

Development and validation of the Public Attitudes Questionnaire for Cancer Survivors of Returning to Work (PAQ-CSRTW)

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Abstract

Public attitudes significantly influence cancer survivors' successful return to work, yet no validated instrument exists to assess these perceptions. This study aimed to develop and validate the Public Attitudes Questionnaire for Cancer Survivors' Return to Work, providing a practical tool for future research and practice. An initial version of the questionnaire was developed through a literature review and qualitative interviews, then refined using two rounds of Delphi expert consultation with 15 experts and a pilot study with 28 participants. The structure, validity, and reliability of the questionnaire were examined using exploratory factor analysis with 302 participants and confirmatory factor analysis with 305 participants. The final questionnaire comprised six dimensions and 25 items. Exploratory factor analysis yielded a total cumulative variance contribution of 69.649%. Confirmatory factor analysis showed a standardized fit index of 0.903 and a comparative fit index of 0.954. The Cronbach's alpha coefficient for the total questionnaire was 0.888, the split-half reliability coefficient was 0.716, and the test-retest reliability coefficient was 0.904. The Public Attitudes Questionnaire for Cancer Survivors' Return to Work demonstrates good reliability and validity, making it a valid instrument for assessing public attitudes toward cancer survivors reentering the workforce.

Keywords: Cancer Survivors, Public Attitudes, Return to Work, Reliability and Validity

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Introduction

With the improvement of five-year relative survival rates for cancer, the number of cancer survivors has increased accordingly^[1]. According to statistics, approximately 40%–50% of cancer patients worldwide are of working age when they receive their diagnosis^[2], and returning to work is a crucial pathway for them to resume normal life and achieve self-worth^[3]. However, studies indicate that cancer survivors must face not only their own health conditions^[4] but also the attitudes and perceptions from the general public during their reintegration into the workforce^[5].

Social support serves as a pivotal positive factor influencing the return to work of cancer survivors^[6]. Specifically, the material, emotional, or informational support cancer survivors receive through establishing and maintaining positive social relationships plays a crucial role in facilitating their occupational rehabilitation and social integration^[7]. Public attitudes, as a key social environmental factor, constitute an essential component of social support^[8]. However, due to factors such as education level, cultural background, and customs, some members of the public may develop misconceptions or fears about cancer^[9]. This can hinder cancer survivors' employment prospects, leading to their marginalization from mainstream society, unemployment, or forced job changes.

Current research on cancer survivors returning to work primarily encompasses studies focusing on the survivors themselves, including job changes^[10], challenges of returning to work^[11], experiences of re-employment^[12], and influencing factors^[13]. However, reports on public attitudes towards their return to work remain scarce. The

Chinese government places high importance on the comprehensive recovery and social integration of cancer patients, issuing a series of policy documents, including the Healthy China Program (2019–2030)^[14], and the plan to boost employment during the 14th Five-Year Plan period (2021–2025)^[15]. These emphasize improving cancer survival rates and ensuring equal employment rights for all groups. Therefore, understanding public attitudes towards cancer survivors returning to work can provide a basis for policymakers to formulate humane policies and measures, thereby promoting social harmony and fairness.

Since public attitudes are subjective emotions that are difficult to detect through objective assessment methods, the development of questionnaires is necessary^[16]. Through a search of assessment tools related to work in the field of cancer, we found that the current main tools include the Cancer and Work Scale (CAWSE)^[17], the Return to Work Readiness Scale (RRTW)^[18], the 19-item Self-Efficacy Questionnaire for Returning to Work (SEQ-RW-19)^[19], and the Work Support Scale (WSS)^[20]. These tools primarily target cancer survivors themselves, assessing their return-to-work capacity, employment sustainability, readiness for employment, self-efficacy, and support needs. However, there remains a lack of assessment tools specifically designed from the public's perspective to measure their attitudes toward cancer survivors' employment.

A previous study investigated public perceptions of cancer survivors returning to work through semi-structured interviews^[21]. This study aims to further develop a questionnaire based on the existing research to measure the public's attitudes toward cancer survivors' return to work and to quantitatively analyze the composition, influencing

factors, and trends of these attitudes. Ultimately, enhance public understanding and support for cancer survivors, facilitating their successful return to work.

Materials and methods

Design

The exploratory sequential research design^[22], a mixed-methods research methodology frequently employed in tool development, was employed in this work. One of its main characteristics is that it is carried out in two stages: first, qualitative research is used to explore the phenomena, and then, using the data from the qualitative research, quantitative research is designed and implemented to confirm or generalize the preliminary findings.

