



UNIVERSITY
OF WOLLONGONG
AUSTRALIA

University of Wollongong
Research Online

Faculty of Social Sciences - Papers

Faculty of Social Sciences

2016

Colorectal cancer screening: Barriers to the faecal occult blood test (FOBT) and colonoscopy in Singapore

Sook Kwin Yong

National University of Singapore

Whee Sze Ong

National Cancer Centre Singapore

Gerald Choon Huat Koh

National University of Singapore

Richard Ming Chert Yeo

National University of Singapore

Tam C. Ha

University of Wollongong, tamha@uow.edu.au

Publication Details

Yong, S., Ong, W., Koh, G., Yeo, R. & Ha, T. C. (2016). Colorectal cancer screening: Barriers to the faecal occult blood test (FOBT) and colonoscopy in Singapore. *Proceedings of Singapore Healthcare*, 25 (4), 207-214.

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library:
research-pubs@uow.edu.au

Colorectal cancer screening: Barriers to the faecal occult blood test (FOBT) and colonoscopy in Singapore

Abstract

Introduction: This study aims to identify the barriers to adopting faecal occult blood test (FOBT) and colonoscopy as colorectal cancer (CRC) screening methods among the eligible target population of Singapore. **Materials and methods:** This study was previously part of a randomised controlled trial reported elsewhere. Data was collected from Singapore residents aged 50 and above, via a household sample survey. The study recruited subjects who were aware of CRC screening methods, and interviewed them about the barriers to screening that they faced. Collected results on barriers to each screening method were analysed separately. **Results:** Out of the 343 subjects, 85 (24.8%) recruited knew about FOBT and/or colonoscopy. Most of the respondents (48.9%) cited not having symptoms as the reason for not using the FOBT. This is followed by inconvenience (31.1%), not having any family history of colon cancer (28.9%), lack of time (28.9%) and lack of reminders/recommendation (28.9%). Of the respondents who indicated not choosing colonoscopy as a screening method, more than one-half (54.8%) identified not having any symptoms as the main barrier for them, followed by not having any family history (38.7%) and having a healthy/low-risk lifestyle (29.0%). There was no difference between the reported barriers to each of the screening methods and the respondents' dwelling types. **Conclusions:** Lack of knowledge, particularly the misconceptions of not having symptoms and being healthy, were identified as the main barriers to FOBT and colonoscopy as screening methods. Interventions to increase the uptake of CRC screening in this population should be tailored to address this misconception.

Keywords

blood, occult, (fobt), colonoscopy, cancer, colorectal, screening:, test, barriers, singapore, faecal

Disciplines

Education | Social and Behavioral Sciences

Publication Details

Yong, S., Ong, W., Koh, G., Yeo, R. & Ha, T. C. (2016). Colorectal cancer screening: Barriers to the faecal occult blood test (FOBT) and colonoscopy in Singapore. *Proceedings of Singapore Healthcare*, 25 (4), 207-214.

Colorectal cancer screening: Barriers to the faecal occult blood test (FOBT) and colonoscopy in Singapore

Proceedings of Singapore Healthcare
 2016, Vol. 25(4) 207–214
 © The Author(s) 2016
 Reprints and permissions:
sagepub.co.uk/journalsPermissions.nav
 DOI: 10.1177/2010105816643554
psh.sagepub.com


Sook Kwin Yong¹, Whee Sze Ong¹, Gerald Choon-Huat Koh²,
 Richard Ming Chert Yeo³ and Tam Cam Ha⁴

Abstract

Introduction: This study aims to identify the barriers to adopting faecal occult blood test (FOBT) and colonoscopy as colorectal cancer (CRC) screening methods among the eligible target population of Singapore.

Materials and methods: This study was previously part of a randomised controlled trial reported elsewhere. Data was collected from Singapore residents aged 50 and above, via a household sample survey. The study recruited subjects who were aware of CRC screening methods, and interviewed them about the barriers to screening that they faced. Collected results on barriers to each screening method were analysed separately.

