

RESEARCH ARTICLE

Development of health behaviour questionnaire for breast cancer women in Mainland China

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Funding information

Department of Science & Technology of Liaoning Province, Grant/Award Number: 2015225023; Department of Science & Technology, Grant/Award Number: 2015225023

Abstract

Aim: To develop a questionnaire on the health behaviour of breast cancer women with adjuvant endocrine therapy and to test its reliability and validity.

Design: An instrument-development study was applied that comprised three steps: conceptualization, item generation, content validity and field testing of the health behavior properties.

Methods: On the basis of literature review, the conceptual framework and initial items of each dimension of were designed. The questionnaire investigation was divided into two steps: pre-experiment (group 1) and psychometrics evaluation (group 2). Correlation procedure and factor analysis were employed to rescreen the items. Reliability testing and validity testing were conducted to analyse the psychometric properties of questionnaire.

Results: Exploratory and confirmatory factor analyses yielded a five-factor solution. Cronbach's α was 0.93, the sub-semi-reliability of the questionnaire was 0.79 and internal consistency coefficients was 0.70.

KEYWORDS

breast cancer, health behaviour, nurses, nursing, questionnaire, reliability, validity

1 | INTRODUCTION

Breast cancer (BrCa) is the most common malignant tumour among women worldwide (Fan et al., 2014; Li et al., 2016). According to GLOBOCAN 2018, about 2.1 million new cases of BrCa occurred globally in 2018, accounting for almost a quarter of cancer cases among BrCa women. It is the most common diagnosed cancer in most countries (83.24%) and the leading cause of cancer-related death in more than 100 countries (Bray et al., 2018). About two-thirds of BrCa women test positive for the oestrogen receptor (ER) and/or progesterone receptor (PR) (Burstein et al., 2019). Adjuvant endocrine therapy (AET) is an important component of effective therapy for most hormone receptor-positive BrCa women. AET reduces recurrence and mortality in BrCa women significantly

(Anderson et al., 2014; Bender et al., 2014; Harrow et al., 2014; Weaver et al., 2013). Updated clinical practice guidelines recommend that hormone receptor-positive BrCa women need 5–10 years of endocrine therapy after surgery (Burstein et al., 2019; Wang et al., 2016). Despite the radical difference made by AET in BrCa outcomes, up to 50% of women do not adhere to prescribed regimens (van Herk-Sukel et al., 2010; Hershman et al., 2010) and 31%–73% of women are non-persistent with AET (Murphy et al., 2012; Xu et al., 2020). Thus, the clear benefits of AET are often lost owing to poor adherence.

The World Health Organization (WHO) defines adherence as “the extent to which a person's behaviour—taking medication, following a diet and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider” (World

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Health Organization, 2003). Consistent reductions in risk ranging from 27%–68% over 10.5–24 years of follow-up were reported in those patients with the highest adherence to cancer prevention guidelines compared with the lowest adherence (Kabat et al., 2015; Khaw et al., 2008; McCullough et al., 2011; Petersen et al., 2015; Thomson et al., 2014).

Breast cancer is a chronic disease that needs to be closely monitored throughout each patient's subsequent lifetime. Epidemiologic studies have reported that maintaining or adopting a health behaviour (such as healthy diet and being physically active) after diagnosis may improve BrCa prognosis (George et al., 2011; Holmes et al., 2005; Kelly et al., 2015), while also reducing all-cause mortality (George et al., 2014; Irwin et al., 2011). The health behaviour of BrCa women (such as AET adherence, dietary nutrition status, weight change, physical activity status, smoking, and drinking) was associated with tumour metastasis and recurrence, disease-free survival rate and mortality (Chlebowski, 2013; World Cancer Research Fund International & American Institute for Cancer Research, 2014). Studies have shown that many health behaviours usually co-occur (Spring et al., 2015), therefore, a composite variable may better capture how health behaviour factors synergistically affect BrCa specificity and total mortality. These impacts of a combination of health behaviour on mortality have been investigated in several studies (Kabat et al., 2015; McCullough et al., 2011; Petersen et al., 2015; Thomson et al., 2014), but few have applied a simple questionnaire taking national guidelines into account.

After an extensive literature review, no questionnaire was found that reveals the health behaviour of BrCa women undergoing AET, among the few studies available regarding the health behaviour of BrCa women. For instance, Heitz et al. (2018) proposed a healthy behavior index (HBI). The HBI was constructed from smoking status, alcohol consumption, dietary pattern, vigorous physical activity, body mass index (BMI), to evaluate associations with all cause and BrCa-specific mortality in non-Hispanic white and Hispanic women. The dietary pattern and vigorous physical activity in HBI are only a general term, which cannot well distinguish health behaviour. According to the WHO definition of health behaviour, medical adherence and maintaining a good mental health are also considered as the categories of health behaviour, these two kinds of behaviour are particularly important for BrCa women with AET, but they were not shown in the HBI. Therefore, HBI is not applicable to BrCa women with AET. Another article reported on the Spanish women's breast health behaviour questionnaire, which was designed for breast health behaviour in healthy women (Wells et al., 2001). Other studies on health behaviour are some questions or a summary variable about five lifestyles in accordance with relevant guidelines (Chirgwin et al., 2016; Heitz et al., 2018; Kelly et al., 2015; Kwan et al., 2010; Petersen et al., 2015; Warren Andersen et al., 2016), which makes it difficult to really understand the comprehensive state of BrCa women's health behaviour. Therefore, an easy and composite variable questionnaire was developed that can be used to evaluate the status of health behaviour implementation in BrCa women and to guide health professionals when making decisions about effective intervention to

promote health behaviour. Our study aimed to construct and validate a health behaviour questionnaire (HBQ) for BrCa women with AET.

2 | METHOD

2.1 | Participants

This cross-sectional study was conducted during the period from June 2018 to October 2019 in two university hospitals in Shenyang, China. The questionnaire investigation was divided into two steps: pre-experiment (group 1) and psychometrics evaluation (group 2). Initial exploratory factor analysis (EFA) and internal reliability analyses were performed using responses from group 1 (N = 264). Responses from group 2 (N = 329) were used to confirm the factor structure. The cases included in each subsample satisfied the requirement for the sample size to be 5–10 times the number of items for EFA and at least 200 cases for confirmatory factor analysis (CFA).

Inclusion criteria: positive for the ER and/or PR; diagnosed with BrCa; taking endocrine therapy for more than 1 month; BrCa women above 18 years old; facility with the Chinese language; and volunteered participation in the survey.

Exclusion criteria: Women with other malignant tumours history; and patients with other critical diseases (such as severe infection, malignant hypertension, severe cerebrovascular accident, myocardial infarction and heart failure).

