Validity and Reliability of Instruments to Measure Colorectal Cancer Screening Benefits and Barriers - Turkish Version

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Introduction

Colorectal Cancer (CRC), which has a high and rapidly increasing morbidity and mortality, remains an important health problem in the world. According to the International Agency for Research on Cancer (IARC) statistics (GLOBOCAN 2018), CRC incidence is ranked third highest among all cancers at 10.2% and the CRC mortality rate is second highest at 9.2%. [1] In Turkey, CRC is the third most commonly diagnosed cancer and fourth leading cause of death in both women and men. [2]

The most common approach for decreasing CRC-related morbidity and mortality is screening. Various screening methods are used for early detection of CRC, however fecal occult blood test (FOBT) and colonoscopy are the most commonly recommended screening tests. [3-5] Although research has demonstrated that screening decreases colorectal-related morbidity and mortality significantly, [6-15] participation rates of individuals at average risk is suboptimal. [14, 16-21]

Numerous studies have investigated perceptions and experiences with CRC screening participation.[21-24] These studies have identified factors that affect screening behavior, as well as benefits and barriers of CRC screening in a variety of settings. Perceived barriers and benefits have been consistently associated with CRC screening behavior. [21-25] The constructs of perceived benefits and barriers are core elements of many health behavior models and theories, among them the Health Belief Model and the Transtheoretical Model (TTM) that are frequently used to guide research. [14, 26-33]

Perceived benefits and barriers are consistent with the constructs of pros (benefits) and cons (barriers) in the TTM which proposes that pros and cons are weighed against each other to form a decisional balance about engaging in protective health behavior. When associated with CRC screening behaviors, if individuals believe that CRC screening will reduce their chance of

getting CRC and reduce the threat of dying from CRC, their perceived benefits are high. If individuals believe they do not need CRC screening because they have no symptoms and perceive collecting a stool sample is unpleasant, they are afraid their colon will be injured, or they do not have transportation, their perceived barriers to CRC screening will be high. If perceived barriers to CRC screening are higher than perceived benefits, participating in screening becomes less likely.

According to the TTM, behavior change is not a discrete outcome but is a non-linear process involving movement through different stages (pre-contemplation, contemplation, preparation, action and maintenance). An individual can go forward (from pre-contemplation stage to action stage) or backward (from the action stage to the pre-contemplation stage). [14, 30] The TTM suggests that perceived barriers (cons) and perceived benefits (pros) of a preventive health behavior (in this case, CRC screening) are weighed by individuals and influence whether they will perform the behavior or not. According to the TTM, for individuals in precontemplation, perceived barriers outweigh perceived benefits. For individuals in contemplation, there is a balance between perceived barriers and benefits of participating in CRC screening. Among those in the action stage, perceived benefits of CRC screening outweigh the perceived barriers. For this reason, determining the individual's perceived benefits and barriers to CRC screening will enable planning of effective interventions matched to an individual's stage of behavior change that have greater potential to move people to get screened (action stage).

Understanding individual perceptions about CRC screening is essential for developing behaviour change interventions that will increase screening rates. [30, 34] Information about the barriers that keep people from getting screened for CRC will guide development of strategies to improve screening rates. [35]

To assess health beliefs regarding CRC screening behaviors of individuals in Turkey, 'Champion's Health Belief Model Scales' by Özsoy et al [36] and 'Instrument to Measure Factors Related to Colorectal Cancer Screening Adherence' by Koc et al [37] were translated into the Turkish language. In the scale by Özsoy et al [36], individuals' perceived susceptibility, perceived seriousness, perceived benefits, perceived barriers, health motivation and confidence of CRCS were assessed; in the scale by Koç et al [37] individuals' caring and consistency, perceived susceptibility, response efficiency, cancer worry and social impact were assessed. Although there are instruments defining CRC screening behaviors, the '*Instruments to Measure Colorectal Cancer Screening Benefits and Barriers'* developed and tested by Rawl and colleagues is an easy to implement and short scale which can be administered by phone or face-to-face. [34] These scales allow assessment of barriers and benefits to having a FOBT and a colonoscopy, the two most recommended screening tests. A valid and reliable cross-cultural adaptation of Turkish version of the '*Instruments to Measure Colorectal Cancer Screening Benefits and Barriers'* could be useful for comparison across settings and in assessing Turkish individuals' beliefs about CRC and screening behaviors. The purposes of this study were to describe the translation process and to assess the validity and reliability of the Turkish version of the '*Instruments to Measure Colorectal Cancer Screening Benefits and Barriers'*.

