

## Original Article

## Quality of life patient/cancer survivor version in Chinese cancer survivors: A validation study

Hai-Ying Wang<sup>a</sup>, Stephen Wai Hang Kwok<sup>b</sup>, Xian-Liang Liu<sup>a</sup>, Tao Wang<sup>a</sup>, Daniel Bressington<sup>b</sup>, Yushan Shen<sup>c</sup>, Qing Zhang<sup>c</sup>, Hou-Qiang Huang<sup>c</sup>, Jing-Yu Tan (Benjamin)<sup>b,\*</sup>

<sup>a</sup> School of Nursing (Brisbane Centre), Faculty of Health, Charles Darwin University, Brisbane, QLD, Australia

<sup>b</sup> School of Nursing, Faculty of Health, Charles Darwin University, Ellengowan Drive, Casuarina, NT, Australia

<sup>c</sup> Affiliated Hospital of Southwest Medical University, Luzhou, China

## ARTICLE INFO

## Keywords:

Quality of life  
Cancer survivors  
Measurement instrument  
Validation study

## ABSTRACT

**Objective:** To validate the Chinese version of the Quality of Life (QoL) Patient/Cancer Survivor Version (QOLCSV-C) for measuring QoL in Chinese cancer survivors.

**Methods:** The study followed a seven-step research practice guideline for cross-cultural research instrument validation study including translation, adaptation, and psychometric assessment. A forward- and backward-translation procedure was approached, followed by cultural adaptation and acceptability assessment. For its psychometric properties, its concurrent validity with the Functional Assessment of Cancer Therapy-General (FACT-G) was examined with correlation analysis. The internal consistency (Cronbach's alpha) and item-total and item-subtotal correlations of the QOLCSV-C were obtained. Factor analyses were conducted. Floor and ceiling effects and the discriminant performance of the selected variables on QOLCSV-C score were also examined.

**Results:** The QOLCSV-C was translated from the 41-item QOLCSV with four domains: psychological, physical, spiritual and social well-being. The content validity was excellent (CVI = 1.00). Time spent to complete the QOLCSV-C was about 10 min. The QOLCSV-C was found easy to use, appropriate in length, and reflective of their QoL. The strong correlation between QOLCSV-C and FACT-G indicates a satisfactory concurrent validity (Spearman's rho = 0.765,  $P < 0.001$ ,  $n = 205$ ). The overall internal consistency of the QOLCSV-C (Cronbach's alpha = 0.888) and the split-half reliability (Spearman-Brown  $r = 0.918$ ) were excellent. Most of the items show moderate to strong item-total correlation. The exploratory factor analysis revealed a four-factor solution, and confirmatory factor analysis has a satisfactory model fit with indicative items. None of the total scores of QOLCSV-C reveal the floor or ceiling effect. For discriminant performance, variables demonstrating significant between-group differences include sleep quality, pain, fatigue, nausea, physical health, and financial burden.

**Conclusions:** The QOLCSV-C is a reliable and valid instrument for measuring the QoL in Chinese cancer survivors. Future studies can explore the factor structure, gender universal or specific items, and significant predictors of QoL of cancer survivors in different cultures.

## Introduction

With the advancement of medical technology and treatments, cancer survival rates have been consistently increasing.<sup>1-3</sup> Pursuing high levels of quality of life (QoL) has become a crucial goal, particularly for those who have completed curative anticancer treatment.<sup>4,5</sup> The concept of QoL indicates the "goodness" of multiple aspects of an individual's life from physical, psychological, social and functional perspectives.<sup>6,7</sup>

Cancer and its associated treatments can have a significant impact on an individual's QoL. A survey showed that 82.3% of cancer survivors rated their QoL as low.<sup>8</sup> To improve the QoL of cancer survivors, measuring QoL is the initial step. Measuring QoL can provide information on survivors' unmet needs, physical symptoms, psychosocial issues, cancer treatment outcomes, cancer progress, and future intervention requirements, and all of this information provides evidence to healthcare professionals to take appropriate actions to improve survivor care.<sup>8-10</sup>

\* Corresponding author.

E-mail address: [benjamin.tan@cdu.edu.au](mailto:benjamin.tan@cdu.edu.au) (J.-Y. Tan).

<https://doi.org/10.1016/j.apjon.2023.100255>

Received 13 March 2023; Accepted 2 June 2023

2347-5625/© 2023 The Authors. Published by Elsevier Inc. on behalf of Asian Oncology Nursing Society. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Numerous instruments have been utilized in practice and research to assess the concept of QoL in cancer survivors, such as the European Organization for Research and Treatment of Cancer QLQ-C30 (EORTC QLQ-C30),<sup>11,12</sup> the Functional Assessment of Cancer Therapy-General (FACT-G),<sup>13,14</sup> the Functional Assessment of Cancer Therapy-Breast (FACT-B),<sup>15</sup> the 36-Item Short Form Survey (SF-36),<sup>16</sup> the Warwick-Edinburgh Mental Wellbeing Scale (WEMWBS),<sup>17</sup> the EuroQol 5 Dimension (EQ-5D),<sup>18</sup> the Quality of Life Patient/Cancer Survivor Version (QOLCSV),<sup>19</sup> and others.<sup>10,20</sup> However, despite the abundance of QoL measurement instruments available, very few instruments are specifically designed to measure the QoL of cancer survivors, particularly for those who have completed their initial curative anticancer treatment and in cancer survivorship care. For instance, the EQ-5 is a generic QoL measurement tool, not specifically developed for cancer survivors.<sup>21,22</sup> The FACT-B is intended for patients with breast cancer only. The FACT-G was initially developed to measure “patients receiving cancer treatment”<sup>23</sup> and not for survivors who have completed curative anticancer treatment. As a result, to fully capture the unique experiences and challenges faced by cancer survivors who have finished their initial curative anticancer treatment,<sup>4</sup> an appropriate QoL measurement tool is required.

The QOLCSV is a 41-item instrument specially designed for measuring QoL among cancer survivors.<sup>19</sup> It was developed by Ferrell, Hassey Dow and Grant<sup>19</sup> at the City of Hope National Medical Centre in California, USA. The QOLCSV has demonstrated concurrent validity with FACT showing moderate to strong correlations ( $r = 0.44-0.74$ ) between corresponding subscales. The QOLCSV also has a satisfactory test-retest reliability overall ( $r = 0.89$ ), and in its subscales such as physical well-being (items 1–8) ( $r = 0.88$ ), psychological well-being (item 9–26) ( $r = 0.88$ ), social well-being (items 27–34) ( $r = 0.81$ ), and spiritual well-being (items 35–41) ( $r = 0.90$ ).<sup>19</sup> It also demonstrated excellent to acceptable internal consistency in term of Cronbach's alpha of the global scale ( $\alpha = 0.93$ ) and the subscales of physical well-being ( $\alpha = 0.77$ ), psychological well-being ( $\alpha = 0.89$ ), social well-being ( $\alpha = 0.81$ ), and spiritual well-being ( $\alpha = 0.71$ ). The QOLCSV has been validated in various languages including Korean,<sup>24</sup> Japanese,<sup>25</sup> and Dutch<sup>26</sup> with satisfactory outcomes. However, this instrument has not been validated among Chinese cancer survivors and there is a need for such instrument.<sup>27</sup> Also, the operational definition of long-term survivor was unclear.

Cancer survivor is defined as a person with a diagnosis of cancer but still alive.<sup>28</sup> Although there is no consensus on a clear definition of long-term cancer survivors,<sup>29</sup> usually it indicates cancer survivors who have lived for 2–5 years since their first diagnosis of cancer.<sup>30–32</sup> The present study recruited cancer survivors who had completed their initial curative anticancer treatment for six months and over considering that many cancer survivors can restore their energy levels to normal within 6 months of completing the treatment,<sup>33</sup> and both short-term (1–5 years) and long-term ( $\geq 5$  years) cancer survivors experience similar levels of morbidity, psychosocial situation, and lifestyle changes.<sup>34</sup> This study aims to validate the Chinese version of the QOLCSV in Chinese cancer survivors.

## Methods

### Ethics consideration

The study is to determine the psychometric properties of the Chinese version of the QOLCSV and its utility in measuring the QoL among Chinese cancer survivors. This study is part of a multi-phased research project that has obtained ethical approval from the Human Research Ethics Committee at Charles Darwin University (IRB No. H21089) and the Clinical Trial Ethics Committee at the Affiliated Hospital of Southwest Medical University (IRB No. KY2022107). Before the study's initiation, formal approval was obtained from the original instrument developer, granting permission for the translation and validation of the QOLCSV in a Chinese population of cancer survivors.

### Validation pipeline

This study followed a seven-step research practice guideline for cross-cultural research instrument validation study, including translation, adaptation, and psychometric assessment.<sup>35</sup> The adaptation stage involves investigations on acceptability and content validity. Psychometric assessment includes works on concurrent validity, internal consistency, item-total, and item-subtotal correlations, as well as factor analysis. In addition, floor and ceiling effects and discriminant performance analysis were conducted.

### Translation (steps 1–4)

Based on the practice guideline, the translation process consists of steps 1–4 using forward- and backward-translation approach.<sup>35</sup> In step 1, two bilingual and bicultural (English and Chinese) translators independently translated the original English QOLCSV into simplified Chinese. In step 2, the third bilingual and bicultural (English and Chinese) translator consolidated the two translated Chinese versions from step 1 into one version. In step 3, two additional bilingual and bicultural (English and Chinese) translators, who did not involve in the previous two steps, translated the Chinese version (developed in step 2) back into English. In step 4, another bilingual and bicultural (English and Chinese) translator consolidated the translated English versions (from step 3) into one version. The six translators were all Australian healthcare professionals with an average working experience of over 10 years. Among them, four were Australian registered nurses, and two were medical practitioners. Any discrepancies and ambiguities were discussed among translators and resolved through the research team meeting attended by four additional bilingual and bicultural (English and Chinese) healthcare research professionals until the consensus was reached and the prefinal Chinese QOLCSV was confirmed.