Results: Out of the 343 subjects, 85 (24.8%) recruited knew about FOBT and/or colonoscopy. Most of the respondents (48.9%) cited not having symptoms as the reason for not using the FOBT. This is followed by inconvenience (31.1%), not having any family history of colon cancer (28.9%), lack of time (28.9%) and lack of reminders/recommendation (28.9%). Of the respondents who indicated not choosing colonoscopy as a screening method, more than one-half (54.8%) identified not having any symptoms as the main barrier for them, followed by not having any family history (38.7%) and having a healthy/low-risk lifestyle (29.0%). There was no difference between the reported barriers to each of the screening methods and the respondents' dwelling types.

Conclusions: Lack of knowledge, particularly the misconceptions of not having symptoms and being healthy, were identified as the main barriers to FOBT and colonoscopy as screening methods. Interventions to increase the uptake of CRC screening in this population should be tailored to address this misconception.

Keywords

Barriers, colonoscopy, colorectal cancer, faecal occult blood test, preventive medicine, screening, survey, Singapore

Introduction

Colorectal cancer (CRC) is the second leading cause of cancer death.¹ From 2009 to 2013, about 14.6% of the most frequent cancer deaths in Singapore were caused by CRC.¹ Several research studies show that screening for CRC, which results in early detection, can reduce mortality rates from 33% to 15%.^{2,3}

The Clinical Practice Guidelines on Cancer Screening by the Ministry of Health Singapore (2010) recommends that for average-risk individuals, screening for CRC should begin at the age of 50, with the faecal occult blood test (FOBT) being the choice for population-based annual screening, with a colonoscopy performed once every 10 years.^{4,5} Even though Singapore's cancer screening guidelines have been established since 2003,⁴ it was only in early 2011 that the Singapore government launched a nationwide CRC screening programme encouraging Singaporeans to screen for CRC

using FOBT (also known as the faecal immunochemical test, FIT).⁶ The Singapore National Health Survey 2010⁷ also

¹Division of Clinical Trial and Epidemiological Sciences, National Cancer Centre Singapore, National University of Singapore (NUS), Singapore.

²Saw Swee Hock School of Public Health, Yong Loo Lin School of Medicine, NUS, Singapore.

³Department of Radiation Oncology, National Cancer Centre Singapore, NUS, Singapore.

⁴Medical Education, Research and Evaluation Department (MERE); Duke-NUS Graduate Medical School Singapore; Singapore.

Corresponding author:

Sook Kwin Yong, Division of Clinical Trial and Epidemiological Sciences, National Cancer Centre Singapore, National University of Singapore, 11 Hospital Drive, 169610, Singapore.
 Email: graceyongncc@gmail.com



shows this lack of awareness of the importance of CRC screening. Findings showed that only 27.8% of Singaporeans who are 50–69 years old had the FOBT performed at least once, and only 14.2% of Singaporeans of that same age group had undergone screening by colonoscopy or sigmoidoscopy at least once in their lifetime.⁷ These low rates of CRC screening were worrisome, because they showed that Singapore residents were either sceptical or unaware of the importance of screening for the most commonly diagnosed cancer in this country.

There are a limited number of studies that were conducted in Singapore that investigate the barriers to CRC screening among local residents. In particular, there are no local studies that we are aware of, which have been conducted to specifically examine the barriers among eligible Singapore residents who were aware of CRC screening methods. This is a population that should be undergoing regular screening, yet most are not doing so. It is important to determine the reasons for their resistance towards regular screening, because they represent a unique target population that may require a different approach to push them to get screened. Other countries have shown that poor awareness of CRC and its screening programmes, the characteristics of the screening test, a lack of time, a lack of financial support, the fear of pain, embarrassment and bowel preparation were some of the barriers to undergoing CRC screening that were identified.^{2,8–10}

This study aims to identify the barriers of CRC screening modalities (FOBT and colonoscopy) among Singapore residents aged 50 and older who are aware of CRC screening modalities. This study was part of a larger randomised controlled trial (RCT) reported elsewhere¹¹ on the effect of test-kit provision, and individual and family education on the uptake rates of FOBT in Singapore. Our study revealed that when FOBT kits were mailed to residential homes of eligible residents, only 26.0% responded by sending back the completed FOBT.¹¹ Identifying barriers and subsequently implementing targeted efforts to overcome the barriers to CRC screening will guide planning strategies to increase the uptake of screening, and reduce the incidence of CRC.

