

## Adherence of Participation in the Colorectal Cancer Screening Program: Five-Year Follow-up

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**Objective:** The present study aimed to evaluate the adherence to the colorectal cancer (CRC) screening protocol and determine the predictors during 5 years of follow-up.

**Materials and Methods:** A retrospective study was conducted in 1,228 Thai participants, aged 50 to 65 years, who joined the CRC screening project. Adherence was defined by receiving of the first screening colonoscopy, annual fecal immunochemical test (FIT) for 5 years and second colonoscopy based on risk groups.

**Results:** Of the 1,228 participants, 44.5% adhered to the protocol, 45.3% completed annual FIT, and 97.2% completed colonoscopy. Male participants were more likely to adhere to the protocol (OR 1.34, 95% CI 1.04 to 1.71) and annual FIT (OR 1.32, 95% CI 1.03 to 1.69). Participants with adequate vegetable consumption tended to adhere to the protocol (OR 1.49, 95% CI 1.05 to 2.12) and annual FIT (OR 1.52, 95% CI 1.07 to 2.15), and individuals with adequate fruit consumption adhered to the protocol (OR 1.82, 95% CI 1.07 to 3.08) and annual FIT (OR 1.76, 95% CI 1.04 to 2.95). The model of these three predictors demonstrated goodness of fit.

**Conclusion:** Rates of adherence to CRC screening protocol and annual FIT are less than 50%. Promoting the adherence to CRC screening remains necessary.

**Keywords:** Adherence, CRC screening, Colorectal cancer, 5-year follow-up

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In Thailand, while the incidence rates of some cancers are decreasing, such as liver cancer and cervical cancer, the incidence of colorectal cancer (CRC) is increasing. The average annual percent change of CRC in the Thai population is positive, with 4.1% in males and 3.3% in females<sup>(1)</sup>.

CRC screening can reduce the incidence and mortality rates<sup>(2-4)</sup>. Screening guidelines have been proposed for clinical benefits based on the level of risk, which is classified into four groups<sup>(5)</sup>: 1) average-risk: age of 50 to 75 years, 2) moderate-risk: family history of first-degree relative age  $\geq 60$  years, 3) high-risk: personal history of a bowel condition, and 4) highest-risk: personal history of a bowel condition and family history of CRC.

CRC screening guidelines recommend that the average-risk group should be screened at the age of 50 years by annual fecal occult blood test (FOBT) or fecal immunochemical test (FIT), sigmoidoscopy every 5 years or colonoscopy every 10 years. The moderate risk group should also be screened at the age of 40 years by FOBT and FIT, while screening in the high and the highest-risk groups is suggested at the age 40 years by colonoscopy every 5 years<sup>(6,7)</sup>.

CRC screening can be a beneficial for early detection, but the adherence of CRC screening is still low, especially the annual fecal test<sup>(5,8-10)</sup>. Factors determining the adherence to CRC screening include individual characteristics and behavior<sup>(8-13)</sup>. Therefore, this study aimed to evaluate the adherence to a CRC screening protocol and determine the predictors during a 5-year follow-up.

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### Materials and Methods

This retrospective study was conducted with data collected from the electronic case record forms of participants in the royal charity project of the CRC screening program at Chulabhorn Hospital between 2009 and 2013. It was approved by the Human Research Ethical Committee of Chulabhorn Research Institute (No. 021/2019). Inclusion criteria were as follows: 1) age 50 to 65 years and 2) no bowel habit change, no lower gastrointestinal bleeding, no decrease of stool caliber and no anemia. Exclusion criteria were as follows: 1) adults

who underwent colonoscopy within 10 years and 2) adults with history of cancer.

Following the protocol of the CRC screening program, all participants were first screened by colonoscopy. Participants without malignancy were followed for general evaluation and FIT screening annually. The second colonoscopy was performed based on clinical findings and CRC risks. All cases with high-risk adenoma, low-risk adenoma, hyperplastic polyp and normal colonoscopy from the first colonoscopy underwent a second colonoscopy at year 3, 4 and 5, respectively. The participants were reminded by telephone call at 1 week prior to the date of each visit and contacted again if they did not come for the follow-up visit. Therefore, the present study defined protocol adherence as completion of the first screening colonoscopy, annual FIT for 5 years and the second colonoscopy.