Generation of the initial version of the questionnaire

The initial pool of items was formed through semi-structured interviews with 28 members of the public between October 2022 and December 2022, which focused on attitudes and perceptions of cancer survivors returning to work. The interview guidelines were as follows: (1) What is your personal opinion on cancer survivors returning to work? (2) What factors do you think hinder cancer survivors from returning to work? (3) What factors do you think promote cancer survivors to return to work? (4) How do you think the public views cancer survivors returning to work? After three successive interviews, data saturation is considered to have been reached when no new topics showing up. Two researchers independently double-coded themes and subthemes, resolving disagreements through discussion, to guarantee the validity of the results. In the end, they identified six themes with 12 subthemes using Colaizzi's seven-step content analysis method: (1) working ability (ability diminished and changing jobs or positions); (2) health status (enhancing physical and mental health and adverse effects on physical and mental health); (3) support system (policy support, employer support, colleague support, and family support); (4) returning to family; (5) self-realization (self-reconstruction and physical and mental reintegration); and (6) colleagues' and leaders' stress (interpersonal relationship pressure and psychological burden). Simultaneously, searches were conducted in databases including CNKI, Wanfang, PubMed, Cochrane Library, CINAHL, and Web of Science using keywords such as 'cancer survivors', 'cancer', 'tumour', 'return to work', 'public', and 'public attitudes'. Relevant content and theoretical frameworks were extracted and synthesised, with social support theory providing its theoretical foundation^[23]. These methods identified six essential dimensions: working ability, health status, support system, returning to family, self-realisation, and colleagues' and leaders' stress, with a total of 31 items. Ultimately, the basic questionnaire with 30 items and six categories was finalised after the group meeting.

Scoring methodology

The Public Attitudes to Returning to Work for Cancer Survivors questionnaire was scored on a 5-point Likert scale, with 1 = completely disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = completely agree. With items 1, 2, 4, 5, 7, 10, 11, 15, 16, 17, 23, 24, and 25 being reverse-scored items. High scores represent public scepticism or negativity towards the return of cancer survivors to work, and the mean score is the sum of the items divided by the number. Reverse scoring attempts to ensure the validity of individuals' attitudes by preventing habitual responses and balancing response bias^[24].

Procedures

There were two stages of the investigation. The first phase included two rounds of Delphi expert consultations and a pre-test to evaluate and revise the preliminary items identified earlier, thereby forming the original questionnaire. The second phase employed two rounds of cross-sectional surveys, utilising exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) respectively to assess the questionnaire's reliability. The distributed questionnaires were collected on the spot and checked by two researchers, and if a large number of blanks or multiple duplicates and identical questionnaires were found, they were judged as invalid. Questionnaire entry was done in parallel by two researchers. All data were collected anonymously.

Phase 1: assessment and revision of the initial questionnaire

Delphi survey

The study assessed the content of the questionnaire through two rounds of Delphi surveys, based on expert ratings of the importance of the questionnaire items (using a 5-point Likert scale: 1 = not important, 5 = very important) and suggestions for modifications provided in the 'Modify Comments Columns and Add Items Columns', indicating what should be deleted or adding new ideas. The formula for the expert coefficient (Cr) is $Cr = (Cs + Ca)/2$, where Ca is the foundation for the expert's judgement and Cs is the expert's familiarity with the study's subject. It is widely accepted that an expert with a $Cr \geq 0.7$ has significant authority in the subject of study and that the results derived from contacting the expert are more trustworthy. The degree of coordination and consistency of the experts' opinions was assessed by computing Kendall's harmony coefficient, or Kendall's W, the value range is between 0 and 1; the greater the value of Kendall's W, the more consistent the experts' opinions were^[25].

Pilot study

Thirty target audiences in the Nantong area were chosen for the survey, and each participant was interviewed to gauge their comprehension of the options, items, and directions of the questionnaire. These were rated on a two-point scale from 'clear' to 'unclear'. When instructions, alternatives, or items were rated as options or several items were rated as unclear, participants were asked to recommend improvements to the questionnaire. To ensure that the questionnaire content was readable (6th-grade reading level) and that the patient understood the process of filling out the form, items that were deemed unclear by more than 20% of participants had to be reassessed. The questionnaire layout was also modified in light of the interviews' findings to improve comfort. Additionally, the audience's time spent filling out the form was used to gauge how easy it was to use, and the rate at which data were missing was used to gauge how well the patient understood and accepted the information.