Materials and methods

Details of the RCT were previously published.¹¹ Briefly, the target population was Singaporeans and permanent residents (PR) aged 50 and older. The study was conducted via a household sample survey, with face-to-face interviews by trained interviewers. The face-to-face interviews were conducted based on a list of addresses assigned to the interviewers. If they failed to meet the potential participants on the first visit, they revisited the household at least twice more, and at a different time and day. A detailed methodology can be found in the previous publication.¹¹ The interviews were conducted in English and Mandarin.

A customised sample of 2100 dwelling units with at least one Singapore resident aged ≥ 50 years old was obtained from the Singapore Department of Statistics. The sample was selected across 27 residential areas in Singapore, using

a 2-stage, proportional-to-size cluster design.¹² Based on the Kish method,¹³ one eligible subject per dwelling unit was selected randomly to participate in the survey. The study was conducted between May 2012 and May 2013. Informed consent was obtained from the subjects. Ethics approval was obtained from the SingHealth Institutional Review Board.

The eligibility criteria for this study were Singaporeans or PR aged ≥ 50 years who:

- Had not undergone FOBT screening in the past 12 months;
- Had not undergone screening colonoscopy in the last 10 years;
- Had no history of any other cancers;
- Had no first-degree family members with history of any cancer;
- Did not have a personal history of surgery or medical treatment for bowel- or colorectal-related disease; and
- Were aware of the methods for CRC screening.

Subjects categorised as those who were aware of CRC screening methods were those who correctly answered the question: 'What methods of colorectal cancer screening are you aware of?' Based on the screening method that subjects identified, they were then asked what acted as barriers to screening, for them. The barriers assessment was conducted before any education package was administered to them, if required (from the previous RCT¹¹). Subjects who returned surveys with missing responses were excluded from the analysis.

The barriers assessment questionnaires were adapted based on a set of known barriers^{14,15} with open-ended questions and refinement based on our study aims. There were three domains of barriers assessed: financial, social and lack of knowledge. The questionnaire (Appendix 1) was pre-tested for face validity during the pilot study. The primary outcome measure in this study was the barriers assessment of FOBT and colonoscopy among the eligible individuals who knew about FOBT or colonoscopy (or both) in Singapore. The study also compared what the different household types identified as barriers to screening, as a proxy measure of socioeconomic status in Singapore.

The study used descriptive statistics to summarise baseline demographics and characteristics of subjects. Households were grouped into two categories:

1. The 4-room Housing and Development Board (HDB) flats; and
2. The 5-room HDB flats, executive HDB flats and private housing such as condominiums, landed properties and private flats.

HDB flats constitute Singapore's public housing solution, built by the Singapore government. With HDB flats, the units with more rooms or larger floor space have a higher market value. The barriers were summarised according to

the screening modality and the two categories of dwelling types. Comparison of various barriers between the two groups of dwelling types was carried out with the Chi-square test or Fisher's exact test, where appropriate. No adjustments for multiple comparisons were made. Statistical analyses were performed using Stata version 12 (Stata Corp, College Station, TX, USA). A 2-sided p -value ($p < 0.05$) was used to define statistical significance. Responses in the open-ended questions were reported as descriptive statements.

Results

There were 343 out of 459 subjects (74.7%) who were eligible, contactable and who completed the study. Of the 343 consenting respondents, 85 (24.8%) were aware of either FOBT or colonoscopy as a CRC screening method. Of these 85 subjects, 19 (22.4%) were aware of FOBT, 38 (44.7%) were aware of colonoscopy and 28 (32.9%) were aware of both FOBT and colonoscopy. The median age was 59 years (age range: 50 to 78 years). There were 48.2% male respondents. The majority of our study population was Chinese (85.9%), had at least a secondary-level education (76.5%) and were married (78.8%); 60.0% resided in 4-room HDB flats or smaller dwellings. The demographic details of these 85 subjects are listed in Table 1.