Methods

Setting, Sample and Design

This methodological study was conducted as the first part of an intervention trial (Nurse Navigation Program) to increase CRC screening among participants at the family health center in Uskudar, a district in southern Istanbul, from January to June 2016. [38] Since validation studies

are required for measurements before intervention trials, this study reports the process of adaptation and psychometric testing for the newly translated instruments used.

In this study, the family health center was selected as a recruitment site because it is one of the main health care providers implementing CRC screening programs in Turkey. In family health centers, which include primary care services in Turkey, preventive, diagnostic, treatment and rehabilitative health services are provided by family physicians and family health workers (nurses, midwives, and health technicians). Cancer screening and other primary health care services (such as immunization, women's and paediatric health care, mobile health care for rural residents, and home care) are offered free of charge by family health centers. [39, 40]

In this study, two samples were recruited to adapt and revise the instruments. The suggested sample size for methodological studies is between three and 10 times the number of variables/items being studied. [41-43] Considering the number of items (31 items) and the response errors in the scales, the first sample (n = 186) was 6 times the number of items and the second sample (n = 208) was approximately 7 times the number of items. Both samples consisted of patients between 50-70 years of age, who had never been diagnosed with cancer, had no family history of CRC, and had no cognitive impairment (Mini mental score ≥ 25). During the study dates, the first author interviewed patients who applied to the family health center at the registration desk and asked their intention to participate in the study, and patients who met the eligibility criteria and agreed to participate in the study on the same day were enrolled using the purposeful sampling method.

Measures

Data were collected using face-to-face and telephone interviews using the *Interview Form* and

Instruments to Measure Colorectal Cancer Screening Benefits and Barriers. Socio-demographic characteristics such as gender, age, marital status, employment status, income level and health status were assessed using the interview form. Cognitive impairment was assessed for all participants older than 65 and was evaluated using a Turkish version of the Mini-Mental State Examination [MMSE]. [44] The MMSE scale consists of 11 items; possible scores range from 0 to 30; persons who scored 24 points or above were considered cognitively competent and eligible for the study.

Instruments to Measure Colorectal Cancer Screening Benefits and Barriers

Instruments to Measure Colorectal Cancer Screening Benefits and Barriers, developed by Rawl et al, [34] assessed perceived benefits and perceived barriers endorsed by individuals in relation to two specific CRC screening test options – fecal occult blood testing (FOBT) and colonoscopy. The CRC screening benefits and barriers scales were based on similar scales developed by Champion [45] for breast cancer screening. The original scales developed by Rawl and colleagues included benefits of fecal occult blood test (FOBT), barriers to FOBT, benefits of colonoscopy and barriers to colonoscopy. [34]

There are four scales namely, benefits of FOBT (3 items), barriers to FOBT (9 items), benefits of colonoscopy (4 items), and barriers to colonoscopy (15 items). Each scale is unique and independent of each other and have considered separate constructs/variables. All items use a 4-point Likert response option ranging from “strongly disagree” =1 to “strongly agree” =4. Responses to each item are summed to create 4 scales scores: 1) perceived benefits of FOBT; 2) perceived barriers to FOBT; 3) perceived benefits of colonoscopy; and 4) perceived barriers to colonoscopy. Higher total scores indicate higher benefits and higher barriers to each test. FOBT

benefits scale scores range from 3 to 12 points, FOBT barriers scale scores from 9 to 36 points, colonoscopy benefits scale scores from 4 to 16 points, and colonoscopy benefits scale scores from 12 to 48 points. These scales are suitable for data collection via self-administration as well as face-to-face and telephone interviews.

Translation, Adaptation of the Instruments

Firstly, researchers and two Turkish bilingual teachers who teach English translated the scales from English to Turkish. After the researchers reached a consensus on the scales of the translated, the Turkish versions of the original scales were back- translated to English by a native-born American teacher, who teaches English and resides in Istanbul. Then, the original scales and the back-translated scales were found to be compatible with each other in terms of meaning and grammar.