Phase 2: cross-sectional surveys

Participants

The public in the Nantong area was chosen as the study population between June 2023 and December 2024 using the convenience sampling method. According to the statistical standards, the sample size was at least five to ten times the number of items, and a 20% loss-to-follow-up rate was taken into account. The following are requirements for inclusion: (1) being between the ages of 18 and 70; (2) having had direct or indirect contact with cancer survivors; and (3) being willing to take part in the study and sign an informed consent form. Cognitive disability or other grounds for not being able to

participate in the survey are exclusion criterion. The study was authorised by the Nantong University Affiliated Hospital Ethics Committee under Ethics No. 2024-K068-01. Prior to their participation, all individuals were told about the study's goal and substance, and they all completed an informed consent form.

Determination of the final questionnaire (structural validity/exploratory factor analysis)

From June 2023 to December 2023, 320 members of the Nantong public who satisfied the exclusion criteria were chosen for the study by convenience sampling in accordance with the inclusion and exclusion criteria using a pretest questionnaire consisting of 28 items in six dimensions. Item analyses and an investigation of the pretest questionnaire's structural validity were conducted using this sample.

Assessment of the final questionnaire (confirmatory factor analysis)

After exploratory factor analysis, the final questionnaire items were reduced to 25, and 305 members of the public in the Nantong area were selected for the survey from June 2024 to December 2024 using the convenience sampling method according to the inclusion and exclusion criteria, and this sample was used to analyse the fit and reliability of the final questionnaire.

Statistical analysis

Item analysis

(1) Critical Ratio method: 27% of high scores and 27% of low scores were grouped by Critical Ratio (CR) after the questionnaire was sorted by total score. Independent samples t-tests were then conducted, and if the difference was significant, the entry was deemed to have a good degree of differentiation^[26]. (2) Correlation coefficient method: each entry's and the total score's scores were subjected to Pearson correlation analysis, which requires that $r > 0.4$ and the difference be at a statistical level ($p < 0.05$). If there is a high degree of correlation between each entry and the entire questionnaire, the questionnaire is thought to be more representative and differentiated.

Validity analysis

Content validity

Using a scale from 'not relevant' to 'very relevant', the expert rating method was used to assess the questionnaire's content. Scores ranged from 1 to 4. The number of experts who receive a score of three or four out of the total number of experts is known as the content validity index (S-CVI). If the S-CVI is greater than 0.78, the content validity is considered satisfactory^[27].

Structural validity

Sampling adequacy values by KMO (Kaiser-Meyer-Olkin measure of sampling adequacy, KMO) test and Bartlett's test of sphericity^[28] were significant with a KMO value > 0.8 . Secondly, principal component analysis and variance maximum orthogonal rotation method test^[29] with the following requirements: eigenvalue (Kaiser's criterion) ≥ 1 and a clear decreasing trend in the gravel plot, each common factor contains at least 3 items, the loading value of each entry in the belonging common factor > 0.50 , and the cumulative variance contribution ratio $> 50\%$. To determine whether the factor models fit the data from each sample well, the researchers focused on seven fit indices: chi-square to degrees of freedom ratio (χ^2/df), standardised root mean square residual (SRMR), root mean square error of approximation (RMSEA), goodness of fit index (GFI), incremental fit index (IFI), non-canonical fit index (Tucker-Lewis index, TLI), comparative fit

index (CFI). Interpretation of model fit indices was based on the following critical criteria: when χ^2/df is closer to 0, the better; < 3.00 is acceptable; RMSEA should be < 0.05 ; SRMR should be ≤ 0.08 ; while CFI, TLI, GFI, and IFI ≥ 0.95 indicate a better fit, and ≥ 0.90 is acceptable^[30,31].

Convergent validity

Calculate the factor loadings, average variance extracted (AVE), and composite reliability (CR) for each item. Factor loadings indicate the importance of an item within a dimension. Convergent validity is considered satisfactory when the factor loading > 0.5 , the AVE > 0.5 , and the CR > 0.7 ^[32].

Discriminant validity

Discriminant validity is deemed sufficient for each factor when the AVE squared value exceeds the factor-factor correlation coefficient's absolute value^[32].

Measurement invariance test

This study used Wu and Estabrook's multi-group confirmatory factor analysis methods^[33] to test for invariance across various gender and educational attainment groups in order to confirm whether the factor structure and reliability were constant across various populations. The invariance assessment encompasses three dimensions: the configuration dimension examines whether latent variables share identical configurations across groups; the metric dimension tests for equal factor loadings across groups; and the scalar dimension verifies equal intercepts for observed variables. If the differences in $\Delta\text{CFI} \leq 0.01$ and the differences in $\Delta\text{RMSEA} \leq 0.015$ between these models, invariance may be assumed^[34].