### Adaptation (steps 5–6)

**Acceptability.** According to the Medical Research Council framework, a pilot test of the main study is essential,<sup>36</sup> and a sample size of 10 participants for pilot testing of a translated instrument is considered acceptable.<sup>35</sup> Therefore, the prefinal Chinese QOLCSV was piloted that the investigator recruited 10 adult cancer survivors at the Affiliated Hospital of Southwest Medical University. Participants were asked to complete the prefinal Chinese QOLCSV, followed by eight questions related to the readability and clarity of the instrument. These questions aimed to assess whether the instrument accurately reflected participants' QoL, if it was easy to complete, if any items were ambiguous or difficult to understand, if any items were too sensitive to answer, if the length and font size were appropriate, how much time was spent to complete the instrument, and any suggestions for improvement.

**Content validity.** Following the pilot test, a content validity test was conducted. Typically, a panel of 6–10 members is recommended.<sup>37</sup> This study recruited a panel of six oncological healthcare experts. The inclusion criteria were (1) having a minimum of 10 years work experience in the fields of cancer-related treatment, care, or rehabilitation; (2) possessing at least a graduate degree or higher in healthcare; and (3) holding an intermediate or high-level academic position at a university or clinical setting. The characteristics of the panel experts are presented in [Table 1](#). The panel experts rated the prefinal Chinese version of the QOLCSV (QOLCSV-C) using a Likert scale from 1 to 4 (1 = “not relevant,” 2 = “somewhat relevant,” 3 = “quite relevant,” and 4 = “very relevant”) in terms of feasibility, usability, and clarity.<sup>38</sup> Based on the cutoff of Item-level Content Validity Index (I-CVI) and Scale-level Content Validity Index (S-CVI) recommended by Polit, Beck and Owen,<sup>39</sup> we determined that a rating of 3 or above for each item and on average given by at least five out of six raters ( $CVI \geq 0.83$ ) will satisfy the content validity. The outcome of Content Validity Index (CVI) is presented in [Table 2](#).

**Table 1**  
Characteristics of the panel experts (N = 6).

Characteristics		n
Gender	Male	1
	Female	5
Age in years	30–40	1
	41–50	5
Profession	Medicine	2
	Nursing	4
Institution	University	1
	Hospital	5
Professional title	Medical consultant	2
	Clinical nursing professor	1
	Associate clinical nursing professor	2
	Senior lecturer	1
Highest academic qualification	Doctorate degree	4
	Postgraduate certificate	2
Years of professional experience	10–15	2
	16–20	2
	> 20	2

Based on the feedback from the participants of the pilot test and the experts, the prefinal Chinese QOLCSV was modified. Item 35 was added to include “going to temple to worship,” and item 36 was added to include “think quietly.” These modifications were based on cultural suitability considerations, as “going to church” and “meditation” are not as popular among Chinese people. The research team then finalized the QOLCSV-C (Appendix A). The finalized QOLCSV-C and its according translated English version were sent to the original developer for approval before the study commencements.

*Psychometric assessment (step 7)*

*Study setting and participants.* Eligible participants were recruited from the Affiliated Hospital of Southwest Medical University, Sichuan, China, from June to August in 2022. The participants inclusion criteria were as follow: (1) has completed initial curative anticancer treatment for at least six months regardless of cancer types, stage and recurrence; (2) aged 18 years and above; (3) can read and understand Mandarin Chinese; (4)

**Table 2**  
CVI of QOLCSV-C for items and the scale rated by experts (N = 6).

Item descriptions	(4) n	(3) n	(4) or (3) n	I-CVI
<b>Physical well-being</b>				
1. Fatigue	4	2	6	1.00
2. Appetite change	5	1	6	1.00
3. Aches or pain	4	2	6	1.00
4. Sleep changes	5	1	6	1.00
5. Constipation	5	1	6	1.00
6. Nausea	5	1	6	1.00
7. Menstrual changes or fertility	5	1	6	1.00
8. Rate your overall physical health	5	1	6	1.00
<b>Psychological well-being</b>				
9. How difficult is it for you to cope today as a result of your disease and treatment?	4	2	6	1.00
10. How good is your quality of life?	5	1	6	1.00
11. How much happiness do you feel?	5	1	6	1.00
12. Do you feel like you are in control of things in your life?	5	1	6	1.00
13. How satisfying is your life?	5	1	6	1.00
14. How is your present ability to concentrate or to remember things?	5	1	6	1.00
15. How useful do you feel?	5	1	6	1.00
16. Has your illness or treatment caused changes in your appearance?	5	1	6	1.00
17. Has your illness or treatment caused changes in your self concept (the way you see yourself)?	5	1	6	1.00
<b>How distressing were the following aspects of your illness and treatment?</b>				
18. Initial diagnosis	5	1	6	1.00
19. Cancer treatments (ie, chemotherapy, radiation, or surgery)	5	1	6	1.00
20. Time since my treatment was completed	4	2	6	1.00
21. How much anxiety do you have?	5	1	6	1.00
22. How much depression do you have?	5	1	6	1.00
<b>To what extent are you fearful of:</b>				
23. Future diagnostic tests	5	1	6	1.00
24. A second cancer	5	1	6	1.00
25. Recurrence of your cancer	5	1	6	1.00
26. Spreading (metastasis) of your cancer	5	1	6	1.00
<b>Social concerns</b>				
27. How distressing has illness been for your family?	4	2	6	1.00
28. Is the amount of support you receive from others sufficient to meet your needs?	4	2	6	1.00
29. Is your continuing health care interfering with your personal relationships?	4	2	6	1.00
30. Is your sexuality impacted by your illness?	5	1	6	1.00
31. To what degree has your illness and treatment interfered with your employment?	5	1	6	1.00
32. To what degree has your illness and treatment interfered with our activities at home?	5	1	6	1.00
33. How much isolation do you feel is caused by your illness or treatment?	5	1	6	1.00
34. How much financial burden have you incurred as a result of your illness and treatment?	5	1	6	1.00
<b>Spiritual well-being</b>				
35. How important to you is your participation in religious activities such as praying, going to church?	2	4	6	1.00
36. How important to you are other spiritual activities such as meditation?	4	2	6	1.00
37. How much has your spiritual life changed as a result of your cancer diagnosis?	3	3	6	1.00
38. How much uncertainty do you feel about your future?	4	2	6	1.00
39. To what extent has your illness made positive changes in your life?	5	1	6	1.00
40. Do you sense a purpose/mission for your life or a reason for being alive?	5	1	6	1.00
41. How hopeful do you feel?	5	1	6	1.00
<b>S-CVI</b>				<b>1.00</b>

QOLCSV-C, Chinese version of the Quality of Life Patient/Cancer Survivor Version; (4), “very appropriate”; (3), “appropriate”; n: number of experts; I-CVI, item level CVI; S-CVI, scale level CVI.

willing to participate in the study and sign the informed consent form; and (5) physically, emotionally, and cognitively capable of participating in the study. The exclusion criterion was that a patient who was in end-of-life care or palliative care focusing on symptom relief as the primary management strategy rather than curative anticancer treatment.

**Sample size.** According to Terwee, Bot, de Boer, van der Windt, Knol, Dekker, Bouter and de Vet,<sup>40</sup> the recommended sample size in instrument validation studies is 4–10 subjects per item. Assuming the response rate is 80%, the range of sample size will be 205–512. Therefore, our sample size 205 is sufficient for a 41-item tool, given that the response rate in this study was 100%.

#### Study instruments

**Demographic questionnaire.** A specially designed questionnaire was developed for this study to collect demographic data from the participants. The questionnaire included a range of information on the participants, such as their general characteristics (age, weight, height, gender, education level, occupation, marital status, employment, religion, sleep quality, history of smoking and alcohol consumption) as well as their clinical information (cancer diagnosis, cancer stage, completed anticancer treatment, time since treatment completion, and comorbidity conditions).

**QOLCSV-C.** Apart from the cultural adaptation, we have taken rigorous translation procedure to ensure the accuracy in the content and semantics before and after forward and backward translation. The format, domains and scoring scale were unchanged after translation. There were four domains, that is, physical well-being (item 1–8), psychological well-being (item 9–26), social well-being (item 27–34), and spiritual well-being (item 35–41). The cancer survivor can rate each item using a 0–10 scale from 0 = worst outcome to 10 = best outcome,<sup>19</sup> where higher score indicates better QoL.<sup>19</sup> The Chinese version of the QOLCSV had been approved by the original developers in the US before being used in this study.

**FACT-G.** The FACT-G contains 27 items measuring four domains of QoL in cancer patients, including physical (1–7), social (8–14), emotional (15–20), and functional well-being (21–27).<sup>41</sup> Each item is answered using a 5-point Likert scale ranging from 0 (not at all) to 4 (very much). The FACT-G measures the respondents' health state over the last seven days.<sup>41</sup> The total score of the FACT-G is calculated by adding each of the item's scores together ranging from 0 to 108, and a higher score indicates a better QoL.<sup>41</sup> The Chinese version of the FACT-G has been validated with good reliability and validity among Chinese cancer patients in mainland China.<sup>42</sup>

**Data collection.** Cross-sectional data were collected by two trained research assistants who administered the instrument to participants who then self-reported their scores for each item. If a participant had difficulty understanding the questions, the research assistant would provide an unbiased explanation. Similarly, if a participant had difficulty holding a pen due to treatment or disease, the research assistant would assist the participant in filling out the instrument based on the self-reported scores.

