Original Article

Translation, Adaptation, and Validation of Revised Colorectal Cancer Perception and Screening Instrument among First-Degree Relatives of People with Colorectal Cancer in China

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ABSTRACT

Objective: The purpose of the study was to translate and validate the psychometric properties of the Revised Colorectal Cancer Perception and Screening (RCRCPS) instrument for the first-degree relatives (FDRs) of people with colorectal cancer (CRC) in China. **Methods:** The translation, adaptation, and validation guideline developed by Sousa and Rojjanasrirat was used to guide this study. All items from the Colorectal Cancer Perception and Screening (CRCPS) instrument and three items from the Perceived Barriers Questionnaire were combined and further adapted for a colonoscopy test, resulting in RCRCPS. The resultant RCRCPS was translated from English to Chinese through forward- and backward-translation methods, and a panel review was conducted to examine its content validity. The RCRCPS (simplified Chinese version) was then tested with a convenience sample of 197 Chinese FDRs of patients with CRC. Validity was tested through confirmatory factor analysis (CFA) and discriminative validity, and reliability was assessed using Cronbach's α and test–retest reliability. **Results:** The content validity index (CVI) of the RCRCPS (simplified Chinese version) was satisfactory (item CVI = 0.80–1 and scale CVI = 0.92). The results demonstrated acceptable internal consistency (Cronbach's α = 0.74–0.87) and test–retest reliability in a 4-week interval (intraclass coefficient = 0.53–0.84). CFA revealed that the RCRCPS (simplified Chinese version) conformed to the four-factor model suggested by the original version (Chi-square/degree of freedom = 1.326,

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root-mean-square error of approximation = 0.041, comparative fit index = 0.904, Tucker–Lewis index = 0.896, and standardized root mean square residual = 0.684). **Conclusions:** The 38-item simplified Chinese version of RCRCPS demonstrated acceptable reliability and validity. Healthcare professionals may use this instrument in the development and evaluation of interventions to promote colonoscopy screening among people at an increased risk of developing CRC.

Key words: Colorectal cancer perception and screening scale, first-degree relatives, psychometric properties, translation

Introduction

Colorectal cancer (CRC) contributes significantly to the global cancer burden. It is viewed as a less common disease in Asia compared with western countries. However, with the rapid aging population and the growing trend of adopting western lifestyles, particularly in dietary habits, the incidence and mortality of CRC are rising rapidly in Asia.[1] The Chinese comprise the largest subgroup Asia population, with a CRC incidence of approximately 37.6 per 100,000 and a mortality rate of 19.1 per 100,000.[2] CRC has become a substantial burden in China, particularly in the more developed cities.

Positive family history is one of the most important risk factors for developing the disease.[3] Approximately 20% of new CRC cases occur among people who are the first-degree relatives (FDRs) of patients with CRC.[4] Screening for CRC involves an efficacious strategy to reduce disease-related morbidity and mortality, especially among at-risk populations.[5] CRC screening can be performed using several tests, including fecal occult blood test, flexible sigmoidoscopy, and colonoscopy.[6] Among these tests, colonoscopy is the preferred option for FDRs, given its advantages in removing preneoplastic and small cancerous lesions.[7] Nevertheless, the rates of colonoscopy screening among families of patients with CRC remain low. An accurate and reliable assessment of individual perceptions in colonoscopy screening is crucial to understand the low colonoscopy screening rate and to help health professionals develop interventions that target identified deficits and strengths.[8]

The health belief model (HBM) provides a theoretical foundation to explain and predict one's health-related behaviors, particularly in regard to the uptake of health services.[9] The basic components of the HBM include perceived susceptibility, severity, barriers, and benefits.[10] The HBM suggests that people will adopt preventive measures if they believe that they are susceptible to the condition, if they believe that it has potentially serious consequences, if they believe that the action available to them is beneficial in reducing their susceptibility to the severity of the condition, and if they believe that the barriers to action are outweighed by its benefits.[9]

To our knowledge, no instrument measures HBM-related concepts for colonoscopy screening. Only a few instruments have been developed for CRC screening, which can be generally used for various CRC screening tests. The lack of a valid instrument in Chinese for colonoscopy tests hampers accurate and consistent assessment, as well as the development of an intervention to promote colonoscopy participation in populations at increased risk. Therefore, this study aimed to test a simplified Chinese version of Revised Colorectal Cancer Perception and Screening (RCRCPS) instrument, which measures four psychosocial concepts derived from the HBM for colonoscopy screening tests, to contribute to the promotion of programs on CRC screening for at-risk populations.