2.2 | Health behaviour questionnaire

According to WHO definition of health behaviour, the conceptual and theoretical framework for the HBQ was based on a review of pertinent literature (Fu, 2017; Ma, 2012; Tian & Cheng, 2016). This study defined healthy behaviour in BrCa women as behaviour considered conducive to disease prevention and positive health, including efforts to reduce or eliminate dangerous behaviour such as drinking, smoking, poor diet and the adoption of positive health behaviour such as reasonable nutrition, rest and regular exercise, keep a good mental state, take AET medication regularly as directed by medical professionals. The initial draft of the HBQ for BrCa patients with endocrine therapy was based on the following: guidelines of the Chinese Society of Clinical Oncology Breast Cancer (CSCO, 2017), guidelines for lifestyle modification for Chinese BrCa survivors (Breast Health Group of the Branch of Women Health of Chinese Preventive Medicine Association, 2017), the American Cancer Society's Cancer-Anticancer Nutrition and Exercise Guide (Kushi et al., 2012), Chinese Nutrition Therapy Guidelines for Cancer Patients (Chinese Anti-cancer Association Cancer Nutrition & Support Treatment Professional Committee, 2015) and Breast Oncopsychology (Kong & Wu, 2016). Then, the HBQ draft was presented to 10 BrCa endocrine therapy patients and one oncologist, who were asked if there was anything that needed to be added or inconsistent based on their understanding of healthy behaviour.

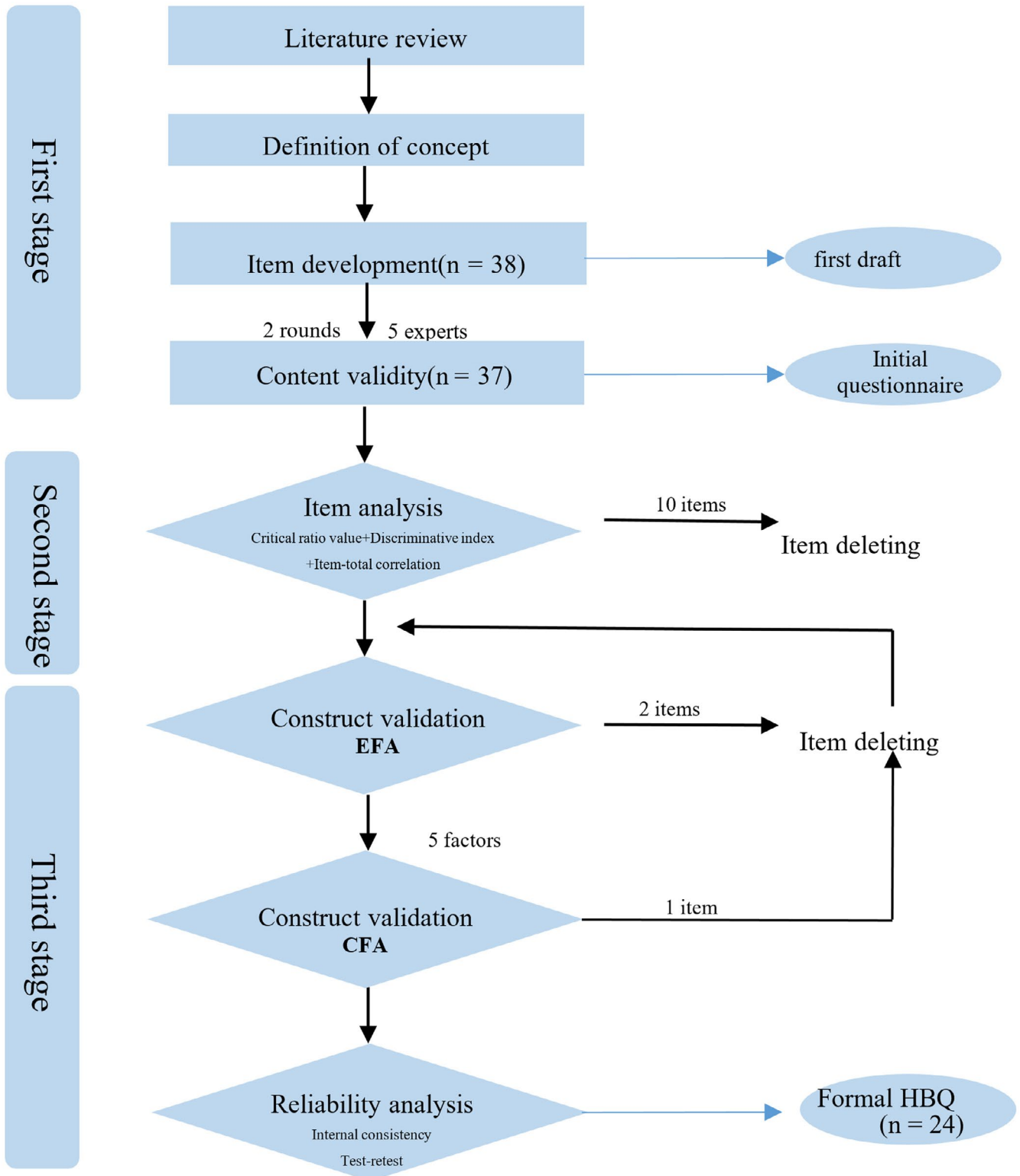


FIGURE 1 Breast cancer HBQ preparation and testing process. HBQ, health behaviour questionnaire

After modification, the original version of the questionnaire was formed and five experts were consulted, including two BrCa experts, one psychology expert and two nursing experts. The five experts were conducted to determine whether an item should be kept, evaluated the content validity of the original questionnaire, measured with the content validity index (CVI). These five experts evaluated the

objectivity, accuracy and comprehensiveness of the questionnaire, as well as the relevance, simplicity and accuracy of each item and measurement objective. The initial questionnaire was formed after the second consultation based on the opinions of five experts. Another 10 BrCa patients with endocrine therapy were asked to evaluate the face validity of the questionnaire to obtain the time required for the

test. Finally, the results from the expert evaluation and patient evaluation were integrated and a revised questionnaire with 37 items was formed. The item content validity index (I-CVI) ranged from 0.8–1 and the scale content validity index (S-CVI) was 0.93.

The questionnaire comprised 37 items in five categories: therapeutic behaviour, medication behaviour, diet behaviour, physical behaviour and psychosocial behaviour. A five-point Likert rating was used (viz., never, seldom, sometimes, often, always). The corresponding score for each positive 5-point item was 1 point, 2 points, 3 points, 4 points and 5 points, while reverse items were scored in reverse (5, 14, 17, 22 & 27). Higher scores indicate better executive health behaviour.

