



## Original Article

## Psychometric properties of a simplified Chinese version of the cancer predisposition perception scale



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## ABSTRACT

**Objective:** Cancer predisposition perception refers to the subjective estimation of the likelihood of being diagnosed with cancer in the future. It affects people's behavior concerning cancer screening and prevention. At present, there is no available tool to evaluate cancer predisposition perception. The aim of this study was to translate the cancer predisposition perception scale into simplified Chinese (C-CPPS), and then test its psychometric properties among Chinese patients.

**Methods:** In phase I, the CPPS was translated into Chinese, and validated by an expert panel. In phase II, data on reliability and validity was evaluated in terms of construct validity, criterion validity, internal consistency, test–retest reliability, and item-total correlations, with a convenience sample of 208 patients recruited from the colorectal cancer surgical ward.

**Results:** The C-CPPS had desirable validity and reliability. The scale-level content validity index was 0.96. Exploratory factor analysis indicated that the six-factor structure of the C-CPPS was good fit to the data. Correlation between the C-CPPS and the Brief Illness Perception Questionnaire was statistically significant. Cronbach's  $\alpha$  for the entire scale was 0.90 and 0.71–0.95 for five of the six subscales. Item-total correlations ranged from 0.309 to 0.775, and the intraclass correlation coefficient was 0.97.

**Conclusions:** The C-CPPS appears to be culturally appropriate, reliable, and valid for assessing cancer predisposition perception among patients with colorectal cancer in China.

## Introduction

Cancer is a complex disease caused by the interaction of multiple genes and the impact of environmental factors,<sup>1</sup> which has become a major public health problem that poses a serious threat to people's health. Cancer is one of the leading causes of death and an important barrier to extend life expectancy.<sup>2</sup> Globally, an estimated 19.3 million new cancer cases and almost 10.0 million cancer deaths occurred in 2020.<sup>3</sup> The global cancer burden is expected to be 28.4 million cases in 2040, a 47% rise from 2020, with a larger increase in transitioning (64% to 95%) versus transitioned (32% to 56%) countries due to demographic differences. Statistics indicate that deaths from cancer account for 23.91% of all deaths in the Chinese population.<sup>4</sup> In China, the incidence rate and mortality rate of malignant tumors have been rising constantly in the past decades.<sup>5</sup>

Increasing risk factors associated with globalization and economic development make the cancer burden situation even more serious. Therefore, cancer prevention and control are vital. Primary and secondary prevention are the most effective and important methods for controlling cancer.<sup>6</sup> Prevention approaches range from clinical treatment like surgery and chemotherapy to population-level interventions, such as cancer screening and surveillance.<sup>7</sup> Regarding cancer prevention at the individual level, predisposition perception of the disease is an important relevant factor.<sup>8,9</sup>

Cancer predisposition perception, developed from illness perception,<sup>10</sup> refers to the subjective estimation of the likelihood of being diagnosed with cancer in the future.<sup>11</sup> For those at high risk for a particular cancer or cancer patients, it includes the perception of cancer risk, disease severity and consequences, cancer recurrence risk, cancer genetic risk, as well as the control and coping style to the disease and treatment.<sup>12,13</sup> The

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self-regulation model states that when an individual perceives himself as experiencing a health threat, he will take actions to reduce risk under the guidance of his subjective opinions and common sense.<sup>14</sup> The perception and assessment of risk is the premise for people to undergo early screening and prevention.<sup>15–17</sup> In this regard, awareness of cancer predisposition perception can facilitate preventive behaviors, promote appropriate screening and improve medical compliance. Patients with colorectal cancer, especially those with hereditary colorectal cancer, have a high risk of tumor recurrence and metastasis, and need regular monitoring and follow-up. Therefore, it is of great significance to consider the cancer risk perception of colorectal cancer patients.