#### Statistical analysis

##### Data

The data set contains 132 variables and 205 observations (cases), in which there is one ID variable, 15 demographic variables, 25 clinical characteristics variables, 41 QOLCSV-C items, 12 acceptability variables of QOLCSV-C, 27 FACT-G items, one variable of time spent on FACT-G, and 10 variables of either total or subtotal of QOLCSV-C and FACT-G. The data analysis was conducted by using the software IBM SPSS Statistics for Windows, Version 28.0<sup>43</sup> as well as AMOS 26 for the structural equation modeling (SEM) in confirmatory factor analysis.<sup>44</sup>

#### Demographic characteristics

Categorical data such as age groups, gender, body mass index (BMI) categories, marital status, religion, type of cancer, stage of cancer, education level, employment status, occupation, smoking status, alcohol consumption, treatment completed, and comorbidity are presented as count and percentages. Continuous data such as age in years are presented in mean and standard deviation (SD). The number of months since completion of anticancer treatment, and number of months of having comorbidity are presented in median and interquartile range (IQR).

#### Acceptability of QOLCSV-C

The acceptability outcomes are presented in descriptive statistics. Acceptability was assessed by measuring the data completion rate and the time spent to complete the QOLCSV-C. Additionally, feedback from the participants was gathered through open-ended questions regarding whether (1) the questionnaire accurately reflected their QoL, (2) the questionnaire was easy to fill out, (3) any items were difficult to understand or too sensitive to answer, (4) the length of the questionnaire was appropriate, (5) the font size of the questionnaire was appropriate, and (6) they had any suggestions for improvement. Any answers to open-ended questions were recorded.

#### Scale reliability

The scale reliability of QOLCSV-C is presented in terms of internal consistency, item-total and item-subtotal correlations, and split-half reliability. A Cronbach's alpha  $\geq 0.8$  indicates an adequate internal consistency and demonstrates strong relationships among the items of the instrument.<sup>45</sup> In addition, the items' correlations with its corresponding subscale, other subscales, and the global scale of QOLCSV-C were computed by Spearman's correlation analysis. A correlation coefficient  $\geq 0.4$  is considered adequate.<sup>46</sup> The split-half reliability (Spearman–Brown coefficient and Guttman coefficient) were computed on data halves by splitting the items according to odd and even numbers.

#### Concurrent validity

The concurrent validity of QOLCSV-C was examined by calculating its correlations with FACT-G and between their subscales. Normality tests revealed normal distributions of QOLCSV-C's total and subtotals, but normal distribution was not evident in FACT-G score. Hence, nonparametric correlation analysis, that is, Spearman's correlations were conducted. The correlation coefficient with an absolute value between 0.4 and 0.7 suggests a moderate correlation, and a value  $> 0.7$  indicates a strong correlation.<sup>47</sup>

#### Construct validity

Exploratory factor analysis (EFA) was conducted to explore the number of factors explaining the items as well as the factor structure. The factorability of correlation matrix was tested by computing the KMO value and Bartlett's test. A KMO index larger than 0.6 and a significant Bartlett's test result support the suitability of factor analysis.<sup>48</sup> In EFA, the technique employed for extracting factors was Principal Axis Factoring, while the rotation method was Oblimin with Kaiser normalization. The number of factors was determined by recognizing the elbow in the scree plot plotting the factor number against eigenvalue. Pattern matrix of loadings was reported. Items with Hoffman's complexity index<sup>49</sup>  $> 1.5$  were excluded from confirmatory factor analysis (CFA). In CFA, the estimation method was maximum likelihood. A SEM plot was generated to report the standardized solution, and the squared multiple correlations. The covariances between errors terms belonging to the same factor were identified and modeled based on the modification indices. The cutoff of incremental fit index (IFI), comparative fit index (CFI), and Tucker–Lewis index (TLI) were set at  $> 0.9$ ; and the cutoff of root mean square error of approximation (RMSEA) was  $< 0.08$ , which indicate good model fit<sup>50–52</sup>. The sample size for EFA and CFA was 205.

**Floor and ceiling effects analysis**

Floor and ceiling effects on the items of QOLCSV-C were counted and calculated in term of the percentage of individuals who have given either the lowest score (0) or the highest score (10) for an item. The percentages of individuals who acquired a zero in the total score or the full mark on the QOLCSV-C were computed also. The cutoff of the percentage was set at 15%<sup>40</sup> above which a floor or ceiling effect might have impact on the item's capability in discriminating between the individuals.

**Discriminant performance**

We investigated the discriminant performance of several selected variables which could demonstrate significant difference in the QoL among cancer survivors as measured by the QOLCSV-C. The variables are identified from the literature, which suggests that education levels,<sup>53,54</sup> cancer treatment protocols,<sup>55</sup> BMI,<sup>55</sup> physical symptoms,<sup>56,57</sup> family income,<sup>53</sup> and employment status<sup>54,58</sup> are the associated factors affecting QoL of cancer survivors. We compared the mean ranks of the QOLCSV-C between categories of each variable by using Kruskal Wallis H test. To adjust the p value for multiple comparisons, we adopted a more stringent significance level ( $\alpha = 0.001$ ) for this test. Mean and SD of the QOLCSV-C in each variable category are presented.

**Results**

**Participants**

In total, 205 participants participated in this study, with a balanced male (46.8%) to female (53.2%) ratio. The mean age of the participants was 56 years (SD = 11.3). Nearly 70% of them had a BMI within normal range (18.5–24.9). A majority of the participants are married (87.3%), have no religious belief (93.1%), received education lower than high school level (79.5%) and were not employed (80.0%). A wide variety of cancer types was noted, and the top three were blood cancer (29.7%), breast cancer (25.4%), and bowel cancer (14.1%). More than 60% of them were at Stage III or IV. A majority of the participants (92.7%,  $n = 190$ ) had completed chemotherapy. The median number of months since the completion of the initial curative anticancer treatment was 17 months (IQR = 27). Above 40% of the participants had comorbidities, in which the most common types are hypertension, diabetes, and hepatitis. Approximately 60% of them never smoke or drink. The participants' social-demographic and clinical characteristics are presented in [Table 3](#).

**Acceptability of QOLCSV-C**

All participants completed the QOLCSV-C questionnaire ( $n = 205$ ), and there were no missing data. Time spent to complete the questionnaire ranged from 4 to 16 min (mean = 10.0, SD = 2.7). All participants stated that all items were easy to understand, and the font size and the layout were appropriate and easy to read. A vast majority of them ( $n = 203$ , 99.0%) thought that the length of the questionnaire was appropriate, despite two participants commented that it was a bit long. Only one participant reflected that it was a bit embarrassing to answer item 33 "Is your sexuality impacted by your illness?" Almost all participants felt the questionnaire was easy to complete ( $n = 201$ , 98.0%), and agreed that the questionnaire can reflect their QoL ( $n = 195$ , 95.1%). The overall acceptability of QOLCSV-C is satisfactory.

**Scale reliability**

The overall internal consistency of the QOLCSV-C is satisfactory (Cronbach's  $\alpha = 0.888$ ) ([Table 4](#)). Regarding its original subscales, the internal consistency of Psychological Well-being is excellent ( $\alpha = 0.898$ ), while the result of Physical Well-being ( $\alpha = 0.722$ ) and Social Well-being ( $\alpha = 0.699$ ) are acceptable. However, the internal consistency of Spiritual Well-being is lower than expected ( $\alpha = 0.356$ ). The

**Table 3**

Demographic and clinical characteristics of the study sample ( $N = 205$ ).

Characteristics	Categories	<i>n</i>	%	
Age (years)	18–39	16	7.8	
	40–59	127	62.0	
	60–79	58	28.3	
	≥ 80	4	2.0	
	(Mean, SD)	(55.73, 11.34)		
Gender	Male	96	46.8	
	Female	109	53.2	
BMI	< 18.5	21	10.2	
	18.5–24.9	142	69.3	
	25–29.9	37	18.0	
	≥ 30	5	2.4	
Marital status	Never married	7	3.4	
	Married	179	87.3	
	Divorced	5	2.4	
	Widow/Widower	14	6.8	
Religion	Buddhism	8	3.9	
	Christianism	3	1.5	
	Catholicism	1	0.5	
	No religion	191	93.2	
	Others	2	1.0	
Education	Below high school level	163	79.5	
	High school and above	42	20.5	
Employment status	Employed	41	20.0	
	Unemployed	109	53.2	
	Retired	55	26.8	
Occupation	Professional work	42	20.5	
	Labor	100	48.8	
	House duty	14	6.8	
	Office work	22	10.7	
	Others	27	13.2	
	Type of cancer	Blood cancer	61	29.8
Breast cancer	52	25.4		
Lung cancer	20	9.8		
Liver cancer	12	5.9		
Bowel cancer	29	14.1		
Ovary cancer	7	3.4		
Esophageal cancer	6	2.9		
Nasopharynx cancer	6	2.9		
Bladder cancer	4	2.0		
Pancreas cancer	4	2.0		
Spleen cancer	1	0.5		
Prostate cancer	1	0.5		
Stomach cancer	2	1.0		
Stage of cancer	I	4	2.0	
	II	32	15.6	
	III	42	20.5	
	IV	83	40.5	
	Nonstaged	44	21.5	
Completed treatment (one or more)	Chemotherapy	190	92.7	
	Radiotherapy	29	14.1	
	Surgery	102	49.8	
	Immunotherapy	34	16.6	
	Endocrine therapy	3	1.5	
	Targeted therapy	62	30.2	
	Months since completion (median, IQR)	(17, 27)		
	Comorbidity	Yes	90	43.9
		No	115	56.1
	Duration in months (median, IQR)	(0, 60)		
Comorbidity types ( $n = 95$ )	Hypertension	48	50.5	
	Diabetes	24	25.3	
	Hepatitis	19	20.0	
	Cardiac disease	3	3.2	
	Stroke	1	1.1	
	Never smoke	126	61.5	
Smoke	Previous smoker	68	33.2	
	Current smoker	11	5.4	
Alcohol drinking	Never drink	120	58.5	
	Drinking in the past	82	40.0	
	Drinking at present	3	1.5	

BMI, body mass index; SD, standard deviation; IQR, interquartile range.

results of internal consistencies of the factors recognized in EFA are consistent with the internal consistencies of the original domains

**Table 4**  
Internal consistency (Cronbach's alpha) of the QOLCSV-C.

	$\alpha$	$\alpha_s$	<i>n</i>
Original domain			
Psychological well-being	0.898	0.895	18
Physical well-being	0.722	0.723	8
Spiritual well-being	0.356	0.435	7
Social well-being	0.699	0.713	8
Overall	0.888	0.889	41
Factor from EFA			
1	0.883	0.878	17
2	0.781	0.792	10
3	0.347	0.420	8
4	0.742	0.755	6
Overall	0.888	0.889	41

$\alpha$ , Cronbach's alpha;  $\alpha_s$ , based on standardized items; *n*, number of items; EFA, exploratory factor analysis; QOLCSV-C, Chinese version of the Quality of Life Patient/Cancer Survivor Version.

despite different groupings of the items to an extent. Yet the split-half reliability was excellent (Spearman–Brown Coefficient = 0.918, Guttman coefficient = 0.916).

