was carried out during the visit of the survivors for their care attention in the centres. Final sample included cancer survivors ranging from 18 to 92 years old ($M=59.2$; $SD=12.2$) and a relative balanced participation of men and women (see Table 1). Most of them (73%) were married or living with their partner. The-most frequent cancer diagnosis being breast (37%), prostate (16%), colorectal (14%), haematological (6%), head and neck (6%), gynaecological (5%), and melanoma (4%). The majority of survivors had undergone surgery (69%), about half (51%) had received radiotherapy, and over two-thirds (41%) chemotherapy. Finally, the mean time elapsed since the end of

primary treatment was 4.5 years (range: 1 month-30 years): 35% had completed their treatment at least 5 years earlier (long-term survivorship phase LTS); 23% had completed it within 12 months earlier (re-entry survivorship phase, RES), and 42% had exceeded 12 months but had not yet reached 5 years after primary treatment (early survivorship phase, ES) (see Table 1).

Measures

Quality of Life. The QLACS scale [18] comprises 47 items concerning seven Generic and five Cancer-Specific domains (previously listed) and provides twelve domains scores and two subtotal scores corresponding to Generic and Cancer-specific domains of HRQoL in the past month. Each domain consists of 4 items (except distress-family with only 3 items, so the resulting score is multiplied by 1.33 to compare with the rest) rated on a seven-point Likert scale. Higher scores indicating lower HRQoL (except for positive feelings and benefits of cancer). The Spanish version of QLACS [24] was used for this study.

Emotional Distress. The Brief Symptom Inventory-18 (BSI-18) [28] is a self-reported symptom checklist comprising 18 items rated on a five-point Likert scale. The respondents are asked to rate how they have felt during the previous week. The instrument provides three symptom scores (anxiety, depression, and somatization), as well as a total score (Global Severity Index, GSI). The Spanish version of BSI-18 has shown adequate psychometric properties in cancer setting [29, 30]. Cronbach's alpha for the GSI (the only score used) was .93.

Subjective wellbeing. The Subjective Happiness Scale (SHS) [31, 32] is composed of four items scale rated on a seven-point Likert scale. The SHS asks the participant to rate his or her own happiness in absolute, relative terms, and with respect to descriptions of happy or unhappy people. A single composite score is computed by averaging the responses to the four items following reverse coding of the fourth item. Cronbach's coefficient alpha was .81.

Data analysis

To study the structural validity of the QLACS we tested the original proposal by Avis et al. [18] (model A) and four second-order models that reflect the different structural modifications proposed by Ashley et al. [11] and Escobar et al. [24], including in all cases the total number of factors and items of the original

instrument: a model in which, following Ashley et al. [11], the sexual problems domain is considered as two-dimensional (model B), a model that, following Ashley et al. [11] and Escobar et al. [24], excludes the sexual problems domain from the Generic subscale (model C), a model that, following Escobar et al. [24], excludes the economic problems domain from the Cancer-specific subscale (model D), and a model in which, following Ashley et al. [11], the Generic subscale is considered to be two-dimensional (model E). The benefits factor is considered in all models as an independent factor. Moreover, we also consider our proposal for one second-order model in which all domains, with the exception of benefits, are grouped into a total score (model F). The possible significant improvement behaved by each modification is analyzed by comparing the model under consideration with the original Avis et al. [18] model.