The Colorectal Cancer Perceptions Scale (CRCPS) involves clear psychometric properties that measure the most complete constructs of the HBM,[11] compared with the instruments of Vernon *et al.*,[12] Rawl *et al.*,[13] and McQueen *et al.*[14] The CRCPS is a 35-item tool developed by Green and Kelly[15] to measure perceived susceptibility, the severity of CRC, and the barrier and benefits of general CRC screening tests. Each item is rated using a five-point Likert-type scale (1 = strongly disagree to 5 = strongly agree). The scores for the CRCPS range from 35 to 175, in which high scores of each subscale indicate a high level of perception. Leung *et al.*[11] translated the CRCPS from English to traditional Chinese and validated it in a sample of community-dwelling older adults; their translated version demonstrated acceptable reliability, with Cronbach's α for these six subscales ranging from 0.74 to 0.88.[11] Exploratory factor analysis was conducted and revealed a six-factor structure: susceptibility, benefits, severity-fear, severity-life impact, psychological barriers, and knowledge barriers. The six-dimensional structure was congruent with the proposed four-factor model but with the different classification of two constructs: severity and barriers. Items in the severity subscale were grouped into severity-fear and severity-life impact, whereas items concerned with barriers were separated into psychological and knowledge barriers. The traditional Chinese version of the CRCPS has been applied in an epidemiological study in Hong Kong.[16]

Considering this instrument was developed for CRC screening tests, barrier items may not be specific when applied to colonoscopy. For instance, a long flexible fiber-optic camera will be inserted into the rectum to examine a large bowel for any unusual growth during colonoscopy. The procedure may raise some negative health consequences such as physical harm or bodily discomfort.[17] However, these barriers were not covered in the CRCPS. To supplement specific barrier

items, items from the perceived negative health barriers subscale of Sung's instrument were added to the CRCPS. The four-item subscale is rated on five-response categories ranging from definitely disagree (0) to agree (4). Total scale scores range from 0 and 16, with higher scores indicating greater perceived barriers of CRC screening. The subscale measured physical harm, bodily discomfort, embarrassment, and apprehension, with Cronbach's α of 0.63. Given that an item assessing embarrassment is already involved in the CRCPS, three other items were added. Then, the term "screening" in all items was replaced by "colonoscopy screening," resulting in a 38-item (RCRCPS) instrument.

Methods

The seven-step guideline on the instrument translation, adaptation, and validation process developed by Sousa and Rojjanasrirat was used in this study.[18] This guideline recommends skipping the step of preliminary psychometric testing when the bilingual population is not accessible, and it will not influence the final validation results. This study implemented the following steps.

Steps 1–4: Translation

In forward translation, two bilingual registered nurses translated the original instrument into simplified Chinese. One of the nurses was familiar with medical terminology in the CRC screening context, and the other was familiar with healthcare slang, jargon, and idiomatic expressions. A third-dependent bilingual registered nurse was invited to compare the forward-translated versions and the RCRCPS in English. After the discrepancies were discussed and a consensus was achieved among the three translators, the instrument was back-translated by two other bilingual Ph.D. students in nursing who were blind to the RCRCPS in English. Given that bilingual translators whose mother language was English are unavailable in this study, two Chinese translators who have lived abroad for more than 3 years were invited to serve as translators in the backward step. One of them was familiar with medical terminology in the CRC screening context, and the other was familiar with healthcare slang, jargon, and idiomatic expressions. The backward-translated versions and the RCRCPS in English were compared by the four translators and one head nurse of the colonoscopy unit who was familiar with colonoscopy. The simplified Chinese version was finalized when the consensus was achieved in the committee.

Step 5: Pilot testing

The translated version of the RCRCPS was then assessed for content validity by an expert panel. An expert panel (*n* = consisting of two physicians and four nurses with expertise in colonoscopy tests or screening) was invited to examine the instruments and rate each item for its relevance by using the following scale: 1 = not relevant; 2 = unable to assess relevance without item revision; 3 = relevant but needs minor alteration, 4 = very relevant. Content validity index at the item level (I-CVI) and content validity index at the scale level (S-CVI) were calculated. The I-CVI was computed as the percentage of experts giving a rating of either 3 or 4. The S-CVI was computed as the percentage of items that achieved a rating of 3 or 4 by all the experts. I-CVI >0.78 and S-CVI >0.9 suggest good content validity.[19] Those items rated by the expert panel as not relevant or unable to assess relevance were revised.

To check if the RCRCPS is easily understood by the target population, 10 Chinese FDRs of patients with CRC were invited to evaluate the instructions, response format, and items of the instrument for clarity.