Barriers assessment of the FOBT

Of the 47 subjects who knew of FOBT, 45 (95.7%) had completed the FOBT barriers assessment (Table 2); 44.5% of the subjects had obtained information about FOBT from television (TV) advertisements. Barriers that were related to social reasons and the lack of knowledge were more commonly reported than barriers related to financial reasons. There were 22 subjects (48.9%) who reported not having symptoms of illness as a top barrier; 31.1% of respondents cited inconvenience (social), 28.9% cited not having a family history of CRC (lack of knowledge), 28.9% cited a lack of time (social) and another 28.9% cited lack of reminders/recommendation (social).

In comparison, < 10% of respondents cited finance/cost as a barrier. For 11 subjects (24.4%) the barriers to screening were not listed in the questionnaire, while seven subjects indicated they 'did not think it (FOBT) was a need' or that it was unnecessary, because their previous test results were negative for CRC. Two subjects found the performance of the test uncomfortable, one cited misgivings about Singapore's existing healthcare system, and one suffered from constipation and would forget to perform the FOBT. In general, the barriers to screening did not differ significantly between the two categories of respondents.

Barriers assessment of colonoscopy

Of the 66 subjects who knew of colonoscopy, 62 (93.9%) completed the barriers assessment for colonoscopy (Table

Table 1. Demographics of subjects who knew about the methods of colorectal cancer screening.

Variable	<i>n</i>	%
Total	85	100
Age (years)		
Median (range)	59 (50–78)	
Gender		
Male	41	48.2
Female	44	51.8
Ethnicity		
Chinese	73	85.9
Malay	5	5.9
Indian	3	3.5
Others	4	4.7
Education level		
No education	2	2.4
Primary	18	21.2
Secondary	42	49.4
Tertiary and higher	23	27.1
Marital status		
Single	3	3.5
Currently married	67	78.8
Widowed	7	8.2
Divorced or separated	8	9.4
Dwelling type		
HDB 1- or 2-room	5	5.9
HDB 3-room	17	20.0
HDB 4-room	29	34.1
HDB 5-room and executive flats	26	30.6
Condominiums and private houses	8	9.4
Method of CRC screening subject was aware		
FOBT	19	22.4
Colonoscopy	38	44.7
FOBT and colonoscopy	28	32.9

CRC: colorectal cancer; FOBT: faecal occult blood test; HDB: Housing and Development Board of Singapore.

3); 28.8% of the subjects obtained information about colonoscopy from a relative or friend, and 24.2% from TV advertisements. Like the cited barriers of FOBT screening, the more commonly reported barriers of colonoscopy were those related to lack of knowledge and social reasons, rather than financial reasons. More than one-half of the respondents (54.8%) cited reasons related to lack of knowledge. There were 38.7% of the respondents who cited not having a family history of cancer or CRC as a barrier, and 29.0% who defined themselves as 'healthy' or who lived 'low-risk' lifestyles, and felt screening was not necessary for them (Table 3).

Under social aspects, 17 subjects (27.4%) indicated colonoscopy was inconvenient, 14 subjects (22.6%) indicated they lacked time to undergo a colonoscopy, while 10 subjects (16.1%) stated that a lack of reminders or recommendations were among the barriers to undergoing colonoscopy as a screening method. Under financial reasons, the cost of colonoscopy was a barrier to nine subjects (14.5%). Out of 62 subjects, 13 (21.0%) also identified other barriers besides those listed in the questionnaire. Of these 13 subjects, 10 perceived themselves as healthy

Table 2. Barriers to undertaking FOBT annually, stratified by dwelling type.

FOBT barriers	Total (%) (n = 45)	Dwelling type		p-value ^a
		HDB ≤ 4-room n (%) (Total of 24 people)	HDB ≥ 5-room n (%) (Total of 21 people)	
Financial				
Cost of test	4 (8.9)	1 (4.2)	3 (14.3)	0.326
Transportation cost	1 (2.2)	0	1 (4.8)	0.467
Cost of further testing/future medical treatment	4 (8.9)	1 (4.2)	3 (14.3)	0.326
Social				
Lack of time	13 (28.9)	6 (25.0)	7 (33.3)	0.538
Inconvenience	14 (31.1)	5 (20.8)	9 (42.9)	0.111
Lack of reminders or recommendation	13 (28.9)	7 (29.2)	6 (28.6)	0.965
Faecal aversion (unhygienic)	3 (6.7)	2 (8.3)	1 (4.8)	1.000
Fatalistic attitude	5 (11.1)	4 (16.7)	1 (4.8)	0.352
Fear of diagnosis	5 (11.1)	4 (16.7)	1 (4.8)	0.352
Lack of knowledge				
No family history	13 (28.9)	5 (20.8)	8 (38.1)	0.202
No symptoms	22 (48.9)	13 (54.2)	9 (42.9)	0.449
Low risk lifestyle, defining themselves as healthy	5 (11.1)	4 (16.7)	1 (4.8)	0.352
Unclear or not sure how to use it	5 (11.1)	1 (4.8)	4 (19.1)	0.169
Doubt the outcome of screening	3 (6.7)	2 (8.3)	1 (4.8)	1.000
Others				
	11 (24.4)	5 (20.8)	6 (28.6)	0.547