Reliability analysis

The Cronbach's α coefficient, split-half reliability coefficient, and retest reliability coefficient were computed in order to assess reliability. Good questionnaire reliability is indicated by alpha values greater than 0.70^[35]. The re-test reliability of the questionnaire was measured by counting the correlation coefficient of the scores obtained from the two questionnaires after 35 members of the public were asked to complete it again after two weeks of distribution. This was done in order to assess the consistency and stability of the questionnaire over time, and if the correlation coefficient of the two-week retest reliability was greater than 0.7, it was considered to be of good reliability^[36].

Results

Delphi survey

In this study, 15 experts from major hospitals in Jiangsu Province, and teachers from universities were selected to conduct two rounds of expert correspondence, and the general information of the experts is shown in Table 1. The authority coefficients of the two rounds of expert correspondence were 0.9178 and 0.9300 (> 0.7), respectively, and the effective recovery rate was 100%. Kendall's W coefficient for expert opinion consistency in the first round of consultation was 0.305 ($p < 0.001$). The items 'Returning to the original state' and 'Colleague's troubles' were changed to 'Self-realization' and 'Colleagues' and leaders' stress', respectively, in response to the input. Additionally, four entries were removed, and based on expert advice, two new entries were added regarding the positive attitude towards cancer survivors in good health returning to work: 'Survivors with milder conditions and good

Table 1. The basic information of experts ($n = 15$).

Code	Gender	Age	Length of employment (years)	Education attainment	Specialist field
1	Woman	35	10	Bachelor's degree	Nursing management
2	Man	42	15	Master's degree	Clinical nursing
3	Woman	48	20	PhD degree	Nursing education
4	Woman	38	10	Master's degree	Clinical nursing
5	Man	56	25	Master's degree	Nursing education
6	Woman	37	10	Bachelor's degree	Nursing education
7	Woman	45	18	Master's degree	Nursing management
8	Man	40	12	Bachelor's degree	Nursing management
9	Woman	50	22	Master's degree	Clinical nursing
10	Man	48	20	Master's degree	Nursing management
11	Woman	40	12	PhD degree	Medical oncology
12	Man	52	23	PhD degree	Medical oncology
13	Woman	39	11	Bachelor's degree	Clinical nursing
14	Woman	36	10	Bachelor's degree	Nursing management
15	Man	44	16	Master's degree	Nursing management

health should return to work', and 'Cancer survivors returning to work contributes to mental wellbeing'. Kendall's W coefficient of association in the second round of consultation was 0.321 ($p < 0.001$), which suggests that expert opinions were more in agreement than in the first round. In the end, a questionnaire test version with 28 items was produced.

Demographic characteristics of the participants

A total of 643 questionnaires were distributed, and 607 valid questionnaires were recovered, with a recovery rate of 94.4%, and there were no missing values in the recovered questionnaires. The basic information of the 607 study participants is shown in Table 2. The questionnaire data collection and processing flowchart is provided in Supplementary File 1.

Item analysis

According to the independent samples t-test results, all 28 items were distinct from one another, and the differences were statistically significant ($p < 0.05$). When paired with the group discussion, the Pearson correlation analysis revealed that items 5, 13, and 22 had a correlation coefficient of less than 0.4. These were all considered more homogeneous and were eventually deleted, leaving 25 items.

Table 2. The basic information of participants for EFA and CFA.

Characteristics		EFA frequency (%) $n = 302$	CFA frequency (%) $n = 305$
Gender	Man	180 (59.60%)	120 (39.34%)
	Woman	122 (40.40%)	185 (60.66%)
Age	Under 30	7 (2.32%)	11 (3.49%)
	31–40	33 (10.93%)	77 (25.19%)
	41–50	139 (46.02%)	143 (46.73%)
	Over 50	123 (40.73%)	74 (24.59%)
Education	Junior high school and below	128 (42.38%)	24 (7.87%)
	High school or specialized	102 (33.78%)	153 (50.16%)
	College and above	72 (23.84%)	128 (41.97%)
Marital status	Unmarried	8 (2.65%)	70 (22.95%)
	Married	294 (97.35%)	235 (77.05%)
Experience of caring for cancer patients	Have	249 (82.45%)	104 (34.10%)
	Haven't	53 (17.55%)	201 (65.90%)

Validity analysis

Content validity

Six experts were invited to evaluate the questionnaire (details of experts are shown in Table 3), and the correlation of each item with its corresponding dimension could be scored from 'very irrelevant' to 'very relevant' in the order of 0 to 4. The final results showed that the S-CVI of the questionnaire was 0.96, and the I-CVI of each item was 0.83 to 1, indicating that the content validity of the questionnaire developed in this study was superior. The final results showed that the S-CVI of the questionnaire was 0.96 and the I-CVI of each item was 0.83–1, indicating that the content validity of the questionnaire developed in this study was superior, as shown in Table 4.