Overall, the items of each subscale of QOLCSV-C have stronger correlations with their corresponding subscales than their correlations with other subscales (Table 5). Most of the items are having moderate to strong correlations with the global scale of QOLCSV-C. That being said, the Q7 “Menstrual changes or fertility” has weak correlations with all

**Table 5**  
Item correlations with each original subscale of QOLCSV-C and the global scale.

Item	Physical (Q1-8)	Psychological (Q9-26)	Social (Q27-34)	Spiritual (Q35-41)	Global
Q1	<b>0.718</b>	0.411			0.524
Q2	<b>0.686</b>	0.372			0.450
Q3	<b>0.624</b>	0.360			0.469
Q4	<b>0.660</b>				0.378
Q5	<b>0.460</b>				
Q6	<b>0.512</b>				0.309
Q7					
Q8	<b>0.653</b>	0.389			0.495
Q9	0.419	<b>0.495</b>			0.520
Q10	0.449	<b>0.467</b>			0.495
Q11		<b>0.318</b>	0.307		0.326
Q12	0.395	<b>0.479</b>			0.485
Q13	0.308	<b>0.432</b>			0.465
Q14		<b>0.317</b>			
Q15		<b>0.479</b>			0.481
Q16		<b>0.313</b>			
Q17		<b>0.564</b>	0.478		0.490
Q18		<b>0.609</b>	0.348		0.551
Q19		<b>0.698</b>	0.408		0.644
Q20		<b>0.738</b>	0.455		0.680
Q21	0.386	<b>0.681</b>	0.528		0.710
Q22	0.348	<b>0.713</b>	0.447		0.669
Q23	0.303	<b>0.822</b>	0.525		0.727
Q24	0.336	<b>0.801</b>	0.501		0.719
Q25	0.336	<b>0.840</b>	0.519		0.745
Q26	0.353	<b>0.820</b>	0.531		0.740
Q27		0.523	<b>0.633</b>		0.542
Q28	0.341	0.330	<b>0.460</b>		0.410
Q29		0.496	<b>0.686</b>		0.563
Q30			<b>0.541</b>		0.301
Q31			<b>0.561</b>		
Q32		0.380	<b>0.505</b>		0.439
Q33	0.304	0.540	<b>0.622</b>		0.601
Q34		0.349	<b>0.478</b>		0.438
Q35				<b>0.374</b>	
Q36				<b>0.537</b>	
Q37		-0.509	-0.410		-0.465
Q38		0.496	0.411		0.505
Q39				<b>0.603</b>	
Q40				<b>0.713</b>	0.308
Q41		0.321		<b>0.670</b>	0.389

The coefficients are Spearman's rho. Coefficients smaller than 0.3 in absolute value are suppressed. Bold coefficients belong to their corresponding subscale. All presented coefficients are statistically significant with  $P < 0.001$ . QOLCSV-C, Chinese version of the Quality of Life Patient/Cancer Survivor Version.

subscales as well as the global scale. The Q37 “How much has your spiritual life changed as a result of your cancer diagnosis?” does not show an expected correlation with the subscale of Spiritual Well-being, but it has moderate negative correlations with Psychological and Social Well-being. The Q38 “How much uncertainty do you feel about your future?”, in contrast, has moderate positive correlations with Psychological and Social Well-being. These findings might partly explain the low internal consistency of the Spiritual Well-being subscale.

Moreover, eight items have weak correlations with the global scale. They are Q5 “Constipation,” Q7 “Menstrual changes or fertility,” Q14 “How is your present ability to concentrate or to remember things?” Q16 “Has your illness or treatment caused changes in your appearance?” Q31 “To what degree has your illness and treatment interfered with your employment?” Q35 “How important to you is your participation in religious activities such as praying, going to church?” Q36 “How important to you are other spiritual activities such as meditation?” and Q39 “To what extent has your illness made positive changes in your life?” However, except Q7, the rest of these items are having moderate to strong correlations with their corresponding subscales.

*Concurrent validity*

The results of correlation analysis suggest an overall concurrent validity of QOLCSV-C (Table 6). First, a strong correlation is observed between the overall QOLCSV-C and the FACT-G ( $\rho = 0.765, P < 0.001$ ).

**Table 6**  
Spearman's correlations between QOLCSV-C and FACT-G and their original subscales.

	Q-Total	F-Total	Q-Physical	Q-Psychological	Q-Social	Q-Spiritual	F-Physical	F-Social/Family	F-Emotional	F-Functional
Q-Total	1									
F-Total	0.765 ***	1								
Q-Physical	0.633 ***	0.524 ***	1							
Q-Psychological	0.922 ***	0.676 ***	0.449 ***	1						
Q-Social	0.744 ***	0.622 ***	0.321 ***	0.613 ***	1					
Q-Spiritual	0.192 **	0.111	0.024	0.084	-0.079	1				
F-Physical	0.708 ***	0.810 ***	0.628 ***	0.594 ***	0.549 ***	0.107	1			
F-Social/Family	0.332 **	0.573 ***	0.211 **	0.250 ***	0.368 ***	0.032	0.313 ***	1		
F-Emotional	0.700 ***	0.782 ***	0.386 ***	0.715 ***	0.555 ***	0.020	0.618 ***	0.262 ***	1	
F-Functional	0.499 ***	0.767 ***	0.338 ***	0.413 ***	0.372 ***	0.207 **	0.488 ***	0.360 ***	0.411 ***	1

Q, QOLCSV-C; F, FACT-G; QOLCSV-C, Chinese version of the Quality of Life Patient/Cancer Survivor Version; FACT-G, the Functional Assessment of Cancer Therapy-General. \*\* $P < 0.01$ , \*\*\* $P < 0.001$ .

With regards the subscales, the Physical Well-being of QOLCSV-C has a strong correlation with the Physical Well-being of FACT-G ( $\rho = 0.628, P < 0.001$ ). The Psychological Well-being of QOLCSV-C has a strong correlation with the Emotional Well-being of FACT-G ( $\rho = 0.715, P < 0.001$ ). The Social Well-being of QOLCSV-C demonstrated a moderate correlation with the Social/Family Well-being of FACT-G ( $\rho = 0.368, P < 0.001$ ). However, the Spiritual Well-being of QOLCSV-C has weaker correlations with other subscales than the other subscales have. The Functional Well-being of the FACT-G revealed moderate correlations with the Physical ( $\rho = 0.338, P < 0.001$ ), Psychological ( $\rho = 0.413, P < 0.001$ ), and Social Well-being ( $\rho = 0.372, P < 0.001$ ) subscales in QOLCSV-C.

*Construct validity*

The factorability of the correlation matrix of QOLCSV-C was excellent (KMO = 0.852, Bartlett's chi-sq = 4600 (df = 820),  $P < 0.001$ ). In EFA, the rotation converged in 15 iterations. Scree plot of the factor number against eigenvalue supported a four-factor solution (Fig. 1). The pattern matrix showed the regression coefficients (factor loadings) of each item onto the factors (Table 7). An item was assigned to a factor to which the absolute value of the loading is the maximum. The number of items which has complexity index lower than 1.5 was 23. The structural and measurement model for CFA (Fig. 2) was constructed based on the results from EFA. After allowing five covariances between error terms based on modification indices, the final model fit in CFA was excellent (chi-sq/df = 340/219 = 1.55) ( $P < 0.001$ ), IFI = 0.948, TLI = 0.94, CFI = 0.948, RMSEA = 0.052 (90% CI = [0.041–0.063])).

In CFA, the items of factor 1 are related to the experience of having cancer, including fears of recurrence, second cancer, metastasis, and future diagnostic tests. They also address the distress caused by cancer treatments, the initial diagnosis, and the impact on family members. There are also items about the level of uncertainty regarding the future, interference with employment, and cognitive abilities. Overall, the items aim to assess the sources of psychological distress and impact of cancer on the survivors.

In factor 2, the items relate to the physical symptoms and overall physical health of a survivor who had cancer. The items include fatigue, changes in sleep patterns and appetite, aches or pain, nausea, and a rating of the overall physical health. Additionally, there is an item regarding how difficult it is for the survivor to cope with the cancer and treatment on a given day. These items aim to assess the physical well-being and the impact of cancer and its treatment on the survivor's daily life.

Factor 3 consisted of two items in which one item asks about positive changes resulting from the cancer. However, the definition of positive change is nonspecific in the item as no examples were given. Another item relates specifically to women and asks about any menstrual changes or fertility issues resulting from cancer. But this item has only weak negative association with factor 3. Factor 3 has weak negative correlation with the other factors.