^aBased on Chi-square or Fisher's exact test, where appropriate.

FOBT: faecal occult blood test; HDB: Housing and Development Board (of Singapore).

Table 3. Barriers to undertaking colonoscopy once every 10 years, stratified by group of dwelling type.

Colonoscopy barriers	Total (%) (n = 62)	Dwelling types		p-value ^a
		HDB ≤ 4-room n (%) (total of 37 people)	HDB ≥ 5-room n (%) (total of 25 people)	
Financial				
Cost of test	9 (14.5)	4 (10.8)	5 (20.0)	0.465
Transportation cost	3 (4.8)	2 (5.4)	1 (4.0)	1.000
Cost of further testing/future medical treatment	3 (4.8)	1 (2.7)	2 (8.0)	0.560
Social				
Lack of time	14 (22.6)	6 (16.2)	8 (32.0)	0.145
Inconvenience	17 (27.4)	9 (24.3)	8 (32.0)	0.506
Lack of reminders/recommendation	10 (16.1)	6 (16.2)	4 (16.0)	0.982
Fatalistic attitude	4 (6.5)	4 (10.8)	0	0.141
Fear of diagnosis	4 (6.5)	4 (10.8)	0	0.141
Discomfort of test	5 (8.1)	4 (10.8)	1 (4.0)	0.640
Embarrassment during testing	2 (3.2)	1 (2.7)	1 (4.0)	1.000
Fear of test (pain, complications, worry)	6 (9.7)	3 (8.1)	3 (12.0)	0.678
Lack of knowledge				
No family history	24 (38.7)	15 (40.5)	9 (36.0)	0.719
No symptoms	34 (54.8)	23 (62.2)	11 (44.0)	0.159
Low-risk lifestyle, defining themselves as healthy	18 (29.0)	11 (29.7)	7 (28.0)	0.883
Doubt the outcome of screening	4 (6.5)	2 (5.4)	2 (8.0)	1.000
Others				
	13 (21.0)	9 (24.3)	4 (16.0)	0.534

^aBased on Chi-square or Fisher's exact test, where appropriate.

HDB: Housing and Development Board (of Singapore).

individuals and did not foresee themselves being diagnosed with CRC in the future; therefore, they 'did not see a need' to undergo colonoscopy. The remaining three subjects had concerns such as the language barrier, held doubts about

the efficacy of modern medicine in treating CRC, or simply 'did not think of screening for CRC'. None of the barriers cited were significantly different between the two categories of dwelling types.

Discussion

The lack of awareness of CRC screening is the main reason subjects in this study chose not to undergo FOBT screening or a colonoscopy. This is consistent with other limited studies performed in Singapore^{16,17} and overseas,^{8,9} where most of the subjects said they were not likely to go for a colonoscopy or FOBT screening, because they did not have any symptoms. They did not understand the importance of screening for early detection and prevention of CRC, especially when there were no symptoms present. Instead, these study subjects believed that to be diagnosed with CRC, one would need to have obvious symptoms.