Step 6: Psychometric testing

Participants and study setting

A convenience sample was recruited from hospital cancer registries in the Nanshan district of Shenzhen. Survivors of CRC who were diagnosed with CRC before 60 years old were contacted to refer to FDRs. The inclusion criteria of FDRs were as follows: (1) age 40 years or older or 10 years before the age the relative was diagnosed; (2) FDRs (parent, sibling, or children) of patients with CRC; and (3) able to speak Chinese. Individuals were excluded if they (1) had a history of cancer or inflammatory bowel disease; (2) had a history of inherited syndromes (Lynch syndrome or familial adenomatous polyposis); and (3) had severe disease or were mentally incompetent.

Sample size estimation in this study was carried out to give the study adequate participants for examining internal consistency, test–retest reliability, and factor analysis of the translated tool of the RCRCPS. According to the recommendation of Bryant and Yarnold,[20] the subjects to variables ratio should be at least 5 for performing factor analysis. By this standard, at least 190 participants were needed for conducting factor analysis on the tools of the 38-item RCRCPS scale. This sample size is also sufficient for estimating Cronbach's α by the standard of Bonett.[21] Furthermore, a sample size of 190 participants allows the study to detect a correlation coefficient as small as 0.21 with 80% power at 5% level of significance. On the basis of the method of Bonett,[22] a sample size of 50 subjects is adequate to confine the precision of the test–retest reliability as assessed by an intraclass correlation coefficient (ICC) of ±0.1 at 5% level of significance with anticipated reliability of ICC ≥0.8. Therefore, a total of 190 participants were targeted for the study, and a random subsample of 50 participants was needed to assess test–retest reliability.

Data collection

Eligible survivors with CRC were identified from cancer registries in the Nanshan district of Shenzhen through the telephone. For patients who showed interest, an introduction of and information on this study were provided, and the patients were invited to (1) provide family history information, (2) help convey information to their FDRs, and (3) provide contact information on one FDR who was over the age of 40 or 10 years before the age the relative was diagnosed. Members from the same cluster, such as family, may share similar characteristics or be exposed to the same external factors; hence, the responses from individuals within a cluster are likely to be more similar than those from different clusters.[23] This study invited only one FDR of each CRC patient to complete the investigation for achieving a broad perception of numerous families. Permission or notification from physicians was obtained before contacting the cancer patients. After obtaining contact information on FDRs, the researcher phoned the FDRs to invite eligible participants to participate in this study. The researcher explained the purpose, procedures, potential risks, and benefits of the study to them. Individuals who agreed to participate were asked to provide verbal consent. After obtaining verbal consent, the researcher signed and dated the information sheet to document each participant's consent. Then, the researcher administrated the instruments, including a demographic information sheet and a simplified Chinese version of RCRCPS, through the telephone by reading the questions and possible responses to the participants and asking them to select an answer. The answers of the participants to each question were recorded by the researcher. Four weeks later, 50 FDRs were randomly chosen from 197 participants to repeat the questionnaire for assessing retest reliability. A long interval (4 weeks) was selected for test–retest reliability because a telephone survey was used to refer to the families' cancer diagnosis, and the participants were unlikely to recall their responses after this interval.

Instruments

The Revised Colorectal Cancer Perception and Screening Instrument (simplified Chinese version)

The RCRCPS (simplified Chinese version) was a 38-item instrument that comprised 35 items from the CRCPS and three items from the Perceived Barriers Questionnaire. In this study, the RCRCPS was translated, and its psychometric properties were established. It is a questionnaire that measures four psychosocial variables derived from the HBM toward colonoscopy screening behavior: perceived susceptibility of CRC, perceived severity of CRC, perceived barriers of colonoscopy screening, and perceived benefits of colonoscopy screening. Each item is rated on a five-point (1–5) Likert scale. The scores for the RCRCPS ranged from 38 to 190, and high scores of each subscale indicated a high level of perception.

Demographic information sheet

The demographic information sheet developed by the research team was used to gather information about age, gender, marital status, educational level, monthly household income, and religion.

Data analysis

Response rate

Response rate is defined as the number of completed interviews divided by the number of interviews (complete plus partial) plus the number of noninterviews (refusal and break-off plus noncontacts plus others).[24] Only individuals who completed all the items were involved in the response calculation and psychometric property analysis.