Factor 4 addresses different aspects of a survivor's life that may be impacted by the cancer. The first item asks about the level of happiness the survivor feels, which can provide insight into emotional well-being. The second item pertains to the amount of support received from others, specifically whether it is sufficient to meet his/her needs, which

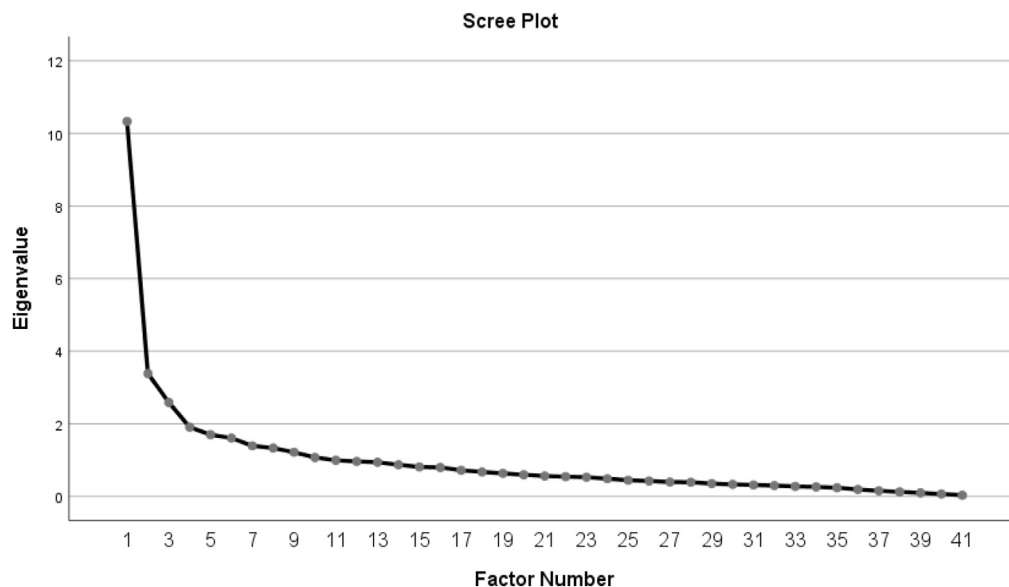


Fig. 1. Scree plot plotting number of factors against eigenvalues.

**Table 7**  
Pattern matrix of exploratory factor analysis for QOLCSV-C.

Items	DOM	Pattern matrix				FTR	HCI
		1	2	3	4		
Q25	Psy	0.831	0.022	-0.116	-0.094	1	1.07
Q24	Psy	0.814	0.043	-0.104	-0.023	1	1.04
Q23	Psy	0.805	0.002	-0.145	-0.112	1	1.10
Q26	Psy	0.795	0.055	-0.119	-0.084	1	1.08
Q19	Psy	0.645	0.183	0.150	0.104	1	1.33
Q18	Psy	0.616	0.127	0.178	0.132	1	1.36
Q20	Psy	0.607	0.121	0.143	-0.096	1	1.25
Q27	Soc	0.574	-0.023	-0.055	-0.009	1	1.02
Q21	Psy	0.553	0.167	0.191	-0.184	1	1.69
Q22	Psy	0.495	0.102	0.153	-0.312	1	2.02
Q34	Soc	0.485	0.099	0.125	0.181	1	1.52
Q38	Spi	0.482	0.007	-0.100	-0.177	1	1.36
Q17	Psy	0.455	0.009	-0.196	-0.242	1	1.94
Q31	Soc	0.404	-0.159	-0.079	0.086	1	1.49
Q33	Soc	0.370	0.147	0.011	-0.332	1	2.31
Q14	Psy	0.292	0.050	0.082	0.037	1	1.25
Q37	Spi	-0.438	-0.139	0.157	0.123	1	1.66
Q1	Phy	0.096	0.645	-0.045	-0.015	2	1.06
Q4	Phy	0.031	0.610	-0.001	0.186	2	1.19
Q2	Phy	0.036	0.576	-0.016	-0.070	2	1.04
Q8	Phy	-0.024	0.561	0.057	-0.267	2	1.46
Q3	Phy	0.102	0.545	-0.107	0.002	2	1.15
Q9	Psy	0.182	0.476	0.103	-0.047	2	1.41
Q10	Psy	-0.033	0.437	0.167	-0.340	2	2.22
Q6	Phy	0.062	0.426	-0.007	0.059	2	1.08
Q5	Phy	-0.140	0.374	-0.055	-0.159	2	1.71
Q16	Psy	0.145	0.183	-0.129	0.006	2	2.75
Q40	Spi	0.289	-0.235	0.787	-0.289	3	1.77
Q41	Spi	0.306	-0.059	0.683	-0.198	3	1.59
Q39	Spi	-0.082	0.009	0.561	0.231	3	1.38
Q36	Spi	-0.047	0.103	0.348	0.170	3	1.70
Q15	Psy	0.116	0.270	0.340	-0.332	3	3.14
Q35	Spi	-0.091	-0.010	0.138	0.116	3	2.73
Q7	Phy	0.054	0.017	-0.223	0.033	3	1.18
Q30	Soc	0.274	-0.066	-0.391	-0.128	3	2.11
Q11	Psy	-0.025	-0.028	0.063	-0.612	4	1.03
Q28	Soc	-0.056	0.077	-0.081	-0.601	4	1.09
Q32	Soc	0.043	0.192	-0.042	-0.513	4	1.31
Q12	Psy	0.014	0.398	0.142	-0.420	4	2.23
Q29	Soc	0.285	0.081	-0.116	-0.394	4	2.13
Q13	Psy	0.117	0.251	0.260	-0.322	4	3.16

DOM: the original domains were from the US version. FTR: an item is assigned to a factor to which the absolute value of the loading is the maximum. HCI, Hoffman's complexity index ( $n = 205$ ); QOLCSV-C, Chinese version of the Quality of Life Patient/Cancer Survivor Version.

can indicate the survivor's level of social support. Finally, the third item asks about the extent to which the cancer and its treatment have interfered with the survivor's activities at home, which can help assess the practical impact of the cancer on daily life. Overall, these items aim to capture the psychosocial and familial implications of cancer on a survivor's life.

*Floor and ceiling effects*

Almost 70% of the items of the QOLCSV-C might have been influenced by the ceiling effect (68.3%), and around one fourth of the items could be impacted by the floor effect (24.4%) (Table 8). More than 78% of the items are subject to either one of the effects, and around 15% of the items are free from these effects. The remaining 7% of the items demonstrated both effects. Overall, none of the individuals obtained a zero or full mark on the QOLCSV-C.

*Discriminant performance*

From the results, the most important variables which show significant difference in QOLCSV-C score between categories are the six variables with all  $P < 0.001$ . Specifically, a good sleep quality, less pain, less

fatigue, less nausea sensation, better physical health, and less financial burden are associated with better QoL in terms of the mean scores of QOLCSV-C. Several other variables show marginal significance such as employment ( $P = 0.002$ ), surgery need ( $P = 0.009$ ), and support from the others ( $P = 0.002$ ). The retired population, no need for surgery, and better support from the others are associated with better QoL (Table 9).

**Discussion**

The aim of this study was to translate the QOLCSV into Chinese and conduct cross-cultural adaptation in terms of investigating its acceptability and content validity, then to examine its concurrent validity with FACT-G and internal consistency. Item-total and item-subtotal correlations were also computed. The factor structure was explored. In addition, some explorative analyses were done to understand the items' floor and ceiling effects, as well as the discriminant performance of selected variables in discriminating between QoL levels. Based on the statistical results, the Chinese version of QOLCSV, that is, QOLCSV-C has attained an excellent acceptability. A vast majority of the participants agreed that the items were easy to understand, appropriate, and reflecting their QoL. In addition, the CVI computed from the experts' input was perfect. The concurrent validity of QOLCSV-C was satisfactory overall. And the internal consistency of the global scale of QOLCSV-C was excellent. Most of the items demonstrated moderate to strong correlations with the QOLCSV-C total. In factor analysis, a four-factor solution was identified although items in the factors showed a mix of original domains, and 23 items were more distinctively loading on single factor. A concise model showed a good fit given that certain covariances were allowed between error terms. Regarding the floor and ceiling effect, although 85% items are subject to either one or both according to the 15% cutoff in all participants, the data distribution of the QOLCSV-C total roughly follows normal distribution, and no participant scored a zero or full mark on the instrument. Therefore, the QOLCSV-C total can discriminate between individuals' QoL. Our results also reveal several important variables such as sleep quality, pain, fatigue, nausea, physical health, and financial burden which demonstrated significant between-group differences in the QoL score. These significant associations are also consistent with the previous reports in the literature. Overall, our results support the validity and reliability of the QOLCSV-C.

Yet, the results in the present study point to several future research directions. We observed that the internal consistency of the Spiritual Well-being subscale was low, and two out of seven items of this subscale have only weak correlations with it in the QOLCSV-C. Furthermore, the Spiritual Well-being shows weak correlations with the total and subtotals of QOLCSV-C as well as FACT-G. In the original study, the item groupings were derived from a theoretical framework.<sup>19</sup> The original study has conducted a PCA which revealed nine "factors" (principal components). However, details of the PCA and explanations of the inconsistency between the theoretical framework and the component structure were unclear. Following the EFA conducted in the present study, we found that the internal consistency of factor 3 was poor, comprising 5 items of Spiritual Well-being and another three. In factor 3, only two items showed a complexity index lower than 1.5. And in CFA only item 39 "To what extent has your illness made positive changes in your life?" was strongly loading on factor 3, which has weak negative correlations with other factors. Therefore, the perceived positive change in life due to cancer might not have associations with perceived physical and psychosocial well-being. Overall, the construct of spiritual well-being remains not well understood given the items in the original scale and the translated scale.