Unfortunately, many people with CRC experience no symptoms at all at the early stages.¹⁸ Early detection of CRC does not only lead to better treatment outcomes, but also overall survival rates.¹⁹ In the assessment of barriers to FOBT and colonoscopy, another barrier that was commonly observed was having no family history. If their family or relatives do not have a history of CRC, many tend to think they would not be susceptible to the disease. This misconception is prevalent not only in Singapore, but also in other countries, such as the USA.²⁰

A study in Virginia²⁰ revealed that focus group participants of all social backgrounds stated that an absence of symptoms and not having a family history of CRC were the reasons that they felt they did not need to be screened. In the assessment of barriers to colonoscopy, the misconception about being healthy (i.e. living a 'low-risk' lifestyle) was also one of the main barriers to screening that was observed. Because the definition of being healthy varies from individual to individual, this did not automatically exclude them from being susceptible to CRC. Studies from other countries also found similar results.^{21–25} This further suggested that the institutions responsible for conducting CRC screening programmes should include detailed strategies to dispel these misconceptions. The lack of knowledge about the methods of CRC screening should be addressed explicitly and thoroughly by the government and the healthcare-related sector. Most importantly, the medium of language used to educate the public about CRC should include dialects, because the majority of our target population for screening have limited education.

Besides the lack of knowledge and awareness of the disease, social factors such as the inconvenience of an FOBT screening or a colonoscopy was one of the main barriers stated. Foo et al.¹⁵ found that after educating study participants on both the FOBT and colonoscopy, inconvenience was observed to be less of a concern in going for a FOBT screening. In our study, more subjects stated there was an inconvenience in having to perform the FOBT, rather than for the colonoscopy. If we can effectively communicate the ease and convenience of undertaking the FOBT to the target population, we would likely be able to significantly reduce the inconvenience barrier, as was seen in Foo et al.¹⁵

The other reported social barriers such as the lack of time, lack of reminders and lack of recommendations occurred more frequently in the assessment of FOBT barriers than the colonoscopy barriers. Many studies show that the lack of physician reminders or recommendations was the topmost barriers reported.^{2,9,10,15,20,24,26} In the Asian context, general practitioners (GP) are highly regarded by patients, whom

generally tend to be more compliant and receptive to their medical advice, especially among the older generation of Singaporeans.^{27,28} In that case, the physician's recommendation is important in helping to increase the uptake of CRC screening. In Hong Kong, the Sung et al. study²⁹ found that the role of the physician's recommendation in the uptake of a screening test was significant. The study cited a 23-fold increase in the likelihood of the patient undergoing CRC screening when it was recommended by a family physician. To achieve a considerable rate of CRC screening, the medical community in Singapore would need to be pro-active in recommending FOBT or colonoscopy to their patients who are eligible for screening.

There were several limitations in our study. First, the number of subjects who knew of CRC screening methods was small, because a large proportion of the recruited subjects who were aware of, but unable to describe FOBT and/or colonoscopy were excluded from the interview. In such a context, the barriers that were observed cannot be generalised to the eligible Singaporean population who were aware of CRC screening. Secondly, we did not find a significant difference in the barriers to having their screening tests, when the two subject groups were compared. This is probably because of the small number of respondents for each barrier type, and of each group comprising the dwelling types that we studied.

In conclusion, the lack of knowledge, especially in the areas of the misconception of being healthy and not having symptoms, were identified as the main barriers to CRC screening among the population of Singapore. Future CRC screening programmes that are disseminated to the public should highlight such discrepancies.

Acknowledgements

We thank the Colorectal Cancer Screening Study Team, the pool of interviewers and part-time staff.

Declaration of conflicting interest

The authors declare that there is no conflict of interest. Also, the funding body had no role in the study design, collection, analysis, interpretation of the data, writing of this report or the decision to submit the paper for publication.

Funding

This work was supported by the National Cancer Centre Research Fund.

References

1. Office NROD. Trends in Cancer Incidence in Singapore 2009–2013. Health Promotion Board, 2015.
2. Resa MJ, Steven HW, Tina DC, et al. The relative importance of patient-reported barriers to colorectal cancer screening. *Am J Prev Med* 2010; 38: 499–507.
3. Sidney W, Robert F, Douglas R, et al. Colorectal cancer screening and surveillance: Clinical guidelines and rationale. Update based on new evidence. *Gastroenterol* 2003; 124: 544–560.
4. Cancer Screening. Ministry of Health Singapore, Clinical Practice Guidelines 1/2010, 2010.
5. Lee HP, Chew CT, Consigliere DT, et al. Ministry of health clinical practice guidelines: Cancer screening. *Singapore Med J* 2010; 51: 170–173.