Reliability

The reliability of the adapted instrument was assessed by internal consistency and test–retest reliability. The internal consistency was assessed using Cronbach's α coefficient analysis and corrected item-total correlation analysis. A Cronbach's α coefficient >0.7 indicates acceptable internal consistency.[25] Items that had an item-total correlation <0.3 and whose deletion caused an increase of 0.1 or more in the α coefficient for the overall scale were considered nonhomogenous and dropped.[26] As for test–retest reliability in 4 weeks, the ICC was calculated, in which >0.7 indicates good reliability.[27]

Factorial validity

The factorial validity was evaluated by confirmatory factor analysis (CFA). CFA was performed to determine whether the simplified Chinese version of the RCRCPS conforms to the four-factor model suggested by the HBM. The four-factor model in the original version was selected to test the hypothesized factor structure; the subscale of psychological barriers in the traditional version has very few items (n = 3), which results in an unstable six-factor model. The overall fit of the model was examined by the Chi-square/degree of freedom (χ^2/df), root-mean-square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), and Tucker–Lewis index (TLI).[28] The values of χ^2/df below 3.00, RMSEA and SRMR below 0.08, and CFI and TLI above 0.90 indicate a good model fit. When indicators did not suggest adequate model fit, changes were made to the model on the basis of modification indices (MIs). An MI greater than 4 indicates that a change will result in a significant improvement in model fit.[29]

Discriminative validity

Known-group comparison was performed to examine discriminative validity. Considering the conceptual proposition of the HBM, participants who had undergone CRC screening would have a higher level of perceived susceptibility, severity, and benefits and a lower level of perceived barriers than those who had not. If the scores of the subscale were normally distributed, then an independent *t*-test was performed by comparing the mean scores of each subscale by CRC screening status. For nonnormal distributions, Mann–Whitney U-test was performed to test the difference in subscale scores between different screening statuses.[30]

Ethical approval

The study was conducted in accordance with the Declaration of Helsinki and approved by the Chinese University of Hong Kong Survey and Behavioural Research Ethics Committee. Informed written consent was obtained from all participants before their enrolment in this study.

Results

Results of pilot testing

Content validity

All six members of the expert panel submitted their rating without missing answers. The I-CVI was computed as 0.80–1, and the S-CVI was computed as 0.92. The results showed that the RCRCPS (simplified Chinese version) presented acceptable content validity. The expert panel commented that the instrument was culturally and conceptually relevant to measure HBM-related concepts for colonoscopy screening in China. However, item 35 "Having CRC screening costs too much money" had to be revised to "Having CRC screening costs a bit too much money." Currently, the price of this test costs around CNY300–1000 in China, depending on if it utilizes no pain technique, which is not difficult in residences. Moreover, the panel recommends that items in the susceptibility subscale should be ordered in time sequence: "currently," "in the next few years," and "in the near future," which would allow participants to easily understand the items. Thus, modifications were made accordingly. All of the invited FDRs indicated that the instructions, response format, and items of the instruments are clear and that no modification is required.

Results of psychometric testing

Sample characteristics

The study was conducted from September 2018 to November 2018. A total of 197 FDRs of patients with CRC were recruited. The characteristics of the FDRs are summarized in Table 1. The mean age of the entire sample was 42.2 (standard deviation = 8.4), 46.7% were male, 84.8% were married, and 78.5% received tertiary education. About one-third of the respondents (37.4%) reported a monthly household income of more than CNY30,000. Most of the participants (94.9%) were covered by health insurance. Among the FDRs, 29.5% had previous CRC screening behavior, and the majority received a colonoscopy.

Response rate

A total of 273 FDRs were identified. Among them, 49 refused to participate in this investigation, six were not contacted successfully, 21 did not complete RCRCPS, and 197 completed RCRCPS, resulting in a response rate of 72.2% (197/273).

Factorial validity

The standardized estimates output provided by Amos 25 using maximum likelihood estimation is shown in Figure 1. The factor loading ranged from 0.27 to 0.80.

Table 1: Sample characteristics ($n=197$)

Characteristics	Values [frequency (%) or mean±SD]
Age, years	42.2±8.4 (20-62)
Male	92 (46.7)
Marital status	
Single	21 (10.7)
Married	167 (84.8)
Divorced	6 (2.9)
Widowed	3 (1.6)
Education level	
No formal education	1 (0.5)
Primary	2 (1.0)
Secondary	41 (20.8)
Tertiary	153 (77.7)
Month household income ($n=123$)[a]	
None	1 (0.9)
<CNY10,000[b]	33 (26.8)
CNY10,000-19,999	25 (20.3)
CNY20,000-29,999	18 (14.6)
≥CNY30,000	46 (37.4)
Having health insurance	
No	10 (5.1)
NRCMI	16 (8.1)
Commercial insurance	9 (4.6)
Society insurance	105 (53.3)
NRCMI and commercial insurance	5 (2.5)
Society insurance and commercial insurance	52 (26.4)
Have received CRC screening	
No	139 (70.5)
FOBT	9 (4.6)
Colonoscopy	49 (24.9)

[b]USD $1=CNY7.08; [a]Missing data: 74 participants refused to report their monthly household income. NRCMI: New rural cooperative medical insurance; CRC: Colorectal cancer; FOBT: Fecal occult blood test; SD: Standard deviation

Original model fit

The initial four-factor model did not fit well, with $\chi^2/df = 1024.284/659 = 1.554$, RMSEA = 0.053, CFI = 0.835, TLI = 0.823, and SRMR = 0.0725 [Table 2]. These fit indices suggested that the model needed to be modified.