Both the Turkish and original scales were evaluated by 10 expert academicians/researchers working in the area of CRC, meeting the recommended 3 to 10 persons to establish content validity. [46, 47] Polit and Beck [48] defined the content validity index (CVI) as "….the degree to which an instrument has an appropriate sample of items for the construct being measured". [47] Based on ratings provided by the panel of experts, CVI of the scales were found to be .90 for FOBT barriers scale, .83 for FOBT barriers, COL benefits .80, COL barriers .90.

Expert reviewers provided several suggestions to improve specific items; as a result, some expressions were changed, and the future tense in the original language of the scales was altered to present tense by the experts' suggestion. For example, in the perceived benefits of FOBT and colonoscopy scales, *will help* was replaced with *enables* and *reduces* in items FOBT 1, 2, 3 and COL 13, 14, 15, 16, which are more general expressions.

The scales were piloted with 10 individuals who met eligibility criteria; they evaluated the clarity of all items and their understandability for Turkish people. The individuals participating in the pilot study were not included in the larger study. After the scales took their final form, they were administered to 186 individuals. In the first analyses of the scales, some items (FOBT 4, 6, 7, 8, 10, 12; COL 17, 19, 23) demonstrated low /unacceptable corrected item-total correlations (<. 30), and factor loadings of some items (FOBT 4, 6, 10, 12 and COL 17, 19, 23, 28) were below .40. [49] The expert panellists reviewed the instruments and it was decided that the items would be more understandable by adding emojis to represent the 4-point likert scales for response options instead of the classic Likert-type numeric scales (see the Figure).

Despite being used in some studies[50], this was the first use of emoji-based facial response options in the Instruments to Measure Colorectal Cancer Screening Benefits and Barriers. The revised emoji-based facial scales for CRC Screening Benefits and Barriers was psychometrically evaluated on 208 individuals who differed from the first sample but met the same eligibility criteria.

Data collection

Data were collected via face-to-face interviews in the family health center. Patients were informed about the study, eligibility was assessed, and those who were eligible were invited to participate. Data were collected by trained interviewers from those who accepted to participate in the study. Data collection took about 10-15 minutes. For test-retest reliability, 33 participants were administered the scales 4 weeks after the first administration via telephone interviews that took approximately 15-20 minutes.

Data Analysis

Data were analyzed using IBM SPSS software, version 21 (IBM Corp., Armonk, New York). Demographics and clinical characteristics were analyzed using the Student t-test for normally distributed continuous data, Mann-Whitney U test for non–normally distributed continuous data, and $\chi 2$ test or Fisher exact test for categorical data. Number, percentage, average and standard deviation were used to evaluate descriptive data. Significance level was set at $p < .05$.

The reliability of the scales was examined through corrected item total score correlations, internal consistency (Cronbach's alpha) and test-retest reliability assessment. Specifically, total score correlations were examined for item reliability, Cronbach's alpha was calculated to determine internal consistency, and test-retest correlations were used for invariance of the scales over time. Cronbach's alpha coefficients were considered acceptable if higher than .70. [51, 52] Test-retest correlations greater than 0.7 suggested adequate stability; less than 0.3, weak; and between 0.3 and 0.7, moderate and acceptable. [53]

The validity of the scales was examined through CVI and Exploratory Factor Analysis (EFA) / Principal Components Analysis (PCA). CVI was used to assess the degree of consensus of experts on English and Turkish items. CVI values above 0.74 are considered excellent, between 0.6 - 0.74 are good, 0.59 - 0.4 are considered to be fair [47]. The suitability for factor analysis was determined based on the Kaiser-Meyer-Olkin test and Bartlett test. Kaiser-Meyer-Olkin test (ranges from 0 to 1) greater than 0.50 and the result of the Bartlett test of sphericity were considered as eligible to perform EFA [52, 53].

Ethical Consideration

Written permission was obtained from Rawl to adapt the scales for use with Turkish adults. The study was approved by the Institutional Review Board at Bahcesehir University Clinical Research Ethics Committee (Number: 22481095). Eligible patients were informed about the aim of the study, how data would be collected, and how long it would take. For patients who were willing to participate, verbal consent was obtained.

