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Factors associated with patients' decision on colorectal cancer screening

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Abstract

Cancer prevention and control are critical public health concerns. However, the screening uptake and referral rate for colorectal cancer (CRC) in Taiwan remain low. This study focused on the factors influencing whether a patient with a CRC diagnosis chooses to undergo referral follow-up.

A cross-sectional research and used the Health Belief Model was method applied in this study. Variables such as demographic factors, CRC diagnosis-related knowledge factors, and health belief factors were employed to investigate the decisive factors that affect the health behavior of patients diagnosed with CRC who test positive on the fecal occult blood test. Study identified prospective participants in Daliao District, Kaohsiung City, Taiwan aged 50 to 75 years. A structured questionnaire was administered to the individuals, and 200 responded. The questionnaires of 100 who went for a referral group and 80 who did not a nonreferral group were analyzed. The questionnaire was reliable and valid, as determined through an expert evaluation and pretest, respectively.

Among the 200 participants, T test indicated that those who underwent a referral were significantly more likely to be younger (Age [Mean ± SD] n: 62.7, 7.1%; Unreferred group: n: 65.1, 7.0%; Referred group: n:60.7, 6.6%; $P \leq .001$), be more educated ($P = .002$), exercise more ($P < .05$), and have more family members with cancer ($P = .001$) or CRC ($P < .05$). Participants who underwent a referral also had significantly more knowledge ($P < .001$). Furthermore, those who underwent a referral had significantly perceived greater susceptibility ($P < .05$), greater benefits ($P = .002$), and lower barriers ($P < .001$) of screening; they also received greater encouragement to do so from sources (e.g., clinicians or the media) around them ($P = .009$).

Age, education level, number of family members with cancer or CRC, exercise habits, knowledge of CRC, perceived susceptibility, perceived benefits, perceived barriers, and encouragement from others influence referral behavior. Government policy should focus on older patients and health education, especially in the mass media. Hospitals should also ensure the ease of referrals to lower perceived barriers.

Abbreviations: CRC = colorectal cancer, CSPY = Colonoscopy, CVI = content validity index, FOBTs = fecal occult blood tests, HBM = health belief model, HPA = health promotion administration.

Keywords: colonoscopy behavioral intention, colorectal cancer screening, health belief model, positive result follow up

1. Introduction

Cancer is a leading cause of death worldwide. The World Health Organization projects that deaths from cancer will reach over 13 million by 2030. In 2008, 7.6 million people died from cancer, and approximately 608 000 people died from colorectal cancer (CRC) globally.[1] Therefore, cancer prevention and control are critical public health concerns. In Taiwan, CRC is the most common cancer, accounting for approximately 10 000 new cases per year. Moreover, CRC has the third highest mortality rate, accounting for over 4000 deaths per year. Furthermore, the numbers are rapidly increasing each year.[2]

The annual population of Daliao Township (2020) is 112 286, with 49 100 residents aged 50 years or over (43.7%). Among the population over 50 years of age, 43 121 people (87.8%) had an education level below high school, which indicates that the majority of middle-aged and elderly residents in this district were not college-educated. The data from the questionnaire administered to the high-risk groups of CRC and positive screening cases during the medical clinic visit at the Daliao District Health Center indicated that socioeconomic status and education levels were lower in the high-risk groups than in the low-risk groups; furthermore, the proportion of working-class patients was higher than the proportion of white-collar class patients. Most of these ethnic minority groups are predominantly working class, and most individuals belonging to ethnic minority groups have insufficient knowledge of health care.

Patients are affected by their fears regarding test results, pain, and complications of examination even if they are willing to undergo CRC screening. The public's willingness to participate in

disease screening and health screening is low. Most residents believe that there is no pain without an inspection; consequently, the probability of chronic diseases, cancers, and relative mortality rate increases yearly.[3,4,8]

The Health Belief Model (HBM) can be used to predict and explain the adoption of certain preventive health behaviors and clarify the circumstances under which people adopt preventive behavior or comply with it. The model was originally developed by the United States Public Health Service in the 1950s as a tool to assess the risk of health behaviors. The HBM comprises 3 principal components: individual perception, modifying factors, and likelihood of action.[9] This model assumes that personal behavior is affected by health beliefs and modifying and facilitating factors. Certain variables are used to predict health behaviors, such as perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers. However, even if an individual has a high level of awareness regarding their susceptibility to and the seriousness of the disease and assesses that the benefits of taking action outweigh the barriers, cues to action are still required. Without these cues, no health behavior is likely to follow. Factors such as demography, social psychology, and social structure directly affect an individual's perceptions and attitude and indirectly affect health behaviors.[10,11]

Many conceptual models are applied in CRC screening, with the most common being the HBM. Therefore, we employed it as the conceptual framework for this study. The HBM was constructed by Rosenstock[9] to describe and predict health behavior through patients' intentions and perceptions. It is divided into three categories: individual perceptions, modifying factors, and likelihood of action. The components of the HBM were modified by Becker (1974) as follows (Fig. 1):

1. Perceived susceptibility: Individuals' subjective assessment of the likelihood of contracting a disease. In the HBM, patients with higher perceived susceptibility are more likely to take action.
2. Perceived seriousness: Individuals' perception of the severity of their disease. In the HBM, patients with higher perceived seriousness are more likely to take action.
3. Perceived benefits of taking action: Individuals' subjective assessment of benefits, such as whether their actions will reduce their susceptibility to or the seriousness of a disease. In the HBM, patients who perceive higher benefits from taking action are more likely to take action.
4. Perceived barriers of taking action: Individuals' assessment of potential barriers encountered during the course of action. In the HBM, patients who perceive higher barriers to taking action are less likely to take action.
5. Cues to action: Cues triggering appropriate behavior, which can be classified into two types: intrinsic (e.g., physical discomfort and the occurrence of symptoms) and extrinsic cues (e.g., doctor's advice, encouragement from relatives and friends, and education from the media).