6. Hou CH. Colorectal Screening Programme kicks off: *Sunday Times*, 2011. Available from: <http://www.healthxchange.com.sg/News/Pages/Colorectal-screening-programme-kicks-off.aspx> (2011, accessed 28 May 2015).
7. Epidemiology and Disease Control Division, Ministry of Health (MoH). National Health Survey 2010. MoH 2010.
8. Cai SR, Zhang SZ, Zhu HH, et al. Barriers to colorectal cancer screening: A case-control study. *World J Gastroenterol* 2009; 15: 2531–2536.
9. Hoffman RM, Rhyne RL, Helitzer DL, et al. Barriers to colorectal cancer screening: Physician and general population perspectives, New Mexico, 2006. *Prevent Chronic Dis* 2011; 8: A35.
10. Demyati E. Knowledge, attitude, practice, and perceived barriers of colorectal cancer screening among family physicians in National Guard Health Affairs, Riyadh. *Int J Family Med* 2014; 2014. DOI: 10.1155/2014/457354
11. Ha TC, Yong SK, Yeoh KW, et al. The effect of test kit provision, and individual and family education on the uptake rates of fecal occult blood test in an Asian population: A randomized controlled trial. *Cancer Causes Control* 2014; 25: 1473–1488.
12. Department of Economic and Social Affairs SD. *Designing Household Survey Samples: Practical Guidelines*. New York: United Nations Publications, 2008.
13. Kish L. A procedure for objective respondent selection within the household. *J Am Statist Assoc* 1949; 44: 380–387.
14. Wee LE and Koh GCH. The effect of neighborhood, socioeconomic status and a community-based program on multi-disease health screening in an Asian population: A controlled intervention study. *Prev Med* 2011; 53: 64–69.
15. Foo AS, Thia JJ, Ng ZP, et al. Colorectal cancer screening: The effectiveness of education on its barriers and acceptability. *Asia Pac J Public Health* 2012; 24: 595–609.
16. Wong NY, Nenny S, Guy RJ, et al. Adults in a high-risk area are unaware of the importance of colorectal cancer: A telephone and mail survey. *Dis Colon Rectum* 2002; 45: 946–950.
17. Ng ES, Tan CH, Teo DC, et al. Knowledge and perceptions regarding colorectal cancer screening among Chinese: A community-based survey in Singapore. *Prev Med* 2007; 45: 332–335.
18. Staff Mayo Clinic. Colon Cancer: Symptoms. Mayo Foundation for Medical Education and Research; 2013. Available from: <http://www.mayoclinic.org/diseases-conditions/colon-cancer/basics/symptoms/con-20031877>. (Accessed 22 May 2015)
19. O'Connell JB, Maggard MA and Ko CY. Colon cancer survival rates with the New American Joint Committee on Cancer, Sixth Edition staging. *J Nat Cancer Inst* 2004; 96: 1420–1425.
20. Jones RM, Devers KJ, Kuzel AJ, et al. Patient-reported barriers to colorectal cancer screening: A mixed-methods analysis. *Am J Prev Med* 2010; 38: 508–516.
21. Bidouei F, Abdolhosseini S, Jafarzadeh N, et al. Knowledge and perception toward colorectal cancer screening in East of Iran. *Int J Health Policy Manag* 2014; 3: 11–15.
22. Saengow U, Chongsuwiatwong V, Geater A, et al. Preferences and acceptance of colorectal cancer screening in Thailand. *Asia Pac J Cancer Prevent* 2015; 16: 2269–2276.
23. Gimeno-Garcia AZ, Quintero E, Nicolas-Perez D, et al. Public awareness of colorectal cancer and screening in a Spanish population. *Public Health* 2011; 125: 609–615.
24. Madlensky L, Esplen M and Goel V. Reasons given by relatives of colorectal cancer patients for not undergoing screening. *Prev Med* 2004; 39: 643–648.
25. Wong R, Wong M, Chan Y, et al. Gender differences in predictors of colorectal cancer screening uptake: A national cross-sectional study based on the health belief model. *BMC Public Health* 2013; 13: 677.
26. Janda M, Stanton WR, Hughes K, et al. Knowledge, attitude and intentions related to colorectal cancer screening using faecal occult blood tests in a rural Australian population. *Asia Pac J Public Health* 2003; 15: 50–56.
27. Cheen MHH, Kong MC, Zhang RF, et al. Adherence to osteoporosis medications amongst Singaporean patients. *Osteoporos Int* 2012; 23: 1053–1060.
28. Loong TW. Primary non-compliance in a Singapore polyclinic. *Singapore Med J* 1999; 40: 691–693.
29. Sung JJ, Choi SY, Chan FK, et al. Obstacles to colorectal cancer screening in Chinese: A study based on the health belief model. *Am J Gastroenterol* 2008; 103: 974–981.