Results

Socio-demographic Characteristics

A total of 394 subjects (186 first sample and 208 second sample) were interviewed for the study. The mean age of the participants was 59.3 years for the first sample (SD = 5.64) and 59.3 years for the second sample (SD = 5.98). Most participants were women (71%, 65%), married (81%, 79%), had completed high school (60%, 62%), were not actively employed (80%, 78%), perceived their income level as fair (58%, 67%) and perceived their health status as good (57%, 49%). There were no statistically significant differences between the first and second samples in terms of demographic characteristics and health-related characteristics ($p > .05$). (Table 1).

First Sample Results of Instruments Adaptation (N=186)

In the first sample, the validity of the instruments was examined using factor construct validity. Before conducting an exploratory factor analysis, Kaiser- Meyer-Olkin (KMO) value and Bartlett's test results of each scales were tested separately. The FOBT benefit KMO value was .725 and the significance level of Bartlett's test was p = .000 ($X^2 = 268.820$); FOBT barrier KMO value was .616 and the significance level of Bartlett's test was p = .000 ($X^2 = 211.884$). The Colonoscopy Benefit KMO value was .809 and the significance level of Barlett's test was p = .000 ($X^2 = 418.689$); the Colonoscopy Barrier KMO value was .817 and the significance level of

Bartlett's test was p=.001 (X = 1008.49). Total explained variance results were 82.3% of FOBT benefits, 25.4% of FOBT barriers, 76.9% of Colonoscopy benefits and 32.9% of Colonoscopy barriers respectively. Factor loadings of the items were between .08 - .93. The factor coefficients of some items (FOBT 4, 6, 10, 12; COL 17, 19, 23, 28) were lower than .40.

In order to evaluate the reliability of the instruments, corrected item total score correlation, Cronbach's alpha and test-retest correlations were calculated. The corrected item-total correlations showed that the correlation coefficients of FOBT benefits and barriers scales varied between .09-.83, COL benefits and barriers scales varied between .09-.85. Certain items of the FOBT scale (item 4, 6, 7, 8, 10, 12) and the COL scale (item 17, 19, 23) demonstrated low/unacceptable corrected item-total correlations (<.30). Cronbach's alpha coefficients were .88 for the FOBT benefits scale, .53 for the FOBT barriers scale, .89 for the COL benefits scale, and .84 for the COL barriers scale (Table 2).

The test-retest correlations of the first sample including 33 patients were evaluated at four-week intervals. According to the findings, test-retest correlations were positive and strong and statistically significant for FOBT benefits (r = .80), FOBT barriers (r = .79), Colonoscopy benefits (r = .78), and Colonoscopy barriers scale (r = .72) (p <.001) (Table 3). In addition, total scale scores for FOBT benefits and barriers, and COL benefits and barriers from the first and second administrations were compared with t-tests and no significant differences were found (p> .05).

Second Sample Results for Revised Instruments (N=208)

The revised emoji-based scales to measure CRC screening benefits and barriers was administered to a second sample of 208 individuals and re-evaluated psychometrically. Results showed that the FOBT benefits dimension KMO value was .736 and the significance level of

Bartlett's test was p = .001 (X^2= 274,664), FOBT barriers dimension KMO value was .821 and the significance level of Bartlett's test was p = .001 (X^2 = 474,377); COL benefits dimension KMO value was .811 and the significance level of Barlett's test was p = .001 (X^2 = 399.838), COL barriers dimension KMO value was .863 and the significance level of Barlett's test was p = .001 (X^2 = 989,551). The total explained variance was 78% for the FOBT benefits scale, 39% for the FOBT barriers scale, 71% for the COL benefits and 35% for the COL barriers scale. All factor loadings of the items were higher than .40 (between, .41-.89.).

In order to evaluate the internal consistency of the instruments administered to the second sample, corrected item total score correlation and Cronbach alphas were calculated. The corrected item-total correlation analyses showed that the correlation coefficients of FOBT barriers varied between .39 and .59, COL barriers varied between .36 and .64, and COL benefits varied between .73 and .89. The correlation coefficients of all FOBT benefits items were .73. Cronbach alpha coefficients were .85 for FOBT benefits, .79 for FOBT barriers, .84 for COL benefits and .86 for COL barriers (Table 4).