The HBM indicates that individuals' perceived susceptibility and seriousness are the motivations for their actions, whereas their perceived benefits of and barriers to taking action affect
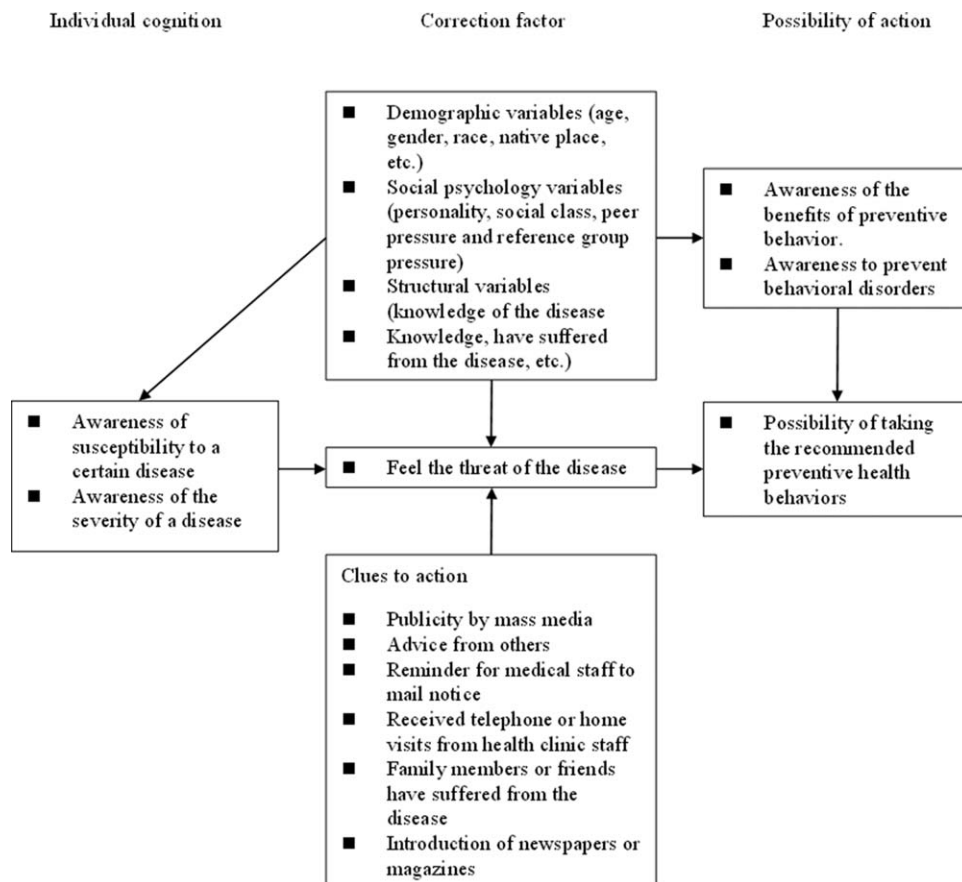

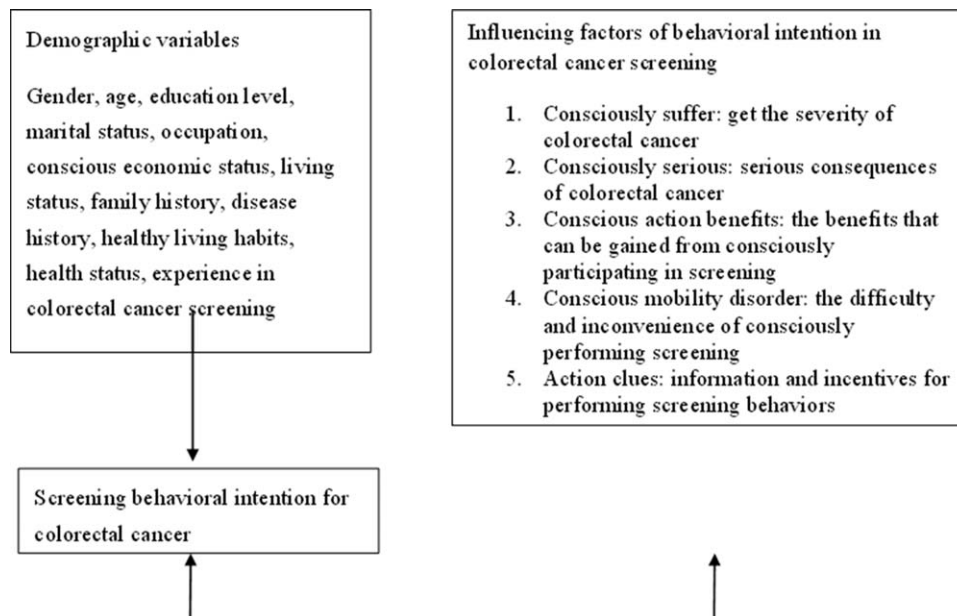**Figure 1.** Becker's health belief model.

Figure 2. Research architecture diagram.

their choice regarding the most appropriate approach. In addition, their cues to action facilitate their likelihood of having positive health behavior. According to the HBM, we established our research framework (Fig. 2).

Studies related to CRC screening have focused on how to encourage people to receive CRC screening. Studies on the subsequent CRC diagnosis for CRC positive cases are quite rare. However, the Second National Cancer Prevention Plan Cancer Screening for CRC prevention and control should consider the referral follow-up for CRC screening positive cases. The present study provided suggestions regarding the main factors affecting the diagnosis and treatment of positive cases, which can be used to improve medical treatment, complete the judgment of confirmation, implement early detection and early treatment, and improve the survival rate of CRC patients.[6,7,11–13]

2. Materials and methods

2.1. Design and procedure

A cross-sectional research method was applied in this study. The sampling targeted 603 individuals aged 50 to 75 years with CRC positive results in fecal occult blood tests (FOBTs) in Daliao District, Kaohsiung City. The sample size of this research is estimated using medium effect size (=0.95, =0.05); the sample size of the research plan calculated by G Power is 165. Structured questionnaires were administered. However, some participants were too old and had reading difficulties. Furthermore, unreferred participants were unwilling to enroll if the question-naires were collected by mail and they refused to be interviewed. The survey was conducted through family interviews. A total of 200 surveys were completed: 100 surveys were completed by individuals who returned for follow-ups and were subsequently referred to appropriate physicians and the other 100 remained unreferred. After the interview, 20 out of the 100 unreferred participant questionnaires were determined to be incomplete and

were excluded. Therefore, 180 participants were included in the statistical analysis, of which 100 were further referred (referred group) to Colonoscopy (CSPY), and 80 were unreferred (unreferred group).