Model modification

By examining the MI, the largest MI suggested adding a covariance between the errors for C7 and C9 (MI = 23.998), C1 and C21 (MI = 19.914), C33 and C34 (MI = 23.392), and C26 and C27 (MI = 16.371). Item 7 is "uncomfortable when thinking of CRC" and item 9 is "'heart beats aster when thinking of CRC." Therefore, discomfort may be related to heart rate when thinking of CRC. Item 1 is "It is extremely likely that I will get CRC," and item 21 is "screening decreases the chance of dying of CRC." The one who perceived him or she is at increased risk and is more likely to be concerned about the benefits of screening to reduce the chance of dying. Adding covariance between e1 and e21 is reasonable. Item 33 is "I have some other problems that are more important than getting colonoscopy screening" and item 34 is "Colonoscopy screening would interfere with my activities." Items 33 and 34 express that screening is not more important than other activities. Item 26 is "I do not know how to go about scheduling colonoscopy screening," and Item 27 is "I cannot remember to schedule an appointment for colonoscopy screening." These two items are related to the screening schedule. The covariances between e7 and e9, e1 and e21, e33 and e34, and e26 and e27 were added. After modification, the model still did not fit well with $\chi^2/df = 935.987/655 = 1.429$, RMSEA = 0.047, CFI = 0.873, TLI = 0.863, and SRMR = 0.0702 [Table 2].

The MI was examined for the second modified model, and fewer MIs were reported. Most were smaller than the initial model, and the largest remaining MI suggested adding a pathway between e15 and e38 (9.867), e6 and e13 (9.652), and e23 and e35 (8.333). Item 15 is "Problems I would experience from CRC would last a long time." Item 38 is "I am scared of colonoscopy." Item 6 is "the thought of getting CRC scares me." Item 13 is "I am afraid to even think about CRC." These four items all express the feeling of fear raised by CRC. Item 23 is "CRC screening is embarrassing," and item 35 is "Having CRC screening costs too much money." Thus, adding covariance between errors for these items is reasonable. After the modification, the model fit noticeably better than the earlier two models, with the fit indices of $\chi^2/df = 895.052/648 = 1.326$, RMSEA = 0.041, CFI = 0.904, TLI = 0.896, and SRMR = 0.684 [Table 2].

The final version of the CRCPS model retained the original four factors, but 11 error covariances were added between the error terms for items 1 and 21, items 3 and 20, items 6 and 13, items 7 and 9, items 14 and 15, items 15 and 32, items 15 and 38, items 21 and 22, items 23 and 35, items 26 and 27, and items 33 and 34. The final model is shown in Figure 2.

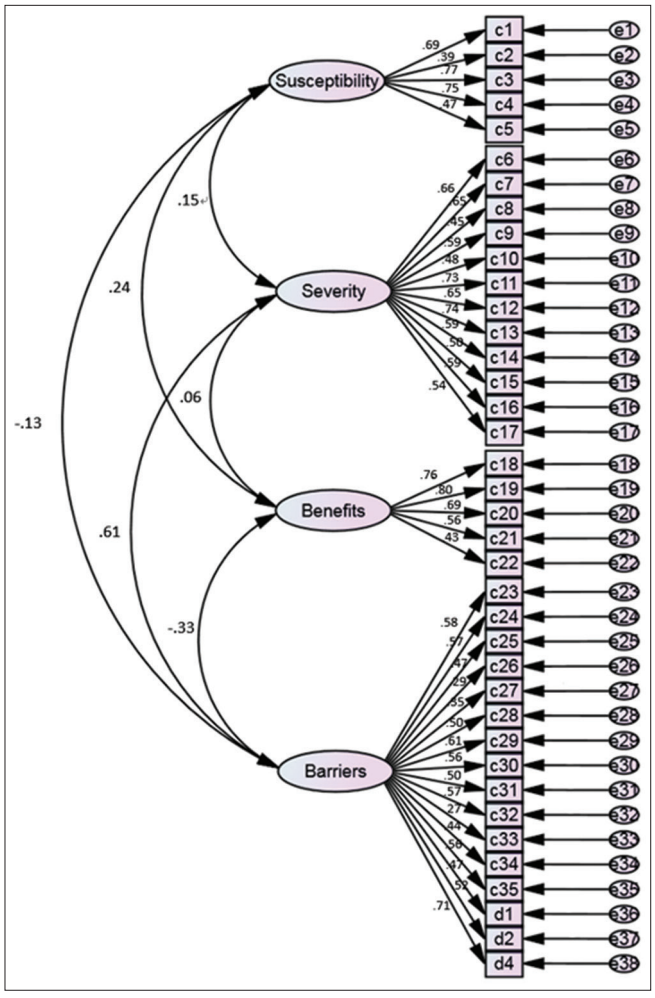

Figure 1: Four-factor RCRCPS CFA Model Standardised Estimates (n = 197)

