

Factors Associated With Colorectal Cancer Screening Via Immunochemical Fecal Occult Blood Test in an Average-Risk Population From a Multiethnic, Middle-Income Setting

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abstract

PURPOSE The Malaysian Ministry of Health had launched free opportunistic screening for colorectal cancer using immunochemical fecal occult blood test (iFOBT) targeting the average-risk individuals since 2014. This study aims to determine factors associated with colorectal cancer screening using iFOBT among the average-risk Malaysian population.

METHODS A cross-sectional study was conducted at five government-run health clinics in the state of Selangor. Adults with an average risk of colorectal cancer (age > 50 years, asymptomatic, and no family history of colorectal cancer) were recruited using systematic random sampling. An interviewer-administered questionnaire adapted from the Cancer Awareness Measure and Health Belief Model was used.

RESULTS The median age of participants was 61 years (interquartile range, 56 to 66). Almost 60% of participants indicated their willingness to be screened. However, only 7.5% had undergone iFOBT. Good knowledge of risk factors of colorectal cancer, perceived susceptibility to the disease, and the doctor's recommendation were associated with increased willingness to be screened: adjusted odds ratio (aOR), 1.66 (95% CI, 1.12 to 2.46); aOR, 1.70 (95% CI, 1.08 to 2.70); and aOR, 5.76 (95% CI, 2.13 to 15.57), respectively. Nevertheless, being elderly (aOR, 0.67; 95% CI, 0.45 to 0.99) and high negative perception toward the testing method (iFOBT) (aOR, 0.12; 95% CI, 0.05 to 0.30) were independently associated with lower willingness to be screened. Multivariable analysis within the average-risk individuals who were willing to be screened for colorectal cancer showed that the doctor's recommendations remained as an important cue for positive action, whereas negative perception toward the test was a significant barrier to the actual uptake of iFOBT.

CONCLUSION The present findings must be factored in when tailoring colorectal cancer screening promotion activities in multiethnic, middle-income settings.

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INTRODUCTION

Colorectal cancer has been reported as the second most common cancer in men and women in Malaysia in 2018. A well-recognized challenge to cancer control in the nation is that most of the patients with colorectal cancer tended to present at advanced stage of the disease.¹ Although the Malaysian Ministry of Health had launched free opportunistic screening for colorectal cancer using immunochemical fecal occult blood test (iFOBT) targeting the average-risk individuals since 2014, via its nationwide network of primary care clinics,² the screening behavior of Malaysians and the associated factors remain largely unknown. This is particularly important considering that barriers to undergo iFOBT in affluent settings have been attributed to the complexity of

the screening itself, such as uncertainty about sampling instructions or procedures that might be overwhelming for laypersons.³ Knowledge of such factors within the local context may be most helpful in the development of measures to mitigate them to ensure the efficiency of current screening approaches and to embark on an organized national screening program for colorectal cancer in Malaysia.⁴ Hence, this study determined factors associated with colorectal cancer screening via iFOBT among the average-risk population using public outpatient healthcare facilities in Malaysia, which presently caters to a majority (65%) of Malaysians.⁵ Average-risk individuals comprised those of age 50 years and above who were asymptomatic and have no positive family history of colorectal cancer.

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CONTEXT

Key Objective

What are the factors (barriers) influencing colorectal cancer screening using immunochemical fecal occult blood test (iFOBT) among the average-risk population (age > 50 years) in Malaysian setting?

Knowledge Generated

Only 7.5% of the average-risk individuals in this study had undergone iFOBT despite it being available at no cost in the government health clinics. Good knowledge of risk factors, perceived susceptibility, and the doctor's recommendations positively influenced the willingness to undergo screening, whereas negative perception toward the test was a significant barrier of iFOBT uptake.

Relevance

The knowledge from this study is expected to be beneficial in the development of measures to improve the uptake of iFOBT, which in turn may act as a stepping stone to embark on an organized nationwide colorectal cancer screening program.