Given the importance of cancer predisposition perception, a reliable instrument is necessary for evaluation. Currently, the scales used in China are mostly general disease perception questionnaires, and until now there is no standardized measurement tool for cancer predisposition perception. In the 1990s, Morris et al.<sup>18</sup> developed the Illness Perception Questionnaire (IPQ) to measure individuals' illness perceptions. However, the original IPQ neglected emotional representation components, and some items failed to integrate completely into their corresponding domains. The Revised Illness Perception Questionnaire (IPQ-R) was therefore come into being<sup>19</sup> and has been validated among patients with different diseases.<sup>20,21</sup> In 2015, Lam et al.<sup>22</sup> reported the preliminary development of an instrument derived from the IPQ-R to measure perceived cancer predisposition, namely the cancer predisposition perception scale (CPPS). The CPPS has been used in hepatitis B carriers and other healthy individuals in Hong Kong, appearing to be a reliable instrument after validation.<sup>22</sup> However, the scale is not available in Mainland China. This study aimed to translate the CPPS into simplified Chinese and evaluate its psychometric properties among the Chinese population.

## Methods

### Study design

The study included two parts. First, the was translated and cross-culturally adapted from English into Chinese (C-CPPS) according to the Brislin model,<sup>23</sup> and then tested for its content validity. Second, certain crucial psychometric properties of the C-CPPS, including internal consistency and construct validity, were assessed.

### Phase I: Translation, cultural adaptation, and content validation

#### Translation

The CPPS was independently translated into Chinese by two nurses who were proficient in English and Chinese, had a master's degree of nursing and at least one-year clinical experience in colorectal cancer surgery. Two translated versions were formed after this process.

#### Synthesis

Two translated versions and the original scale were integrated by a nursing expert, forming the Chinese version I.

#### Back translation

The first draft of translation was translated back into English by two experts who had not contacted the original scale. Then, all research group members analyzed the original scale and the back-translated version. After back translation, comparison, and modification, the Chinese version II was formed.

#### Cultural adaptation

Cultural adaptation of the Chinese version II was accomplished by six experts, two professors with doctoral degrees and four nurses with master's degrees. Using their professional theoretical knowledge and clinical work experience, the experts commented on each item of the scale from the aspects of clarity of expression, language habits, cultural background

and content relevance. Four changes were made to items after considering the suggestions made by the experts (Appendix 1 for the detailed changes). Eventually, the final C-CPPS was formed (Appendix 2).

#### Content validation

A panel of six experts (the same as cultural adaptation) was then invited to evaluate each items' relevance to the scale and context. Items were scored by a four-point scale (1 = not relevant, 2 = somewhat relevant, 3 = relevant, 4 = highly relevant). The content validity index (CVI) was evaluated in terms of two aspects: item-level CVI (I-CVI) and scale-level CVI (S-CVI). The item-level CVI was determined by the proportion of experts who rated it 3 or 4, and the scale-level CVI was calculated by the proportion of items with full agreement on their relevance by the expert panel.<sup>24</sup> As suggested by Polit and Beck,<sup>24</sup> an I-CVI score of 0.78 and S-CVI of 0.90 were the minimum acceptable indexes.

### Phase II: Psychometric testing of the C-CPPS

#### Participants and study setting

Participants were inpatients recruited from the colorectal cancer surgical ward in a hospital during July 2019 and June 2020. Inclusion criteria were patients who (1) were aged 18 or above, (2) were diagnosed with colorectal cancer, (3) knew about their diseases, (4) were able to read Chinese and complete the questionnaire, and (5) were informed consent. The exclusion criteria included a history of psychiatric disease and/or having other severe complications. According to the principle, the sample size is 5–10 times of the number of items in the scale,<sup>25</sup> a sample of 115–230 participants was considered suitable for our study. Finally, 210 patients were selected to take part in this study using a convenience sampling method.

#### Measures

**CPPS.** The CPPS was developed from the Revised IPQ for Genetic Predisposition (IPQ-R-GP) by Lam et al.<sup>22</sup> in 2015. The CPPS consists of 23 items, which can be categorized into six domains: emotional representation (5 items), illness coherence (4 items), treatment control (3 items), consequences (5 items), internal locus of control (2 items) and external locus of control (4 items), based on the validation study conducted by the original author. The scale uses a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The score of each dimension is the sum of its items to yield a total score. Higher score of each domain indicates higher negative emotion, perceiving higher consequence of the condition, perceiving lower illness coherence, perceiving higher treatment control, external control and internal control. The scale demonstrated good internal reliability, with an overall Cronbach's  $\alpha$  of 0.82, and 0.90, 0.83, 0.81, 0.72, 0.63 and 0.69 for each dimension, respectively.