2.3 | Data collection

The questionnaire was administered and explained its purpose, significance and study requirements to the participants beforehand, so as to obtain the participants' cooperation. The participants were informed that their data would remain confidential. The participants were then instructed to fill in the questionnaire. Meanwhile, items that were not understood by the patient were explained. To ensure accurate and authentic results, items were read aloud to patients with poor eyesight or low education. The questionnaire was filled in anonymously and collected immediately on completion. Exclusion criteria for invalid questionnaires: the number of unanswered items in the questionnaire exceeded 20%; the questionnaire contained undulating or monogrammed answers (Qian & Yuan, 2011).

2.4 | Statistical analysis

2.4.1 | Reliability

Cronbach alpha coefficient was used to reflect the internal consistency of each domain and facet. An alpha value >0.70 was considered acceptable for group comparisons (DeVellis, 2010; Wan et al., 2008). The test-retest reliability (reproducibility) was assessed through calculating the Pearson correlation coefficient (or Spearman rank correlation coefficient for non-normal distribution) of the first and second test data to determine stability of the questionnaire; the interval between the two test times was two weeks.

2.4.2 | Validity

We performed three statistical procedures to explore the construct validity of the HBQ: (a) Pearson correlation coefficient was calculated to find the correlation between items and facets, (b) EFA with varimax rotation was conducted by using principal component analysis to probe the potential structure of the questionnaire. Factors were extracted according to eigenvalues > 1 and (c) CFA using structural equation modelling was carried out to further test the relationship between the observed variables and their underlying latent

constructs identified from the EFAs. CFA quality was measured by fitting index, standardized factor load λ , composite reliability, convergent validity and discriminant validity.

2.4.2.1 The goodness of fit of the overall model was tested using the following judgment criteria: (a) χ^2 , (b) χ^2 and degrees of freedom (χ^2/df), (c) goodness-of-fit index (GFI), (d) root mean square error of approximation (RMSEA), (e) root mean square residual (RMR) along with the relative fit indices (f) comparative fit index (CFI) and (g) normed fit index (NFI), (h) incremental fit index (IFI). χ^2/df value of <3 and RMSEA, RMR of <0.08 indicated good model level, researchers have suggested that GFI, AGFI, CFI, IFI and NFI of 0.8 or greater indicate acceptable level (Abedi et al., 2015).

2.4.2.2 Standardized factor load λ reflects the influence of potential variables on the measurement variables, where λ above 0.71 is ideal and λ above 0.45 indicates decent explanatory power (Tabachnick & Linda, 2007). A composite reliability (CR) above 0.7 is a relatively stable measurement. Raine-Eudy argued that a CR above 0.5 indicates that the measuring tool can obtain basic stability when reflecting a true score (Raines-Eudy, 2000).

2.4.2.3 Convergent validity was determined by measuring the significance level of the factor loading and the average variation extraction value (AVE) of the latent variable. When the factor loading of all items to latent variables reaches a significant level and latent variables can explain a considerable degree of variation, it can be regarded as having convergent validity (Garbarino & Johnson, 1999). AVE was used to extract the values by calculating the average variance of the square root of each dimension and the internal consistency of variables in the structure was tested to determine the validity of convergence. The AVE for each dimension is generally recommended to be >0.5 (Fornell & Larcker, 1981).

2.4.2.4 Discriminant validity was assessed using Square root of AVE: can be understood as the correlation coefficient of data within the underlying variable. According to the criteria given by Fornell and Larcker (Fornell & Larcker, 1981), if the AVE arithmetic square root is greater than the absolute value of correlation coefficient between potential variables, internal correlation is greater than external correlation, indicating that there is a difference between potential variables, then the discriminant validity is high.

Data were analysed using IBM SPSS Statistics (version 25) and AMOS software (version 23). The statistical description included frequency, percentage, maximum, minimum, mean and standard difference. The statistical inference was conducted by *t* test, factor analysis and Spearman correlation analysis.

2.5 | Ethical considerations

This study was approved by the ethics committee at Liaoning Cancer Hospital (Project No. 20180450). Participants had sufficient information about the purpose, method and process of the research. The participants have the right to freely choose and they can freely choose to participate in or withdraw from the study. All participants signed an informed consent.

3 | RESULTS

3.1 | Participant characteristics

Initially, we collected data from 264 participants, adapting an initial version of the HBQ questionnaire to select the items and then analysed validity and reliability of modified versions by enrolling another 329 participants to finish the survey. Figure 1 shows the preparation and detection of HBQ for BrCa. Participants' characteristics in the two surveys are shown in Table 1.

3.2 | Project analysis

Project analysis was performed on all 264 valid questionnaires. According to the questionnaire extreme group test method, the score difference between the low group and the high group in item

17 and item 29 was not significant ($p > .05$). Item 4 had a higher missing value of 1.5%. Spearman correlation analysis was adopted and the correlation value for each item was 0.103–0.671. The correlation coefficient between the items and the total questionnaire was <0.4 , the factor load value was 0.39–0.757 and Item 30 had a value of <0.4 . After a comprehensive analysis, 10 items were deleted, and 27 items were retained.

3.3 | Validity

3.3.1 | EFA with group 1

Structural validity was calculated by EFA. The KMO of the HBQ for BrCa patients with AET was 0.901. The Bartlett sphericity test statistic was 2,786.507 (degrees of freedom: 300, $p < .001$). Information from the research project could thus be extracted effectively and suitable

TABLE 1 General characteristics of the study participant

Variable	Content	Group 1 (N = 264)		Group 2 (N = 329)	
		Cases	Percentage	Cases	Percentage
Age	≤39	32	12.1	43	13.1
	40–49	112	42.4	138	42.0
	50–59	94	35.6	113	34.3
	≥60	26	9.8	35	10.6
Marital status	Unmarried	3	1.14	2	0.6
	Married	234	88.64	291	88.5
	Widowed	3	1.14	2	0.6
	Divorced	17	6.44	23	7.0
	Cohabitation	7	2.65	11	3.3
Occupational status	Yes	102	38.6	194	59.0
	No	162	61.4	135	41.0
Religious beliefs	Yes	50	18.94	74	22.5
	No	214	81.06	255	77.5
Smoking	Never smoking	247	93.56	273	83.0
	have given up smoking	15	5.68	53	16.1
	still smoking	2	0.76	3	0.9
Drinking	Never	143	54.2	170	51.7
	have given up	26	9.8	38	11.6
	Still drinking	95	36	121	36.7
BMI	<18.5	4	1.5	7	2.1
	18.5–24.99	167	63.3	186	56.5
	25–29.99	75	28.4	117	35.6
	≥30	15	5.7	19	5.8
Duration of oral drug (month)	≤12	91	34.5	119	36.2
	13–24	34	12.9	74	22.5
	25–36	43	16.3	51	15.5
	37–48	44	16.7	49	14.9
	≥49	52	19.6	36	10.9