METHODS

Participants and Settings

Participants of this cross-sectional study were selected among visitors attending five urban and semiurban government-run primary care clinics (Ampang, Batu 14, Sungai Chua, Kajang, and Batu 9 health clinic) in Hulu Langat district in the state of Selangor. Potential participants comprised Malaysians seeking primary care services including outpatient services and routine health checks as well as the accompanying persons. Attendees of age > 50 years, asymptomatic of colorectal cancer, with no family history of colorectal cancer (average risk) were selected via systematic random sampling. Participant recruitment was conducted concurrently in all clinics, and on a given day, the selection of the first participant was done using a table of random numbers based on the registration list of eligible patients (and accompanying persons). The subsequent participants were chosen with an interval of two based on the calculation of the estimated previous year attendance of adults of age 50-75 years, per day divided by the calculated sample size. In total, 508 participants were recruited between May 1, 2019, and July 31, 2019.

This study received approval from the Medical Research Ethics Committee (NMRR-19-396-46040). Written informed consent was obtained from all participants.

Study Tool

Interviews were conducted using validated questions adapted from a questionnaire used by the Asia Pacific Colorectal Cancer Working Group,⁶ which was developed based on the Health Belief Model,^{6,7} and the Cancer Awareness Measure.⁸ These questions were forward translated from English to Malay language by two research staff, reconciled, and then back-translated before being incorporated into a bilingual questionnaire. Before the initiation of this study, face validation of the new questionnaire was conducted among experts and laypersons, who were independent of the present study. Test-retest was

conducted with a Cronbach's alpha of .70. It must nonetheless be acknowledged that the cross-cultural adaptation for construct validity among Malaysian population was not determined.

Apart from collecting information on sociodemographic characteristics including age, sex, ethnicity, highest-attained education level, employment status, and total household monthly income, the questionnaire included a few sections:

Knowledge of Colorectal Cancer and Its Screening

For the knowledge of colorectal cancer symptoms, there were nine close-ended items where the respondents had the options to answer "yes" or "no" comprising bleeding from back passage or rectal, persistent abdominal pain, altered bowel habits, tenesmus, blood in stools, pain in back passage, lump in abdomen, lethargy (anemia), and unexplained weight loss. Each correct answer was given one mark. A total score ≤ 4 was considered as poor and ≥ 5 as good knowledge.^{9,10}

Risk factors were assessed using 10 questions based on a 5-point Likert scale from definitely agree (scored 1), agree (scored 1), do not know (scored 0), disagree (scored 0), and definitely disagree (scored 0).⁸ The accepted answers included alcohol consumption > 1 unit per day; low-fiber, vegetables, and fruit intake; high red meat and/or processed food consumption; obesity; being > 70 years of age; a positive family history of colorectal cancer; lack of physical activities or exercise; inflammatory bowel disease; and diabetes mellitus.^{8,11,12} The total score was then categorized into good (score ≥ 5) and poor (score ≤ 4).¹⁰

For the knowledge of screening, colonoscopy, fecal occult blood testing, sigmoidoscopy, colon capsule endoscopy, and barium enema were listed. A score of 1 was given for each test correctly recognized by the respondents (score 1: poor knowledge and score ≥ 2 : good knowledge).⁶

Health Beliefs About Colorectal Cancer and Its Screening

The attitude and barriers toward colorectal cancer screening were assessed based on the Health Belief Model with four main perceptions: perceived susceptibility (one item),^{6,7} perceived severity (four items), perceived benefit (one item), and perceived barrier (eight items). Those who answered yes for susceptibility perceived that they were at risk of developing colorectal cancer. Perceived severity, benefits, and barriers were assessed based on a 5-point Likert scale. Scores ranging from 0 (strongly disagree), 1 (disagree), 2 (do not know), 3 (agree), and 4 (strongly agree) were given. Total score was divided into low, moderate, and high.^{6,7}

Cues to action included (i) the physician's recommendation, (ii) health insurance that covers colorectal cancer screening, and (iii) personal experience (close friends with colorectal cancer).

Participants' willingness to undergo screening via iFOBT was assessed. Respondents were required to provide a reason if they had indicated that there were not willing to undergo screening (open-ended). History of undergoing prior iFOBT was also assessed.