2.2. Measures

We evaluated the questionnaire's validity using the expert validity test. As soon as the first draft of the questionnaire was complete, we invited the attending physicians at the teaching hospital where the participants were recruited, heads of primary care clinics, the director of the public health center, and researchers to examine its correctness, comprehensiveness, applicability, and completeness. The content was modified based on the suggestions provided by the experts, and the content validity index (CVI) of the questionnaire was calculated according to scores given by them; The CVI was calculated according to the expert feedback. The CVI of this questionnaire is 0.93.

Reliability of the questionnaire: A total of 30 eligible participants were invited for a pretest. The researcher was present to receive questions and provide suggestions if the questionnaire items were unclear or difficult to answer. The results were used as a reference for revisions. After the pretest questionnaires were collected, the data were coded and computed. SPSS was used to verify the internal consistency and reliability of the questionnaire. The results were in the range of 0.61 to 0.90, demonstrating satisfactory reliability. The official questionnaire was revised based on the aforementioned pretest and its results. A Cronbach α coefficient of 0.60 was interpreted as acceptable. After verification of internal consistency reliability for each scale using the official questionnaire, the results revealed satisfactory reliability with Cronbach α coefficients in the range of 0.74 to 0.94. This study was approved by the Institutional Review Board of Taipei City Hospital (TCHIRB-1030810-E), and thereafter, the participants were enrolled.

2.3. Analysis

Valid questionnaires were coded for data entry, and data analysis was performed using SPSS. The descriptive statistics used included percentages, means, standard deviations (SDs), maximums, and minimums. The inferential statistics used were ANOVA, chi-squared test, *t* test, Pearson correlation, and Use stepwise logistic regression, put the significant variables in the bivariate analysis (chi-square analysis, t test, etc.), and then use stepwise to select suitable (significant) variables into the model.

3. Results

3.1. Overall descriptive statistical analysis of participants

Purposive sampling. The sampling targeted 603 individuals aged 50 to 75 years with CRC positive results in FOBTs in Daliao District, Kaohsiung City. A total of 200 questionnaires were collected: 100 respondents were referred for CSPY and 100 remained unreferred. Among the questionnaires, 20 out of the 100 unreferred participant questionnaires were determined to be incomplete and were excluded. Therefore, 180 participants were included in the statistical analysis, among which 100 were further referred to CSPY (referred group) and 80 remained unreferred (Unreferred group).

3.2. Descriptive statistics and bivariate analysis
3.2.1. Influence of demographic variables on referral behavior.
The average age of men is 79.6 years old (SD = 5.2) is higher than that of women 75.6 years old (SD = 4.8). The demographic characteristics of the sample groups were compared using *t* tests (Table 1). The results revealed significant differences in age of the 101 (56.1%) women and 79 (43.9%) men were 62.7 years (SD = 7.1 years). The 60 to 69 year age group 75 (41.7%) was the largest in size, followed by the ≤59 year age group 66 (36.7%),

and the ≥70 year age group 39 (21.7%) (P ≤ .001). Findings indicated that willingness to undergo cancer screening was greatly reduced after the age of 65 years. Overall, 69 participants (38.3%) had an elementary school level of education (this also included those who had developed literacy through self-study or attended private schools); 43 (23.9%) had a junior high school level; 30 (16.7%) had a senior and vocational high school level; and 9 (5.0%) had a junior college/university and above level (P = .002). For the question regarding the number of family members with cancer, 94 of the participants (52.2%) marked "*No*," 48 (26.7%) marked "Yes," and 38 (21.1%) marked "Do not know" (P = .001). For the question regarding the number of family members with CRC, 125 participants (69.4%) marked "No," 35 (19.4%) marked "Do not know," and 20 (11.1%) marked "Yes" (P = .006). The unreferred group was significantly older than the referred group, which indicates that older age was associated with reduced willingness to receive a confirmatory diagnosis with CSPY.

Furthermore, the referred group exhibited higher education levels than the unreferred group. The results further demonstrated that the referred group had more family members with cancer compared with the unreferred group, which may be because family members with cancer increase the awareness among others in the family. The results further demonstrated that the participants in the referred group had more family members with CRC compared with the unreferred group. This finding may also be explained by family members with CRC raising awareness among other members of the same family.

Differences in the lifestyles of the groups were compared using the chi-squared test. The results revealed a significant difference in weekly exercise habits. Overall, 90 participants (50.0%) had a weekly exercise habit but did not reach the standard of 150 minutes of exercise per week; 73 (40.6%) did not have a weekly exercise habit; and 17 (9.4%) had a weekly exercise habit and

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Table 1

Relationship between demographic variables and referral behavior.

Variable name	Total		Unreferred group		Referred group		P-value
	n	%	n	%	n	%	
Age[a] (Mean ± SD)	62.7	7.1	65.1	7.0	60.7	6.6	<.001***
Age stratification							<.001***
Under 59 years old	66	36.7	19	23.8	47	47.0	
60 to 69 years old	75	41.7	32	40.0	43	43.0	
Over 70 years old	39	21.7	29	36.3	10	10.0	
education level[b]							.002**
illiterate	29	16.1	20	25.0	9	9.0	
Elementary school (including self-study or private)	69	38.3	33	41.3	36	36.0	
Secondary	43	23.9	19	23.8	24	24.0	
High school/higher vocational	30	16.7	7	8.8	23	23.0	
Specialist/university	9	5.0	1	1.3	8	8.0	
Is there anyone in the family who has cancer?							.001***
Yes	48	26.7	18	22.5	30	30.0	
no	94	52.2	35	43.8	59	59.0	
do not know	38	21.1	27	33.8	11	11.0	
Is there anyone in the family who has colorectal cancer?							.006**
Yes	20	11.1	8	10.0	12	12.0	
no	125	69.4	48	60.0	77	77.0	
do not know	35	19.4	24	30.0	11	11.0	

[a] *t* test.
[b] Fisher exact test; Unmarked chi-squared test.
** *P* < .01.
*** *P* < .001.

Table 2

Relationship between perceived susceptibility and referral behavior.