TABLE 2 Factor loadings and item communalities by EFA (N = 264)

Item	Factor1	Factor2	Factor3	Factor 4	Factor 5
33 Do you take the endocrine medication as prescribed by your doctor?	0.827				
23 Are you willing to take the medicine until the end of the treatment?	0.773				
21 Are you taking the medication recommended by your doctor?	0.75				
15 Do you always take endocrine therapy every day?	0.732				
27 Have you stopped using endocrine drugs due to adverse reactions?	0.649				
1 Are you able to follow your doctor's advice?	0.637				
26 Do you insist on a doctor's recommendation?	0.612				
25 Do you insist on brisk walking, jogging or other moderate intensity exercise for more than 30 min once?		0.841			
6 Do you insist on fast walking, jogging and other exercises 150 min per week?		0.82			
24 Do you often take aerobic exercise such as walking/jogging/swimming/cycling/dancing/taijiquan?		0.81			
31 Do you exercise more than three times a week?		0.796			
13 Do you find time to exercise when you are busy?		0.71			
36 Do you have a suitable way of exercise?		0.562	0.503		
37 Do you always have a way of keeping yourself from feeling lonely?			0.7		
34 Do you find ways to help yourself relax?			0.663		
12 Do you control your negative emotions and stay positive?			0.656		
20 Do you often initiate conversations with others?			0.609		
32 Do you often maintain a steady optimism in the face of illness?			0.604		
9 Do you eat fresh fruit every day?				0.757	
10 Do you usually pay attention to calcium and vitamin D supplements?				0.646	
7 Do you eat fresh vegetables every day?				0.626	
8 Do you drink enough water (2,000 ml) every day?				0.622	
3 Do you always eat calcium-rich foods such as fish, meat, eggs, milk and soy products?				0.56	
28 Do you seek medical help when you need?					0.789
2 During the treatment, do you communicate with the medical staff timely when vomiting, dizziness, irregular vaginal bleeding and other symptoms occur?					0.741
Eigenvalue	4.02	3.94	2.78	2.57	1.55
Variance, %	16.08	15.76	11.11	10.29	6.21
Cumulative, %	16.08	31.82	42.93	53.22	59.43

Note: Factor loadings below 0.4 are not shown.

Abbreviation: EFA, exploratory factor analysis.

for factor analysis. Using the principal component analysis method, the characteristic value is >1, the maximum variance is orthogonal rotation and five common factors are extracted. The gravel diagram is formed after the fifth factor and the cumulative contribution rate is 59.425%. The factor loads for Items 16 and 35 were <0.4. Therefore, items 16 and 35 were removed. Finally, a questionnaire with 25 items and 5 factors was formed. According to the percentage of explanatory variance, the order of each factor was as follows: treatment behaviour (seven items), exercise behaviour (six items), psychological adjustment

(five items), diet behaviour (five items) and active medical-seeking behaviour (two items). The results are shown in Table 2.

3.3.2 | CFA with group 2

Five-factor models were obtained through EFA and the results were verified using AMOS software. Item 5's λ is 0.33, <0.45, so delete the item and start the CFA again. λ ranged from 0.576–0.912, combined

TABLE 3 The standardized factor load, composite reliability and convergent validity

	UNSTD	SE	Z	p	STD	CR	AVE
Item1 ← Factor1	1				0.808	0.94	0.72
Item2 ← Factor1	1.014	0.056	18.165	***	0.847		
Item3 ← Factor1	1.036	0.051	20.286	***	0.912		
Item4 ← Factor1	0.875	0.05	17.438	***	0.824		
Item6 ← Factor1	0.945	0.048	19.834	***	0.898		
Item7 ← Factor1	0.922	0.056	16.367	***	0.788		
Item8 ← Factor2	1				0.783	0.93	0.69
Item9 ← Factor2	1.076	0.068	15.78	***	0.793		
Item10 ← Factor2	1.042	0.061	16.959	***	0.839		
Item11 ← Factor2	1.129	0.061	18.491	***	0.896		
Item12 ← Factor2	1.067	0.059	18.079	***	0.88		
Item13 ← Factor2	1.009	0.063	15.904	***	0.798		
Item14 ← Factor3	1				0.779	0.83	0.50
Item15 ← Factor3	0.932	0.091	10.249	***	0.576		
Item16 ← Factor3	1.086	0.069	15.718	***	0.858		
Item17 ← Factor3	0.859	0.081	10.579	***	0.593		
Item18 ← Factor3	0.847	0.07	12.153	***	0.673		
Item19 ← Factor4	1				0.746	0.88	0.59
Item20 ← Factor4	1.079	0.071	15.222	***	0.842		
Item21 ← Factor4	0.969	0.066	14.576	***	0.807		
Item22 ← Factor4	0.855	0.068	12.572	***	0.703		
Item23 ← Factor4	0.817	0.061	13.367	***	0.745		
Item24 ← Factor5	1				0.86	0.76	0.61
Item25 ← Factor5	0.953	0.096	9.975	***	0.698		

Abbreviations: AVE, average variation extraction value; CR, composite reliability; SE=Standard error; STD, standardized factor load; UNSTD, Unstandardized factor load; Z, regression weight estimate.

*** $p < .001$.

reliability CR ranged from 0.76–0.94, convergent validity AVE ranged from 0.50–0.72 and discriminant validity ranged from 0.71–0.85. The fit indices indicated that the five-factor model provided a good fit to the data: χ^2/df ratio = 2.561 ($\chi^2 = 619.86$, $df = 242$, $p < .001$), RMSEA = 0.069, RMR = 0.057, GFI = 0.867, CFI = 0.931, IFI = 0.931, and NFI = 0.892. The results are shown in Table 3 and 4 and Figure 2.

3.4 | Reliability

The Cronbach's α of the HBQ for BrCa patients with AET was 0.934. The split-half reliability of the questionnaire was 0.792. After a two-week interval, another 50 BrCa women were given health behaviour questionnaires. The internal consistency coefficients (ICC) for the total scale were 0.704 ($p < .01$). Table 5 lists the results.