Statistical Analysis

Continuous variables were described using mean or median, whereas categorical variables were presented using frequencies and percentages. Univariable logistic regression analyses were performed to determine factors that were significantly associated with willingness to undergo colorectal screening using iFOBT. Variables with P -value < .25 were included in a multivariable logistic regression model using the backward elimination technique. A second model was used to assess factors that were associated with the actual uptake of iFOBT among study participants who had indicated willingness to undergo screening via iFOBT.

RESULTS

The response rate in this study was 95.8%. The median age of participants was 61 years (interquartile range, 56 to 66). An ethnically representative sample of the Malaysian population was obtained, with almost equal representation of males and females (Table 1). Approximately 75% of study participants were from low-income (B40) groups, and more than 90% had comorbidities.

The majority of participants fared well in terms of overall knowledge of colorectal cancer. Among the respondents, 263 (51.8%) had good knowledge of signs and symptoms of colorectal cancer, whereas 306 (60.2%) had good knowledge of risk factors and 269 (53%) had good knowledge of screening methods.

Health Beliefs and Perceptions About Colorectal Cancer and Screening with iFOBT

Overall, a majority of respondents perceived that colorectal cancer was a severe disease leading to pain (82.5%),

impairment in activities of daily living (85.8%), financial difficulties (77.2%), and family burden (82.9%). Most patients also had moderate-to-high perception that screening for colorectal cancer will be beneficial in preventing or reducing deaths because of the disease.

It was nonetheless intriguing to note that only one fourth ($n = 131$) of the respondents perceived that they were susceptible to get colorectal cancer (Table 2). Close to 20% of the study participants reported having close friends with colorectal cancer, whereas < 10% had received recommendation from their doctors to undergo screening for colorectal cancer or had health insurance with coverage for colorectal cancer screening (Table 2).

It was observed that more than half (65%) of the study respondents had high-to-moderate negative perception toward iFOBT as a screening tool. Close to 50% of the participants agreed that they would avoid iFOBT as it required them to handle stool. Approximately 21% agreed that it was embarrassing. Only a small proportion (10%) had perceived that iFOBT was harmful or painful. Most of the respondents had moderate-to-high perceived access barriers to iFOBT; 41.1% of the respondents were not aware of the (zero) cost, whereas 30.9% were unaware of the availability of the test in government clinics (not mutually exclusive). A substantial proportion of respondents also perceived colorectal cancer screening as time-consuming, with 43.5% indicating preference for a test that does not need to be done annually.

Further analysis showed that participants who had previously undergone colorectal cancer screening were significantly associated with low perceived negativity toward iFOBT and low perceived barrier to access screening (not shown).

Willingness to Undergo Colorectal Cancer Screening Using iFOBT

Half of the respondents (51.4%) indicated willingness to undergo screening for colorectal cancer using iFOBT. From the remaining respondents who were not willing to be screened, up to 59% justified that they were asymptomatic and therefore did not require testing, whereas about 15% preferred to wait for their doctor's recommendation. Approximately 5% of participants also cited additional reasons including lack of knowledge of the test and that the screening process is dirty (open-ended).

Following multivariable analysis, it was found that good knowledge of risk factors, perceived susceptibility, and recommendation from physicians were independent facilitators associated with willingness to be screened for colorectal cancer using iFOBT (Table 2). Older age and moderate and high negative perceptions toward the test itself were inversely associated with willingness to be screened using iFOBT. Education status nonetheless was not associated with willingness for screening using iFOBT. The P -value from Hosmer-Lemeshow test for the above multivariable logistic regression model was .933 with areas

TABLE 1. Distribution of the Characteristics of Respondents by Screening Behavior