No	Variable name	Total		Unreferred group		Referred group		P-value
		n	%	n	%	n	%	
3–3	If your body is not uncomfortable, even if the fecal occult blood test results are positive, you do not need to check it.							.002**
	Yes	43	23.9	17	21.25	26	26.0	
	No	104	57.8	39	48.75	65	65.0	
	Unknow	33	18.3	24	30.00	9	9.0	
6–4	Worried about checking report results							.801
	Yes	56	31.1	23	28.75	33	33.0	
	No	116	64.4	53	66.25	63	63.0	
	unknow	8	4.4	4	5	4	4.0	

Analyzed using the chi-squared test.
** $P < .01$.

reached the standard of 150 minutes of exercise per week ($P = .041$). No significant differences in the other items were observed. The number of individuals with exercise habits was higher in the referred group than in the unreferred group. In both groups, the majority exercised for less than 150 min per week, and no exercise was the next most common habit.

3.2.2. Knowledge as a factor influencing referral behavior.
The proportion of patients in the referred group answering 5 CRC-related items correctly (n = 74,74%) was higher than the proportion in the unreferred group (n = 32,40%). Further analysis of the correct rate for each item demonstrated that the referred group had a higher correct rate for items related to knowledge of confirmatory CRC diagnosis than the unreferred group. llustrates whether the subjects are knowledgeable regarding the diagnosis of CRC and the effect on accepting the referral. The median CRC knowledge of referred patients was 5 points higher than that of unreferred patients. The scores of the referred patients were 4–5 points, whereas the scores of the unreferred were 1–5 points, indicating that the knowledge (4–5) of the referral group was higher ($P < .001$).

3.2.3. Health belief factors influencing referral behavior.
Perceived susceptibility was investigated as a health belief factor (Table 2). Both groups reported that they would not seek further examination if they felt well, even if their FOBTs yielded positive results (Unreferred group:Yes [n = 17,21.3%], No [n = 39,48.8%], Unknow [n = 24,30.0%]; Referred group:Yes [n = 26,26.0%], No [n = 65,65.0%], Unknow [n = 9,9.0%]). The chi-squared test result revealed that the aforementioned attitude had a significant correlation with referral behavior ($P = .002$). This finding indicated a higher susceptibility in the referred group than in the unreferred group and low awareness of the probability of CRC in the unreferred group. Furthermore, the referred group (Yes [n = 75,75.0%], No [Unknown] [n = 25,25%]) perceived CRC as a more serious condition compared with the unreferred group (Yes [n = 55,68.8%], No [Unknown] [n = 25,31.3%]); however, the chi-squared test results revealed no significant correlation between the perception of CRC as a serious disease and referral behaviors ($P = .35$).

Table 3, several items related to perceived benefits had a significant correlation with referral behavior ($P < .05$): "Therapy is more effective for early-stage CRC" (Referred group: Very much agree n = 50,50%;Unreferred group Very much agree n =

22,27.5%, $P = .002$), "CSPY or colorectal screening helps identify CRC at an early stage" (Referred group: very much agree n = 48, 48%; Unreferred group Very much agree n = 21, 26.3%, $P = .003$), "Individuals demonstrate increased willingness to undergo CSPY after having understood CRC and CSPY procedures" (Referred group: Very much agree n = 38, 38%; Unreferred group Very much agree n = 20, 25%, $P = .032$), "A regular health check is crucial for one's health and for a better understanding of one's health status" (Referred group: Very much agree n = 43, 43%; Unreferred group Very much agree n = 17, 21.3, $P = .007$), and "Staying healthy is crucial for family members" (Referred group: Very much agree n = 45, 45%; Unreferred group Very much agree n = 20, 25%, $P = .011$). The results revealed that the referred group had a more positive perception of confirmatory diagnosis with CSPY. The perception of the benefits of confirmatory diagnosis with CSPY encouraged referral behavior.

Table 4, several items related to perceived barriers had a significant correlation with referral behavior ($P < .05$), which indicates that these barriers influenced participants' referral behavior. Participants confirmed the following "I consider myself healthy; therefore, a CSPY is not necessary" (Referred group: Very much agree& Agree n = 36, 36%;Unreferred group Very much agree & Agree n = 47, 58.8%, $P = .005$), "I know my own health status; I do not require several consultations" (Referred group: Very much agree& Agree n = 30, 30%;Unreferred group Very much agree& Agree n = 48, 60.1%, $P < .001$), "I do not feel pain or discomfort in the stomach, nor do I feel defecation pain; therefore, a CSPY is not necessary" (Referred group: Very much agree& Agree n = 33,33%;Unreferred group Very much agree& Agree n = 49,61.3%, $P = .001$), "I am worried about being diagnosed as having CRC; therefore, I do not want to undergo a CSPY" (Referred group: Very much agree& Agree n = 8, 8%; Unreferred group Very much agree& Agree n = 16, 20.1%, $P = .016$), "The doctor who explained my CRC screening report thought that a CSPY was unnecessary" (Referred group: Very much agree& Agree n = 16, 16%;Unreferred group Very much agree& Agree n = 34, 42.5%, $P < .001$), "I am faced with economic pressure, so I do not want to undergo a CSPY" (Referred group: Very much agree& Agree n = 7, 7%;Unreferred group Very much agree & Agree n = 16, 20.1%, $P = .029$), "I cannot coordinate my time with the CSPY arranged by the hospital" (Referred group: Very much agree& Agree n = 19,

Table 3

Relationship between perceived benefits and referral behavior.

No	Variable name	Total		Unreferred group		Referred group		P-value
		n	%	n	%	n	%	
4–1	Therapy is more effective for early-stage CRC							.002[**]
	Very much agree	72	40	22	27.5	50	50.0	
	Agree	91	50.6	45	56.3	46	46.0	
	Disagree	11	6.1	8	10.0	3	3.0	
	Strongly disagree	6	3.3	5	6.3	1	1.0	
4–2	CSPY or colorectal screening helps identify CRC at an early stage							.003[**]
	Very much agree	69	38.3	21	26.3	48	48.0	
	Agree	92	51.1	45	56.3	47	47.0	
	Disagree	15	8.3	11	13.8	4	4.0	
	Strongly disagree	4	2.2	3	3.8	1	1.0	
4–6	Individuals demonstrate increased willingness to undergo CSPY after having understood CRC and CSPY procedures							.032[*]
	Very much agree	58	32.2	20	25.0	38	38.0	
	Agree	99	55	44	55.0	55	55.0	
	Disagree	18	10	13	16.3	5	5.0	
	Strongly disagree	5	2.8	3	3.8	2	2.0	
4–7	A regular health check is crucial for one's health and for a better understanding of one's health status .							.007[**]
	Very much agree	60	33.3	17	21.3	43	43.0	
	Agree	104	57.8	53	66.3	51	51.0	
	Disagree	15	8.3	9	11.3	6	6.0	
	Strongly disagree	1	0.6	1	1.3	0	0.0	
4–8	Staying healthy is crucial for family members							.011[*]
	Very much agree	65	36.1	20	25.0	45	45.0	
	Agree	102	56.7	51	63.8	51	51.0	
	Disagree	11	6.1	8	10.0	3	3.0	
	Strongly disagree	2	1.1	1	1.3	1	1.0	

Analyzed using Fisher exact test.
[*] $P < .05$.
[**] $P < .01$.