We cannot rule out some study limitations such as the cultural factor could have impacts on the interpretation of items, and the potential change in the conceptualization of spiritual well-being over decades. Intensive qualitative studies are required to explore the meaning of spiritual well-being in a culture. Regarding the number analyzed in factor analysis, our EFA and CFA worked on the same sample ( $n = 205$ ), which



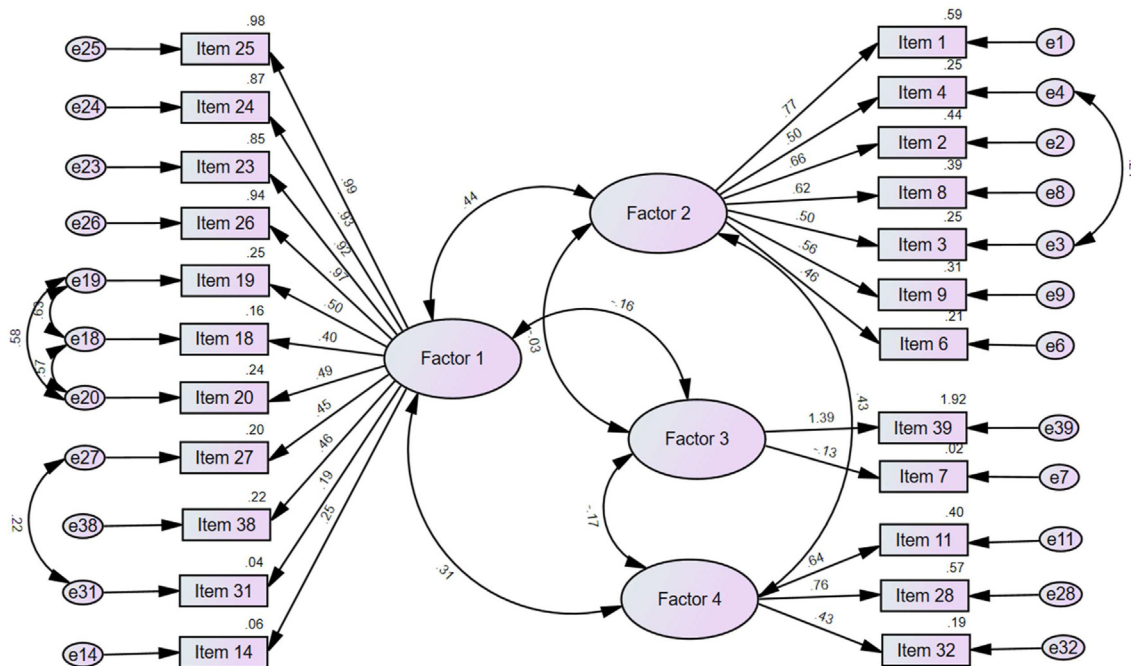


Fig. 2. The SEM plot of the standardized regression weights (on arrows), correlations between factors, and between error terms (on double arrows), as well as squared multiple correlations for the items (on boxes) (N = 205). SEM, structural equation modeling.

Table 8

Item score percentiles, and the floor and ceiling effects of the items in QOLCSV-C.

Item	Percentile			Floor effect %	Ceiling effect %	Floor > 15%	Ceiling > 15%	Effect
	25th	50th	75th					
Q1	4.5	8	10	6.3	44.9	No	Yes	Either one
Q2	3.5	8	10	10.7	43.9	No	Yes	Either one
Q3	5	10	10	4.9	50.7	No	Yes	Either one
Q4	2	7	10	13.2	37.6	No	Yes	Either one
Q5	7	10	10	4.4	70.2	No	Yes	Either one
Q6	8.5	10	10	3.9	73.7	No	Yes	Either one
Q7	5	10	10	4.9	67.3	No	Yes	Either one
Q8	4	5	7.5	5.9	3.9	No	No	None
Q9	5	7	9.5	1.5	24.9	No	Yes	Either one
Q10	5	6	8	3.4	5.4	No	No	None
Q11	8	10	10	1.0	54.1	No	Yes	Either one
Q12	6	8	10	2.4	34.1	No	Yes	Either one
Q13	6	8	9	1.0	21.5	No	Yes	Either one
Q14	3	5	6.5	12.7	2.0	No	No	None
Q15	5	6	7	2.0	2.0	No	No	None
Q16	0.5	3	8	24.9	16.6	Yes	Yes	Both
Q17	3	5	8	5.9	16.1	No	Yes	Either one
Q18	1	2	5	22.9	6.8	Yes	No	Either one
Q19	1	3	5	15.1	4.9	Yes	No	Either one
Q20	3.5	5	8	6.8	15.6	No	Yes	Either one
Q21	3	6	8	5.4	20.0	No	Yes	Either one
Q22	7	9	10	0.5	48.3	No	Yes	Either one
Q23	3	7	10	7.3	33.2	No	Yes	Either one
Q24	2.5	7	10	9.3	32.7	No	Yes	Either one
Q25	2	5	10	14.6	30.2	No	Yes	Either one
Q26	2	5	10	14.6	30.7	No	Yes	Either one
Q27	0	2	4	40.0	2.9	Yes	No	Either one
Q28	8	10	10	0.5	50.2	No	Yes	Either one
Q29	4	7	10	4.9	38.5	No	Yes	Either one
Q30	4	10	10	3.9	52.2	No	Yes	Either one
Q31	0	3	10	34.6	33.7	Yes	Yes	Both
Q32	4	8	10	5.9	42.0	No	Yes	Either one
Q33	4.5	8	10	2.0	44.9	No	Yes	Either one
Q34	0	0	2	60.0	2.9	Yes	No	Either one
Q35	0	0	0	80.0	2.4	Yes	No	Either one
Q36	0	2	5	46.3	2.4	Yes	No	Either one
Q37	3	5	6	11.2	1.5	No	No	None
Q38	1.5	5	8	15.6	21.5	Yes	Yes	Both
Q39	0	4	7	30.7	3.4	Yes	No	Either one
Q40	5	8	9	1.0	13.7	No	No	None
Q41	5	8	9	1.5	18.5	No	Yes	Either one

%: the percentage of individuals who have scored the lowest (0) or the highest (10) in an item. QOLCSV-C, Chinese version of the Quality of Life Patient/Cancer Survivor Version.

**Table 9**  
Discriminant performance of demographic and clinical variables on QOLCSV-C total score.

Variable	Category	QOLCSV-C Mean rank	QOLCSV-C Mean (SD)	H <sup>a</sup>	P
Gender	Male (n = 96)	107.92	242.75 (58.04)	1.240	0.265
	Female (n = 109)	98.67	236.10 (49.32)		
Age (years)	≤ 30 (n = 6)	90.75	231.33 (56.91)	1.811	0.404
	31-59 (n = 137)	99.85	236.03 (55.31)		
	≥ 60 (n = 62)	111.15	239.21 (53.55)		
BMI (kg/m <sup>2</sup> )	≤ 18.5 (n = 21)	65.64	201.57 (55.25)	11.266	0.010
	18.6-24.9 (n = 142)	105.20	241.65 (53.49)		
	25.0-29.9 (n = 37)	110.50	247.16 (47.39)		
	≥ 30.0 (n = 5)	114.90	269.20 (23.45)		
Marital status	Never married (n = 7)	104.29	243.71 (56.67)	0.714	0.870
	Married (n = 179)	102.97	239.06 (52.90)		
	Divorced (n = 5)	83.60	221.00 (62.82)		
	Widowed (n = 14)	109.64	245.50 (61.64)		
Education level	Illiterate (n = 12)	117.21	253.17 (39.89)	15.156	0.010
	Primary school (n = 73)	91.42	228.88 (49.22)		
	Middle school (n = 78)	118.73	254.54 (50.00)		
	High school or occupation training (n = 22)	107.55	238.55 (62.22)		
	Diploma (n = 13)	68.73	208.38 (64.70)		
Employment	Bachelor degree or above (n = 7)	73.50	211.71 (61.93)	12.773	0.002
	Employed (n = 41)	114.33	248.73 (52.04)		
	Unemployed (n = 109)	89.30	226.61 (51.98)		
	Retired (n = 55)	121.70	257.11 (53.55)		
Cancer stage	I (n = 4)	92.50	235.5 (48.80)	6.093	0.192
	II (n = 32)	105.78	242.59 (57.73)		
	III (n = 42)	92.18	229.71 (50.79)		
	IV (n = 83)	98.42	234.73 (55.29)		
	Nonstaged (n = 44)	120.90	254.61 (53.55)		
Time since Initial treatment completion	≤ 12 months (n = 77)	111.70	247.79 (52.01)	2.817	0.244
	13-60 months (n = 111)	98.55	234.58 (55.052)		
	≥ 61 months (n = 17)	92.53	230.65 (47.95)		
Surgery	Yes (n = 102)	92.08	228.27 (54.08)	6.876	0.009
	No (n = 103)	113.81	250.05 (51.01)		
Chemotherapy	Yes (n = 190)	104.14	240.41 (52.56)	1.240	0.265
	No (n = 15)	88.53	224.13 (65.03)		
Comorbidity	Yes (n = 90)	111.48	247.72 (52.37)	3.280	0.070
	No (n = 115)	96.37	232.56 (53.8)		
Alcohol drinking	Never drink (n = 120)	95.73	232.72 (51.71)	5.183	0.075
	Previously drinking (n = 82)	112.14	247.55 (55.55)		
	Currently drinking (n = 3)	144.00	271.33 (38.59)		
Smoke	Never smoke (n = 126)	94.41	231.58 (52.51)	7.069	0.029
	Previous smoker (n = 68)	115.47	250.46 (54.24)		
	Current smoker (n = 11)	124.32	257.18 (48.76)		
Sleep quality	Poor (n = 64)	81.91	218.52 (55.79)	17.876	< 0.001
	Average (n = 67)	99.60	235.96 (47.38)		
	Good (n = 74)	124.32	260.07 (49.71)		
Pain (Out of 10)	≤ 3 (n = 36)	52.88	192.50 (45.87)	49.621	< 0.001
	4-6 (n = 34)	74.63	215.47 (43.57)		
	≥ 7 (n = 135)	123.51	257.65 (47.72)		
Fatigue (Out of 10)	≤ 3 (n = 38)	57.96	195.24 (50.28)	50.255	< 0.001
	4-6 (n = 38)	72.37	212.18 (47.38)		
	≥ 7 (n = 129)	125.29	260.13 (44.26)		
Nausea (Out of 10)	≤ 3 (n = 22)	57.18	195.05 (50.63)	23.041	< 0.001
	4-6 (n = 17)	68.94	202.71 (57.96)		
	≥ 7 (n = 166)	112.56	248.81 (49.03)		
Constipation (Out of 10)	≤ 3 (n = 28)	74.18	210.50 (55.13)	8.882	0.012
	4-6 (n = 17)	92.41	228.71 (56.85)		
	≥ 7 (n = 160)	109.71	245.36 (51.41)		
Physical health (Out of 10)	≤ 3 (n = 50)	63.52	200.48 (54.39)	46.790	< 0.001
	4-6 (n = 80)	96.44	234.33 (46.64)		
	≥ 7 (n = 75)	136.32	270.25 (44.60)		
Financial burden (Out of 10)	≤ 3 (n = 16)	93.20	230.10 (50.50)	32.887	< 0.001
	4-6 (n = 17)	134.79	267.94 (41.29)		
	≥ 7 (n = 172)	174.59	306.69 (36.94)		
Support from others (Out of 10)	≤ 3 (n = 7)	73.43	213.29 (46.45)	12.700	0.002
	4-6 (n = 15)	55.43	197.27 (57.85)		
	≥ 7 (n = 183)	108.03	243.64 (51.92)		

