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Psychometric properties of a Chinese version of four-factor colorectal cancer screening belief scale

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ABSTRACT

Objective: Screening improves the early diagnosis rate of colorectal cancer (CRC) and effectively reduces its mortality. The four-factor CRC screening belief scale is conducive to understanding the psychometric properties of screening beliefs, but no Chinese version of this scale is available. The purpose of this study was to test the psychometric properties of a Chinese version of the four-factor CRC screening belief scale in patients with cancer and their relatives.

Methods: The four-factor CRC screening belief scale was translated into Chinese based on Brislin's model. A panel review ensured the cultural adaptation and content validity of the scale. The scale was then administered to a convenience sample of 425 Chinese people recruited from July 2019 to June 2021.

Results: Exploratory factor analysis identified the factor structure for the Chinese version of the four-factor CRC screening belief scale, including perceived barriers, perceived benefits, self-efficacy, and optimism. Confirmatory factor analysis showed that the model fits well. The scale-level content validity index was 1.0. The correlation between the Chinese version of the four-factor CRC screening belief scale and the CRC health belief model scale was statistically significant ($r = 0.831$, $P < 0.01$). McDonald's omega coefficients for the entire scale were 0.939 and 0.774–0.948 for the four subscales. The translated scale had test-retest reliability of 0.719 and split-half reliability of 0.646.

Conclusions: The Chinese version of the four-factor CRC screening belief scale showed adequate reliability and validity. The translation and validation of psychosocial assessment tools for CRC screening across languages, cultures, and countries will contribute to further international research collaborations and the improvement of the prospects for the prevention and care of CRC.

Introduction

According to global cancer statistics, more than 1.9 million colorectal cancer (CRC) cases and 935,000 deaths occurred in 2020. Among all types of cancer, CRC ranks third in terms of incidence but second in terms of mortality.[1] The Chinese National Cancer Center reported that there were 387,600 new cases of CRC in China in 2015, accounting for 9.87% of all malignant tumours. CRC caused 187,100 deaths, accounting for 8.01% of all malignant tumour deaths.[2] The disease burden of CRC in China is a major public health problem that urgently needs to be effectively reduced.

Primary prevention remains a key strategy to reduce the global burden of CRC, and CRC screening leads to mortality declines and improvements in survival.[3] Precancerous lesions and early cancers can be found through screening, and the 5-year survival rate is up to 97% after intervention and treatment.[4] Screening methods include a fecal occult blood test, colonoscopy, and digital rectal examination, and so on. The advantages of fecal occult blood test are its simple operation and non-invasiveness; in positive cases, further colonoscopy is required. In the United States,

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50.9%–55.3% of people over 50 years of age have undergone CRC screening. The Korean National Cancer Screening Survey reported that 19%–27.6% of Koreans have undergone screening for CRC.[5] In contrast, the CRC screening compliance rate in a southern Chinese city was only 4.8%,[6] and the colonoscopy screening rate for CRC high-risk groups (eg, blood relatives of patients with CRC) was 24.66% in China.[7] The American Cancer Society recommends that people with average risk start screening at age 45.[8] People with a family history of CRC are strongly recommended to undergo screening because CRC has more obvious genetic traits than other cancers.[9] In addition, approximately 90% of patients with CRC die of recurrence or metastasis, and the recurrence rate of intestinal tumors was 20%–30%.[10] Patients with CRC are urged to be screened after the surgery every three months for two years, every six months after two years, and every year after five years.[11] Therefore, regular screening is also of great significance for patients with CRC.

