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Barriers to colorectal cancer screening: A case-control study

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Abstract

AIM: To investigate barriers to colorectal cancer (CRC) screening in a community population.

METHODS: We conducted a community-based case-control study in an urban Chinese population by questionnaire. Cases were selected from those completing both a fecal occult blood test (FOBT) case and colonoscopy in a CRC screening program in 2004. Control groups were matched by gender, age group and community. Control 1 included those having a positive FOBT but refusing a colonoscopy. Control 2 included those who refused both an FOBT and colonoscopy.

RESULTS: The impact of occupation on willingness to attend a colorectal screening program differed by gender. *P* for heterogeneity was 0.009 for case *vs* control group 1, 0.01 for case versus control group 2, and 0.80 for control group 1 *vs* 2. Poor awareness of CRC and its screening program, characteristics of screening tests, and lack of time affected the screening rate. Financial support, fear of pain and bowel preparation were barriers to a colonoscopy as a screening test. Eighty-two percent of control group 1 and 87.1% of control group 2 were willing attend if the colonoscopy was free, but only 56.3% and 53.1%, respectively, if it was self-paid. Multivariate odds ratios for case *vs* control group 1 were 0.10 among those unwilling to attend a free colonoscopy and 0.50 among those unwilling to attend a self-paid colonoscopy.

CONCLUSION: Raising the public awareness of CRC and its screening, integrating CRC screening into the health care system, and using a painless colonoscopy would increase its screening rate.

Key words: Colorectal cancer screening; Barrier; Community-based case-control study; Colonoscopy; Fecal occult blood test

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INTRODUCTION

Colorectal cancer is the second to fifth cause of cancer death in urban populations among different cities in China. The incidence and mortality of colorectal cancer is increasing rapidly in developing countries[1,2]. Recently, strong evidence from several randomized intervention studies indicated that colorectal cancer screening is effective in reducing its mortality[3-7]. However, the reported compliance of colorectal cancer screening in the general population varies widely and is generally low. The reported participation rate for fecal occult blood tests (FOBT) ranges from 12% to 95% in community-based programs and from 12% to 27% for a flexible sigmoidoscopy[8-14].

In 2004, we carried out a free community-based colorectal cancer screening program in Hangzhou city in China, where the target population (38 337

people) was 40-74 years old. 14269 people accepted an immunochemical FOBT for colorectal cancer screening (participation rate was 37.2%) and of the 509 people who were positive, only 94 people accepted a free colonoscopy, a participation rate of 18.5% (94/509). Thus, 415 people refused the free colonoscopy[15]. Though poor knowledge about colorectal cancer, social factors and the test provider might have influenced compliance of colorectal cancer screening[16-21], it is not clear why people are unwilling to attend the colorectal cancer screening program in China. To better understand why people are unwilling to attend the colorectal cancer screening program in China, we conducted this study to explore the barriers to conducting a colorectal cancer screening.

MATERIALS AND METHODS

Study design and population

We conducted a population-based case-control study of barriers to colorectal cancer screening in Hangzhou city in China. Cases were selected from those who underwent both an FOBT and a colonoscopy in a previous colorectal cancer screening program, resulting in a total of 94 subjects. All permanent residents in the Changqing and Chaoming communities in the Xiachen district of Hangzhou city, aged from 40 to 74 years old, were invited to attend a free colorectal cancer screening program in 2004[15]. A two-step screening method was applied in this screening program. Immunochemical FOBT and a questionnaire of high-risk factors were used in the first step. If the FOBT was positive or the questionnaire reported high-risk factors [including other cancer or polypi history; or a family history of colorectal cancer among the first relatives; or at least two of the following histories: chronic coprostasis, chronic diarrhea, mucous bloody feces, stressful life events (such as divorce and deaths among the first relatives); and chronic appendicitis] then a colonoscopy without any auxiliary medicine was suggested as the second step. Only 11 subjects at the first step were identified as high-risk population by the questionnaire, so they were excluded from this study. Every qualified subject from the first step or the second step of screening was invited three times (orally, by letter, and by telephone invitation). If subjects refused all three invitations, we defined them as refusers that could be included as a control.