Discriminative validity

Results of known-group difference [Table 3] indicated that participants who had undergone CRC screening scored significantly higher in susceptibility and benefits and significantly lower barriers than those who had not. No significant differences were observed in severity.

Table 2: Model fit indices

Model	χ^2/df	RMSEA	CFI	TLI	SRMR
Original	1.554	0.053	0.835	0.823	0.0725
1st modified	1.429	0.047	0.873	0.863	0.0702
2nd modified	1.368	0.043	0.891	0.883	0.0688
Final	1.326	0.041	0.904	0.896	0.0684

χ^2/df: Chi-square/degree of freedom; RMSEA: Root-mean-square error of approximation; CFI: Comparative fit index; SRMR: Standardized root-mean-square residual; TLI: Tucker-Lewis index

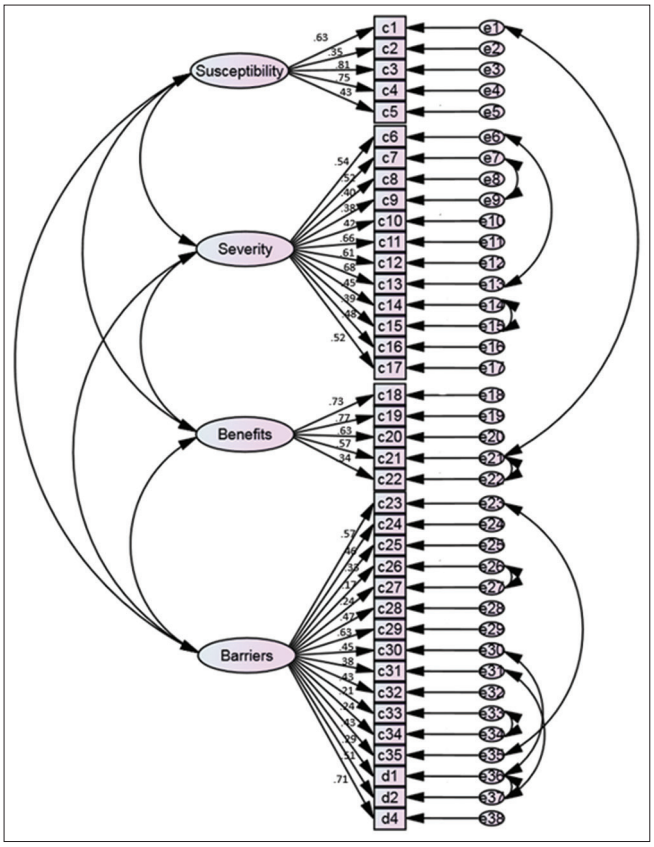

Figure 2: RCRCPS CFA model with three modifications (final model)

Reliability

Table 4 presents the reliability measures and test–retest reliability coefficients for the four subscales of the CRCPS. Cronbach's α for all four subscales was high (>0.74), suggesting acceptable internal consistency. The corrected item-total correlation ranged from 0.24 to 0.71 [Table 4]. C23 and C26 fell below the 0.3 criteria. Nevertheless, Cronbach's α of the subscale was only raised less than 0.1 upon the deletion of the item. Therefore, these items were retained for further analysis. Test–retest reliability for a subsample of 40 participants ranged from 0.53 to 0.84.

Discussion

Despite the effectiveness of colonoscopy screening in reducing mortality among at-risk populations, the adoption of screening behaviors by FDRs is low. The HBM has been consistently found to be effective in shaping screening behaviors.[9] Measuring variables derived from the HBM is essential for the development of interventions to promote screening behavior and the outcome evaluation of existing healthcare services for FDRs. This study was the first to provide evidence for reliability and validity in measuring psychosocial variables for colonoscopy screening behaviors using an at-risk Chinese population. All items of the RCRCPS were appropriately translated. On the basis of suggestions from our expert panel, the price of colonoscopy was modified and the order of items in the perceived susceptibility subscale was rearranged.