To assess the goodness-of-fit for the models, we considered the Satorra-Bentler chi-squared statistic (SB X2) and other goodness-fit indexes: Robust Comparative Fit Index (R-CFI; cutoff values close to 0.95), Root Mean Square Error of Approximation (RMSEA; cutoff values lower than 0.08), Robust Non-Normed Fit Index (R-NNFI; cutoff values of 0.90), and Robust Akaike Information Criterion (R-AIC) as described by Hu and Bentler [33] and Browne and Cudeck [34]. However, Hu and Bentler's [33] guidelines are regarded as a conservative approach to the performance of fit statistics, which may vary depending on the complexity of the specified model [35]. Internal consistency of the QLACS was assessed using Cronbach's alpha, Composite reliability and average variance extracted indexes. The test-retest reliability analysis was conducted on 69 subjects assessed at an interval of two or three weeks. The convergent validity of the QLACS was tested through correlations between total and domain scores of the QLACS and the following criterion measures: BSI-18 (GSI) and SHS (Total score). Both convergent validity and test-retest reliability were explored using Pearson correlation coefficients. The suitability of a total score was explored by estimating two bifactor models. The first bifactor model hypothesized that the correlations between domains were due to the presence of a general factor, comparing the weight of domain-specific factors with respect to the total score. The second bifactor model was defined equally for both models without distinguishing variations between Model A and B. This second bifactor model compared the weight of each specific and generic subscale with respect to the total score. For the interpretation of the hierarchical omega index w_H , magnitudes $\geq .70$ are expected to conclude, at least partially, in favor of unidimensionality [36]. On the other hand, for the case of w_E values $\geq .30$ could be considered as significant [37]. Additionally, measurement invariance procedures were applied in order to test for configural, metric and scalar robustness of the suggested model across survival periods. Finally,

after examining the measurement invariance of the selected model across the three previously mentioned survivorship phases, we analyzed the differences in the QLACS scale as a function of survival phase through a one – way Analysis of Variance.

Results

Structural validity

The goodness – of – fit of the suggested models was evaluated and compared (Table 2). While the fit to the data exhibited by the different models tested was quite similar, Models C and E were excluded due to their comparatively high R-AIC values. In addition, since Model D obtained similar performance to the original version of the scale (Model A), we opted for excluding it from subsequent analysis for the sake of parsimony. This conservative approach led us to select Model A and Model B as the best – fitting and theoretically supported models to improve. Thus, two new models (Model F_A and Model F_B) were built as counterparts of Model A and Model B, in which the different domains contemplated by each one (except benefits) were grouped into a single total score. In both cases, the R-AIC index showed the superiority of fit of these new models compared to the initial A and B models.

In addition, the appropriateness of using a total score on domains, instead of subscales, is evidenced by the comparison of the goodness-of-fit of the bifactor models. First, the bifactor model applied to the eleven generic and specific domains (except cancer benefits) versus the total score confirmed the strength of the total score (*Model A: $w_H = 88.6\%$, Model B: $w_H = 89.0\%$*) versus the variance explained by each of these domains

(*Model A: $w_E \sim 1\%$ all domains; Model B: *Idem, except for sexual function $w_E = 0.4\%$ and sexual interest $w_E = 0.3\%$**). In contrast, the bifactor model applied to the two subscales generic and specific versus total score showed considerable differences in the variance explained by each subscale (*Both models: $w_E = 2.5\%$ for cancer – specific factor and $w_E = 32.1\%$ and $w_H = 60.6\%$*). Both bifactor models fit the data satisfactorily, but this result is not surprising as there is evidence that traditional fit indices (e.g. CFI, RMSEA, etc.) tend to favor bifactor models.

The examination of the modification indexes suggested by the CFA in both models led us to include error covariances between three pairs of items belonging to three different domains: sexual (10-12), pain (13-21) and family distress (31-34). In addition to their belonging to the same QoL domain, the similarity in terms of the content reflected by each pair of items also stands out. The items belonging to the sexual

domain are precisely the two that measure sexual function (vs. interest). In contrast to the other items that explore the domain, items 13 and 21 assess the presence of pain rather than its socio-emotional impact. Finally, items 31 and 34 address the generic fear of family members having cancer as opposed to concern about the actual fact of having to undergo genetic testing.

The inclusion of those error covariances improved substantially the goodness of fit of these selected models (Improved Model F_A : $S.B.X^2 = 3916$, $df = 1012$, $\frac{S.B.X^2}{df} = 3.9$, $NNFI = .915$, $CFI = .915$, $R-AIC = 1878$, $R-RMSEA = .041$; Improved Model F_B : $S.B.X^2 = 4513$, $df = 1020$, $\frac{S.B.X^2}{df} = 4.4$, $NNFI = .898$, $CFI = .903$, $R-AIC = 2473$, $R-RMSEA = .045$).