**Brief IPQ.** The Brief IPQ was simplified and formed by Broadbent<sup>26</sup> in 2006 based on the Illness Perception Questionnaire<sup>27</sup> and the IPQ-R.<sup>28</sup> The Brief IPQ is consisted by nine items, used to evaluate the cognitive illness representations (5 items), emotional representations (2 items), illness comprehensibility (1 item) and causal representation (1 item). All of the items except the causal question are rated using a 0-to-10 response scale. The reliability of each item is 0.70, 0.67, 0.63, 0.55, 0.65, 0.66, 0.48, 0.65, and the correlation coefficient is 0.02–0.46, showing good reliability and validity.<sup>26</sup>

#### Sociodemographic and clinical data

A self-report questionnaire was developed to collect the general information of the patients, including demographics (age, gender, education level, religious belief, and marital status and so on) and disease-related characteristics (domain of tumor, diagnosis times, pathological differentiation level, and year of last operation).

### Data collection

First, the researchers explained the purpose of this study to the participants and asked if they would be willing to take part in the investigation. After writing the informed consent, participants will complete the demographic questionnaire and C-CPPS independently. Then, a check was carried out immediately to examine the quality of the questionnaire. A total of 220 questionnaires were collected in this study, of which 208 were valid.

### Data analysis

IBM SPSS Statistics version 25.0 (Armonk, NY, USA) was used for analyzing the psychometric properties of the scale. Participants' demographic information and disease-related characteristics were summarized and reported by frequency, percentage, mean, and standard deviation (SD), as appropriate.

To access the construct of the items, we tested the construct validity through exploratory factor analysis (EFA), using principle components analysis with varimax rotation.<sup>29</sup> Before conducting factor analysis, the suitability of the data was examined. If the Kaiser–Meyer–Olkin (KMO) index (ranging from 0 to 1) is greater than 0.50, and the result of the Bartlett test of sphericity is significant, EFA is considered appropriate.<sup>30</sup> The common factors were determined by the following criteria: (1) eigenvalues greater than 1.0, (2) Cattell scree plot, and (3) interpretability of factors.<sup>31</sup> In addition, only items with loadings above 0.40 were retained.<sup>31</sup> Correlation of the C-CPPS and the Brief IPQ was analyzed to test the scale's criterion validity.

Internal consistency using Cronbach's alpha coefficient and coefficient of correlation between items and scale were calculated to demonstrate the reliability of the scale. An alpha value ranging from 0.70 to 0.95 was regarded as acceptable.<sup>25</sup> The test–retest reliability was also considered, using the Intraclass Correlation Coefficient (ICC) calculated by the Pearson correlation. ICC value greater than 0.70 suggested adequate stability; less than 0.3, weak stability; between 0.30 and 0.70, moderate and acceptable stability.<sup>32,33</sup>

### Ethical considerations

Ethical approval of the study was obtained from the Ethics Committee of the study institution (Approval No. GZR2020.159). All participants were volunteers and their voluntary informed consent was obtained before conducting this survey.

## Results

### Participant characteristics

A total of 208 individuals were surveyed, and their demographic and treatment information is presented in Table 1. In the sample, ages ranged from 16 to 81 years (mean, 45.0 [SD, 12.1] years). There were 118 males (56.7%) and 90 females (43.3%). Among them, a majority was married (81.3%), had no religion (97.6%), had completed senior school education (49.5%), and lived in provincial capitals (43.3%); 63.5% of the patients had a diagnosis of colon cancer, 13.9% had rectal cancer, 22.6% had other or multiple cancers. Most of the patients had single diagnosis time (82.2%) and medium pathological differentiation level (88.5%). In the aspect of treatment, 53.8% had an operation over 3 years ago, 42.8% within three years, and 3.4% did not have operation.