Statistical analyses were performed using PASW statistics 18. Descriptive analysis was applied to describe the characteristics of participants based on categorical or continuous variables. Binary logistic regression was performed to analyze the potential factors for adherence to the protocol. Multivariate analysis was employed to estimate the association between the potential factors and the adherence. Two-tailed and significance level was defined as p-value less than 0.05.

## Results

Among the 1,228 participants who joined the program, 547 (44.5%) completed the 5-year protocol, 557 (45.3%) underwent the annual FIT screening and 1,194 (97.2%) adhered to the colonoscopy. The majority of the adherent patients were male (72.9%), with a mean age of 57.2 years (SD  $\pm 4.2$ ), married status (67.1%), secondary to diplomat level graduate education (37.5%), no smoking history (89.4%), low income (75.2%), low vegetable consumption (89.2%), low fruit consumption (96.0%), low exercise (63.6%) and hyperlipidemia (42.8%) (Table 1).

In determining the potential factors of protocol and annual FIT adherence, univariate analysis was performed and showed that male sex and consumption of adequate vegetable and fruit ( $>7$  meals/week) were significantly associated with adherence to the CRC screening program ( $p < 0.05$ ) (Table 2).

The potential factors were examined in multivariate analysis to find the predictors determining CRC screening protocol adherence and annual FIT adherence. Regarding protocol adherence, males (OR 1.34, 95% CI 1.04 to 1.72,  $p < 0.02$ ), participants with adequate vegetable consumption (OR 1.49, 95% CI 1.05 to 2.12,  $p < 0.02$ ), as well as participants with adequate fruit consumption (OR 1.82, 95% CI 1.08 to 3.08,  $p < 0.02$ ) were more likely to adhere with goodness of model fit ( $p = 0.59$ ). For annual FIT adherence, males (OR 1.32, 95% CI 1.02 to 1.69,  $p < 0.03$ ), adequate vegetable consumption (OR 1.52, 95% CI 1.07 to 2.15,  $p < 0.02$ ) and adequate vegetable consumption (OR 1.76, 95% CI 1.04 to 2.95,  $p < 0.03$ ) tended to adhere

with goodness of model fit ( $p = 0.62$ ) (Table 3).

## Discussion

Our retrospective study found that 44.5% of the participants adhered to the 5-year CRC screening protocol, 45.3% completed the annual FIT and 97.2% completed colonoscopy. In other randomized trials, Liang et al showed that 14% of the participants completed the 3-year CRC screening protocol<sup>(8)</sup> and Inadomi et al reported protocol adherence in 58% of participants, colonoscopy in 38% of participants, and FOBT in 67% of participants<sup>(11)</sup>. Sewitch et al found that 30% of the participants adhered to the CRC screening protocol, while 15% completed FOBT and 12% completed endoscopy<sup>(9)</sup>. Cyhaniuk and Coombes conducted a study from 5-year secondary data and showed that 64% of individuals adhered to CRC screening recommendation<sup>(10)</sup>. The current study showed the highest adherence of colonoscopy.

Colonoscopy is the gold standard of diagnostic test, while FIT can provide better test parameters than FOBT. After a positive fecal test, colonoscopy should be performed as a verification test<sup>(14)</sup>. Although our study demonstrated high adherence to colonoscopy, there was still low adherence to the CRC screening protocol in both short and long follow-up.

Regarding the factors determining the adherence to CRC screening, a systematic review categorized the factors into four characteristics including socio-demographic, environmental, healthcare utilization and psychological characteristics<sup>(15)</sup>. Many studies reported socio-demographic characteristics associated with adherence such as male sex, high income, high education, high fruit consumption, moderate exercise, part-time job, living with chronic diseases, preventive disease behavior, homosexual, married status or having partners and getting warning for follow-up<sup>(8-10,12,13)</sup>. Reminder by telephone call may affect the adherence to CRC screening in the present study.