Appendix I

Subject's Name: _____ Today's Date: ___/___/___ (dd/mm/yy)
 Interviewer's Name: _____ Time of Interview: ___:___ am/pm

BARRIER ASSESSMENT

Form A (FOBT)- Administer to subjects with some understanding of FOBT

What are the reasons that prevent you from undergoing fecal occult blood testing (FOBT)?

	Barriers	Before Education
a.	Financial:	<input type="checkbox"/>
	- Cost of test	<input type="checkbox"/>
	- Transportation costs	<input type="checkbox"/>
	- Cost of further testing and/or medical treatment	<input type="checkbox"/>
b.	Social:	<input type="checkbox"/>
	- Lack of time	<input type="checkbox"/>
	- Inconvenience (travel, collection and return of kit, referrals, laziness)	<input type="checkbox"/>
	- Lack of reminders/recommendation	<input type="checkbox"/>
	- Faecal aversion (messy, unhygienic)	<input type="checkbox"/>
	- Fatalistic attitude	<input type="checkbox"/>
	- Fear of diagnosis	<input type="checkbox"/>
c.	Lack of knowledge:	<input type="checkbox"/>
	- Not at risk because:	<input type="checkbox"/>
	- No family history	<input type="checkbox"/>
	- No symptoms	<input type="checkbox"/>
	- Low risk lifestyle	<input type="checkbox"/>
	- Not sure how to use it /instructions are unclear	<input type="checkbox"/>
	- Doubts effectiveness of screening	<input type="checkbox"/>
d.	Other, please specify	<input type="checkbox"/>

Comments: _____

Colorectal cancer Screening Barriers Assessment Questionnaire for Faecal Occult Blood Test (FOBT).

Appendix 2

Subject's Name: _____ Today's Date: __/__/__(dd/mm/yy)
 Interviewer's Name: _____ Time of Interview: __:__:__ am/pm

BARRIER ASSESSMENT

Form B (Colonoscopy)- Administer to subjects with some understanding of Colonoscopy

What are the reasons that prevent you from undergoing colonoscopy to screen for CRC?

	Barriers	Before Education
a.	Financial:	<input type="checkbox"/>
	- Cost of test	<input type="checkbox"/>
	- Transportation costs	<input type="checkbox"/>
	- Cost of further testing and/or medical treatment	<input type="checkbox"/>
b.	Social:	<input type="checkbox"/>
	- Lack of time	<input type="checkbox"/>
	- Inconvenience (travel, collection and return of kit, referrals, laziness)	<input type="checkbox"/>
	- Lack of reminders/recommendation	<input type="checkbox"/>
	- Fatalistic attitude	<input type="checkbox"/>
	- Fear of diagnosis	<input type="checkbox"/>
	- Discomfort of test	<input type="checkbox"/>
	- Embarrassment during testing	<input type="checkbox"/>
	- Fear of test (pain, complications, etc)	<input type="checkbox"/>
c.	Lack of knowledge:	<input type="checkbox"/>
	- Not at risk because:	<input type="checkbox"/>
	- No family history	<input type="checkbox"/>
	- No symptoms	<input type="checkbox"/>
	- Low risk lifestyle	<input type="checkbox"/>
	- Doubts effectiveness of screening	<input type="checkbox"/>
d.	Other, please specify	<input type="checkbox"/>

Comments: _____

Colorectal cancer (CRC) Screening Barriers Assessment Questionnaire for colonoscopy.