Structural validity/exploratory factor analysis

Following exploratory factor analysis, the Bartlett's spherical test value was 3678.885 (with 300 degrees of freedom, $p < 0.001$), and the

Table 3. Basic information of experts ($n = 6$).

Code	Age	Specialist field	Professional title	Education attainment	Length of employment
1	47	Clinical medicine	Chief physician	Master's degree	22
2	47	Clinical medicine	Deputy chief physician	PhD degree	20
3	49	Clinical nursing	Chief nurse	Master's degree	25
4	44	Clinical nursing	Deputy chief nurse	Bachelor's degree	20
5	45	Clinical nursing	Deputy chief nurse	Bachelor's degree	23
6	44	Clinical nursing	Senior nurse	Bachelor's degree	20

Table 4. Content validity of the questionnaire.

Item	Expert number						I-CVI	S-CVI
	1	2	3	4	5	6		
1	3	3	4	3	4	4	1	0.96
2	4	4	4	4	3	4	1	
3	4	3	2	4	3	3	0.83	
4	3	4	4	4	3	4	1	
5	4	4	4	2	3	3	0.83	0.83
6	4	3	4	2	4	3	0.83	
7	3	3	3	4	4	4	1	
8	3	3	3	4	3	4	1	
9	3	3	3	3	3	4	1	0.83
10	3	4	3	4	3	4	1	
11	3	4	3	3	4	4	1	
12	3	3	3	4	3	3	1	
13	3	3	3	4	3	3	1	0.83
14	4	4	3	3	3	4	1	
15	3	3	4	3	3	3	1	
16	3	3	4	4	4	4	1	
17	4	3	3	4	3	3	1	0.83
18	4	3	4	4	3	3	1	
19	4	2	3	3	4	4	0.83	
20	3	4	3	3	4	4	1	
21	4	4	3	3	3	4	1	0.83
22	2	4	3	3	3	4	0.83	
23	4	4	3	3	4	3	1	
24	3	3	3	3	4	3	1	
25	4	3	4	4	4	3	1	0.83
26	4	4	4	3	4	3	1	
27	3	4	4	4	4	4	1	
28	4	4	4	3	3	3	1	

KMO value was 0.870, both of which satisfied the requirements for factor analysis. Using principal component analysis and the maximum variance approach, common factors with eigenvalues larger than one were recovered from them by orthogonal rotation (Varimax). With a cumulative variance of 69.649%, the results demonstrated that six common factors with eigenvalues greater than 1 were successfully retrieved. All of the questionnaire's items had loadings > 0.4, and the results of the factor loading matrix are shown in Table 5. The final official questionnaire retained 25 items, including four items on working ability, four items on health status, six items on support systems, five items on returning to family, three items on self-realisation of self, and three items on colleagues' and leaders' stress; see Supplementary File 2 for details.

Confirmatory factor analysis

Maximum likelihood estimation was used to fit the model, and the results of the fit are shown in Table 6.

The model was modified using the Modification Index (MI) to improve fit by releasing covariance paths between certain error terms. All modified model fit indices met acceptable standards. The final obtained model modification index cardinal degrees of freedom ratio (χ^2/df) was 1.617, which was lower than before modification, indicating that the fit had become higher; the value of root mean square error of approximation (RMSEA) was equal to 0.045, and the value of standardized root mean square residual (SRMR) was equal to 0.030, all achieved a good fit range of < 0.05; the value of comparative fit index (CFI) was 0.961, the value of tucker-lewis index (TLI) was 0.954, value of incremental fit index (IFI) was equal to 0.960 and the goodness fit index (GFI) was equal to 0.904, the four indices met the evaluation criteria of 0.9. Overall, the measurement model's goodness of fit was deemed to be consistent with theoretical assumptions, and the model's overall fit was sufficient to support the built model.