### Validity

#### Content validity

The content validity of C-CPPS was confirmed by the panel members. Nearly all items were rated 1.00 for I-CVI, except for one that was rated

**Table 1**  
Sample characteristics (n = 208).

Variable categories	n (%)
Gender	
Male	118 (56.7)
Female	90 (43.3)
Education level	
Primary school and below	35 (16.8)
Senior school	103 (49.5)
Junior college	39 (18.8)
Bachelor degree or above	31 (14.9)
Religious belief	
Yes	5 (2.4)
No	203 (97.6)
Marital status	
Single	39 (18.8)
Married	169 (81.3)
Habitation	
Provincial capital	90 (43.3)
Prefecture level city	68 (32.7)
County, township, and village	50 (24.0)
Per capita monthly income (RMB)	
< 3000	58 (27.9)
3000–6999	116 (55.8)
≥ 7000	34 (16.3)
Medical insurance	
None	23 (11.1)
Urban	83 (39.9)
Rural cooperative	76 (36.5)
Public	26 (12.5)
Domain of canceration	
Colon	132 (63.5)
Rectum	29 (13.9)
Other/Multiple	47 (22.6)
Diagnosis times	
Single	171 (82.2)
Multiple	37 (17.8)
Pathological differentiation level	
Low	17 (8.2)
Medium	184 (88.5)
High	7 (3.4)
Year of last operation	
No operation	7 (3.4)
< 3	89 (42.8)
≥ 3	112 (53.8)

0.80. The S-CVI was accorded a score of 0.96. One item rated as “somewhat relevant” by one expert was: “The negative effects of any cancer predisposition I might have can be prevented by following the doctors' behavioral advice” (item 12). After discussion among panel members and researchers, this item was remained in the scale.

### Construct validity

In the analysis of EFA, the obtained KMO value was 0.847, and the significance of Bartlett sphericity was 0.000 ( $\chi^2 = 2906.72$ ,  $df = 253$ ). These results supported the rationality of conducting the factor analysis. Finally, six common factors were extracted with cumulative total variance of 71.85% (Table 2). The higher factor loadings of the items were in accordance with the original study, suggesting to retain the original dimensions. To confirm the rationality of EFA and overcome potential over-extraction, we conducted a parallel analysis (PA). Results showed that six components presented eigenvalues greater than the corresponding randomly generated matrix in PA (eigenvalues for Factor 1 = 7.38, Factor 2 = 2.29, Factor 3 = 1.60, Factor 4 = 1.31, Factor 5 = 0.80, Factor 6 = 0.56), verifying a six-factor structure in the scale.

### Criterion validity

Correlation between the C-CPPS and the Brief IPQ was statistically significant (Table 3).

**Table 2**  
Factor loadings of the items of the C-CPPS after principal component analysis and orthogonal rotation.

	Item in brief	Factor loading					
		F1	F2	F3	F4	F5	F6
1	A serious condition	<b>0.687</b>	-0.123	0.193	0.252	-0.029	0.285
2	Have major consequences	<b>0.791</b>	-0.162	0.148	0.099	0.009	0.314
3	Affect the way others see me	<b>0.529</b>	0.352	0.174	-0.114	0.024	0.451
4	Have financial consequences	<b>0.799</b>	0.023	0.077	0.032	0.173	0.112
5	Cause difficulties	<b>0.767</b>	0.180	0.038	-0.005	0.127	0.193
6	What I do	0.198	<b>0.622</b>	-0.099	0.282	-0.169	0.275
7	Depends on me	-0.040	<b>0.774</b>	0.081	0.189	0.089	0.014
8	Nothing I do	0.059	0.298	<b>0.684</b>	-0.023	0.012	0.275
9	My actions have no effect	0.170	-0.026	<b>0.798</b>	0.126	0.170	-0.039
10	Very little can be done	0.057	-0.038	<b>0.498</b>	0.212	0.134	0.446
14	Nothing can help to stop	0.233	-0.029	<b>0.574</b>	0.131	0.275	0.258
12	Following behavioral advice	0.086	0.181	0.059	<b>0.877</b>	0.009	-0.014
13	Control my risk of cancer	0.034	0.146	0.029	<b>0.880</b>	0.048	-0.043
15	Be puzzling to me	0.160	-0.017	0.265	0.091	<b>0.564</b>	0.551
16	Be a mystery to me	0.224	-0.106	0.161	0.098	<b>0.790</b>	0.220
17	Do not understand why	0.066	0.117	0.087	-0.120	<b>0.827</b>	0.198
18	Make no sense to me	-0.156	0.518	0.275	-0.055	<b>0.510</b>	0.023
19	Get depressed	0.200	0.001	0.132	0.046	0.192	<b>0.858</b>
20	Get upset	0.224	0.093	0.074	-0.026	0.181	<b>0.873</b>
21	Feel angry	0.208	0.137	0.131	-0.002	0.170	<b>0.841</b>
22	Feel anxious	0.205	0.118	0.140	-0.023	0.039	<b>0.859</b>
23	Feel afraid	0.193	0.007	0.068	0.069	0.091	<b>0.881</b>
	Eigenvalue	2.207	2.076	1.665	2.536	3.065	4.975
	Variance explained, %	55.580	64.605	71.846	45.984	34.957	21.630