Table 3: Mean differences/rank in the four subscales by screening status

Variables	CRC screening, mean/mean ±SD		*P*
	Yes (*n*=58)	No (*n*=139)	
Susceptibility	15.43±3.04	14.10±3.02	<0.01[a]
Severity	34.52±7.87	36.08±8.60	0.901[a]
Benefits	113.34	92.26	<0.001[b]
Barriers	37.71±6.81	43.52±7.35	<0.001[a]

Statistical analyses: [a]Independent *t*-test, [b]Mann-Whiney U-test. SD: Standard deviation; CRC: Colorectal cancer

The original version of the CRCPS was developed based on the four-factor HBM model. Even though the six-factor structure was identified from the traditional Chinese version of the CRCPS, it was certainly congruent with the proposed four-factor model.[11] In addition, the subscale of psychological barriers in the CRCPS (traditional Chinese version) had very few items (n = 3) to permit a stable factor solution. Therefore, the four-factor model in the original version was selected to test the hypothesized factor structure. The results from initial CFA for the four-factor RCRCPS was found to have fit indices lower than the criterion level, suggesting a model modification. After adding error covariance between error terms for items based on the highest MI, the model fit is noticeably better than the earlier models, with acceptable model fit indices (χ^2/df = 1.326, RMSEA = 0.041, CFI = 0.904, TLI = 0.896, and SRMR = 0.684). These findings support the application of the original four-factor HBM model for the 38-item RCRCPS. The four-factor model confirmed by the simplified Chinese version RCRCPS and six-factor model identified from the traditional Chinese version CRCPS, all demonstrated good consistency with the structure of the HBM. The findings may indicate that consistent cultural meaning of the HBM toward CRC screening between our samples and people in Hong Kong.

The HBM posits that susceptibility, severity, and benefits are positively associated with screening behavior, whereas barriers are negatively associated with screening behavior. The concurrent validity of this study showed that participants who received colonoscopy perceived significantly higher susceptibility and benefits and fewer barriers than those who did not. However, no significant differences were observed in the severity subscale. The findings in this study were consistent with the review conducted by Kiviniemi *et al.*[31] This review summarized 81 studies examining the relationship between psychosocial constructs and CRC screening behavior, and the results revealed that the majority

Table 4: Reliability of the final Revised Colorectal Cancer Perception and Screening (simplified Chinese version)

Item/subscale	Item-to-total correlation ($n=197$)	Cronbach's α if item deleted	Cronbach's α ($n=197$)	Intraclass coefficient ($n=50$)
Susceptibility				
1. It is extremely likely that I will get CRC 我非常有可能患上大肠癌	0.57	0.66	0.74	0.74
2. My chances of getting CRC in the next few years are great 我非常有可能患上大肠癌	0.34	0.75		
3. I feel I will get CRC some time in my life 我觉得我在生命中的某个阶段会患上大肠癌	0.64	0.64		
4. Developing CRC is currently a possibility for me 未来数年我有很大的可能患上大肠癌	0.60	0.65		
5. I am concerned about the likelihood of developing CRC in the near future 我担心我将来有可能患上大肠癌	0.38	0.74		
Severity				
6. The thought of getting CRC scares me 我会因为有患上大肠癌的想法而感到害怕	0.60	0.86	0.87	0.81
7. When I think of CRC, I feel nauseated 我想到大肠癌时会感觉不舒服	0.60	0.86		
8. If I had CRC, my career (life) would change 如果我患上大肠癌，我的事业会有改变	0.43	0.87		
9. When I think of CRC, my heart beats faster 我想到大肠癌时会心跳加速	0.53	0.86		
10. CRC would endanger my marriage (relationship) 大肠癌会破坏我的婚姻	0.46	0.87		
11. CRC is a hopeless disease 大肠癌是令人绝望的疾病	0.67	0.85		
12. My feelings about myself would change if I got CRC 如果我患上大肠癌，我对自己的看法会改变	0.60	0.86		
13. I am afraid to even think about CRC 我一想起大肠癌便感到害怕	0.68	0.85		
14. My financial security would be endangered if I got CRC 大肠癌会花费我的大量积蓄	0.58	0.86		
15. Problems I would experience from CRC would last a long time 患上大肠癌导致的问题会持续很长时间	0.50	0.86		
16. If I got CRC, it would be more serious than other diseases 如果我患上大肠癌，它会比其他疾病更严重	0.54	0.86		
17. If I got CRC, my whole life would change 如果我患上大肠癌，我整个生命将会改变	0.52	0.86		
Benefits				
18. CRC can be found early if screening 大肠癌能通过肠镜筛查及早发现	0.63	0.72	0.78	0.59
19. Treatment not as bad if screening 若提早进行肠镜筛查，有利于疾病的治疗	0.64	0.71		
20. Best way to find smaller cancer if screening 肠镜筛查是发现初期癌症的最佳方法	0.57	0.74		
21. Screening decreases chance of dying of CRC 肠镜筛查会减低大肠癌导致的死亡风险	0.54	0.75		
22. Screening doing something to take care of myself 肠镜筛查是一个自我保护的方法	0.44	0.78		
Barriers				
23. CRC screening is embarrassing 肠镜筛查令我感到尴尬	0.53	0.82	0.84	0.84
24. I am afraid I will find out there is something wrong with me 我害怕接受肠镜筛查时发现问题	0.49	0.85		
25. I am afraid to have CRC screening because I do not understand what will be done in the test 我害怕接受肠镜筛查因为我不了解检查的内容	0.43	0.83		