19%;Unreferred group Very much agree& Agree n=30, 37.6%, $P = .033$), "I fear the pain and discomfort caused by the CSPY" (Referred group: Very much agree & Agree n=38, 38%; Unreferred group Very much agree & Agree n=46, 47.5%, $P = .046$), "I feel insecure about having a CSPY" (Referred group: Very much agree& Agree n=28, 28%;Unreferred group Very much agree& Agree n=41, 51.3%, $P = .010$), "The preparation for a CSPY procedures is inconvenient" (Referred group: Very much agree& Agree n=37, 37%;Unreferred group Very much agree& Agree n=43, 53.8%, $P = .020$), "I think the bleeding is only caused by hemorrhoids" (Referred group: Very much agree& Agree n=17, 17%;Unreferred group Very much agree& Agree n=35, 43.8%, $P < .001$), "Physicians are not sufficiently professional" (Referred group: Very much agree& Agree n=11, 11%;Unreferred group Very much agree& Agree n=10, 12.5%, $P = .013$), and "The location for CSPY testing is too far away" (Referred group: Very much agree& Agree n=22, 22%; Unreferred group Very much agree& Agree n=17, 21.3%, $P = .048$).

Table 5, one of the internal factors regarding cues to action "Over the last year, I have occasionally felt discomfort with my stomach" (Unreferred group:Yes [n=6,7.5%], No [n=66, 82.5%], Unknow [n=8,10.0%]; Referredgroup:Yes [n= 21,21.0%], No [n=78,78.0%], Unknow [n=1,1.0%], $P =.001$])was significantly correlated with referral behavior ($P < 0.05$).

The following external factors exhibited significant correlation with referral behavior: "I learned about CSPY from television, radio, or newspapers" (Unreferred group: yes [n=45,56.3%], No [n=9,11.3%], Unknow [n=26,32.5%]; Referredgroup: yes [n=65,65.0%], No [n=20,20.0%], Unknow [n=15,15.0%], $P=.014$), "Physicians or nurses reminded me to go to the hospital for CSPY" (Unreferred group: yes [n=53,66.3%], No [n= 21,26.3%], Unknow [n=6,7.5%]; Referred group: Yes [n= 83,83.0%], No [n=14,14.0%0, Unknow [n=3,3.0%], $P =.032$), "I received a notice from hospital reminding me to have a CSPY" (Unreferred group:Yes [n=49,61.3%], No [n= 19,23.8%], Unknow [n=12,15.0%]; Referredgroup: Yes [n= 76,76.0%], No [n=20,20.0%], Unknow [n=4,4.0%], $P=.022$), "I received a notice from health units reminding me to have a CSPY" (Unreferred group:Yes [n=61,76.3%], No [n= 9,11.3%], Unknow [n=10,12.5%]; Referredgroup:yes [n= 83,83.0%], No [n=15,15.0%], Unknow [n=2,2.0%], $P=.018$), and "I have been involved in health-related activities within the community, so I know that I should undergo a CSPY if the result of the CRC screening is abnormal" (Unreferred group: Yes n= 6,7.5%, No n=32,40%, Unknow n=42,52.5%;Referred group: Yes n=27,27.0%, No n=35,35.0% Unknow n=38,38.0%), $P=.002$). The results revealed a more favorable performance in the referred group than in the unreferred group, indicating that participants with positive results in the Daliao District were more willing to receive suggestions and notices from mass media, health care professionals, and health units as well as resources from health-related activities in the community. The results further indicated that the referred group had better resources of action cues than the unreferred group.

Table 4

Relationship between perceived barriers and referral behavior.