Discussion

Instruments to measure CRCS (FOBT and Colonoscopy) benefits and barriers were translated into Turkish and their psychometric properties were evaluated with two samples of the Turkish population ages 50 to 70 years. The results obtained from this two-phase study showed that the Turkish version of the the emoji-based facial scales for CRC screening are understandable and useful scales to measure perceived benefits and barriers to CRC screening in the Turkish population. To our knowledge, there were not any Turkish language scales to assess perceived

benefits of and barriers to CRC screening with FOBT and colonoscopy. Therefore, this study fills an important gap in the field.

The adaptation of instruments is a complex process that needs careful planning regarding content maintenance, psychometric properties, and general validity for the target population.[54] Cross-cultural adaptation encompasses both language translation and cultural adaptation to prepare a questionnaire for use in another country.[55] Likert scales might be culturally biased and some individuals have difficulty understanding the meaning of the ordered continuum of responses characterized by the Likert format. [56] In the current study, adaptation of the instruments was carried out in two-steps and two samples were used. Since the results of the first step required revision of the instruments, they were tested psychometrically in the second sample. In first step the original Likert type response options were used. Based on feedback and analyses, the second step involved adapting the instruments to include emoji-based response options. Emojis were first developed in Japan and can reflect facial expressions, concepts and ideas, emotions and activities. [57-59] Researchers from different fields have studied emoji-based response options from different perspectives, including computer science, communication, marketing, behavioral science, linguistics, psychology, medicine, and education. [60] Alismail and Zhang[57] report the advantages of using emoji-based response options in scales are that they make a survey easy to understand, fun and engaging. These response options have also been found to facilitate decision-making, increase language proficiency, and thinking style (visual, systematic, and/or mathematic). [57]

In the first adaptation step of the instruments, the adequacy of the Turkish-language scales was evaluated with the content validity index as well as the translation and back-translation process. An adequate CVI means that a sample of items, taken together, constitute an

adequate operational definition of a construct. Among nurse researchers, CVI is the most widely used method for determining the content validity. [47] CVI analyses showed that the linguistic equivalence of scales was sufficient. The test-retest correlations were strong ($p < .001$), but the validity of the factor structure and internal consistency of the instruments showed that some items were not well understood by the participants.

Compared with results reported by Rawl and colleagues who developed and tested the original scales, [34] the factor structure in the first study sample showed that factor loadings of the 3 items of the FOBT barrier scale were quite low ranging from .08 to .22 and 3 items of COL barrier scales were quite low ranging from .08 to .24.

In Rawl's study, the lowest factor loading on the FOBT and COL barrier scales was .45. The reliability findings of the present study showed that both barriers scales were insufficient. Compared to the original English scales developed by Rawl both the alpha coefficient of the FOBT barriers scale ($\alpha = .53$) and the item total correlations of the 9 items of the FOBT and COL scales were quite low with item-total correlations of the 9 items of the FOBT and COL scales ranging from .09 to .29. The most common barriers identified in the current study included "unpleasantness, not needing testing, embracing and not knowing how to do, fear of pain, worrying about the risk of testing, and fear of cancer". These were similar to barriers identified in other studies. [61-63]

After revising the tools and adding emoji-based face response options, Cronbach's alpha coefficient of FOBT barriers scale increased from .53 to .79. Cronbach's alpha coefficients of all other scales were found similar and sufficient level in the second sample. The improvement in reliability is likely due to the emoji-based response scales being easier to understand for study

participants. Colorectal Cancer Screening Benefits and Barriers scales are a Likert type scale and sometimes it could be difficult to decide between responses. We wanted to test if emoji-based scales were more understandable and appropriate for 50-70 year old adults. The study findings were consistent with our expectations. We concluded that the emoji-based scales were suitable for Likert type scales format for adults 50-70 years old of Turkish culture**.** It is suggested that a reliability of .70 or higher is acceptable for instruments used in research. The revised sample of study results showed that item total score correlation get higher and values are on suitable reliability level. The results of Cronbach's alpha coefficients obtained from the second sample were similar to the findings from the original English version of this scale and other studies. [14, 34, 64, 65]

The revised sample of study results showed that factor loadings are on suitable validity level between .41-.89. While the explained variance in the first sample was found high in benefits scales and very low in barriers scales, revised barriers scales increased to 39.5% for FOBT and 35.5% for COL. Compared to the original scale findings, it showed that the explained variance of revised benefits scales was higher than Rawl's study, [34] and the explained variance rates of barriers scales were relatively similar. These results of the revised scales were sufficient to explain the construct validity.