4 | DISCUSSION

In our study, HBQ was developed and its reliability, convergence validity and discriminant validity were tested in total samples of

593 BrCa women with AET. Exploratory factor analysis, reliability analysis and CFA all significantly supported the questionnaire presented in this paper. That indicates that the questionnaire has good reliability and validity. The HBQ can be used to evaluate the status of health behaviour implementation in BrCa women. Studies have shown that maintaining or adopting a health behaviour after diagnosis may improve BrCa prognosis, while also reducing all-cause mortality (George et al., 2014; Kelly et al., 2015). Among the few studies available regarding the health behaviour of BrCa women, few questionnaires that reveal the health behaviour of BrCa women undergoing AET was found.

In our study, 10 patients with BrCa under endocrine therapy were interviewed to see if the description of each item matched the questionnaire itself. The results indicate that these items can accurately express the content to be measured. It is generally believed that an I-CVI above 0.78 indicates better content validity (Shi et al., 2012). In this study, the I-CVI and the S-CVI above that, this indicates that the questionnaire had good content validity.

In the project analysis, there were 10 items with the correlation coefficient < 0.4 , which were 4, 5, 11, 14, 17, 18, 19, 22, 29 and 30, respectively. Item 4 ("do you adhere to contraception during

treatment?") had a higher missing value, accounting for 1.5%, the analysis found that this item was not applicable to postmenopausal or unmarried patients. The factor loads for Items 16 and 35 were <0.4, they were considered for deletion (Laura et al., 2004; North

Carolina State University, 2008). After EFA analysis, 12 items were excluded from the questionnaire. The removal of 12 items did not affect the overall assessment scope of the questionnaire. A questionnaire with 25 items and 5 factors was ultimately formed. The dimension structure of the initial questionnaire formation hypothesis is generated according to the classification of healthy behaviours and activities of patients with chronic disease, which is consistent with the original theoretical conception. Therefore, the questionnaire has a good structural validity.

TABLE 4 The correlation coefficients and discriminant validity (N = 329)

	AVE	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factor 1	0.72	0.85				
Factor 2	0.69	0.34	0.83			
Factor 3	0.5	0.475	0.482	0.71		
Factor 4	0.59	0.456	0.631	0.712	0.77	
Factor 5	0.61	0.383	0.429	0.617	0.627	0.78

Note: The value on the diagonal is the square root of AVE, the value of the lower triangle is the Pearson correlation coefficient between different dimensions.

The AVE value is the sum of the square of the factor loading value, which represents the comprehensive explanatory ability of the potential variable for all measured variables. The larger the AVE value is, the stronger the potential variable of corresponding items can be explained. Conversely, the stronger the variable convergence, the better the convergence effectiveness. The convergence validity was $AVE > 0.5$, with a minimum not < 0.36 (Fornell & Larcker, 1981). The AVE for this questionnaire ranged from 0.50–0.72, indicating

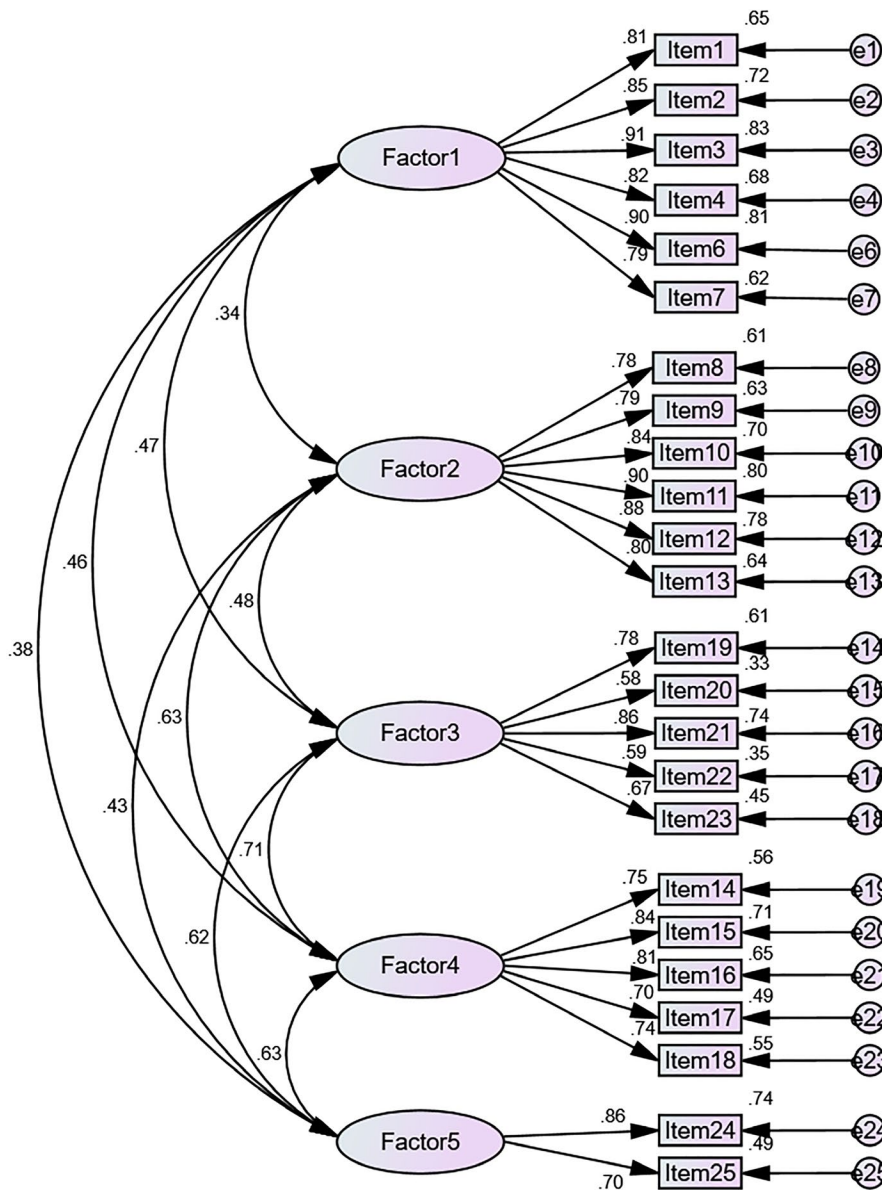


FIGURE 2 Bootstrapped five-factor HBQ CFA model. CFA, confirmatory factor analysis; HBQ, health behaviour questionnaire

TABLE 5 Internal consistency reliability and test-retest reliability

	Total scale/subscale	Numbers of items	Mean	SD	Cronbach's alpha	ICC
	Total scale	24	97.38	13	0.934	0.704**
Factor 1	treatment behaviour	6	31.12	4.44	0.937	0.802**
Factor 2	exercise behaviour	6	21.28	5.13	0.93	0.769**
Factor 3	psychological adjustment behaviour	5	18.78	3.48	0.811	0.542**
Factor 4	diet behaviour	5	18.89	3.14	0.877	0.743**
Factor 5	active medical seeking behaviour	2	7.31	1.93	0.744	0.577**

Abbreviation: ICC, internal consistency coefficients.