Reliability and convergent validity

Cronbach's alpha values were higher than .70 in all domains, summary scales, and total scores (Table 3). Composite reliability (CR) values also corroborate the internal consistency of all subscales, except for sexual function (34%). The values of the Average Variance Extracted (AVE) did not surpass the accepted value of 50% (except for sexual interest, fatigue, social avoidance, and distress-family domains). However, since CR values were greater than 0.6, the reliability of these subscales can be considered adequate even although values of AVE range from 40% to 50% [38]. This, however, would not be the case for the sexual function domain. As a consequence, improved model F_B that include this domain was not considered in subsequent analyses. The test-retest reliability values (range .60-.88) showed high temporal stability of QLACS scale over two/three weeks.

Table 3 also shows the correlations between the total score and domains of the QLACS and BSI-18 and SHS. As expected, the association was positive with emotional distress and negative with subjective well-being. QLACS total score was highly correlated with emotional distress. Among domains, negative feelings, fatigue, and pain showed the highest correlations while financial problems and distress-family were the least associated with this criterion variable. On average, associations were lower with subjective well-being. Only positive feelings and negative feelings domains showed a high association, the rest of domains, as well as total score showed moderate/weak correlations with subjective well-being. Once again, distress-family and financial problems were the domains least associated with criteria measure.

Factorial invariance and differences in HRQoL by survivorship phase

In order to test the robustness of model F_A between the three observed survival periods, we firstly assessed configural invariance, which provided adequate fit of the baseline model $X^2(df = 3057) = 7149$ ($p < .001$), $SB - X^2(df = 3057) = 5928$ ($p < .001$), $R - CFI = 0.920$, $R - RMSEA = 0.041$ [0.039, 0.043]. The model assessing metric invariance between survival periods indicated no significant difference between the baseline model ($\Delta X^2 = 98$, $\Delta df = 70$, $p < .001$, $\Delta CFI = 0.01$), suggesting there were similar factor loadings onto different survival periods. Significant changes between confirmatory fit indexes were assessed rather than modifications in the X^2 statistic, due to its sensitivity to large sample sizes. Finally, scalar invariance was confirmed for this model ($\Delta X^2 = 260$, $\Delta df = 164$, $p < .001$, $\Delta CFI = 0.01$), proving the invariance of item intercepts across survival periods.

Having supported the invariance of the QLACS structure across the different survival periods established, we proceeded to examine possible mean differences between survival groups. As Table 4 shows, the differences in HRQoL between the survival subgroups were mainly concentrated in the generic domains and between the re-entry and long-survival phases. Survivors in the re-entry phase reported less positive feelings and more fatigue than the other two subgroups. They also indicated more negative feelings, pain, social avoidance, sexual problems, concern about appearance, and lower perceived benefits of cancer than long-term survivors. Compared to long-term survivors, the short survivors manifested more fatigue, more sexual problems and less benefit from cancer.

Discussion

The main focus of this paper was to analyse, using the Spanish version of the instrument, the substantive improvement over the original QLACS structure resulting from several possible modifications collected in the literature [11, 24]. In contrast to some of the suggestion [11, 24], our results showed that excluding the sexual and economic domains from the generic and cancer-specific subscales, respectively, did not lead to improvements in the fit of the QLACS factor structure. Additionally, the proposal by Ashley et al. [11] to consider the generic subscale as two-dimensional, contemplating the emotional aspects and the physical aspects separately, did not represent a significant improvement to the QLACS structure either. The only modification tested that obtained empirical support in our study was the consideration of the

sexual problems domain as two-dimensional; something already contemplated even in the initial study by Avis et al. [18]. However, two reasons lead us to recommend maintaining a single domain of sexual problems as opposed to dividing into a double domain of function and interest. We consider that the minimal improvement in the model fit resulting from this modification does not outweigh the difficulties of empirical underidentification, highlighted by our own results, derived from assessing a variable based on only two items [39]. In spite of what has been said and in accordance with the weakness of the sexual factor structure suggested by the path coefficients and error covariance, future qualitative research would be desirable to deepen the differentiation of the aspects of sexual function and interest and to include new items that allow their reliable assessment. Likewise, future qualitative research would also be advisable to improve the evaluation of the financial factor, given the low loading that characterizes one of the items that compose it. Regarding this last factor, it is also necessary to point out a possible limitation of the results obtained that has to do with the fact that financial costs of cancer treatments are covered by the National Health Service in Spain. Thus, the validity of our results, particularly in reference to the financial domain, should be established in those countries with different health care coverage. Regarding the higher-order structure, our results supported the use of a total score versus that of the generic and specific subscales. The starting point that justified the establishment of these subscales continues to be useful for the recognition of aspects specifically linked to cancer, such as concern about the recurrence of the disease as well as the possibility of other family members suffering from it. However, their usefulness in the assessment and comparison of quality of life between different subgroups (defined by type of cancer, survival time, etc.) seems less than that of using an average rating or turning directly to the domains assessed, in order to be able appreciate the impact of the disease on each of them. Likewise, our results also provide validity to the calculation of a total score in HRQoL from QLACS as has been done in some previous study [40].