Limitations

Although important findings were obtained in the study some limitations should be considered when interpreting the results. The main limitations are that this study was carried out in a single center, in a sample that does not represent all adults between the ages of 50-70 and in a single geographical area.

Conclusions

Study findings showed that adding emoji-based response options to Turkish language scales to measure benefits and barriers to CRC screening increased validity and reliability. Emoji-based scales are now widely used in research and this study was the first study to evaluate CRC screening behavior in people aged 50-70 years. These measurement tools can contribute to CRC screening studies of healthcare professionals, especially in primary health care centers. However, it should be taken into consideration that the revised scales are not suitable for phone calls because they are visual. Further research is needed to test the instruments in different languages and with larger samples of individuals for whom CRC screening is recommended. However, since the revised scales are visual, the participants could receive the survey tools via e-mail beforehand and then complete phone calls as an alternative to in-person testing.

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Table 1. Socio-demographic Characteristics of First and Second Samples (N=394)

Variables	**First Sample** (N=186) n (%)	**Second Sample** (N=208) n (%)	**Total** (N=394) n (%)	**p-value**
Age, Mean±SD	59.33±5.64	59.34±5.98	59,34±5,81	p=.983
Gender				
Men	54 (29)	72 (34.6)	126(32)	p=.236
Women	132 (71)	136 (65.4)	268 (68)	
Marital status				
Married	150 (80.6)	165 (79.3)	315 (79.9)	p=.744
Single/widowed/Divorced	36 (19.4)	43 (20.7)	20.1 (79)	
Education				
Illiterate	6 (3.2)	9 (4.3)	15 (3.8)	p=.783
Elementary s.	41 (22.0)	47 (22.6)	88 (22.3)	
Secondary s.	27 (14.5)	24 (11.5)	51 (12.9)	
High s.	56 (30.1)	57 (27.4)	113 (28.7)	
University	56 (30.1)	71 (34.1)	127 (32.2)	
Employment Status				
Employed	38 (20.4)	46 (22.1)	84 (21.3)	p=.683
Unemployed	148 (79.6)	162 (77.9)	310 (78.7)	
Income				
Good	72 (38.8)	67 (31.7)	138 (35)	p=.157
Fair	108 (58.1)	126 (60.6)	234 (59.4)	
Poor	6 (3.2)	16 (7.7)	22 (5.6)	
Health Status				
Good	90 (56.5)	106 (51)	211 (53.5)	p=.275

Fair	65 (34.9)	87 (41.8)	152 (38.6)
Poor	16 (8.7)	15 (7.2)	31 (7.9)

Table 2. Factor Loadings, Item Analyses and Cronbach's Alpha Correlations of the First Sample (N=186)

	Items	Factor Loadings	Item Mean (±SD)	Corrected Item/Total Correlation	Cronbach's Alpha	Variance explained (%)
FOBT Benefits	FOBT 1- Find colon cancer early	.90	3.52 (.74)	.77		
	FOBT 2- Decrease chances of dying	.93	3.42 (.85)	.83	.88	82.3
	FOBT 3- Not worry as much	.88	3.31 (.96)	.75		
FOBT Barriers	FOBT 4- Worry	.22	1.55 (1.05)	.16		
	FOBT 5- Embarrassing	.67	1.31 (.80)	.34		
	FOBT 6- Time	.31	1.48 (1.00)	.09		
	FOBT 7- Don't know how	.41	2.23 (1.40)	.29		
	FOBT 8- Unpleasant	.72	1.45 (.93)	.28	.53	25.4
	FOBT 9- Cost	.73	1.24 (.70)	.42		
	FOBT 10-No problems	.09	3.14 (1.27)	.18		
	FOBT 11- Privacy	.62	1.16 (.52)	.37		
	FOBT 12-Not important	.21	2.70 (1.40)	.24		
Colonoscopy Benefits	COL 13- Avoid getting colon cancer	.80	3.14 (1.09)	.70		
	COL 14- Find colon cancer early	.85	3.50 (.78)	.74	.89	76.9
	COL 15- Decrease chances of dying	.92	3.32 (.95)	.85		
	COL 16- Not worry as much	.91	3.33 (.95)	.83		