** $p < .001$.

that the questionnaire has good convergent validity. When the value on the diagonal between the dimensions of the discriminant validity is greater than all the values in the row and column, the questionnaire has better discriminant validity. The following results pertain to the fitting degree index: $\chi^2/df < 3$, RMR < 0.08 , RMSEA < 0.08 and PGFI > 0.5 . The closer that the CFI, IFI, NFI, GFI and AGFI are to 1, the better the fitting degree. This questionnaire obtained a good degree of fit.

A Cronbach's α coefficient ≥ 0.70 was reserved for this purpose of the questionnaire (Cronbach, 1951). The comprehensive CFA results showed that the questionnaire had good reliability. The overall Cronbach's α of the questionnaire was 0.934. This indicates that the questionnaire has good internal consistency and reliability.

4.1 | Strengths and limitations

The main advantage of this study is the innovativeness of the questionnaire. An extensive review of the literature was conducted before preparing the questionnaire. Thus far, no suitable questionnaire for the health behaviour of BrCa patients with endocrine therapy is available. Further, the concept for the questionnaire was designed on the basis of this literature review and its content was derived from the latest guidelines and standards domestically and abroad. Combined with the psychological characteristics and clinical characteristics of patients with BrCa endocrine therapy, the questionnaire was prepared with the express purpose of making the questionnaire comprehensive and clear. Finally, the results of this study show that this questionnaire can be used as a tool for clinical nursing workers to evaluate the health behaviour of BrCa women and to guide targeted measures to improve the health of patients with BrCa endocrine therapy, which in turn can improve the treatment effect and reduce the cost of treatment.

The HBQ draft was based on a review of the literature and recommendations in the guidelines and we only gave the draft to 10 BrCa endocrine therapy patients and one oncologists, asked if there was anything that needed to be added or inconsistent based

on their understanding of healthy behaviour. But if we can carry on the semi-structured interviews with potential stakeholders, such as BrCa patients receiving endocrine therapy and their oncologists, will have a better understanding of the endocrine therapy of BrCa patients health behaviour and will give our questionnaire is more specific.

The health behaviour questionnaire did not find an appropriate questionnaire as the calibration questionnaire, so it was impossible to compare the correlation validity with the criterion-related validation known-groups comparison validation. However, the study carried out CFA on the questionnaire and comprehensively verified the structural validity of the questionnaire through λ , CR, AVE and square root of AVE and fitting degree index to remedy this limitation.

5 | CONCLUSIONS

The results demonstrated that the average score of the health behaviour of BrCa women treated with AET was 97.38 (SD 13). Participants whose total score was higher than the average accounted for 53.41%, which was generally in the midrange level in this study. The health behaviour questionnaire developed in our research showed good reliability and validity and can serve as an effective tool for clinical workers to evaluate the health behaviour of BrCa patients with endocrine therapy.

ACKNOWLEDGEMENTS

The authors would like to thank the librarians at China Medical University for their help retrieving literature. We thank International Science Editing for editing this manuscript. (<http://www.international-scienceediting.com>)

CONFLICT OF INTEREST

All authors declare that they have no conflict of interest.

FUNDING INFORMATION

This work was supported by the Department of Science & Technology of Liaoning Province (code: 2015225023).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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REFERENCES