Based on the model described above, the scores provided by the QLACS scale (domains and total score) showed satisfactory levels both internal consistency (Cronbach's alpha, Composite Reliability and Average Variance Extracted) and temporal stability in a two or three-week interval. Probably due to the more general content they refer to (e.g., pain vs. distress-family), the overall association with the criterion measures of distress and well-being was greater for the different generic domains than for those cancer-specific. Likewise, given the focus on the negative impact of cancer on the subject's HRQoL and consistent with the predominant two-dimensional conception of the structure of positive and negative

affect [41-42], the different QLACS scores showed a greater association with emotional distress than with subjective well-being. Just as, positive feelings and benefits of cancer domains showed greater association with subjective well-being than with emotional distress. Consequently, the relationship of the QLACS with these two criterion variables provides us with relevant information regarding well-being/distress associated with the impact that cancer and its treatment have had on the subject's HRQoL, as well as the construct validity of the instrument.

The QLACS final factor structure was invariant across cancer survivorship phases, supporting the validity of the scale for assessing HRQoL throughout the survival period. The differences between the subgroups were established mainly in the domains considered to be generic. In all of them (with the exception of cognitive problems), QoL was better in long-term survivors and worse in those in the re-entry phase. In contrast, among the domains defined as cancer-specific, the presence of financial problems and distress about both family and recurrence was similar in the different survival phases. Only concerns about the appearance and benefits of cancer showed scores indicative of better HRQoL in those survivors who had completed primary treatment 5 years or more earlier. Consequently, the greater impact on HRQoL characterizing the re-entry subgroup supports the consideration of this phase as distinct from the more usual short and long survival phases. It seems, indeed, that the first year after the end of primary treatment constitutes a patient-to-survivor transition phase that requires particular attention, as psychosocial and behavioral experiences are more pronounced than in other phases of post-treatment survival [6, 26-27]. The view of this initial period after the end of treatment as a specific phase with particular characteristics has also been recently endorsed by the EORTC Quality of Life Group [9].

Patient-reported HRQoL measurements are crucial to good patient-physician communication and adequate health care of cancer survivors. While opening the lines of communication between patient and physician, the inclusion of timely and accurate HRQoL assessment in routine clinical care can translate into better management of areas most impacted in each survivor by cancer and its treatment [43]. The results obtained in this study, using the Spanish version of the QLACS [24], support the validity of the first-order original structure of the scale [18] as well as the feasibility of a total HRQoL score. At the same time, they extend the validity and usefulness of the QLACS in its use across different phases of survivorship (re-entry, early and long-term survivorship) and in a wide group of survivors with different cancer types (breast, prostate, colorectal, hematologic, head & neck, gynaecologic, melanoma, etc.). In short, QLACS scale is a cancer PRO instrument suitable for capturing problems in the different adaptive

tasks (medical health, psychological, practical, interpersonal, and existential) experienced by post-treatment cancer survivors.

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Declarations

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Conflicts of interest

All authors declare that they have no conflict of interest

Data Transparency

The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

All authors whose names appear on the submission made a substantial contribution to the conception or design of the work and/or the acquisition, analysis, or interpretation of data. Moreover, all authors have drafted the work and approved the version to be published.

Ethics approval

This study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments. The study was approved by the ethics committees of the main participating centers that had such a committee: F.I.V.O., Hospital Clínico Universitario de Valencia, Hospital Universitario Dr. Peset de Valencia.

Consent to participate

All participants gave their informed consent prior to their inclusion in the study.

Consent to publish

Not applicable

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Table 1. Characteristics of the sample.