No	Variable name	Total		Unreferred group		Referred group		P-value
		n	%	n	%	n	%	
5–1	I consider myself healthy; therefore, a CSPY is not necessary							.005[**]
	Very much agree	8	4.4	6	7.5	2	2.0	
	Agree	75	41.7	41	51.3	34	34.0	
	Disagree	76	42.2	23	28.8	53	53.0	
	Strongly disagree	21	11.7	10	12.5	11	11.0	
5–2	I know my own health status; I do not require several consultations							<.001[***]
	Very much agree	11	6.1	7	8.8	4	4.0	
	Agree	67	37.2	41	51.3	26	26.0	
	Disagree	83	46.1	24	30.0	59	59.0	
	Strongly disagree	19	10.6	8	10.0	11	11.0	
5–3	I do not feel pain or discomfort in the stomach, nor do I feel defecation pain; therefore, a CSPY is not necessary							.001[***]
	Very much agree	16	8.9	10	12.5	6	6.0	
	Agree	66	36.7	39	48.8	27	27.0	
	Disagree	82	45.6	24	30.0	58	58.0	
	Strongly disagree	16	8.9	7	8.8	9	9.0	
5–4	I am worried about being diagnosed as having CRC; therefore, I do not want to undergo a CSPY							.016[*]
	Very much agree	5	2.8	3	3.8	2	2.0	
	Agree	19	10.6	13	16.3	6	6.0	
	Disagree	127	70.6	57	71.3	70	70.0	
	Strongly disagree	29	16.1	7	8.8	22	22.0	
5–6	The doctor who explained my CRC screening report thought that a CSPY was unnecessary							<.001[***]
	Very much agree	11	6.1	8	10.0	3	3.0	
	Agree	39	21.7	26	32.5	13	13.0	
	Disagree	115	63.9	43	53.8	72	72.0	
	Strongly disagree	15	8.3	3	3.8	12	12.0	
5–7	I am faced with economic pressure, so I do not want to undergo a CSPY							.029[*]
	Very much agree	4	2.2	3	3.8	1	1.0	
	Agree	19	10.6	13	16.3	6	6.0	
	Disagree	141	78.3	60	75.0	81	81.0	
	Strongly disagree	16	8.9	4	5.0	12	12.0	
5–8	I cannot coordinate my time with the CSPY arranged by the hospital							.033[*]
	Very much agree	9	5.0	5	6.3	4	4.0	
	Agree	40	22.2	25	31.3	15	15.0	
	Disagree	119	66.1	44	55.0	75	75.0	
	Strongly disagree	12	6.7	6	7.5	6	6.0	
5-12	I fear the pain and discomfort caused by the CSPY							.046[*]
	Very much agree	20	11.1	12	15.0	8	8.0	
	Agree	64	35.6	34	42.5	30	30.0	
	Disagree	92	51.1	32	40.0	60	60.0	
	Strongly disagree	4	2.2	2	2.5	2	2.0	
5-13	I feel insecure about having a CSPY							.010[**]
	Very much agree	15	8.3	9	11.3	6	6.0	
	Agree	54	30.0	32	40.0	22	22.0	
	Disagree	105	58.3	38	47.5	67	67.0	
	Strongly disagree	6	3.3	1	1.3	5	5.0	
5-14	The preparation for a CSPY procedures is inconvenient							.020[*]
	Very much agree	14	7.8	11	13.8	3	3.0	
	Agree	66	36.7	32	40.0	34	34.0	
	Disagree	92	51.1	35	43.8	57	57.0	
	Strongly disagree	8	4.4	2	2.5	6	6.0	
5-15	I think the bleeding is only caused by hemorrhoids							<.001[***]
	Very much agree	5	2.8	4	5.0	1	1.0	
	Agree	47	26.1	31	38.8	16	16.0	
	Disagree	115	63.9	41	51.3	74	74.0	
	Strongly disagree	13	7.2	4	5.0	9	9.0	
5-19	Physicians are not sufficiently professional							.013[*]
	Very much agree	3	1.7	2	2.5	1	1.0	
	Agree	18	10.0	8	10.0	10	10.0	
	Disagree	145	80.6	63	78.8	82	82.0	
	Strongly disagree	14	7.8	7	8.8	7	7.0	
5-21	The location for CSPY testing is too far away							.048[*]
	Very much agree	5	2.8	5	6.3	0	0.0	
	Agree	34	18.9	12	15.0	22	22.0	
	Disagree	132	73.3	60	75.0	72	72.0	
	Strongly disagree	9	5.0	3	3.8	6	6.0	

CRC = colorectal cancer, CSPY = colonoscopy.

Analyzed using Fisher exact test.

[*] $P < .05$.

[**] $P < .01$.

[***] $P < .001$.

Table 5

Relationship between internal and external factors and referral behavior.

No	Variable name	Total		Unreferred group		Referred group		P-value
		N	%	n	%	n	%	
Internal factors								
6–3	Over the last year, I have occasionally felt discomfort with my stomach							.001***
	Yes	27	15.0	6	7.5	21	21.0	
	No	144	80.0	66	82.5	78	78.0	
	Unknow	9	5.0	8	10.0	1	1.0	
External factors								
6–5	I learned about CSPY from television, radio, or newspapers							.014*
	Yes	110	61.1	45	56.3	65	65.0	
	No	29	16.1	9	11.3	20	20.0	
	Unknow	41	22.8	26	32.5	15	15.0	
6–9	Physicians or nurses reminded me to go to the hospital for CSPY							.032*
	Yes	136	75.6	53	66.3	83	83.0	
	No	35	19.4	21	26.3	14	14.0	
	Unknow	9	5.0	6	7.5	3	3.0	
6-11	I received a notice from hospital reminding me to have a CSPY							.022*
	Yes	125	69.4	49	61.3	76	76.0	
	No	39	21.7	19	23.8	20	20.0	
	Unknow	16	8.9	12	15.0	4	4.0	
6-12	I received a notice from health units reminding me to have a CSPY							.018*
	Yes	144	80.0	61	76.3	83	83.0	
	No	24	13.3	9	11.3	15	15.0	
	Unknow	12	6.7	10	12.5	2	2.0	
6-13	I have been involved in health-related activities within the community, so I know that I should undergo a CSPY if the result of the CRC screening is abnormal							.002**
	Yes	33	18.3	6	7.5	27	27.0	
	No	67	37.2	32	40.0	35	35.0	
	Unknow	80	44.4	42	52.5	38	38.0	

CRC = colorectal cancer, CSPY = colonoscopy.

Analyzed using Fisher exact test.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

The dimension of health belief was then investigated (Table 6). Perceived susceptibility (No 3–1, No 6–4; $P = .030$), perceived benefits ($P = .002$), perceived barriers ($P < .001$), and external factors ($P = .009$) exhibited significant correlations with referral behavior ($P < .05$). Both groups had the same median perceived susceptibility. However, the quartile deviation of the referred group (0.5–0.5) was higher than that of the unreferred group (0–0.5).

The referred group had significantly higher perceptions of benefits (median = 3.3; IQR = 3–3.9) than the unreferred group (median = 3; IQR = 2.9–3.6). The unreferred group perceived significantly greater barriers (median = 2.4; IQR = 2.1–2.5) than the referred group (median = 2.1; IQR = 2–2.4). Among the 5 dimensions of health belief, perceived barriers exhibited the most noticeable difference between groups ($P < .001$). Regarding action cues, external factors exerted a significantly greater effect

Table 6

Relationship between dimensions of health belief and referral behavior.

Facet name	Referred group		Unreferred group		P-value
	Median	IQR	Median	IQR	
Perceived susceptibility (3–1, 6–4)	0.5	0.5–0.5	0.5	0–0.5	.030*
Perceived benefits	3.3	3–3.9	3	2.9–3.6	.002**
Perceived barriers	2.1	2–2.4	2.4	2.1–2.5	<.001***
External Factors	0	0–0.3	0	0–0	.059
Internal Factors	0.8	0.6–0.9	0.7	0.3–0.8	.009*

Analyzed using Wilcoxon signed-rank sum test.

#Analyzed using Fisher exact test.

* $P < .05$.

** $P < .01$.

*** $P < .001$.

on the referred group (median=0.8; IQR=0.6–0.9) than on the unreferred group (median=0.7; IQR=0.3–0.8).