- Abedi, G., Rostami, F., & Nadi, A. (2015). Analyzing the dimensions of the quality of life in hepatitis B patients using confirmatory factor analysis. *Global Journal of Health Science*, 7(7), 22–31. <https://doi.org/10.5539/gjhs.v7n7p22>
- Anderson, W. F., Rosenberg, P. S., Prat, A., Perou, C. M., & Sherman, M. E. (2014). How many etiological subtypes of breast cancer: Two, three, four, or more? *Journal of the National Cancer Institute*, 106(8), dju165. <https://doi.org/10.1093/jnci/dju165>
- Bender, C. M., Gentry, A. L., Brufsky, A. M., Casillo, F. E., Cohen, S. M., Dailey, M. M., Donovan, H. S., Dunbar-Jacob, J., Jankowitz, R. C., Rosenzweig, M. Q., Sherwood, P. R., & Sereika, S. M. (2014). Influence of patient and treatment factors on adherence to adjuvant endocrine therapy in breast cancer. *Oncology Nursing Forum*, 41(3), 274–285. <https://doi.org/10.1188/14.ONF.274-285>
- Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., & Jemal, A. (2018). Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians*, 68(6), 394–424. <https://doi.org/10.3322/caac.21492>
- Breast Health Group of the Branch of Women Health of Chinese Preventive Medicine Association. (2017). Guidelines on lifestyle modification for Chinese breast cancer survivors. *Zhonghua Wai Ke Za Zhi*, 55(2), 81–85. <https://doi.org/10.3760/cma.j.issn.0529-5815.2017.02.001>
- Burstein, H. J., Lacchetti, C., Anderson, H., Buchholz, T. A., Davidson, N. E., Gelmon, K. A., Giordano, S. H., Hudis, C. A., Solky, A. J., Stearns, V., Winer, E. P., & Griggs, J. J. (2019). Adjuvant endocrine therapy for women with hormone receptor-positive breast cancer: ASCO clinical practice guideline focused update. *Journal of Clinical Oncology*, 37(5), 423–438. <https://doi.org/10.1200/jco.18.01160>
- Chinese Anti-cancer Association Cancer Nutrition and Support Treatment Professional Committee. (2015). Chinese nutrition therapy guidelines for cancer patients (pp. 320). People's Medical Publishing House (PMPH).
- Chirgwin, J. H., Giobbie-Hurder, A., Coates, A. S., Price, K. N., Ejlertsen, B., Debled, M., Gelber, R. D., Goldhirsch, A., Smith, I., Rabaglio, M., Forbes, J. F., Neven, P., Láng, I., Colleoni, M., & Thürlimann, B. (2016). Treatment adherence and its impact on disease-free survival in the breast international group 1–98 trial of tamoxifen and letrozole, alone and in sequence. *Journal of Clinical Oncology*, 34(21), 2452–2459. <https://doi.org/10.1200/JCO.2015.63.8619>
- Chlebowski, R. T. (2013). Nutrition and physical activity influence on breast cancer incidence and outcome. *Breast*, 22(Suppl 2), S30–S37. <https://doi.org/10.1016/j.breast.2013.07.006>
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297–334. <https://doi.org/10.1007/bf02310555>
- CSCO (2017). *Guidelines of Chinese Society of Clinical Oncology (CSCO) Breast Cancer.V1* (G. w. c. o. C. s. o. c. oncology Ed.). People's Medical Publishing House (PMPH).
- DeVellis, R. F. (2010). *Scale development: Theory and applications*. Translated by: Yonggang W, Zhongen, Changque L. Chongqing University Press.
- Fan, L., Strasser-Weippl, K., Li, J.-J., St Louis, J., Finkelstein, D. M., Yu, K.-D., Chen, W.-Q., Shao, Z.-M., & Goss, P. E. (2014). Breast cancer in China. *The Lancet Oncology*, 15(7), e279–289. [https://doi.org/10.1016/s1470-2045\(13\)70567-9](https://doi.org/10.1016/s1470-2045(13)70567-9)
- Fornell, C., & Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research (JMR)*, 18(1), 39–50. <https://doi.org/10.2307/3151312>
- Fu, H. (2017). *Health education* (3rd ed.). People's Medical Publishing House (PMPH).
- Garbarino, E., & Johnson, M. S. (1999). The different roles of satisfaction, trust and commitment in customer relationships. *Journal of Marketing*, 63(2), 70–87. <https://doi.org/10.1177/002224299906300205>
- George, S. M., Ballard-Barbash, R., Shikany, J. M., Caan, B. J., Freudenheim, J. L., Kroenke, C. H., Vitolins, M. Z., Beresford, S. A., & Neuhauser, M. L. (2014). Better postdiagnosis diet quality is associated with reduced risk of death among postmenopausal women with invasive breast cancer in the women's health initiative. *Cancer Epidemiology, Biomarkers & Prevention*, 23(4), 575–583. <https://doi.org/10.1158/1055-9965.epi-13-1162>
- George, S. M., Irwin, M. L., Smith, A. W., Neuhauser, M. L., Reedy, J., McTiernan, A., Alfano, C. M., Bernstein, L., Ulrich, C. M., Baumgartner, K. B., Moore, S. C., Albanes, D., Mayne, S. T., Gail, M. H., & Ballard-Barbash, R. (2011). Postdiagnosis diet quality, the combination of diet quality and recreational physical activity and prognosis after early-stage breast cancer. *Cancer Causes & Control*, 22(4), 589–598. <https://doi.org/10.1007/s10552-011-9732-9>
- Harrow, A., Dryden, R., McCowan, C., Radley, A., Parsons, M., Thompson, A. M., & Wells, M. (2014). A hard pill to swallow: A qualitative study of women's experiences of adjuvant endocrine therapy for breast cancer. *British Medical Journal Open*, 4(6), e005285. <https://doi.org/10.1136/bmjopen-2014-005285>
- Heitz, A. E., Baumgartner, R. N., Baumgartner, K. B., & Boone, S. D. (2018). Healthy lifestyle impact on breast cancer-specific and all-cause mortality. *Breast Cancer Research and Treatment*, 167(1), 171–181. <https://doi.org/10.1007/s10549-017-4467-2>
- Hershman, D. L., Kushi, L. H., Shao, T., Buono, D., Kershenbaum, A., Tsai, W.-Y., Fehrenbacher, L., Lin Gomez, S., Miles, S., & Neugut, A. I. (2010). Early discontinuation and nonadherence to adjuvant hormonal therapy in a cohort of 8,769 early-stage breast cancer patients. *Journal of Clinical Oncology*, 28(27), 4120–4128. <https://doi.org/10.1200/jco.2009.25.9655>
- Holmes, M. D., Chen, W. Y., Feskanich, D., Kroenke, C. H., & Colditz, G. A. (2005). Physical activity and survival after breast cancer diagnosis. *JAMA*, 293(20), 2479–2486. <https://doi.org/10.1001/jama.293.20.2479>
- Irwin, M. L., McTiernan, A., Manson, J. E., Thomson, C. A., Sternfeld, B., Stefanick, M. L., Wactawski-Wende, J., Craft, L., Lane, D., Martin, L. W., & Chlebowski, R. (2011). Physical activity and survival in postmenopausal women with breast cancer: Results from the women's health initiative. *Cancer Prevention Research (Philadelphia, Pa.)*, 4(4), 522–529. <https://doi.org/10.1158/1940-6207.capr-10-0295>
- Kabat, G. C., Matthews, C. E., Kamensky, V., Hollenbeck, A. R., & Rohan, T. E. (2015). Adherence to cancer prevention guidelines and cancer incidence, cancer mortality and total mortality: A prospective cohort study. *American Journal of Clinical Nutrition*, 101(3), 558–569. <https://doi.org/10.3945/ajcn.114.094854>
- Kelly, K. M., Bhattacharya, R., Dickinson, S., & Hazard, H. (2015). Health Behaviors Among Breast Cancer Patients and Survivors. *Cancer Nursing*, 38(3), E27–E34. <https://doi.org/10.1097/ncc.0000000000000167>
- Khaw, K. T., Wareham, N., Bingham, S., Welch, A., Luben, R., & Day, N. (2008). Combined impact of health behaviours and mortality in men and women: The EPIC-Norfolk prospective population study. *PLoS Medicine*, 5(1), e12. <https://doi.org/10.1371/journal.pmed.0050012>
- Kong, L., & Wu, K. (2016). *Breast oncopsychology*. Science Press.