Variable		n	%
Mean: 59.2; SD=12.2 Range (18-92)		1823	-
Sex	Female	1094	58.8
	Male	753	41.2
Civil status (<i>n</i> =1.820)	Single	164	9.0
	Married / Partner	1328	73.0
	Divorced	198	10.9
	Widowed	130	7.1
Level of studies (<i>n</i> =1.763)	No studies	134	7.7
	Primary education	717	41.1
	Secondary education	372	21.3
	Higher education	540	31.0
Employment status (<i>n</i> = 1.788)	Employed	495	27.7
	Unemployed	164	15.2
	Retired/on sick leave	930	41.7
	Housework	166	9.3
	Other	35	6.2
Cancer-site (<i>n</i> =1.827)	Breast	673	36.8
	Prostate	288	15.8
	Colorectal	250	13.7
	Hematologic	108	5.9

	Head & neck	106	5.8
	Gynaecologic	97	5.3
	Melanoma	80	4.4
	Multiple	95	5.2
	Others (lung, genitourinary, gastric, brain, thyroid, sarcoma, etc.)	130	7.1
Primary treatments (<i>n</i> =1.823)	Surgery (S)	342	18.8
	Chemotherapy (CT)	77	4.2
	Radiotherapy (RT)	126	6.9
	S+CT+RT	602	33.0
	S+CT	249	13.7
	S+RT	351	19.3
	CT+RT	76	4.2
Time since the end of primary treatment (<i>n</i> =1.825) (mean=53.7; SD=54.2; Range: 1- 360 months)	≤ 12 months	418	22.9
	>12 months - < 5 years	771	42.2
	≥ 5 years	636	34.8

Table 2. Summary of model fit statistics from the confirmatory factor analysis.

	$S.B. X^2$	d.f. (p – value)	$S.B. X^2/d.f.$	R-CFI	R-NNFI	R-AIC	R-RMSEA
Model A	5865	1017 (< .001)	5.8	.866	.857	3831	.053
Model B	5389	1017 (< .001)	5.3	.879	.871	3355	.050
Model C	6316	1017	6.2	.853	.844	4283	.050
Model D	5877	1017	5.8	.866	.857	3843	.053
Model E	7064	1016	7.0	.833	.822	5032	.059
Model F _A	4694	1022	4.6	.898	.893	2650	.046
Model F _B	4681	1021	4.6	.899	.893	2639	.046

Note: all models include the total number of items of the original instrument. *Model A:* Factor 1 - Generic (negative feelings, positive feelings, cognitive problems, physical pain, fatigue, social avoidance, and sexual problems), Factor 2 - Cancer-specific domains (financial problems, distress-family, appearance concerns, distress-recurrence), and Factor 3 - Benefits of Cancer. *Model B:* Factor 1 - Generic (negative feelings, positive feelings, cognitive problems, physical pain, fatigue, social avoidance, sexual interest, and sexual function), Factor 2 - Cancer-specific domains (financial problems, distress-family, appearance concerns, distress-recurrence), and Factor 3 - Benefits of Cancer. *Model C:* Factor 1 - Generic (negative feelings, positive feelings, cognitive problems, physical pain, fatigue, and social avoidance), Factor 2 - Cancer-specific domains (financial problems, distress-family, appearance concerns, distress-recurrence), Factor 3 - Sexual Problems, and Factor 4 - Benefits of Cancer. *Model D:* Factor 1 - Generic (negative feelings, positive feelings, cognitive problems, physical pain, fatigue, social avoidance, sexual problems), Factor 2 - Cancer-specific domains (distress-family, appearance concerns, distress-recurrence), Factor 3 - Financial Problems, and Factor 4 - Benefits of Cancer. *Model E:* Factor 1 - Emotional (positive feelings, negative feelings and social avoidance domains), Factor 2 - Physical (fatigue, pain, cognitive, and sexual problems domains), Factor 3 - Cancer-specific domains (financial problems, distress-family, appearance concerns, distress-recurrence), and Factor 4 - Benefits of Cancer. *Model F_A:* Factor 1 – QoL TS (negative feelings, positive feelings, cognitive problems, physical pain, fatigue, social avoidance, sexual problems, financial problems, distress-family, appearance concerns, distress-recurrence) and Factor 2 - Benefits of Cancer. *Model F_B:* Factor 1 – QoL TS (negative feelings, positive feelings, cognitive problems, physical pain, fatigue, social avoidance, sexual interest, sexual function, financial problems, distress-family, appearance concerns, distress-recurrence) and Factor 2 - Benefits of Cancer.