Characteristic	Overall (%) (N = 508), No. (%)	Not Willing to Be Screened (n = 209), No. (%)	Willing But Never Underwent iFOBT (n = 261), No. (%)	Had Undergone iFOBT (n = 38), No. (%)	P ^a
Age					
50-59 years	216 (42.5)	80 (38.3)	123 (47.1)	13 (34.2)	0.087
60-75 years	292 (57.5)	129 (61.7)	138 (52.9)	25 (65.8)	
Sex					
Male	236 (46.5)	85 (40.7)	134 (51.3)	17 (44.7)	0.068
Female	272 (53.5)	124 (59.3)	127 (48.7)	21 (55.3)	
Ethnicity					
Chinese	120 (23.6)	39 (18.7)	75 (28.7)	6 (15.8)	0.072
Malay	300 (59.1)	129 (61.7)	146 (55.9)	25 (65.8)	
Indian	79 (15.6)	37 (17.7)	35 (13.4)	7 (18.4)	
Others ^b	9 (1.8)	4 (1.9)	5 (1.9)	0	
Education level					
No education or primary education	159 (31.3)	76 (36.4)	65 (24.9)	18 (47.4)	0.021 ^c
Secondary education	263 (51.8)	105 (50.2)	143 (54.8)	15 (39.5)	
Tertiary education	86 (16.9)	28 (13.4)	53 (20.3)	5 (13.2)	
Employment status					
Unemployed	157 (30.9)	62 (29.7)	81 (31.0)	14 (36.8)	0.656
Self-employed	70 (13.8)	29 (13.9)	33 (12.6)	8 (21.1)	
Government servant	35 (6.9)	14 (6.7)	17 (6.5)	4 (10.5)	
Private sector	73 (14.4)	28 (13.4)	42 (16.1)	3 (7.9)	
Housewife	69 (13.6)	34 (16.3)	32 (12.3)	3 (7.9)	
Retiree	104 (20.5)	42 (20.1)	56 (21.5)	6 (15.8)	
Monthly household income^d					
Low (B40) (< USD \$912.50)	382 (75.2)	162 (77.5)	190 (72.8)	30 (78.9)	0.656
Middle (M40) (USD \$912.70-1,966.70)	99 (19.5)	38 (18.2)	54 (20.7)	7 (18.4)	
High (T20) (> USD \$1,966.90)	27 (5.3)	9 (4.3)	17 (6.5)	1 (2.6)	
Smoking status					
Smoker	69 (13.6)	20 (9.6)	43 (16.5)	6 (15.8)	0.087
Nonsmoker	439 (86.4)	189 (90.4)	218 (83.5)	32 (84.2)	
Medical conditions					
No illness ^e	39 (7.7)	15 (7.2)	22 (8.4)	2 (5.3)	0.743
Hypertension ^f	351 (69.1)	151 (72.2)	175 (67.0)	25 (65.8)	0.432
Diabetes mellitus ^g	262 (51.6)	118 (56.5)	128 (49.0)	16 (42.1)	0.133
Dyslipidemia ^h	210 (41.3)	84 (40.2)	108 (41.4)	18 (47.4)	0.711
Others	101 (19.9)	37 (17.7)	53 (20.3)	11 (28.9)	0.271

Abbreviations: iFOBT, immunochemical fecal occult blood test; USD, US dollars.

^aDerived using chi-square test.

^bOther races were excluded in the chi-square test.

^cStatistically significant.

^dBased on the findings from the Eleventh Malaysia Plan, 2016-2020. B40: bottom 40%, M40%: middle 40%, Top 20: top 20%. 1 USD = 4.23 Malaysian Ringgit.

^eIn comparison with those with medical illness.

^fIn comparison with those without hypertension.

^gIn comparison with those without diabetes mellitus.

^hIn comparison with those without dyslipidemia.

TABLE 2. Factors Associated With Willingness to Undergo Colorectal Cancer Screening via iFOBT Among Malaysians With Average Risk of Colorectal Cancer (N = 508)