Colonoscopy Barriers	COL 17- Worry	.08	1.46 (1.01)	.09		
	COL 18- Embarrassing	.46	1.71 (1.20)	.38		
	COL 19- Time	.24	1.61 (1.13)	.23		
	COL 20- Don't understand how	.63	2.24 (1.38)	.60		
	COL 21- Pain	.79	2.42 (1.39)	.68		
	COL 22- Cost	.51	1.75 (1.20)	.40		
	COL 23- No problems	.22	3.29 (1.19)	.23		
	COL 24- Transportation	.45	1.51 (.98)	.39	.84	32.9
	COL 25- Special medicine	.71	2.46 (1.39)	.57		
	COL 26- Special diet	.72	2.32 (1.41)	.59		
	COL 27- Complications	.75	2.06 (1.31)	.64		
	COL 28- Not important	.30	2.76 (1.36)	.30		
	COL 29- Anxious about test	.79	2.61 (1.39)	.70		
	COL 30- Unknown doctor	.71	1.83 (1.21)	.62		
	COL 31- Not need	.50	2.35 (1.37)	.50		

Table 3. Test Re-test Correlations of FOBT and Colonoscopy Benefits-Barriers Scales of the First Sample (N = 33)

Variables	**Test** Mean (± SD)	**Re-test** Mean (± SD)	**r**
FOBT Benefits	3.55 (0.67)	3.47 (0.64)	.807
FOBT Barriers	1.91 (0.33)	1.87 (0.39)	.792
Colonoscopy Benefits	3.34 (0.67)	3.57 (0.59)	.788
Colonoscopy Barriers	2.12 (0.53)	2.09 (0.60)	.729

Table 4. Validity and Reliability Analyses for the Revised Emoji-Based Face Scale (N=208)

	Item No	Factor Loadings	Item Mean (±SD)	Corrected Item/Total Correlation	Cronbach's Alpha	Variance explanation rate (%)
FOBT Benefits	FOBT 1- Find colon cancer early	.88	3.24 (.68)	.73		
	FOBT 2- Decrease chances of dying	.88	3.08 (.78)	.73	.85	78
	FOBT 3- Not worry as much	.88	3.16 (.80)	.73		
FOBT Barriers	FOBT 4- Worry	.61	2.02 (1.07)	.47		
	FOBT 5- Embarrassing	.70	1.65 (.80)	.55		
	FOBT 6- Time	.58	1.76 (.85)	.43		
	FOBT 7- Don't know how	.64	2.29 (1.06)	.49		
	FOBT 8- Unpleasant	.72	2.05 (.95)	.59	.79	39.5
	FOBT 9- Cost	.65	1.81 (.88)	.53		
	FOBT 10-No problems	.47	2.82(1.03)	.39		
	FOBT 11- Privacy	.69	1.71(.79)	.55		
	FOBT 12-Not important	.53	2.62 (1.09)	.43		
Colonoscopy Benefits	COL 13- Avoid getting colon cancer	.73	2.88(1,02)	.57		
	COL 14- Find colon cancer early	.86	3.38 (.68)	.71	.84	71.1
	COL 15- Decrease chances of dying	.87	3.13(.85)	.75		

Colonoscopy Barriers	COL 16- Not worry as much	.89	3.21 (.83)	.76		
	COL 17- Worry	.54	2.05 (1.07)	.46		
	COL 18- Embarrassing	.65	1.95 (1.01)	.56		
	COL 19- Time	.46	1.81(.88)	.38		
	COL 20- Don't understand how	.60	2.15(1.05)	.52		
	COL 21- Pain	.61	2.29(1.03)	.53		
	COL 22- Cost	.60	2.1 (.98)	.52		
	COL 23- No problems	.41	2.97(.97)	.36		
	COL 24- Transportation	.62	1.67(.79)	.53	.86	35.9
	COL 25- Special medicine	.66	2.4 (1.15)	.57		
	COL 26- Special diet	.73	2.1 (1.06)	.64		
	COL 27- Complications	.67	2.15(1.04)	.58		
	COL 28- Not important	.43	2.6(1.06)	.38		
	COL 29- Anxious about test	.65	2.47(1.07)	.58		
	COL 30- Unknown doctor	.68	2.25(1.04)	.61		
	COL 31- Not need	.49	1.81(.90)	.43		