Table 3. Summary Statistics for the QLACS Items by Subscale and Criterion measures.

	Scale reliability			Validity		Test – retest corr. (sig.)
	α	CR	AVE	SHS	BSI-18	
Generic	87.9	96.1%	47.0%	-	-	-
Negative feelings	78.0	72.7%	40.5%	-.51	.70	0.75 (<.001)
Positive feelings <i>Not reversed</i>	85.5	79.3%	49.0%	.72	-.58	0.76 (<.001)
Cognitive problems	80.5	75.2%	43.3%	-.38	.57	0.69 (<.001)
Pain	86.3	78.0%	47.1%	-.35	.62	0.83 (<.001)
Sexual problems (<i>only F_A</i>)	78.6	69.7%	38.1%	-.36	.43	0.60 (<.001)
Sexual function (<i>only F_B</i>)	81.2	34.0%	20.5%	-	-	-
Sexual interest (<i>only F_B</i>)	81.0	69.8%	53.6%	-	-	-
Fatigue	86.6	80.9%	51.6%	-.40	.64	0.72 (<.001)
Social avoidance	89.1	82.0%	53.3%	-.48	.57	0.69 (<.001)
Cancer specific:	85.8	92.5%	46.5%	-	-	-
Financial problems	78.4	76.4%	48.1%	-.18	.37	0.67 (<.001)
Distress - family	82.7	77.0%	53.4%	-.11	.23	0.72 (<.001)
Appearance concerns	79.0	73.3%	41.2%	-.27	.46	0.65 (<.001)
Distress - recurrence	82.6	76.6%	45.0%	-.27	.41	0.61 (<.001)
Benefits of cancer	83.6	78.0%	47.4%	.25	-.12	.88
Total HRQoL	90.1	90.7%	45.7%	-.30	.71	.78

Note: SHS = Subjective Happiness Scale; BSI = Brief Symptom Inventory. Validity and test-retest reliability indicators were obtained through Pearson correlations.