In the light of the association between socio-demographic characteristics and adherence to CRC screening protocol and annual FIT, The present study showed that male sex and adequate vegetable and fruit consumption were the important factors related to the adherence. Males were more likely to adhere to the CRC screening protocol and annual FIT by approximately 1.3-fold and participants with adequate vegetable and fruit consumption were more likely to adhere by approximately 1.8-fold.

Interestingly, high numbers of individuals with low socio-economic status and unhealthy behavior joined our royal charity project. Regarding inadequate fruit and vegetable consumption, the World Health Organization reveals that people worldwide intake inadequate fruit and vegetables<sup>(16)</sup>, which is associated with CRC risk<sup>(17-19)</sup>. Therefore, participation in the CRC screening program could be beneficial for CRC detection at early stage.

Our study had some limitations, including a lack of data to compare adherence among different risk groups, as well as warning strategy related to CRC screening adherence.

**Table 1.** Characteristics of participants according to adherence to the CRC screening program

Characteristic	Total n (%)	Protocol adherence n (%)	FIT adherence n (%)	Colonoscopy adherence n (%)
	1,228	547 (44.5)	557 (45.3)	1,194 (97.2)
Sex				
Male	853 (69.5)	399 (72.9)	405 (72.7)	830 (69.5)
Female	375 (30.5)	148 (27.1)	152 (27.3)	364 (30.5)
Age (mean±SD)	57 (±4.2)	57.2 (±4.2)	57.3 (±4.3)	56.9 (±4.2)
Marital status				
Single	179 (14.6)	77 (14.1)	77 (13.8)	174 (14.6)
Married	831 (67.7)	367 (67.1)	375 (67.3)	810 (67.8)
Widow/divorce/separated	218 (17.7)	103 (18.8)	105 (18.9)	210 (17.6)
Educational attainment				
Primary level	304 (24.7)	142 (26.0)	142 (25.5)	298 (25.0)
Secondary-diploma level	461 (37.5)	205 (37.5)	211 (37.9)	447 (37.4)
Bachelor's degree and higher	463 (37.7)	200 (36.5)	204 (36.6)	449 (37.6)
Smoking history				
Yes	143 (11.6)	58 (10.6)	59 (10.6)	139 (11.6)
No	1,085 (88.4)	489 (89.4)	498 (89.4)	1,055 (88.4)
Income (baht/month)				
<25,000	926 (75.4)	411 (75.2)	416 (74.7)	899 (75.3)
≥25,000	302 (24.6)	136 (24.8)	141 (25.3)	295 (24.7)
Vegetable consumption				
≤7 meals/week	1,054 (85.8)	488 (89.2)	497 (89.2)	1,022 (85.6)
>7 meals/week	174 (14.2)	59 (10.8)	60 (10.8)	172 (14.4)
Fruit consumption				
≤7 meals/week	1,050 (93.7)	525 (96.0)	534 (95.9)	1,118 (93.7)
>7 meals/week	78 (6.3)	22 (4.0)	23 (4.1)	76 (6.4)
Exercise				
<3 times/week	795 (64.7)	348 (63.6)	356 (63.9)	772 (64.7)
≥3 times/week	433 (35.3)	199 (36.4)	201 (36.1)	422 (35.3)
Living with NCDs				
Diabetes	170 (13.8)	74 (13.5)	78 (14.0)	162 (13.6)
Hyperlipidemia	506 (41.2)	234 (42.8)	239 (42.9)	484 (40.5)
Hypertension	441 (35.9)	194 (35.5)	198 (35.5)	426 (35.7)

CRC = colorectal cancer; FIT = fecal immunochemical test

Further study is thus recommended to compare the adherence among risk groups and explore the adherent strategies to promote higher cancer screening adherence.