Psychosocial constructs are critical in the study of health behavior and they are often chosen as intervention targets to improve CRC screening participation.[12] The health belief model (HBM) revised by Becker[13] is a psychological model that tries to explain and predict health behaviors based on people's beliefs related to health and disease. The HBM emphasizes the decisive role of subjective perceptions in the formation and maintenance of healthy behaviors and holds that beliefs are the basis and motivation for people to accept persuasion and adopt healthy behaviors. The main tools to measure CRC screening beliefs based on HBM are the colorectal cancer perceptions scale (CRCPS) and the colorectal cancer health belief model scale (CCHBMS). The CRCPS is a 35-item tool developed by Green[14] to measure perceived susceptibility, the severity of CRC, and the barrier and benefits of general CRC screening tests, which was also available in Chinese.[15,16] Bai et al[16] adapted this scale and expanded the perceived barriers subscale to form a simplified Chinese version of revised CRCPS, providing evidence in measuring psycho-social variables for colonoscopy screening behaviors among the at-risk Chinese population. The health belief model scale (HBMS) designed by Champion[17] is currently the most authoritative scale to assess health beliefs. HBMS was applied to patients with breast cancer for the first time and Jacobs[18] developed the CCHBMS based on the HBMS (with Champion's authorization), substituting CRC for breast cancer in the wording of the questions in each of the six subscales. The scale measures six core concepts of the model[19]: (1) health motivation, a general state of intent that leads to behaviors that maintain or improve health; (2) self-efficacy, which introduces the concept that confidence promotes behavior; (3) perceived susceptibility, defined as the degree to which a person perceives himself or herself vulnerable to a threat; (4) perceived severity, the person's interpretation of the intensity of disease; (5) perceived benefits, the perceptions of the effectiveness of proposed actions to reduce risks; and (6) perceived barriers, the perceptions of costs of the proposed actions. The CCHBMS has good structural characteristics with Cronbach'α coefficients of 0.54–0.88 and test-retest reliability of 0.72–0.91[20,21]. Wu et al[22] introduced CCHBMS to China in 2020 and confirmed that its six-factor structure was suitable for the cultural background with good reliability and validity. The content validity index (CVI) of each item ranged from 0.84 to 1.00, Cronbach'α coefficients ranged from 0.801 to 0.944, and the test-retest reliability of the scale was 0.848.[22]

The four-factor colorectal cancer screening belief scale (CRCSBS) based on a correlated four-factor model[12] was developed to specifically measure beliefs about CRC screening by Murphy.[23] The CRCSBS reveals the following psychosocial constructs of CRC screening: (1) perceived benefits/pros, the reasons for being willing to participate in screening, (2) perceived barriers/cons, the reasons for not wanting to be screened, (3) self-efficacy, and (4) outlook/optimism. Self-efficacy is the thought of a situational state associated with a particular behavior, while optimism can be considered as a trait that is more stable across situations. A higher score on the CRCSBS indicates a more positive belief in screening. The CRCSBS is an appropriate tool to assess the psychosocial constructs of CRC screening, and the structural validity has been thoroughly explored and verified. Cronbach'α coefficients were 0.822–0.964 for the subscales, and item-total correlations ranged from 0.422 to 0.912.[24,25] Although the CRCSBS overlaps with CCHBMS in three core concepts, the items used to measure the construct differ. Compared with CCHBMS, CRCSBS measures the psychological structures of CRC screening more specifically (33 items), while CCHBMS has only 17 items related to screening (other items are related to disease). In addition, the CRCSBS investigates in detail the reasons for the individual rejection of screening (11 items) and thus can facilitate the targeted intervention measures to promote screening. However, the CCHBMS is the most widely used tool to assess CRC beliefs. The higher the score, the better an individual's perception of CRC and beliefs in screening. Therefore, we will use it in the criterion validity analysis and hypothesize that the results of the two scales are closely correlated. The development of CRC screening belief assessment tools facilitates the improvement of screening behavior to prevent CRC. At present, a few tools[15,16] for measuring CRC beliefs have been introduced to China, further exploration of the psychosocial constructs of beliefs about CRC screening is still needed. Therefore, the aim of the study was to translate the four-factor CRC screening belief scale into Chinese and describe its psychometric characteristics.

Methods

Participants

Approved by the Ethics Committee of Sun Yat-sen University Cancer Center (SL-B2021-185-02), a convenience sampling method was used to select patients and their relatives hospitalized in the departments of one cancer hospital in southern China from July 2019 to June 2021. The inclusion criteria were (1) age older than 18 years, (2) ability to communicate and literacy, and (3) informed consent. After subjects understood the method of filling out the questionnaires and all precautions, the questionnaires were required to be completed independently within a specified time and were collected in a uniform manner. The sample size for factor analysis was planned to be at least 100,[26] and we included a total of 425 participants, all of whom responded effectively. Two hundred subjects were randomly selected for exploratory factor analysis (EFA) and the remaining 225 subjects were selected for confirmatory factor analysis (CFA). Fifty participants completed the pretest, and repeated measurements were taken after seven days.