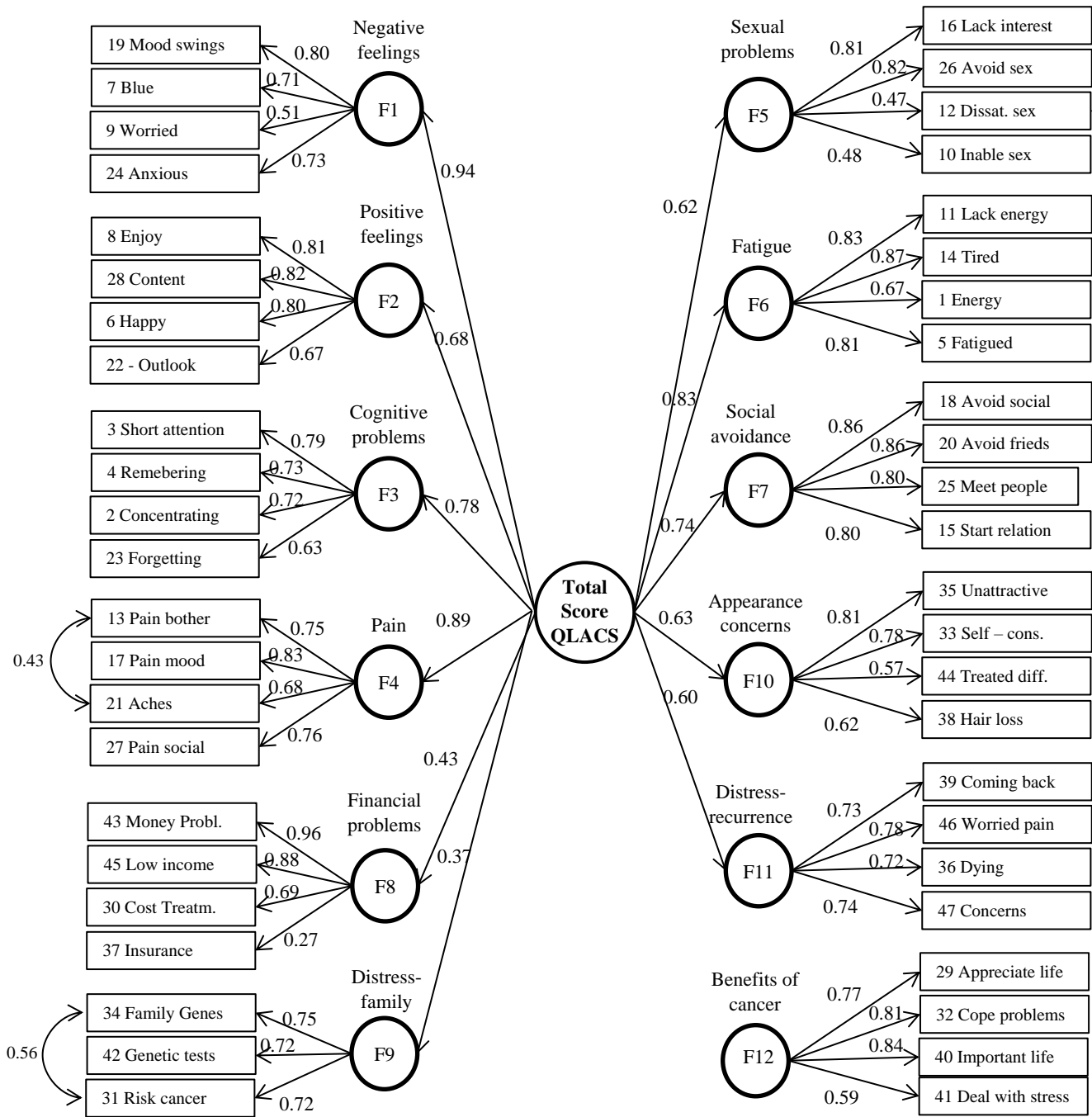


Figure 1. Structural model of the QLACS.

Table 4. ANOVA and Bonferroni post – hoc analysis for survivorship phase.

	RES (N = 415)	ES (N = 760)	LTS (N = 630)	F (Sig.)
Negative feelings	12.8 (5.2) ^c	12.4 (5.3)	11.8 (5.0) ^a	4.5 (0.011)
Positive feelings	19.3 (6.0) ^{b,c}	20.6 (5.7) ^a	21.3 (5.7) ^a	14.4 (0.001)
Cognitive problems	11.1 (5.7)	11.3 (5.6)	10.8 (5.3)	1.3 (0.270)
Physical pain	11.7 (6.0) ^c	10.9 (6.4)	10.4 (6.1) ^a	5.6 (0.004)
Fatigue	13.6 (5.7) ^{b,c}	12.6 (5.9) ^{a,c}	11.6 (5.7) ^{a,b}	15.5 (0.001)
Social Avoidance	8.9 (5.7) ^c	8.5 (5.5)	8.0 (4.9) ^a	3.5 (0.031)
Sexual problems	12.7 (6.9) ^c	12.5 (6.8) ^c	11.5 (5.9) ^{a,b}	6.0 (0.002)
Financial	6.7 (4.6)	7.1 (5.3)	6.5 (4.6)	2.4 (0.095)
Distress-family	13.4 (6.1)	12.8 (6.1)	13.2 (6.1)	1.7 (0.189)
Appearance concerns	10.2 (6.4) ^c	9.5 (6.3)	9.2 (6.1) ^a	3.6 (0.026)
Distress-recurrence	14.6 (7.0)	13.9 (6.7)	13.7 (7.0)	2.2 (0.113)
Benefits	17.3 (7.0) ^c	17.6 (7.0) ^c	18.7 (6.8) ^{a,b}	6.9 (0.001)
Total Scale	134.7 (36.8) ^c	131.8 (38.2)	127.4 (34.5) ^a	4.9 (0.008)

Note: RES: Re-Entry survivorship phase; ES: Early Survivorship phase; LTS: Long-Term Survivorship phase. ^a: significant differences with re-entry survivorship phase; ^b: significant differences with early survivorship phase; ^c: significant differences with long-term survivorship phase