Values in bold font indicate higher factor loadings.

C-CPPS, Chinese version of the Cancer Predisposition Perception Scale; F1, consequences; F2, internal locus of control; F3, external locus of control; F4, treatment control; F5, illness coherence; F6, emotional representation.

**Table 3**  
Pearson correlations between the C-CPPS and the brief IPQ (n = 208).

	Brief IPQ			
	Cognitive illness representations	Emotional representations	Illness comprehensibility	Total score
C-CPPS	0.433 <sup>b</sup>	0.303 <sup>b</sup>	0.168 <sup>a</sup>	0.352 <sup>b</sup>

C-CPPS, Chinese version of the Cancer Predisposition Perception Scale; IPQ, Illness Perception Questionnaire.

<sup>a</sup> P < 0.05.  
<sup>b</sup> P < 0.01.

**Reliability**

*Internal consistency*

Cronbach's α coefficient for the entire C-CPPS scale was 0.900, and the subscales of emotional representation, illness coherence, treatment control, consequences, internal locus of control and external locus of control domains varied from 0.529 to 0.951 (details are shown in Table 4). The item-total correlations ranged between 0.309 and 0.775, suggesting that the items were sufficiently homogeneous.

*Test-retest reliability*

To evaluate time durability, the scale was administered twice to 30 patients with an interval of two weeks. The intraclass correlation coefficient value was 0.97, indicating good stability over time. As shown in Table 5, test-retest reliability coefficients over a two-week interval computed for the subscales ranged from 0.937 to 0.994.

**Table 4**  
Descriptive statistics and internal consistency of the six subscales (n = 208).

Subscale	Number of items	Mean	SD	Cronbach's α
Emotional representation	5	14.83	4.92	0.951
Illness coherence	4	12.06	3.27	0.774
Treatment control	3	12.19	1.95	0.858
Consequences	5	16.75	4.37	0.843
Internal locus of control	2	6.47	1.75	0.529
External locus of control	4	12.22	3.10	0.710

**Table 5**  
Test-retest correlations of the six subscales (n = 30).

Subscale	Test		Retest		r
	Mean	SD	Mean	SD	
Emotional representation	16.47	4.53	16.50	4.23	0.980 <sup>a</sup>
Illness coherence	12.63	3.22	12.70	3.19	0.994 <sup>a</sup>
Treatment control	11.83	1.88	11.73	1.87	0.987 <sup>a</sup>
Consequences	16.63	4.63	16.73	3.85	0.937 <sup>a</sup>
Internal locus of control	6.23	1.89	6.01	1.84	0.980 <sup>a</sup>
External locus of control	12.70	2.83	12.70	2.90	0.984 <sup>a</sup>

<sup>a</sup> P < 0.01.

**Discussion**

Cancer predisposition perception originates from illness perception,<sup>10</sup> which is linked to individual help-seeking and preventive behaviors. Its theoretical basis is the self-regulation theory, which conceptualizes the individual as an active problem solver whose behavior reflects an attempt to close the perceived gap between his or her current status and a goal, or an ideal state.<sup>34</sup> Behavior, such as compliance to health recommendations, depends on the individual's cognitive representations of the current situation and the goal, plans for changing the current state, and rules for the appraising progress.<sup>35</sup> Leventhal et al.<sup>34</sup> emphasized that risk perception is the primary determinant of how an individual copes with health threats cognitively. The original CPPS was developed based on the self-regulation theory, aimed to measure the predisposition perception of



cancer. The evaluation content of this scale refers to the personal perceived predisposition of general cancer risk. Besides, it can be used to evaluate cancer-risk-related cognitions among individuals at higher and lower cancer risk. After validation, the original CPPS has desirable psychometric properties, appearing to be a reliable instrument.<sup>22</sup>