Table 5. Rotated component matrix for exploratory factor analysis

Item	Factors					
	1	2	3	4	5	6
II1	0.119	0.116	0.092	0.788	0.022	0.075
II2	0.023	0.114	0.106	0.808	0.097	0.037
II3	0.058	0.173	0.091	0.794	-0.020	0.112
II4	0.078	0.114	0.167	0.789	0.131	0.073
II6	0.053	0.134	0.750	0.102	0.138	0.112
II7	0.129	0.064	0.805	0.099	0.148	0.098
II8	0.100	0.100	0.824	0.106	0.047	0.044
II9	0.134	0.137	0.786	0.153	0.039	0.039
II10	0.796	0.079	0.063	0.053	-0.007	0.021
II11	0.790	0.124	0.143	0.078	0.114	0.068
II12	0.790	0.065	0.110	0.032	0.113	0.041
II14	0.800	0.088	0.107	0.042	-0.035	0.092
II15	0.773	0.049	0.048	0.098	0.152	0.157
II16	0.774	0.140	0.013	0.034	0.040	0.038
II17	0.131	0.815	0.091	0.172	0.090	0.050
II18	0.094	0.801	0.151	0.043	0.071	0.132
II19	0.093	0.816	0.044	0.119	0.045	0.141
II20	0.133	0.806	0.049	0.112	0.063	0.120
II21	0.083	0.810	0.161	0.143	0.028	0.056
II23	0.094	0.126	0.184	0.050	0.833	0.085
II24	0.107	0.043	0.099	0.118	0.825	0.111
II25	0.082	0.071	0.063	0.039	0.848	0.066
II26	0.160	0.158	0.168	0.124	0.107	0.793
II27	0.094	0.152	0.094	0.111	0.092	0.815
II28	0.085	0.123	0.026	0.054	0.075	0.858

Bold values = item loadings (> 0.75).

Convergent validity, discriminant validity

All the item load values ranged from 0.624 to 0.912 and were > 0.5 ($p < 0.05$) (Table 7). The AVE values across all dimensions ranged from 0.548 to 0.717, all exceeding 0.5, and the squared AVE values were greater than the absolute values of the inter-factor correlation coefficients. The CR values ranged from 0.784 to 0.910, all exceeding 0.7 (Table 8). This indicates that the questionnaire possesses good convergent validity and discriminant validity.

Measurement invariance test

In the public sample (120 men and 185 women; 177 had less than a college degree and 128 had a college degree or more), we used a

Table 6. Fit indices of the confirmatory factor analysis model.

Item	χ^2/df	RMSEA	SRMR	IFI	TLI	CFI	GFI
Unmodified	4.518	0.108	0.134	0.650	0.590	0.644	0.697
Modified	1.617	0.045	0.030	0.961	0.954	0.960	0.904
Range	< 3.00	< 0.05	< 0.05	> 0.90	> 0.90	> 0.90	> 0.90

χ^2/df is the chi-square to degrees of freedom ratio; RMSEA is the root mean square error of approximation; SRMR is the standardised root mean square residual; IFI is the incremental fit index; TLI is the Tucker-Lewis index; CFI is the comparative fit index; GFI is the goodness of fit index.

Table 7. Factor loadings from confirmatory factor analysis.

Code	Item	Load values
1	Cancer survivors not fully competent	0.652
2	Cancer survivors less able to work than normal	0.774
3	Cancer survivors can gradually return to work	0.794
4	Cancer survivors should go back to an easy job	0.895
5	Cancer survivors are prone to depression, which interferes with work	0.786
6	Harmonious Colleague Relationships Help Cancer Survivors Stay Physically and Mentally Healthy	0.773
7	Returning to work can lead to a worsening of the condition	0.912
8	Survivors who are less ill and in better health should return to work	0.906
9	Lack of policies and experience in social support for cancer survivors to return to work	0.734
10	Managers don't know how to meet the needs of cancer survivors who want to maintain a balance between health and work (weighing work and health)	0.776
11	Managers don't know how to keep the workload and performance of cancer survivors balanced	0.794
12	Cancer survivors get more time off	0.737
13	Colleagues should give more care to cancer survivors	0.757
14	Managers should refrain from scheduling night shifts for cancer survivors whenever possible	0.762
15	Cancer survivors should rely more on family than work	0.724
16	Family love helps them recover physically and mentally	0.761
17	Returning to the family allows for more care in terms of food, living, etc.	0.776
18	Cancer survivors returning to work helps physical and mental health	0.890
19	Returning to work for cancer survivors can ease the financial burden on families	0.816
20	Survivors returning to work can realize their self-worth and increase their sense of achievement	0.840
21	Working with cancer survivors can be stressful	0.624
22	Working with cancer survivors can be emotionally draining	0.773
23	Communicating with cancer survivors can be stressful for fear of hurting them by saying the wrong thing.	0.730
24	Family love helps them recover physically and mentally	0.750
25	Returning to the family allows for more care in terms of food, living, etc.	0.741

Item codes are consistent with the Cancer Survivors Return to Work Public Attitudes Questionnaire; factor loading values reflect the importance of the entry in the dimension.

Table 8. AVE and CR values for PAQ-CSRTW.