Translation

Brislin's translation mode was used for translation and cultural adjustment of the four-factor CRC screening belief scale with authorization from the author of the original scale. The scale was forward translated independently by two researchers who had master's degrees in nursing, had working experience in colorectal departments, and were proficient in both English and Chinese. Then, the forward translations were integrated by a PhD in nursing. The initial version was backward translated independently by two Chinese nursing specialists working in the United States who had master's degrees in nursing and who had never been exposed to the original scale. A detailed comparison was made between the translated English scale and the original English scale by the above four translators. The sentences with a semantic consistency approval rate of less than 75% were forward and backward translated again until the approval rate reached 100% (Chinese version 1).

The Delphi method[27] was used to re-verify the accuracy and cultural adaptability of the scale. Five clinical experts and university professors in cancer care evaluated the expressions, language, cultural background, and content relevance of the scale items according to their practical work experience and professional theoretical knowledge. The scale was further revised according to their advice until the CVI reached 1.0 (Chinese version 2). Some of the subjects who met the requirements were selected for a pretest. Adjustments were made based on the feedback from the respondents and recommendations of the expert panel to obtain the final

version (Chinese version 3). For instance, subjects were added to the sentences for each item to facilitate understanding.

Instruments

Four-factor CRCSBS- Chinese version

According to theory-based evidence of the psychosocial constructs associated with CRC screening, McQueen[12] built a correlated four-factor model explaining CRC screening, based on which a complete scale to assess belief in CRC screening was eventually developed.[23] The CRCSBS is composed of thirty-three items divided into four domains related to screening for CRC. Perceived benefits are measured with six items, and perceived barriers are measured using eleven items. The self-efficacy dimension assesses confidence in performing CRC screening with ten items. Optimism is defined as a positive expectancy of the future, and six items are used to measure expectations of good versus bad outcomes. All items are rated on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5). Items 1–11, 29, 31, and 32 are scored in reverse. The total score of the scale ranges from 33 to 165. The higher the score, the more positive the beliefs in screening. Chinese version 3 of the CRCSBS was administered to the respondents in this study.

CCHBMS-Chinese version

The Chinese version of the CCHBMS was developed by Wu et al[22] It consists of six dimensions with thirty-six items, including perceived susceptibility and severity of CRC, health motivation, perceived benefits and barriers of undergoing screening, and self-efficacy to undergoing screening. A five-point Likert scoring method was adopted, and the perceived barrier dimension was reverse scored. The total score for the scale ranges from 36 to 180, and higher scores represent a better perception of CRC and beliefs in screening. Although this scale is not as detailed as the four-factor CRC screening belief scale in measuring the psychological constructs of screening, it is widely used and is sufficiently reliable.

Data analysis

Questionnaires were numbered uniformly, and Epidata 3.1 software was used for double data entry and automatic error detection. Data analysis was performed by SPSS 20.0 and JAMOVI software with a significance level of 0.05. The central tendency and frequency distribution of demographic characteristics were examined by descriptive statistics.

Item analysis examined the distribution of options for each item and critical ratios (CRs) of items. Items were considered deleted if they exhibited a skewed distribution (the percentage of one option in the item was more than 80%) or CR < 3.[28] The total scores were sorted from high to low with the first 27% being the high group and the last 27% being the low group. The independent sample t-test was used to calculate the CR of each item and compare the differences between high and low groups to investigate the discriminability of items.

Principal component analysis and maximum variance orthogonal rotation were used for EFA. Before EFA, a Kaiser-Meyer-Olkin index greater than 0.70 and Bartlett's test value of sphericity less than 0.05 were verified to confirm the suitability of the data for EFA. Common factors with eigenvalues > 1.0 were extracted, and items with loadings above 0.40 were retained.[29] Maximum likelihood estimation was used for CFA. The indicators for the goodness-of-fit assessment were the chi-square to df ratio (χ^2/df), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), and incremental fit index (IFI). In this study, $\chi^2/df \leq 5$, RMSEA < 0.1, SRMR < 0.05, CFI > 0.9, and IFI > 0.9 were considered acceptable.[30] The CVI of the scale adopted a four-point correlation evaluation method ranging from completely irrelevant (1) to strongly relevant (4). The number of items rated 3–4 by all evaluators was calculated as a percentage of the total number of items. The correlation of the CRCSBS-C and the CCHBMS (Chinese version) was analysed to test the criterion validity.

McDonald's omega coefficient and coefficients of item-total correlation and dimension-total correlation were used to demonstrate internal consistency. Omega coefficients >0.70 reflect satisfactory reliability of the scale and items with a range of no more than 0.10 after deletion are considered homogeneous.[31] The test-retest reliability was calculated by the Pearson correlation, and $r > 0.70$ suggested adequate stability. All items were divided into two parts according to the odd-even property for split-half reliability analysis.