Our study introduced the CPPS into China, including sinicization and psychometric properties test. The translation of C-CPPS strictly followed the Brislin guidelines, involving forward-backward translation, cultural adaptation and expert panel content validation. For content validation, only minor alterations were made following the advice of experts, apart from some slight adjustments to the sentence order. For example, in the original item “Behaviors prescribed by the doctors will be effective in preventing me from being predisposed to cancer”, as there was no direct reference to “screening”, the word for screening in Chinese was deleted to ensure accuracy. Consequently, the final translated version can express the original meaning faithfully in Chinese and is culturally acceptable.

Construct validity is used to describe the integration degree of the scale and its conceptual framework. The most commonly used and effective method is exploratory factor analysis (EFA). Generally speaking, a scale with good structural validity should meet the following conditions: the cumulative explanatory variation of common factors is greater than 40%; the load value of each item on one common factor is higher than 0.400, and the load value on other common factors is lower.<sup>36</sup> The six factors structure was highly consistent with the original research results. Criterion validity is the correlation between the testing questionnaire and a recognized and effective standardized one. In this study, the Brief IPQ, commonly used in China, was used as the standard to verify the simplified Chinese version of CPPS. The results showed that all the variables of the Brief IPQ were significantly, moderately, positively correlated with the CPPS, indicating good criterion validity.

Reliability is an important aspect of any patient-based measure. For reliability, the C-CPPS showed high internal consistency with Cronbach's  $\alpha$  of 0.90 for the total scale. The  $\alpha$  value was higher than the minimum acceptable level of 0.70 for the subscales, except for the “internal locus of control” subscale. The number of items and their inter-relatedness affects the value of Cronbach's  $\alpha$ ,<sup>37</sup> and there were only two items in the “internal locus of control” subscale. Therefore, in this study, one possible reason for the low  $\alpha$  value may be that the number of items in the internal locus of control was less than that in the other five subscales. An interval of 1–2 weeks is generally considered appropriate for the evaluation of test–retest reliability, being long enough to prevent recall and short enough to ensure the clinical stability.<sup>38</sup> The good test–retest reliability reflected the stability of the C-CPPS, indicating that it can stably measure the cancer predisposition perception of cancer patients. Due to the lack of previous research data, it's difficult for us to make a comparison or analysis. Data from our study can be used as a reference for future research.

### Limitations

There are limitations in this study. One limitation is that the participants were selected from only one hospital, which could not fully represent the entire Chinese population. Generalizability of the results of other patient groups needs to be explored. Second, the participants in our study were all colorectal cancer patients, and more cancer types should be involved in future studies. Third, the analysis methods we applied were limited. Confirmatory factor analysis (CFA), face validity and time required to complete could be evaluated for more in-depth research.

### Implications for clinical practice

The C-CPPS showed satisfactory psychometric properties for assessing the cancer predisposition perception of cancer patients. Using the instrument to test individual cognition can help healthcare workers understand how patients perceive their disease risk. On the other hand, the scale can be used to identify people with high or low cancer predisposition perception in clinical practice, so as to give specific interventions to

promote medical practice. As one of the factors influencing medical adherence, the predisposition perception of cancer patients should be given more attention in the healthcare practice.

### Conclusions

In this study, the English version of CPPS was successfully translated and adapted into simplified Chinese. The analysis results demonstrated its desirable reliability and validity among the Chinese population with colorectal cancer. Our results provide evidence that the C-CPPS can be readily applied to measure cancer predisposition perception among colorectal cancer patients in China. In order to further verify the usability of the scale, longitudinal and comparative studies among different cancer-predisposed risk groups could be conducted in the future.

### Supplementary material

To access the supplementary material accompanying this article, visit the online version of the *Asia-Pacific Journal of Oncology Nursing* at <http://doi.org/10.1016/j.apjon.2021.10.001>.

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### Declaration of competing interest

None declared.

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