3.3. Important predictors for health care–seeking behavior after diagnosis

Table 7: This study used multivariate analysis to analyze three major independent variables: demographic characteristics, related knowledge regarding confirmatory CRC diagnosis, and health beliefs. Using referral behavior as a dependent variable, use stepwise logistic regression, put the significant variables in the bivariate analysis (chi-square analysis, t test, etc.), and then use stepwise to select suitable (significant) variables into the model. (Note: Although gender is not significantly related, gender is a basic demographic variable and therefore has a model).

The results revealed that the following variables were achieved significance ($P < .05$): age, Gender, family members with cancer, weekly exercise habits and Action disorder. The other variables were nonsignificant.

Further analysis indicated that, after controlling for of intervening variables, the odds ratio of referral behavior for participants younger than 59 years was 7.2 times higher than for patients older than 70 years or more [Logistic regression model= 0.8 OR Lever (95%Cl) = 7.2 (2.6–20.1) $P < .05$]. After controlling for other variables, the odds ratio of referral behavior among participants who exercised for less than 150 min was 0.1 times higher than that among patients who exercised more than 150 min per week. Therefore, the odds ratio of referral behavior for participants who spent less than 150 min per week exercising was 0.8 times lower than for those who spent over 150 min per week exercising (Logistic regression model=–0.8 OR Lever [95% Cl] = 0.1 [0.0–0.5] $P < 0.05$). The odds ratio for each perceived barrier aspect was 0.2, indicating that the odds ratio for referral behavior was 0.8 times lower for every additional point representing a perceived barrier (Logistic regression model=– 1.7 OR Lever [95%Cl]= 0.2 [0.1–0.6] $P < .01$].

Figure 3: ROC curve of stepwise logistic regression for positive referral case

ROC curve shows that 0.7828 falls within $0.7 \leqq AUC \leqq 0.8$ (acceptable discrimination)

4. Discussion

Domestic and international literature has indicated that demographic characteristics (gender, age, education level, marital status, working experience, economic status, living with family, family history, lifestyle, health status, and experience of CRC screening) had varying degrees of impact on referral behavior.

The results of this study indicated that the demographic characteristics of gender, marital status, work experience, economic status, living with family, lifestyle (excluding exercise habits), health status, and experience in CRC screening had no significant relationship with referral behavior, suggesting that these variables did not influence referral behavior. However, the demographic variables such as age, education level, and exercise habits exerted a significant effect on referral behavior. Logistic regression revealed that older age was associated with a lower referral intention.

The results of the present study indicated that increased knowledge regarding confirmatory CRC diagnoses is associated with greater referral intentions. Similar results were reported by Xue, Pinling, Jingmin, Congye, and Jiaming,[21] Alexandraki and Mooradian,[20] and Soskolne et al,[14] who investigated factors related to medical care–seeking behavior following positive Papanicolaou test results. The respective results corresponded with the scholars' recommendation to sensitize perceptions concerning breast cancer. Information regarding breast screening could be used to promote the screening rate.

The results demonstrated that all dimensions of the HBM, excluding perceived seriousness, the following items had significantly positive correlations with referral behavior: perceived susceptibility, perceived benefits, perceived barriers, and cues to

Table 7

Stepwise logis regression analysis of positive cases accepting referral.

Variable name	Logistic regression model	OR Lever (95%CI)	P-value
Gender			
Male	0.2	1.4 (0.7–2.9)	.3425
Female	1		
age			
Under 59 yr old	0.8	7.2 (2.6–20.1)	.0014**
60 to 69 yr old	0.3	4.4 (1.6–11.7)	.1843
Over 70 yr old	1		
Is there anyone in the family who has cancer?			
no	0.5	1.0 (0.5–2.3)	.0456
do not know	−0.9	0.2 (0.1–0.7)	.0033
Yes	1		
Do you have exercise habits every week (more than 150 min per wk)			
No	−0.7	0.1 (0.0–0.6)	.0416*
Yes, but less than 150 min per wk	−0.8	0.1 (0.0–0.5)	.0154*
Yes, more than 150 min per wk	1		
Action disorder	−1.7	0.2 (0.1–0.6)	.0044*

$log\left(\frac{P_{Positive}}{1-P_{Positive}}\right) = \beta_0 + 0.2(Male) + 0.8(Under\ 59\ years\ old) + 0.3(60\ to\ 69\ years\ old) + 0.5(Is\ there\ anyone\ in\ the\ family\ who\ has\ cancer?\ no)$

− 0.9 (Is there anyone in the family who has cancer? do not know).

− 0.7 (Do you have exercise habits every week (more than 150 min per week) no).

− 0.8 (Do you have exercise habits every week (more than 150 min per week) Yes, but less than 150 min per week).
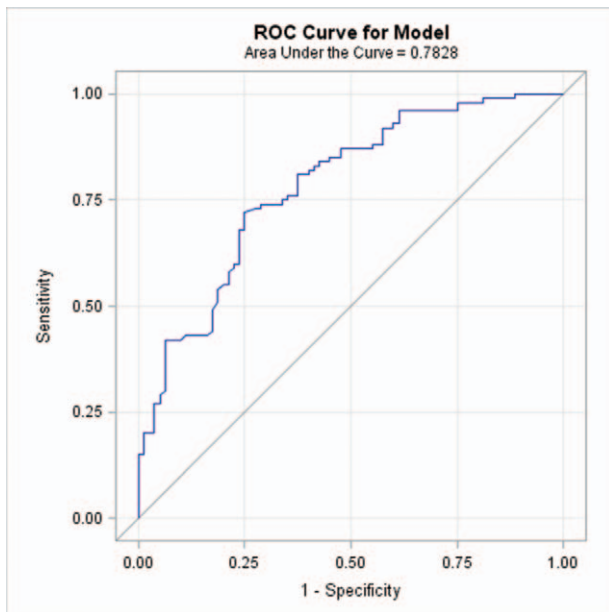
− 1.7 (Action disorder)).

Figure 3. ROC curve for HBM model.

action. Higher perceived susceptibility, higher perceived benefits, lower perceived barriers, and more cues to action (such as radio and media, reminders, and suggestions from nurses and physicians) were associated with stronger referral intentions.[14–16]

Perceived susceptibility: The findings indicated that individuals with higher perceived susceptibility exhibited significantly higher referral intentions. Similar results were observed by Martin, Haskard-Zolnierek, and DiMatteo,[17] Abbaszadeh et al,[18] and Soskolne et al,[14] in their studies on perceived susceptibility and breast screening.