Results

Sample characteristics

We recruited 208 patients and 217 relatives. The participants were aged 45.04 ± 12.12 years, and 63.1% were older than 40 years of age. Most had completed secondary education (89.6%), had no religious beliefs (97.9%), were married (83.8%), and lived in cities (68.0%). The majority were employed (69.9%) and had health insurance (92.7%). Half of the participants had blood relatives with cancer. Among the 208 patients, 75 patients had been diagnosed with cancer before the age of 40, 37 patients had been diagnosed with cancer several times, 168 patients had been diagnosed with cancer within 5 years, and 200 patients had poorly/moderately differentiated cancer. Among the 217 relatives, 95.9% were blood relatives and 81.6% had never undergone CRC screening. Table 1 shows the details.

Item analysis

The results showed that the percentages of options for each item were less than 80%, and no item had a skewed distribution. The CRs of all items ranged from 6.912 to 19.235 ($P < 0.001$); therefore, all items were considered discriminative.

Validity

Structural validity

Table 2 summarizes the EFA results. The Kaiser-Meyer-Olkin index was 0.867, and Bartlett's test of sphericity ($P < 0.001$) supported the factorability of the data. Six factors with characteristic roots > 1.0 were extracted using principal component analysis and maximum variance orthogonal rotation, and these six factors explained 68.3% of the total variation. In the rotated factors matrix, the loading of each item in the dimension to which it belonged was greater than 0.40. Compared with the original scale, items in the factors of perceived barriers and optimism

Table 1
Characteristics of the sample ($n = 425$).

Characteristics		*n*	%
Age	≤ 40 years old	157	36.9
	> 40 years old	268	63.1
Gender	Male	224	52.7
	Female	201	47.3
Education	Primary or below	44	10.4
	Junior high school	105	24.7
	High school	118	27.8
	Bachelor's degree or above	158	37.1
Religious beliefs	Yes	9	2.1
	No	416	97.9
Residence	Rural area	42	9.9
	Township	94	22.1
	City	289	68.0
Marital status	Single	69	16.2
	Married	356	83.8
On-the-job	Yes	297	69.9
	No	128	30.1
With insurance	Yes	394	92.7
	No	31	7.3
Blood relatives with cancer	Yes	215	50.6
	No	210	49.4

were divided into two new factors, and item 30 in the original optimism factor was classified into perceived benefits; these changes might be due to differences in population or culture. Based on professional knowledge and the practical clinical significance of the items, item 30 was still included in the optimism factor, factors 3 and 4 were merged into one factor, and factors 5 and 6 were merged into one factor. The structure of the scale was the same as that of the original scale, and the four factors were named as follows: perceived barriers (items 1–11), perceived benefits (items 12–17), self-efficacy (items 18–27), and optimism (items 28–33). The CFA results showed that the proposed model fit the data well. $\chi^2/df = 3.632$, RMSEA = 0.095, SRMR = 0.044, CFI = 0.906, and IFI = 0.907.

Content validity

After the first round of consultation by the Delphi method, the CVI was only 0.455. Based on the opinions of experts, the items were revised one by one. For example, for item 7, "'I do not have symptoms", the following was added: "'Screening is only necessary if there is discomfort". Item 9, "'There is no one to drive me home from the test", was adjusted to "'Transportation to and from the hospital during screening is not convenient". The consultation was repeated, and a CVI of 1.0 was obtained, which met the standard requirements.[31]

Criterion validity

The scores of the Chinese version of the four-factor CRC screening belief scale were significantly positively correlated ($r = 0.831$, $P < 0.01$) with the scores of the CRC HBM scale (Chinese version), which was consistent with the previous hypothesis. See Table 3 for details.

Table 2
Rotating factors matrix of the CRCSBS-C ($n = 200$).

Items	Factor loading					
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
(20)	0.918					
(21)	0.915					
(23)	0.911					
(19)	0.892					
(18)	0.874					
(25)	0.851					
(22)	0.842					
(24)	0.797					
(26)	0.749					
(27)	0.706					
(14)		0.867				
(13)		0.836				
(12)		0.757				
(16)		0.729				
(15)		0.709				
(17)		0.603				
(30)		0.552				
(8)			0.810			
(11)			0.753			
(9)			0.746			
(1)			0.703			
(6)			0.626			
(5)			0.608			
(7)			0.565			
(2)				0.861		
(10)				0.729		
(3)				0.711		
(4)				0.599		
(32)					0.846	
(31)					0.793	
(29)					0.555	
(33)						0.756
(28)						0.638

CRCSBS-C, the Chinese version of the four-factor colorectal cancer screening belief scale.