	Dimension					
	1	2	3	4	5	6
Dimension 1	0.784					
Dimension 2	0.070	0.847				
Dimension 3	0.288***	0.235***	0.76			
Dimension 4	0.408***	0.231***	0.347***	0.795		
Dimension 5	0.272***	0.213**	0.346***	0.309***	0.751	
Dimension 6	0.295***	0.231**	0.295***	0.431***	0.224*	0.74
CR	0.863	0.910	0.891	0.895	0.793	0.784
AVE	0.614	0.717	0.578	0.633	0.564	0.548

Dimension 1: Working ability; Dimension 2: Health status; Dimension 3: Support system; Dimension 4: Returning to family; Dimension 5: Self-realisation; Dimension 6: Colleagues' and leaders' stress. CR: Composite reliability; AVE: Average variance extraction; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

multi-group technique to examine measurement invariance across gender and educational attainment groups, as indicated in Table 9. Every ΔCFI was less than 0.01, and every $\Delta RMSEA$ increase was less than 0.015. These findings demonstrate that the model has attained scalar, measurement, and configurational invariance. As a result, the questionnaire results for cancer survivors who are going back to work across genders and educational levels are reliable.

Reliability analysis

The reliability results of the questionnaire are shown in Table 10. The total Cronbach's α value of the final questionnaire was 0.888, the Cronbach's α coefficients did not increase significantly after removing the items sequentially, and they were all ≤ 0.888 , and the coefficients of the dimensions ranged from 0.821 to 0.896, which indicated that the results of the internal consistency test were good after correction. The questionnaire was grouped according to the odd-even number of items, and the correlation between the two groups was calculated to measure the split-half reliability, and the correlation coefficient between the two parts was 0.557, and the Spearman-Brown coefficient

Table 9. Measurement invariance test for gender and educational levels.

Invariance	χ^2	DF	CFI	RMSEA	$\Delta\chi^2$	ΔDF	ΔCFI	$\Delta RMSEA$
Gender								
Configurational	753.822	543	0.948	0.036	29.553	19	-0.003	0.000
Metric	771.697	564	0.949	0.035	47.407	40	0.001	-0.001
Scalar	810.748	585	0.945	0.036	86.458	61	-0.004	0.001
Educational levels								
Configurational	774.056	543	0.944	0.037	24.481	19	-0.001	-0.001
Metric	792.255	564	0.944	0.037	42.68	40	0.000	0.000
Scalar	814.554	585	0.944	0.036	64.979	61	0.000	-0.001

DF: Degree of Freedom; CFI: Comparative Fit Index; RMSEA: Root Mean Squared Error of Approximation.

Table 10. Reliability coefficients of the questionnaire.

Dimension name	Cronbach's α coefficient	Retest reliability coefficient	Split-half reliability coefficient
Working ability	0.866	0.917	
Health status	0.823	0.920	
Support system	0.896	0.906	
Returning to family	0.892	0.955	
Self-realization	0.821	0.931	
Colleagues' and leaders' stress	0.828	0.890	
Scale	0.888	0.904	0.716

was 0.716, which verified that the questionnaire had good stability and reliability in terms of the split-half reliability. The reliability coefficient of the retesting of the questionnaire after two weeks for 35 members of the public was 0.904, and the coefficients of the dimensionality coefficients ranged from 0.890 to 0.955, indicating that the questionnaire has a satisfactory retest reliability.

Discussion

This study outlines the initial development and validation of a questionnaire on public attitudes towards returning to work among cancer survivors, which was developed through a process of literature review, qualitative interviews, Delphi expert survey, and reliability and validity tests. The questionnaire, which ultimately consisted of 25 items in six dimensions, was tested to have good reliability and validity and can be used to assess public attitudes towards returning to work among cancer survivors.

The principles of questionnaire creation were closely adhered to during the questionnaire development process^[37]. First of all, the preliminary qualitative study provided a deep understanding of the public's specific perceptions and attitudes by accurately portraying the workplace environment and social attitudes faced by cancer survivors. The study ultimately included opinions and views on six dimensions: working ability, health status, support system, returning to family, self-realization, and colleagues' and leaders' stress. Secondly, with regard to the Delphi expert survey, we invited 15 experts with rich experience in the field of cancer medicine or care to ensure good representativeness, and the results of the two rounds of correspondence yielded high positive and authoritative coefficients for the experts. Regarding the reliability of the questionnaire, the results of internal consistency, split-half reliability, and retest reliability all indicate that the questionnaire has good stability and reliability^[38]. For EFA and CFA, the KMO statistical values and Bartlett's spherical check results of the questionnaire indicated that the questionnaire was suitable for factor analysis, and the loadings of each item on its corresponding factor exceeded the critical value of 0.4, which embodied the structural reasonableness^[39]. Furthermore, the measurement invariance analysis's findings show that it is reasonable to compare attitude scores across the public's various genders and educational levels. Finally, the fitted indicators after model correction were all in the acceptable range, indicating that the questionnaire has good structural validity and can effectively assess public attitudes towards cancer survivors returning to work^[40].