<sup>a</sup> H: Kruskal Wallis H statistics. QOLCSV-C, Chinese version of the Quality of Life Patient/Cancer Survivor Version; BMI, body mass index.

have the same data distributions between methods of factor analysis. After EFA, the CFA can work on an external data source as an external validation. But if there is only a single data source, the dataset can be randomly split into subsets for EFA and CFA, respectively. The data

distributions between subsets will be similar, therefore the results of EFA and CFA will not be biased by different data distributions between subsets. Yet, a subset has a smaller sample size which can be less ideal for either method of factor analysis, particularly when the sample size of the

dataset is small. Furthermore, data coming from the same source cannot exclude source bias. Therefore, we recognized the limitations such as a sample size of 205 and nonrandom sampling might not be representative of the population. We suggested that multinational studies should be conducted with better sampling strategies, such as using different data sources to validate the model in EFA and CFA.

Our study outcomes bring another main future direction in research. If the results of QOLCSV-C are aimed to be compared across sex groups, each item should be nonsex specific. Otherwise, developing a sex specific instrument can be a future direction. In the present study, Q7 “Menstrual changes or fertility” has weak correlations with all subscales as well as the global scale of QOLCSV-C. As half of the sample were males, and the median age of the sample was 55 which is within the age range of menopause, the Q7 was applicable to roughly one fourth of the sample only. This nonapplicable item needs consideration in the future study.

The results in this study also shed light on the need to further validate the factor structure of FACT-G in Chinese. In the present study, FACT-G was chosen to be an instrument for the investigation of the concurrent validity of QOLCSV-C. Several subscales of QOLCSV-C were having moderate to strong correlations with the corresponding subscales in FACT-G, and the Functional Well-being of FACT-G are having moderate correlations with all subscales of QOLCSV-C except Spiritual Well-being. These results indicate that the Functional Well-being may not be a distinct factor, which is clearly separated from the other three factors of FACT-G in this study of the Chinese sample. A previous study has ever presented a five-factor solution of 1262 patients in Hong Kong<sup>59</sup> although the factorability of the correlation matrix is unclear. Further research is required on the factor structure of FACT-G in the Chinese population and its association with QOLCSV-C.

Finally, the identification of the strong predictors of QoL score deserves an independent line of study in the future. In this study, although we have identified six variables, that is, sleep quality, pain, fatigue, nausea, physical health, and financial burden, which show significant differences in the QOLCSV-C score between categories, which are consistent with literature<sup>60–66</sup>, other variables that were deemed associated with QoL are not significant in our results. The heterogeneity of the samples in different studies might contribute to the differences. The important variables identified in the previous studies perhaps highly depend on the context of the study, the sample characteristics, the time as well as the variables selected. Also, the measurement tool of QoL can be different. Therefore, part of the previous results could not be replicated in the present study. In-depth research in finding strong predictors of QoL among cancer survivors can be conducted in systematic scoping reviews, surveys, as well as longitudinal studies.

#### Implications for practice

The present study showed that the QOLCSV-C is a reliable and valid tool and is highly acceptable by the Chinese cancer survivors. As it is user-friendly and appropriate in length, the QOLCSV-C can be utilized by the clinicians in hospital or community setting to measure QoL among cancer survivors over time, as evidence for QoL change with or without intervention. It can also be utilized in healthcare research for quality improvement. Most importantly, the QOLCSV-C can be utilized in a broad range of cancer survivors as early as six months after the completion of their initial curative anticancer treatment.

#### Conclusions

Our study demonstrated the excellent overall validity and reliability of the QOLCSV-C in terms of concurrent validity, content validity, internal consistency, item-total correlations, discriminant performance and acceptability. These results support the future use of QOLCSV-C to measure QoL among Chinese cancer survivors. Our findings also open several lines of research directions which need researchers' attention. The factor structure of QOLCSV-C and FACT-G in different populations

requires further study. Another direction can be the development of gender universal or specific instrument. Furthermore, the exploration of the most important predictors of QoL for cancer survivors should be continued. With new research results, the QOLCSV-C can be further modified into a concise, sensitive, and cost-effective measurement tool of QoL for cancer survivors.

#### Acknowledgments

The authors would like to thank all the study participants and the study site supporting team for their collaboration and support.

#### CRedit author statement

Study concept and design: Wang HY, Tan JY, Liu XL, Wang T, Bressington D; Data collection: Wang HY, Shen YS, Zhang Q, Huang HQ; Data analysis: Wang HY, Kwok S, Liu XL, Tan JY, Zhang Q; Manuscript drafts: Wang HY, Tan JY, Kwok S, Liu XL, Wang T, Bressington D, Shen YS, Zhang Q, Huang HQ. All authors had full access to all the data in the study, and the corresponding author had final responsibility for the decision to submit for publication. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted.

#### Declaration of competing interest

The authors declare no conflict of interest.

#### Funding

This study is supported by the Australian Government Research Training Program (RTP) Scholarship at Charles Darwin University, Australia. The funders had no role in considering the study design or in the collection, analysis, interpretation of data, writing of the report, or decision to submit the article for publication.

#### Ethics statement

The study was approved by the Human Research Ethics Committee at Charles Darwin University (IRB No. H21089) and the Clinical Trial Ethics Committee at the Affiliated Hospital of Southwest Medical University (IRB No. KY2022107). All participants provided written informed consent.

#### Data availability statement

All data generated or analyzed during this study are included in this published article.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.apjon.2023.100255>.

#### References

- Zeng H, Chen W, Zheng R, et al. Changing cancer survival in China during 2003–15: a pooled analysis of 17 population-based cancer registries. *Lancet Global Health*. 2018;6(5):e555–e567.
- Hemminki K, Försti A, Hemminki A. Survival in colon and rectal cancers in Finland and Sweden through 50 years. *BMJ open gastroenterology*. 2021;8(1), e000644.
- Brouwer NP, Bos AC, Lemmens VE, et al. An overview of 25 years of incidence, treatment and outcome of colorectal cancer patients. *Int J Cancer*. 2018;143(11): 2758–2766.
- Van Leeuwen M, Husson O, Alberti P, et al. Understanding the quality of life (QoL) issues in survivors of cancer: towards the development of an EORTC QoL cancer survivorship questionnaire. *Health Qual Life Outcome*. 2018;16(1):1–15.