Reliability

Nternal consistency

The total omega coefficient in this study was 0.939, and it did not increase by more than 0.10 upon deletion of any item. The omega coefficients of the four subscales of perceived barriers, perceived benefits, self-efficacy and optimism ranged from 0.774 to 0.948 (Table 4).

The correlation coefficients between items and the total score of the scale ranged from 0.270 to 0.704 ($P < 0.001$). The correlation coefficients between the subscales and the total scale were 0.582–0.732 ($P < 0.001$).

Test-retest reliability and split-half reliability

Fifty participants were randomly selected for a retest 7 days later, and the test-retest reliability coefficients were 0.664–0.768 for the subscales (Table 4), indicating good stability over time. The items were divided into two parts according to the parity for split-half reliability analysis, with a coefficient of 0.646.

Discussion

When detected early, CRC is highly treatable, and screening is an effective method for early detection.[32] Although demographic predictors of CRC screening can be used to classify populations to provide interventions, psychosocial factors are often targeted for intervention because they are more susceptible to change.[12] Understanding an individual's perception of CRC screening is important for developing effective interventions to improve compliance with screening. Studies have demonstrated that psychosocial constructs are associated with CRC screening[33,34]; however, the different concepts and operational definitions of psychosocial constructs and the fact that these constructs cannot be directly observed mean that studies developing and validating scales regarding CRC screening are necessary. Preliminary explorations of beliefs about CRC screening in China have been conducted. Wu[22] translated the colorectal cancer HBM scale and Bai[16] introduced the revised colorectal cancer perception scale to measure the beliefs about CRC among relatives of patients with CRC. These two instruments are both based on the health beliefs model and partly measure concepts related to CRC screening. The present study introduced the scale based on the four-factor model for the first time applied to both patients and their relatives to further explore the psychological constructs of CRC screening beliefs. In short, the reliability and validity of the scale are satisfactory. The Chinese version of the four-factor CRCSBS has a moderate number of items, and the content is easy to understand, with high operability. Respondents could generally finish the self-assessment within 10 min.

Through factor analysis, we replicated and confirmed the psychosocial factor structure of CRC screening first proposed by Murphy,[23] including perceived barriers, perceived benefits, self-efficacy, and optimism. Our findings indicated that the structure was invariant for Chinese people. Studies have examined the psychosocial structures of CRC screening in different settings. Vernon[35] reported five core constructs relevant to CRC screening among male automotive workers: salience and coherence, perceived susceptibility, worries about screening, screening efficacy, and social influence. This five-factor structure was subsequently

Table 3
Pearson correlations between the CRCSBS-C and the CCHBMS-C ($n = 425$).

	CRCSBS-C				
	Perceived barriers	Perceived benefits	Self-efficacy	Optimism	Total score
CCHBMS-C	0.639**	0.481**	0.699**	0.384**	0.831**

**$P < 0.01$.
CCHBMS-C, the Chinese version of the colorectal cancer health belief model scale; CRCSBS-C, the Chinese version of the four-factor colorectal cancer screening belief scale.

Table 4
Reliability coefficients of the CRCSBS-C and subscales ($n = 425$).

	Perceived barriers	Perceived benefits	Self-efficacy	Optimism	Total score
Omega coefficients	0.940	0.948	0.919	0.774	0.939
Test-retest reliability	0.767**	0.768**	0.766**	0.664**	0.719**