Contd...

Table 4: Contd...

Item/subscale	Item-to-total correlation ($n=197$)	Cronbach's α if item deleted	Cronbach's α ($n=197$)	Intraclass coefficient ($n=50$)
26. I don't know how to go about scheduling CRC screening 我不知道怎样预约肠镜筛查	0.27	0.84	0.84	0.84
27. I cannot remember to schedule an appointment for CRC screening 我常常忘记预约进行肠镜筛查	0.35	0.83		
28. Having CRC screening would take too much time 肠镜筛查需要花很多时间	0.46	0.83		
29. CRC screening exams may be painful 肠镜筛查可能令我感到痛楚	0.54	0.82		
30. People doing CRC screening may be rude 肠镜的检查人员可能很粗鲁	0.50	0.83		
31. Having CRC screening would expose me too much radiation 肠镜筛查会令我吸收过多辐射	0.46	0.83		
32. It is difficult to get transportation to get CRC screening 在接受肠镜筛查的交通安排上觉得有困难	0.53	0.82		
33. I have other problems that are more important than getting CRC screening 我有其他事情比肠镜筛查更重要	0.24	0.84		
34. CRC screening would interfere with my activities 肠镜筛查妨碍了我的私人活动	0.43	0.83		
35. Having CRC screening costs too much money 肠镜筛查比较昂贵	0.51	0.83		
36. Colonoscopy may induce body damage 肠镜筛查对身体可能造成伤害	0.43	0.83		
37. Colonoscopy may make me feel uncomfortable 肠镜筛查会令我觉得身体非常不适	0.47	0.83		
38. I am scared of colonoscopy 我害怕做肠镜筛查	0.64	0.82		
Self-efficacy				
39. If I received the colonoscopy test, I would feel able to complete it 如果接受肠镜筛查，我认为自己有能力完成	0.37	0.82	0.77	0.53
40. Completing the colonoscopy makes sense to me 完成肠镜筛查对我来说是有意义的	0.71	0.65		
41. Colonoscopy is feasible 肠镜筛查是有用及可行的检查	0.62	0.69		
42. If I received an invitation for additional testing, I would accept it 如果被邀请做肠镜筛查，我会乐意接受检查	0.66	0.66		

of studies did not support the theory-derived relation between severity and screening behavior. The perceived severity of CRC may be insufficient to discriminate between people who have received CRC screening and those who have not. In this regard, longitudinal study designs are needed to test the assertion further.

For reliability, the RCRCPS (simplified Chinese version) demonstrated acceptable internal consistency, with a Cronbach's α of 0.74–0.87 for the four subscales. The item-total correlation data showed that each item was highly correlated with the total score, demonstrating that the items in the instrument measured the same construct. However, the stability of the scale may be questionable; two of five observed test–retest correlations were below the acceptable indicator. The results were consistent with the CRCPS (traditional Chinese). The instrument itself may act as an unintended intervention by arousing participants' awareness of their risk of developing CRC and the importance of screening.

Limitations

This study was conducted in one of the most developed cities in China. Besides the high incidence of CRC, people living in Shenzhen also have a high level of education and family income. Over 78.5% of the participants received tertiary education, and 37.4% of the respondents reported a monthly household income of more than CNY30,000 (USD $4392), which may not reflect the general Chinese population. Replication of the study in other regions in China will further enhance the generalizability of the results in a Chinese population.

Conclusion

The 38-item RCRCPS (simplified Chinese version) is conceptually relevant in measuring HBM-related concepts for colonoscopy screening in Chinese at-risk populations. This study provides initial support for the psychometric properties of the RCRCP (Chinese version). The findings of

this study recommended that it may be a useful instrument in understanding the perceived severity and susceptibility of CRC, perceived barriers to receive colonoscopy, and perceived benefits of colonoscopy screening of people at increased risk of CRC. This instrument will also be a useful tool in the development and evaluation of interventions that promote screening behaviors.

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Conflicts of interest

There are no conflicts of interest.

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