### Conclusion

In the present study, the adherence of CRC screening protocol and FIT was less than 50% but adherence to colonoscopy was up to 97.2%. The annual fecal test is a non-invasive standard recommendation and colonoscopy is

a verification test of CRC in every risk group. Adherence to cancer screening could be beneficial for cancer detection at early stage and reduce mortality rate leading to the diminishing costs of care. Hence, adherence to cancer screening is necessary among different risk groups.

### What is already known on this topic?

Annual fecal test is a non-invasive standard test for CRC, and it remains low to adhere to the CRC screening.

**Table 2.** CRC screening protocol and annual FIT adherence by univariate analysis

Variable	Protocol adherence		Annual FIT adherence	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Sex				
Male	1.35 (1.05 to 1.73)	0.018*	1.32 (1.04 to 1.70)	0.02*
Female	Ref.		Ref.	
Marital status				
Single	Ref.		Ref.	
Married	0.95 (0.69 to 1.32)	0.78	0.92 (0.66 to 1.27)	0.61
Widow/divorce/separated	0.84 (0.57 to 1.25)	0.40	0.81 (0.55 to 1.21)	0.31
Educational attainment				
Primary level	Ref.		Ref.	
Secondary-diploma level	1.09 (0.82 to 1.46)	0.54	1.04 (0.78 to 1.39)	0.80
Bachelor's degree and higher	1.15 (0.86 to 1.54)	0.34	1.11 (0.83 to 1.49)	0.47
Smoking history				
Yes	1.20 (0.84 to 1.71)	0.31	1.21 (0.85 to 1.72)	0.29
No	Ref.		Ref.	
Income (baht/month)				
<25,000	Ref.		Ref.	
≥25,000	0.97 (0.75 to 1.26)	0.84	0.93 (0.72 to 1.21)	0.59
Vegetable consumption				
≤7 meals/week	Ref.		Ref.	
>7 meals/week	1.68 (1.20 to 2.35)	0.002*	1.70 (1.21 to 2.37)	0.002*
Fruit consumption				
≤7 meals/week	Ref.		Ref.	
>7 meals/week	2.14 (1.29 to 3.55)	0.003*	2.07 (1.26 to 3.42)	0.004*
Exercise				
<3 times/week	Ref.		Ref.	
≥3 times/week	0.92 (0.72 to 1.16)	0.46	0.94 (0.74 to 1.18)	0.58
Living with NCDs				
Diabetes	1.05 (0.76 to 1.45)	0.77	0.98 (0.70 to 1.35)	0.88
Hyperlipidemia	0.89 (0.71 to 1.12)	0.31	0.88 (0.70 to 1.10)	0.27
Hypertension	1.04 (0.82 to 1.31)	0.77	1.03 (0.81 to 1.30)	0.81

\* p&lt;0.05

**What this study adds?**

People who consume dietary fiber more than seven times per week tend to adhere to the CRC screening protocol and annual fecal test.

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**Potential conflicts of interest**

The authors declare no conflict of interest.

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**Table 3.** CRC screening protocol and annual FIT adherence by multivariate analysis

Variable	B	SE B	Wald $\chi^2$	P	OR	95% CI
Protocol adherence						
Male	0.29	0.13	2.30	0.02	1.34	1.04 to 1.71
Vegetable consumption >7 meals/week	0.40	0.18	2.25	0.02	1.49	1.05 to 2.12
Fruit consumption >7 meals/week	0.60	0.27	2.24	0.02	1.82	1.07 to 3.08
* Goodness of fit test p=0.59						
Annual FIT adherence						
Male	0.28	0.13	2.18	0.03	1.32	1.03 to 1.69
Vegetable consumption >7 meals/week	0.42	0.18	2.34	0.02	1.52	1.07 to 2.15
Fruit consumption >7 meals/week	0.56	0.27	2.12	0.03	1.76	1.04 to 2.95
* Goodness of fit test p=0.62						
p<0.05, * Goodness of fit test p>0.05						

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