Characteristic	Not Willing to Be Screened (%) n = 209	Willing to Be Screened (%) n = 299	P ^a	Multivariable OR ^b (95% CI)
Age				
50-59 years	80 (38.3)	136 (45.5)	.106	1.00
60-75 years	129 (61.7)	163 (54.5)		0.67 (0.45 to 0.99)
Sex				
Male	85 (40.7)	151 (50.5)	.029	—
Female	124 (59.3)	148 (49.5)		—
Ethnicity				
Chinese	39 (18.7)	81 (27.1)	.156	—
Malay	129 (61.7)	171 (57.2)		—
Indian	37 (17.7)	42 (14.0)		—
Others	4 (1.9)	5 (1.7)		—
Education level				
No education or primary education	76 (36.4)	69 (27.8)	.104	—
Secondary	105 (50.2)	158 (52.8)		—
Tertiary	28 (13.4)	58 (19.4)		—
Smoking status				
Nonsmoker	189 (90.4)	250 (83.6)	.027	—
Smoker	20 (9.6)	49 (16.4)		—
Knowledge of symptoms				
Poor	118 (56.5)	127 (42.5)	.002	—
Good	91 (43.5)	172 (57.5)		—
Knowledge of risk factors				
Poor	100 (47.8)	102 (34.1)	.002	1.00
Good	109 (52.5)	197 (65.9)		1.66 (1.12 to 2.46)
Knowledge of screening				
Poor	114 (54.5)	125 (41.8)	.005	—
Good	95 (45.5)	174 (58.2)	.005	—
Perceived susceptibility				
No	169 (80.9)	208 (69.6)	.004	—
Yes	40 (19.1)	91 (30.4)		1.70 (1.08 to 2.70)
Perceived benefit of screening				
Low	28 (13.4)	23 (7.7)	.053	—
Moderate	119 (56.9)	166 (55.5)		—
High	62 (29.7)	110 (36.8)		—
Perceived negativity to iFOBT				
Low	36 (17.2)	139 (46.5)	< .001	1.00
Moderate	156 (74.6)	151 (50.5)		0.25 (0.16 to 0.40)
High	17 (8.1)	9 (3.0)		0.12 (0.05 to 0.30)
Having close friends with colorectal cancer				
No	178 (85.2)	241 (80.6)	.183	—
Yes	31 (14.8)	58 (19.4)		—

(Continued on following page)

TABLE 2. Factors Associated With Willingness to Undergo Colorectal Cancer Screening via iFOBT Among Malaysians With Average Risk of Colorectal Cancer (N = 508) (Continued)

Characteristic	Not Willing to Be Screened (%) n = 209	Willing to Be Screened (%) n = 299	P ^a	Multivariable OR ^b (95% CI)
Doctor's recommendation				
No	204 (97.6)	260 (87)		
Yes	5 (2.4)	39 (13.0)	< .001 ^c	5.76 (2.13 to 15.6)
Health insurance covering cancer screening				
No	196 (93.8)	268 (89.6)	.102	
Yes	13 (6.2)	31 (10.4)		—

Abbreviations: iFOBT, immunochemical fecal occult blood test; OR, odds ratio.

^aDerived using chi-square test. Only factors with *P* value < .25 are shown.

^bDerived using a backward multivariable logistic regression analysis including all variables shown above.

^cStatistically significant.

under the receiver operating characteristic (ROC) curves of > 0.70, indicating a good model fit.

Actual Uptake of iFOBT Screening

In this study, although half of the study participants indicated willingness to be screened, only 7.5% had undergone screening via iFOBT. Multivariable analysis conducted within the subgroup of participants who were willing to participate in colorectal cancer screening showed that the doctor's recommendations were strongly associated with the actual uptake of iFOBT (Table 3). The lack of iFOBT uptake on the other hand was significantly associated with moderate-to-high perceived negativity toward iFOBT itself. The *P*-value from Hosmer-Lemeshow test for the above model was .324. The areas under ROC curve for perceived negativity were 0.59 and 0.83 for the doctor's recommendation, respectively, indicating good model fit. A post hoc analysis where individual components of perceived negativity toward iFOBT were included in the multivariable analysis, however, showed that none of them were independently associated with the actual uptake of iFOBT.