**$P < 0.01$.
CCHBMS-C, the Chinese version of the colorectal cancer health belief model scale.

validated in population-based samples in the United States[33] and Canada.[34] McQueen[12] provided evidence to measure the factor validity of a CRC screening scale, including perceived pros, cons, social influence, and self-efficacy. Rawl[36] recruited patients with adenomatous polyps and the first-degree relatives of patients with CRC and established the construct validity of a CRC screening scale using EFA; the results confirmed the structural unidimensionality of the scale for assessing the perceived benefits of and barriers to CRC screening. Scaglioni[37] found that emotional barriers and, in particular, fear of the screening outcome, were associated with CRC screening attendance. Based on the above, perceived benefits, perceived barriers, and self-efficacy are the most frequently discussed components of the psychosocial structure of CRC screening. According to the HBM, only when people realize that they can obtain a preventive effect in return for the cost they pay (such as time, burden, and perseverance) will they take action with a clear intention.[38] People's awareness of the difficulties of adopting healthy behaviors is a necessary prerequisite for making such behaviors durable. For example, when prevention is expensive, painful, or inconvenient to individuals, the intervenor should point out all these barriers realistically and help people overcome them one by one. Self-efficacy plays an important role; when individuals recognize that there will be obstacles to taking an action, the confidence and willpower that they can overcome those obstacles will help them take the action.[21]

Optimism was also shown to be an independent psychosocial construct of CRC screening in this study. Han et al[39] found that optimism regulates CRC anxiety and alleviates the impact of comparative risk on screening behavior. Researchers have suggested that optimists generally have more positive expectations of future results and are more likely to emphasize important elements in the face of adversity; therefore, optimists are more likely to set goals to change behaviours and put them into practice. By contrast, people with low optimism may be more likely to be deterred by the challenges of changing behavior or have more difficulty setting positive goals or re-engaging in existing goals.[40,41] There are abundant optimistic belief systems in ancient Chinese culture, among which Confucianism and Taoism are the main representatives. Confucianism advocates promising, rational, worldly optimism, which is manifested in the adages that "'benevolent people do not worry" and that " 'poor people are poised and optimistic in their plight". Taoism emphasizes inaction and advocates a life attitude of conforming to nature and not doing anything rashly. These beliefs form the basis of the traditional cultural spirit that influences the Chinese people. Although there is little evidence for a relationship between optimism and CRC screening, the positive correlation observed in this study suggests that more attention to this topic is needed for further research. For example, further work could examine how optimism affects CRC screening decision-making and explore whether optimism moderates the effects of perception and attitude on CRC screening behaviour.

In this study, the CRs of the scale items were statistically significant, which indicated good discriminative ability. Each item reflected the measurement concept with satisfactory content validity, and the Chinese version of the four-factor CRCSBS was accepted easily by Chinese people after cultural adjustment. A high degree of consistency was found between the Chinese versions of the four-factor CRCSBS and the colorectal cancer HBM scale, the most widely used belief scale regarding CRC, so the validity of the scale was supported. Cronbach's alpha is widely used in internal consistency analysis and is reported in almost all studies that measure constructs of psychosocial projects using multiple items. However, it is well known that Cronbach's alpha will underestimate the true reliability unless the items are equivalent. McDonald's omega coefficient is considered a practical substitute for Cronbach's alpha when measuring the internal consistency reliability of scales.[31] McDonald's omega coefficient was 0.939 in the study. The split-half reliability index ($r = 0.719, P < 0.01$) also indicated that the scale has good internal consistency. The test-retest reliability reflects the stability of the test across time considering the error of measurement results caused by different conditions (eg, physical, environment). The test-retest reliability was acceptable in this study.

Limitations

We recognize that there are limitations in the generalizability of the findings to all Chinese residents because this study recruited participants from only one city in China, all of whom were patients with cancer and their relatives. Further studies could recruit larger samples from multiple research centres. In addition, the cross-sectional study design was not predictive, so longitudinal studies can be designed in the future to explore the influence of beliefs on screening behavior.

Conclusions

We verified the structure of the Chinese version of the four-factor CRCSBS and reported its good reliability and validity. This study provides a suitable measurement tool for assessing health beliefs about CRC screening in China and provides a premise for healthcare professionals to improve people's beliefs about CRC screening, which will be of great significance in promoting screening behavior and preventing the occurrence of CRC.

Authors' contributions

Liu Yang: Conceptualization, Methodology, Formal analysis, Writing - Original Draft. Rui Zhao: Investigation, Writing -Original Draft. Shan Li and Chaona Ji: Investigation, Data Curation. Jiexiong Qin: Methodology, Writing - Reviewing and Editing. Yalan Song: Project administration, Writing - Reviewing and Editing. Xiaodan Wu: Conceptualization, Funding acquisition, Resources, Supervision.

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Ethics statement

This study was approved by the Ethics Committee of Sun Yat-sen University Cancer Center (Approval No. SL-B2021-185-02).

Data availability statement

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

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Declaration of competing interest

None declared.

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