Perceived seriousness: This study indicated that individuals who perceived CRC as a more serious condition exhibited stronger referral intentions; however, the differences were not significant. Perceived seriousness was a weaker predictor of referral behavior, which may be because cancer has been ranked as the leading cause of death in Taiwan for years and CRC is the most commonly occurring cancer. Frequent media reports have resulted in CRC being perceived as a serious condition by the general public. Therefore, no differences were observed between the 2 groups. [14,19,20]

The results demonstrated that age, weekly exercise habits, and perceived barriers were crucial predictors of referral and medical care–seeking behavior after controlling for other intervening variables. Participants aged 59 years or less exhibited stronger referral intentions, whereas those aged 70 years or over exhibited weaker referral intentions. These findings may be caused by the reduced health and mobility of patients aged ≥ 70 years, which rendered them less autonomous in seeking medical care without family members' assistance. Therefore, more professional health care services should be provided for elderly people aged than 60 to 69 years to reduce perceived barriers and enhance the convenience of seeking medical care.

Regarding lifestyle, exercise was the most significant health-related habit. Some beneficial health habits (such as consuming vegetables daily and avoiding smoking, drinking, and betel nut chewing) were easy to achieve for most, whereas exercise habits were more difficult to maintain. Therefore, participants who spent more time engaging in sports were generally more concerned about their health, and thus their referral rate was relatively higher.

Regarding perceived barriers, fewer perceived barriers were associated with stronger referral intentions. Reducing perceived barriers is a major responsibility of relevant government agencies and nurses from the public health system. Various supplementary measures should be implemented to mitigate the effect of the perceived barriers reported in this study.

5. Conclusions and suggestions

5.1. Conclusions

Many CRC screening methods have been developed, among which the FOBT is currently the most economical. Shih min recruited 40 middle-aged and older-adult participants and examined their willingness to receive CRC screening and invasive colonoscopy. The results revealed that the perceived susceptibility, perceived barriers to taking action in the HBM, fear of facing one's actual health condition, concern over the preciseness and safety of the screening equipment, perceived bowel symptoms, and level of understanding of CRC-related knowledge all affected patients' willingness to receive a FOBT or colonoscopy. Additional factors affecting their willingness to receive a FOBT were age, social activities, and screening experience.[22–23]

In this study, we studied the correlation between CRC screening and patients' health behavior. The statistical results demonstrated that sex, age, frequency of exercise, continuity of exercise, and family history of cancer were significantly correlated with willingness to receive CRC screening. Accordingly, to increase the screening rate for cancer, tracking of cases with abnormal health conditions, as well as cancer diagnosis and treatment quality, the Health Promotion Administration initiated the Hospital Cancer Treatment Quality Improvement Subsidy Project to achieve early detection and treatment. This project also facilitates in-depth analysis of people's health behavior and encourages health promotion behavior to reduce the incidence of cancer.[24–25]

The aforementioned studies have suggested that greater knowledge regarding cancer prevention and control was associated with stronger intentions toward cancer prevention and control. Knowledge regarding cancer prevention and control could be enhanced through education. The government uses media to publicize information regarding biennial CRC screening and community chiefs, health bureaus, and medical institutions and to vigorously promote cancer screening. However, adequate attention is not paid to monitoring cases with positive results. The necessity of screening was publicly promoted, but the public does not have an in-depth understanding of cancer screening. Therefore, medical staff from public health units could propagate preventive measures through various channels, such as media, community activities, community development associations, and other key figures of influences in communities, and methods including small-scale and prize-winning shows that raise awareness regarding CRC screening referral and address misinformation. Insufficient information regarding cancer and screening should be rectified using campaigns to raise awareness of cancer prevention and control in the general population. As knowledge regarding cancer prevention and control increases in the general population, the referral rate could be improved,

which would lead to early-stage diagnoses, detections, and effective therapies.[16,25]

5.2. Suggestions

5.2.1. Broadening the range of examinations for referred cases to reduce repeat examinations.
Certain examinations were excluded because they did not meet the regulations prescribed by Health Promotion Administration (HPA). Therefore, they counted as unreferred cases in health agencies' statistics. The 20 excluded cases were referred by attending physicians for further examinations based on their physical conditions (such as long-term anticoagulant intake or chemotherapy for other cancers). However, examinations had already been suggested by their physicians; therefore, they exhibited low willingness to undergo the CSPY subsidized by HPA. One patient undergoing 2 or more examinations that closely resemble one another is a waste of medical resources. Therefore, this study suggests that HPA should extend the range of the examinations for referred cases to increase the referral rate and simultaneously reduce repeat examinations.

5.2.2. Enhancing the correctness of demographic information and its integration.
A small number of participants did not receive telephone calls or postcards as reminders from hospitals or health units. One reason may be incorrect personal data. This study suggests that relevant agencies should ensure the correctness of personal data and their integration to prevent misdirected messages.

5.2.3. Strengthening the propagation of CRC-related knowledge.
Enhancing perceived benefits, providing action cues, and reducing perceived barriers requires the dissemination of knowledge. Providing CRC-related knowledge to citizens is a crucial task for relevant government agencies and nurses of the public health system. This study suggests that measures should be implemented based on the living habits of citizens eligible for CRC screening, such as publicity through mass media or local TV programs. Knowledge can also be increased through community activities, community development associations, and influence or persuasion from key figures in communities. For example, small-scale or prize-winning shows could be used to raise awareness regarding CRC screening referrals and clarify poorly understood concepts.

5.2.4. Enhancing perceived benefits and cues to action and reducing perceived barriers.
The results revealed that perceived barriers were a reliable predictor of referral and healthcare-seeking behavior. This study suggests that supplementary measures should be strengthened to compensate for the perceived barriers. Moreover, when hospitals or health units telephone patients for referrals, medical staff should understand why people are reluctant to be referred, assist in solving an individual's problems of individuals, and clarify incorrect perceptions. The following measures are proposed: clarifying misinterpretations of medical reports, reserving clinic hours during patients' free time, providing clinic hours during holidays or evenings, providing medical shuttle transportation, and providing lists of medical institutions near their homes.

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