DISCUSSION

Based on the findings of the Malaysian National Health and Morbidity Survey in 2019, it appears that the distribution of the study population in our present work fairly represents the distribution of Malaysians using services from the government-run health clinics, in terms of income status,⁵ and distribution of comorbidities.¹³ Despite the fact that iFOBT is being offered at no cost in the government health clinics in Malaysia, the present study reveals that only 7.5% of the average-risk individuals attending these clinics had undergone colorectal cancer screening. Similarly, a recent population-based study conducted in an urban Malaysian setting had shown that < 10% of its participants had undergone colorectal cancer screening using either iFOBT or colonoscopy in the preceding 5 years.¹⁴ Although these rates may be construed as low, there appears to be an improvement in the uptake of colorectal cancer screening in Malaysia compared with previous reports in 2012 where

only 3.8% of Malaysians with average risk indicated an intention to participate in screening activities for colorectal cancer,¹⁵ with only 3.0% who had actually undergone any form of screening.^{15,16}

The current study highlights that negative perception toward iFOBT might be a major barrier to colorectal cancer screening in multicultural settings, with the lack of willingness to handle stool being cited as the leading reason. This is in keeping with other studies where stool-based colorectal cancer screening method has been consistently regarded as disgusting, embarrassing, and emotionally distressing.¹⁶⁻¹⁹ It is felt that in multicultural settings, open conversations between healthcare professionals and patients may not only be useful in removing the taboo associated with handling of feces²⁰ but also helping patients to prepare themselves to undergo the test with ease. Furthermore, messaging to promote iFOBT in these settings may need to be more creative and tailored to suit different cultures so that it may effectively convince the community that personal benefits of undergoing iFOBT outweigh any perceived barriers. It has also been previously proposed that simple physical adaptations of the iFOBT kit to allow easier collection of stools and the provision of disposable glove may be worth considering to make the stool specimen collection process less unpleasant.²¹

We found that a recommendation to undergo colorectal screening by the doctors was strongly associated with increased willingness to undergo iFOBT, and the actual uptake of the test has been shown in other settings.^{6,22} Malaysians nonetheless have been reported to receive less recommendation to undergo colorectal cancer screening from their doctors as compared with other countries.¹⁵ In the present study, < 10% of the average-risk population had received prior advice from their physicians to undergo iFOBT. Although this may be attributed to the high patient load and busy working schedule in government-run primary care clinics,²² our findings underscore the need to engage all doctors to routinely recommend iFOBT to patients with average risk during their primary care encounters. In busy clinical practices, educational videos on colorectal cancer in

TABLE 3. Factors Associated With Actual Uptake of iFOBT Among Malaysians With Average Risk of Colorectal Cancer Who Were Willing to Be Screened (n = 299)

Characteristic	Uptake of iFOBT		P ^a	OR ^b (95% CI)
	Yes (%) n = 38	No (%) n = 261		
Age				—
50-59 years	13 (34.2)	123 (47.1)	.135	
60-75 years	25 (65.8)	138 (52.9)		
Ethnicity				—
Chinese	6 (15.8)	75 (28.7)	.186	
Malay	25 (65.8)	146 (55.9)		
Indian	7 (18.4)	35 (13.4)		
Others	0	5 (1.9)		
Knowledge of symptom				—
Poor	12 (31.6)	115 (44.1)	.146	
Good	26 (68.4)	146 (55.9)		
Knowledge of screening				—
Poor	12 (31.6)	113 (43.3)	.171	
Good	26 (68.4)	148 (56.7)		
Perceived severity				—
Low to moderate	6 (15.8)	66 (25.3)	.229	
High	32 (84.2)	195 (74.7)		
Perceived susceptibility				—
No	23 (60.5)	185 (70.9)	.195	
Yes	15 (39.5)	76 (29.1)		
Perceived negativity to iFOBT				
Low	24 (63.2)	115 (44.1)	.027 ^c	1.00
Moderate to high	15 (36.8)	138 (55.9)		0.32 (0.11 to 0.85) ^c
Perceived barrier to iFOBT				—
Low	12 (31.6)	31 (11.9)	.001 ^c	
Moderate to high	26 (68.4)	230 (88.1)		
Doctor's recommendation				
No	11 (28.9)	249 (95.4)	< .001 ^c	1.00
Yes	27 (71.1)	12 (4.6)		58.87 (22.20 to 156.16) ^c

Abbreviations: iFOBT, immunochemical fecal occult blood test; OR, odds ratio.

^aDerived using chi-square and Fisher's exact tests. Only variables with *P* value < .25 are presented in this table.