5. Ang WHD, Lau Y, Ngo LPE, Siew AL, Ang NKE, Lopez V. Path analysis of survivorship care needs, symptom experience, and quality of life among multiethnic cancer survivors. *Support Care Cancer*. 2021;29(3):1433–1441.
6. Theofilou P. Quality of life: definition and measurement. *Eur J Psychol*. 2013;9(1).
7. Post M. Definitions of quality of life: what has happened and how to move on. *Top Spinal Cord Inj Rehabil*. 2014;20(3):167–180.
8. Nayak MG, George A, Vidyasagar M, et al. Quality of life among cancer patients. *Indian J Palliat Care*. 2017;23(4):445.
9. Büttner M, Zebralla V, Dietz A, Singer S. Quality of life measurements: any value for clinical practice? *Curr Treat Options Oncol*. 2017;18(5):1–10.
10. Mokhatir-Hesari P, Montazeri A. Health-related quality of life in breast cancer patients: review of reviews from 2008 to 2018. *Health Qual Life Outcome*. 2020;18(1):1–25.
11. Husson O, de Rooij BH, Kieffer J, et al. The EORTC QLQ-C30 summary score as prognostic factor for survival of patients with cancer in the “real-world”: results from the population-based PROFILES registry. *Oncologist*. 2020;25(4):e722–e732.
12. Imran M, Al-Wassia R, Alkhayyat SS, Baig M, Al-Saati BA. Assessment of quality of life (QoL) in breast cancer patients by using EORTC QLQ-C30 and BR-23 questionnaires: a tertiary care center survey in the western region of Saudi Arabia. *PLoS One*. 2019;14(7), e0219093.
13. Lu Q, You J, Kavanagh A, et al. Differences in quality of life between American and Chinese breast cancer survivors. *Support Care Cancer*. 2016;24(9):3775–3782.
14. Colombo R, Doherty DJ, Wilson CM, Krzys M, Lange S, Maynes H. Implementation and preliminary analysis of FACT-G quality of life questionnaire within an oncology survivorship clinic. *Cureus*. 2018;10(3).
15. Matthies LM, Taran F-A, Keilmann L, et al. An electronic patient-reported outcome tool for the FACT-B (functional assessment of cancer therapy-breast) questionnaire for measuring the health-related quality of life in patients with breast cancer: reliability study. *J Med Internet Res*. 2019;21(1), e10004.
16. da Mata Tiezzi MFB, de Andrade JM, Romão APMS, et al. Quality of life in women with breast cancer treated with or without chemotherapy. *Cancer Nurs*. 2017;40(2): 108–116.
17. Moschopoulou E, Deane J, Duncan M, et al. Measuring quality of life in people living with and beyond cancer in the UK. *Support Care Cancer*. 2021;29(10):6031–6038.
18. King S, Exley J, Parks S, et al. The use and impact of quality of life assessment tools in clinical care settings for cancer patients, with a particular emphasis on brain cancer: insights from a systematic review and stakeholder consultations. *Qual Life Res*. 2016; 25(9):2245–2256.
19. Ferrell B, Hassey Dow K, Grant M. Measurement of the quality of life in cancer survivors. *Qual Life Res*. 1995;4(6):523–531.
20. Chopra I, Kamal KM. A systematic review of quality of life instruments in long-term breast cancer survivors. *Health Qual Life Outcome*. 2012;10(1):1–15.
21. EuroQoL. *About EQ-5D*. Accessed 25th Jan.; 2023. <https://euroqol.org/eq-5d-instruments/>
22. Casadei G, Tolley K, Bettio M, et al. Investigation of health-related quality of life outcomes in cancer patients: findings from an observational study using the EQ-5D in Italy. *SN Comprehensive Clin Med*. 2020;2(9):1579–1584.
23. Cella DF, Tulsky DS, Gray G, et al. The Functional Assessment of Cancer Therapy scale: development and validation of the general measure. *J Clin Oncol*. 1993;11(3): 570–579.
24. Cho J, Kang D, Im Ryung, Kim WSK, Ferrell B, Kim SJ. Validation of the Korean version of the quality of life–cancer survivors (QOL-CS-K) questionnaire in lymphoma survivors. *Cancer Res Treatment Off J Korean Cancer Assoc*. 2018;50(1):204.
25. Fujimori M, Kobayakawa M, Nakaya N, et al. Psychometric properties of the Japanese version of the quality of life–cancer survivors instrument. *Qual Life Res*. 2006;15(10):1633–1638.
26. Van Dis FW, Mols F, Vingerhoets AJ, Ferrell B, Van De Poll-Franse LV. A validation study of the Dutch version of the Quality of Life–Cancer Survivor (QOL-CS) questionnaire in a group of prostate cancer survivors. *Qual Life Res*. 2006;15(10): 1607–1612.
27. Hao z, Zhang j. Research progress on quality of life of long-term cancer survivors. *Chin Nurs Manag*. 2019;18(10):1418–1421.
28. Mayer DK, Nasso SF, Earp JA. Defining cancer survivors, their needs, and perspectives on survivorship health care in the USA. *Lancet Oncol*. 2017;18(1):e11–e18.
29. Provencio M, Romero N, Tabernero J, et al. Future care for long-term cancer survivors: towards a new model. *Clin Transl Oncol*. 2022;1–13.
30. Sullivan J, Snider JT, Emma van Eijndhoven M, Okoro T, Batt K, DeLeire T. *The Well-Being of Long-Term Cancer Survivors*. 2018.
31. Smith TG, Strollo S, Hu X, Earle CC, Leach CR, Nekhyudov L. Understanding long-term cancer survivors' preferences for ongoing medical care. *J Gen Intern Med*. 2019; 34:2091–2097.
32. Mitchell AJ, Ferguson DW, Gill J, Paul J, Symonds P. Depression and anxiety in long-term cancer survivors compared with spouses and healthy controls: a systematic review and meta-analysis. *Lancet Oncol*. 2013;14(8):721–732.
33. Cancer Council NSW. *Feeling tired and lacking energy*. Cancer Council NSW. Accessed 14 April 2023. <https://tinyurl.com/mr3betwz>.
34. Grov EK, Fosså SD, Dahl AA. Short-term and long-term elderly cancer survivors: a population-based comparative and controlled study of morbidity, psychosocial situation, and lifestyle. *Eur J Oncol Nurs*. 2011;15(3):213–220.
35. Sousa VD, Rojjanasrirat W. Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: a clear and user-friendly guideline. *J Eval Clin Pract*. 2011;17(2):268–274.
36. Skivington K, Matthews L, Simpson SA, et al. A new framework for developing and evaluating complex interventions: update of Medical Research Council guidance. *BMJ*. 2021;374.
37. Waltz CF, Strickland OL, Lenz ER. *Measurement in Nursing and Health Research*. Springer publishing company; 2010.
38. Taherdoost H. Validity and reliability of the research instrument; how to test the validation of a questionnaire/survey in a research. In: *How to test the validation of a questionnaire/survey in a research (August 10, 2016)*. 2016.
39. Polit DF, Beck CT, Owen SV. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Res Nurs Health*. 2007;30(4):459–467.
40. Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol*. 2007;60(1): 34–42.
41. FACIT. FACT-G. FACIT.org. Accessed 16 July, 2021. <https://www.facit.org/measures/FACT-G>.
42. Wan C, Meng Q, Tang X, Zhang C, Luo J, Zhang X. Validation of Chinese version of FACT-G in cancer patients. *J Pract Oncol*. 2006;21(1):4.
43. *Version 28.0. IBM SPSS Statistics for Windows*. NY: Armonk; 2021. <https://tinyurl.com/y77etjve>.
44. *Amos (Version 26.0)*. IBM SPSS; 2019.
45. DeVellis RF. *Scale Development: Theory and Applications*. vol. 26. Los Angeles, London, New Delhi, Singapore, Washington DC, Melbourne: Sage publications; 2016.
46. Altman DG. *Practical Statistics for Medical Research*. CRC Press; 1990.
47. Schober P, Boer C, Schwarte LA. Correlation coefficients: appropriate use and interpretation. *Anesth Analg*. 2018;126(5):1763–1768.
48. Tabachnick BG, Fidell LS. *Using Multivariate Statistics*. Allyn & Bacon/Pearson Education; 2007.
49. Hofmann RJ. Complexity and simplicity as objective indices descriptive of factor solutions. *Multivariate Behav Res*. Apr 1 1978;13(2):247–250. [https://doi.org/10.1207/s15327906mbr1302\\_9](https://doi.org/10.1207/s15327906mbr1302_9).
50. Byrne BM. *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming*. Routledge; 2016.
51. Chen K-Y, Wang CW. *Advanced Statistical Analysis Using SPSS and AMOS*. Wunan Book Co.; 2009.
52. Hair JF, Black WC, Babin BJ, Anderson RE. *Multivariate Data Analysis: A Global Perspective*. Pearson Prentice Hall; 2010.
53. Wen L, Liao X, Cao Y, et al. Analysis of hazard factors affecting the quality of life for lung cancer patients after chemotherapy. *J Healthcare Eng*. 2022;2022.
54. Kim K, Kim JS. Factors influencing health-related quality of life among Korean cancer survivors. *Psycho Oncol*. 2017;26(1):81–87.
55. Morimata J, Otomaru T, Murase M, Haraguchi M, Sumita Y, Taniguchi H. Investigation of factor affecting health-related quality of life in head and neck cancer patients. *Gerodontology*. 2013;30(3):194–200.
56. Choi J, Kim S, Choi M, Hyung WJ. Factors affecting the quality of life of gastric cancer survivors. *Support Care Cancer*. 2022;30(4):3215–3224.
57. Pisu M, Azuero A, Halilova KI, et al. Most impactful factors on the health-related quality of life of a geriatric population with cancer. *Cancer*. 2018;124(3):596–605.
58. Chen Q, Li S, Wang M, Liu L, Chen G. Health-related quality of life among women breast cancer patients in eastern China. *BioMed Res Int*. 2018;2018.
59. Yu CL, Fielding R, Chan CL, et al. Measuring quality of life of Chinese cancer patients: a validation of the Chinese version of the functional assessment of cancer therapy–general (FACT-G) scale. *Cancer*. 2000;88(7):1715–1727.
60. Abrahams H, Gielissen M, Verhagen C, Knoop H. The relationship of fatigue in breast cancer survivors with quality of life and factors to address in psychological interventions: a systematic review. *Clin Psychol Rev*. 2018;63:1–11.
61. Pirri C, Bayliss E, Trotter J, et al. Nausea still the poor relation in antiemetic therapy? The impact on cancer patients' quality of life and psychological adjustment of nausea, vomiting and appetite loss, individually and concurrently as part of a symptom cluster. *Support Care Cancer*. 2013;21(3):735–748.
62. Alanazi MT, Alanazi NT, Alfadeel MA, Bugis BA. Sleep deprivation and quality of life among uterine cancer survivors: systematic review. *Support Care Cancer*. 2021;1–10.
63. Tavoli A, Montazeri A, Roshan R, Tavoli Z, Melyani M. Depression and quality of life in cancer patients with and without pain: the role of pain beliefs. *BMC Cancer*. 2008; 8(1):1–6.
64. Jacob J, Palat G, Verghese N, et al. Health-related quality of life and its socio-economic and cultural predictors among advanced cancer patients: evidence from the APPROACH cross-sectional survey in Hyderabad-India. *BMC Palliat Care*. 2019; 18(1):1–12.
65. Tribius S, Meyer M, Pflug C, et al. Socioeconomic status and quality of life in patients with locally advanced head and neck cancer. *Strahlenther Onkol*. 2018;194(8): 737–749.
66. Huang J, Hudson MM, Robison LL, Krull KR. Differential impact of symptom prevalence and chronic conditions on quality of life in cancer survivors and non-cancer individuals: a population StudySymptoms, chronic conditions, and quality of life. *Cancer Epidemiol Biomarkers Prev*. 2017;26(7):1124–1132.