- Kushi, L. H., Doyle, C., McCullough, M., Rock, C. L., Demark-Wahnefried, W., Bandera, E. V., Gapstur, S., Patel, A. V., Andrews, K., & Gansler, T. (2012). American Cancer Society Guidelines on nutrition and physical activity for cancer prevention: Reducing the risk of cancer with healthy food choices and physical activity. *CA: A Cancer Journal for Clinicians*, 62(1), 30–67. <https://doi.org/10.3322/caac.20140>
- Kwan, M. L., Kushi, L. H., Weltzien, E., Tam, E. K., Castillo, A., Sweeney, C., & Caan, B. J. (2010). Alcohol consumption and breast cancer recurrence and survival among women with early-stage breast cancer: The life after cancer epidemiology study. *Journal of Clinical Oncology*, 28(29), 4410–4416. <https://doi.org/10.1200/jco.2010.29.2730>
- Laura, L., Jason, W., & Muriel, J. (2004). Factor analysis as a tool for survey analysis using a professional role orientation inventory as an example. *Physical Therapy*, 84, 84–799.
- Li, T., Mello-Thoms, C., & Brennan, P. C. (2016). Descriptive epidemiology of breast cancer in China: Incidence, mortality, survival and prevalence. *Breast Cancer Research and Treatment*, 159(3), 395–406. <https://doi.org/10.1007/s10549-016-3947-0>
- Ma, X. (2012). *Health education* (2nd ed.). People's Medical Publishing House (PMPH).
- McCullough, M. L., Patel, A. V., Kushi, L. H., Patel, R., Willett, W. C., Doyle, C., & Gapstur, S. M. (2011). Following cancer prevention guidelines reduces risk of cancer, cardiovascular disease and all-cause mortality. *Cancer Epidemiology, Biomarkers & Prevention*, 20(6), 1089–1097. <https://doi.org/10.1158/1055-9965.epi-10-1173>
- Murphy, C. C., Bartholomew, L. K., Carpentier, M. Y., Bluethmann, S. M., & Vernon, S. W. (2012). Adherence to adjuvant hormonal therapy among breast cancer survivors in clinical practice: A systematic review. *Breast Cancer Research and Treatment*, 134(2), 459–478. <https://doi.org/10.1007/s10549-012-2114-5>
- North Carolina State University (Producer). (2008, October 18). Reliability analysis: Key concepts and terms. <http://www2.chass.ncsu.edu/garson/pa765/reliab.htm>
- Petersen, K. E., Johnsen, N. F., Olsen, A., Albieri, V., Olsen, L. K., Dragsted, L. O., & Egeberg, R. (2015). The combined impact of adherence to five lifestyle factors on all-cause, cancer and cardiovascular mortality: A prospective cohort study among Danish men and women. *British Journal of Nutrition*, 113(5), 849–858. <https://doi.org/10.1017/S0007114515000070>
- Qian, H., & Yuan, C. (2011). Reliability and validity evaluation of Chinese version of cancer self-management efficacy scale. *Chinese Journal of Nursing*, 1(46), 87–89.
- Raines-Eudy, R. (2000). Using structural equation modeling to test for differential reliability and validity: An empirical demonstration. *Structural Equation Modeling: A Multidisciplinary Journal*, 7(1), 124–141. https://doi.org/10.1207/s15328007sem0701_07
- Shi, J., Mo, X., & Sun, Z. (2012). Content validity index in scale development. *Journal of Central South University (Medical Science)*, 37(02), 49–52. <https://doi.org/10.3969/j.issn.1672-7347.2012.02.007>
- Spring, B., King, A. C., Pagoto, S. L., Van Horn, L., & Fisher, J. D. (2015). Fostering multiple healthy lifestyle behaviors for primary prevention of cancer. *American Psychologist*, 70(2), 75–90. <https://doi.org/10.1037/a0038806>
- Tabachnick, B. G., & Linda, F. S. (2007). *Using multivariate statistics* (5th ed.). New York: Allyn and Bacon.
- Thomson, C. A., McCullough, M. L., Wertheim, B. C., Chlebowski, R. T., Martinez, M. E., Stefanick, M. L., Rohan, T. E., Manson, J. E., Tindle, H. A., Ockene, J., Vitolins, M. Z., Wactawski-Wende, J., Sarto, G. E., Lane, D. S., & Neuhauser, M. L. (2014). Nutrition and physical activity cancer prevention guidelines, cancer risk and mortality in the women's health initiative. *Cancer Prevention Research (Philadelphia, Pa.)*, 7(1), 42–53. <https://doi.org/10.1158/1940-6207.capr-13-0258>
- Tian, X., & Cheng, Y. (2016). *Basic theory and practice of health education and health promotion*. People's Medical Publishing House (PMPH).
- van Herk-Sukel, M. P. P., van de Poll-Franse, L. V., Voogd, A. C., Nieuwenhuijzen, G. A. P., Coebergh, J. W. W., & Herings, R. M. C. (2010). Half of breast cancer patients discontinue tamoxifen and any endocrine treatment before the end of the recommended treatment period of 5 years: A population-based analysis. *Breast Cancer Research and Treatment*, 122(3), 843–851. <https://doi.org/10.1007/s10549-009-0724-3>
- Wan, C., Yang, Z., Meng, Q., Feng, C., Wang, H., Tang, X., Zhang, C., Lu, Y., Luo, J., & Zhang, X. (2008). Development and validation of the general module of the system of quality of life instruments for cancer patients. *International Journal of Cancer*, 122(1), 190–196. <https://doi.org/10.1002/ijc.23036>
- Wang, B., Gong, C., & Hu, X. (2016). Clinical Practice Guidelines in Breast Cancer by Chinese Anti-Cancer Association (2015 version): Interpretation of updates in terms of systemic treatment. *Chinese Journal of Breast Disease (Electronic Version)*, 2(10), 65–70.
- Warren Andersen, S., Zheng, W., Sonderman, J., Shu, X.-O., Matthews, C. E., Yu, D., Steinwandel, M., McLaughlin, J. K., Hargreaves, M. K., & Blot, W. J. (2016). Combined impact of health behaviors on mortality in low-income americans. *American Journal of Preventive Medicine*, 51(3), 344–355. <https://doi.org/10.1016/j.amepre.2016.03.018>
- Weaver, K. E., Camacho, F., Hwang, W., Anderson, R., & Kimmick, G. (2013). Adherence to adjuvant hormonal therapy and its relationship to breast cancer recurrence and survival among low-income women. *American Journal of Clinical Oncology*, 36(2), 181–187. <https://doi.org/10.1097/COC.0b013e3182436ec1>
- Wells, J. N., Bush, H. A., & Marshall, D. (2001). Psychometric evaluation of Breast Health Behavior Questionnaire: Spanish version. *Cancer Nursing*, 24(4), 320–327. <https://doi.org/10.1097/00002820-200108000-00014>
- World Cancer Research Fund International, & American Institute for Cancer Research. (2014). Diet nutrition physical activity, and breast cancer survivors[R/OL]. Retrieved from <https://www.wcrf.org/int/blog/articles/2014/10/diet-nutrition-physical-activity-breast-cancer-survivors>
- World Health Organization (2003). *Adherence to long-term therapies: Evidence for action*. .
- Xu, H., Jin, F., Zhang, X.-J., Wang, D.-Q., Yu, S.-F., & Wang, A.-P. (2020). Adherence status to adjuvant endocrine therapy in Chinese women with early breast cancer and its influencing factors: A cross-sectional survey. *Cancer Medicine*, 9(11), 3703–3713. <https://doi.org/10.1002/cam4.3017>

How to cite this article: Xu H, Jiang G, Zhang X, Wang D, Xu L, Wang A. Development of health behaviour questionnaire for breast cancer patients in Mainland China. *Nurs Open*. 2021;8:1209–1219. <https://doi.org/10.1002/nop2.737>