Survey results indicate that the Chinese public generally supports and accepts cancer survivors returning to the workplace, a sentiment reflected in specific survey items (Supplementary File 3). The Support System and Return to Family dimensions both received relatively high scores (item 14: mean 4.01 ± 1.02 ; item 18: mean 4.42 ± 0.90), suggesting that the majority of participants agreed with statements like 'Family care contributes to their physical and mental recovery' and 'Managers should avoid scheduling night shifts for cancer survivors whenever possible'. This illustrates how the general population is aware of and sensitive to the unique requirements of employees throughout their recuperation. The average scores for both the colleagues' and leaders' stress dimensions were relatively low (reverse-scored item 23: 1.91 ± 0.93 ; item 24: 2.34 ± 1.06). This indicates that participants generally expressed low agreement with statements such as 'Working alongside cancer survivors causes stress' and 'Working alongside cancer survivors leads to low mood'. This suggests that in actual collaborative settings, the public does not exhibit widespread negative emotions or exclusionary attitudes toward colleagues due to their cancer experiences. The questionnaire successfully captures the

public's complex views regarding cancer survivors going back to work by covering a variety of topics, such as behavior patterns, emotions, and cognition. This enables a more thorough comprehension of the composition of public sentiments and how they affect the process of cancer survivors returning to the workforce.

However, this study also has certain limitations. First, the results may not be as broadly representative as they may be because convenience sampling limited the geographic coverage and concentrated participants in a particular area. Second, the questionnaire items came from qualitative research on the Chinese public; for example, China's collectivist ideology^[41] and Confucian cultural traditions^[42] had a big influence on dimensions like 'returning to family' and 'colleagues' and leaders' stress'. Moreover, variations in cultural backgrounds, economic development levels, and workplace environments across different regions may influence the specific manifestations of public attitudes. Therefore, future research plans to conduct cross-validation across broader geographic areas and more diverse cultural contexts to further test the questionnaire's universality.

Furthermore, there is currently a lack of established validation tools that align with this questionnaire. Although one study^[43] assessed public attitudes toward cancer survivors returning to work, the self-designed questionnaire used only underwent exploratory factor analysis. It is not recognised as a reliable, authoritative instrument, and it measures only negative attitudes, failing to capture comprehensive perspectives. Other questionnaires related to cancer stigma^[44] and the Return-to-Work Self-Efficacy Questionnaire^[45] focused solely on patients' self-assessments, failing to incorporate the public perspective. We also looked for questionnaires about workplace accommodations or helpful behaviors. The results primarily included employment-related questionnaires for individuals with mental illnesses^[46], workplace accommodation questionnaires for individuals with chronic illnesses^[47], and productivity loss assessment questionnaires^[48]. These differ from the measurement context of this questionnaire, and none specifically address the return-to-work event. Therefore, this study did not conduct criterion-related validity comparisons with other relevant established scales, which to some extent limited the comprehensiveness of validity verification. Subsequent research should incorporate such comparisons to further clarify the validity level of this questionnaire.

Additionally, the available data only suggest that the questionnaire is capable of accurately differentiating between various attitudes toward cancer survivors going back to work. However, whether these attitude scores can effectively predict actual supportive behaviours toward cancer survivors or specific workplace accommodation measures remains a key direction for this study. We plan to explore this in depth through future longitudinal or intervention studies.

Conclusions

The Public Attitudes Questionnaire for Cancer Survivors of Returning to Work was tested to have good reliability and validity, and the questionnaire was developed to provide a valid assessment tool for the vocational rehabilitation and social integration of cancer survivors.

Ethical statements

Approval was obtained from the Ethics Committee of Nantong University Hospital (2024-K068-01). The procedures used in the study adhere to the tenets of the Declaration of Helsinki. Informed consent was obtained from all participants for the study.

Authors contributions

The authors confirm contribution to the paper as follows: study conception and design: Huang S, Guo Y; data collection: Yang R, Fan Y; analysis and interpretation of results: Jiang Y, Yang R; draft manuscript preparation: Luo J, Jiang Y. All authors reviewed the results and approved the final version of the manuscript.

Data availability

The datasets generated during and/or analyzed in the current study are available from the corresponding author upon reasonable request.

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Conflict of interest

The authors declare that they have no conflict of interest.

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