^bDerived using a backward logistic regression analysis.

^cStatistically significant.

the waiting room may help improve shared decision making and lessen the time with the physician.²³ This also allows patients to take control of their own health and open room for discussion with their providers on iFOBT. It must nonetheless be noted that doctors in the public service may face additional barriers, such as unavailability of stool test kits,²² which in turn point toward other health systems-related issues in terms of ensuring adequate supply of iFOBT kits to roll out free opportunistic colorectal cancer screening program.

In light of our finding that those who had previously underwent screening via iFOBT had low perceived negativity

toward the test, it may be worthwhile to consider recruiting such individuals as lay health advisors in engaging and motivating the subgroups of average-risk individuals who were shown to be less willing to participate in colorectal cancer screening such as the elderly. Similarly, these lay motivators may play an important role in addressing taboos associated with stool-based screening. The idea of incorporating colorectal cancer screening as part of existing local community-led health programs, such as KOSPEN,²⁴ is also expected to exert a positive impact on colorectal cancer screening practices in Malaysia.

Although a substantial proportion of the average-risk population in this study had perceived that colorectal cancer is severe and that screening via iFOBT may be beneficial, they largely (74%) did not perceive themselves to be susceptible of colorectal cancer and were unwilling to undergo iFOBT, as was also observed in other studies. These findings indicate a lack of awareness that individuals with colorectal cancer might be asymptomatic at earlier stages of the disease. About 40% of the study participants did not possess good knowledge on risk factors of colorectal cancer, which is a significant determinant of willingness to be screened using iFOBT, further highlighting areas for improvement. Policy initiatives are necessary to increase the awareness of colorectal cancer in the community with the development of structured government and community-endorsed messages for the general public about risk factors of colorectal cancer, who should undergo screening, and modalities of colorectal cancer screening. Particularly, strong involvement of cancer survivors and also community leaders in health promotion efforts^{25,26} may be useful in reaching underserved populations such as the low socioeconomic groups and rural dwellers.

We echo a previous recommendation that individual countries in Asia need to take their ethnic diversities into account when structuring screening policies to ensure that the benefit of the program is maximized while remaining cost-effective.¹¹ It is also felt that the development of an Asian-specific colorectal cancer risk prediction tool may facilitate the uptake of iFOBT in our settings as it will enable the general public to appreciate their individuals' risks better. This notion is well supported by the findings of this study where knowledge of risk factors of colorectal cancer was significantly associated with willingness to be screened using iFOBT, indicating that people with good knowledge of risk factors of colorectal cancer were better able to understand their risk of developing colorectal cancer than

those with poor knowledge and hence were more willing to undergo screening. Colorectal cancer risk prediction tools are gaining popularity in affluent Western settings, and their utility in guiding clinical decision making is being widely discussed.²⁷ Further research in this area is also warranted in Asian settings, including the validation and adaptation of previously developed colorectal cancer risk prediction tools.

The present findings are particularly important amid the ongoing COVID-19 pandemic, where home-based stool testing has been reported to be widely gaining acceptance in the United States.²⁸ It is only conceivable that in multiethnic multicultural Asian settings, such as in Malaysia, a similar approach of promoting home-based iFOBT is highly unlikely to succeed if the negative perception against stool-based testing in the population is left unaddressed.

This study used a validated questionnaire and randomly sampled participants representing the low- and middle-income Malaysian population from urban and semiurban settings. Nonetheless, we may have missed factors influencing colorectal cancer screening in the rural populations and those from high-income backgrounds who were under-represented in this study.

In conclusion, in Malaysia, more effort needs to be focused on educating the public that colorectal cancer may be asymptomatic in the earlier stages, and screening via iFOBT enables detection at these stages. Addressing the aversion toward stool-based testing among the average-risk community should also be a priority. A low-hanging fruit in improving the uptake of iFOBT may involve getting all primary care doctors to routinely incorporate the recommendation to undergo iFOBT during clinical encounters with the average-risk population. All these efforts must go hand in hand with ensuring the adequate supply of iFOBT kits in the government facilities and timely follow-up of those with positive screening tests.

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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