Two sets of control groups were designed to match the case group by gender, age group, and community location. Age groups were recorded into groups with an initial age of 40 years old by intervals of 5 years. Control group 1 included those had a positive FOBT test but refused a colonoscopy. Control group 2 included those who refused both an FOBT test and colonoscopy. We were able to accurately select cases and controls from the defined communities because there is a complete registration of all permanent residents in every district in Hangzhou city.

All subjects were asked to complete a questionnaire by interview in-person by fixed interviewers who were well-trained in advance. All data were recorded, numerically transformed into computer files at least three times, and their reliability confirmed for analysis. Data collection was performed in 2006-2007.

Table 1 Characteristics of subjects between case and control groups[1]

Characteristic	Case	Control 1	Control 2	*P*-value
Age (mean ± SD, yr)	53.3 ± 9.0	54.3 ± 8.3	52.7 ± 9.7	0.23
Gender				
Male	47	70	98	
Female	39	94	115	0.19
Marital status				
Ever	83	163	208	
Never	3	1	5	0.25
Occupation				
Worker	19	65	69	
Official/administrator	3	3	9	
Technician/professional	7	8	6	
Businessman	8	11	11	
Other	49	77	18	0.08
Education				
College & above	12	18	23	
High school	17	29	34	
Middle school	45	94	132	
Elementary school or none	12	23	24	0.65
Personal income[2]				
≤ ¥10000	53	92	134	
¥10001-20000	21	45	51	
> ¥20000	9	16	21	0.53

[1]Definition: case, those completing both a fecal occult blood test (FOBT) and colonoscopy; control 1, those having a positive FOBT but refusing a colonoscopy, and control 2, those who refused both an FOBT and colonoscopy in a CRC screening program in 2004. [2]Estimated by yearly household income in Chinese Dollar (Yuan) divided by total number of family members.

Statistical analysis

The STATA 8.0 program was used for data analysis. One-way ANOVA was used to compare means between case and control groups. Chi-square (χ^2) was used for frequency data. If data were not suitable for χ^2 analyses, a Mann-Whitney *U* test was used to compare the ratio between two groups and a Kruskal-Wallis test was used in multiple groups' ratio comparison. Pearson *P* values were estimated for basic characteristics and logistic regression (because we did not match exactly in 1:2 or 1:3, we did not use conditional logistic regression) was used to estimate the odds ratios and 95% confidence intervals for each variable. A likelihood ratio test was used to test heterogeneity..

RESULTS

In the case group, 86 subjects (8 subjects refused participation) were finally included in our analysis. In the control groups, 164 and 213 subjects were included in control 1 and 2, respectively. Overall, there were no significant differences in age, gender, education level, household income, and occupation between the case and control groups based on Pearson *P* values (Table 1). However, cases had a higher percentage of white-collar employees than control groups, including official/

Table 2 Differences by gender in association of occupation and willingness to attend a colorectal screening program

	OR1 (95% CI)[1]			OR2 (95% CI)[1]			OR3 (95% CI)[1]		
	Together[2]	Male	Female	Together[2]	Male	Female	Together[2]	Male	Female
Occupation									
Worker	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Official/administrator	3.42	4.13	-	1.21	3.40	0.50	2.83	1.22	-
	(0.64-18.36)	(0.55-31.26)		(0.30-4.92)	(0.49-23.65)	(0.05-4.67)	(0.73-10.90)	(0.25-5.87)	
Technician/professional	2.99	15.5	0.81	4.24	6.80	5.00	0.71	2.28	0.16
	(0.96-9.32)	(2.34-102.85)	(0.15-4.51)	(1.27-14.11)	(1.44-32.20)	(0.42-59.66)	(0.23-2.15)	(0.41-12.61)	(0.02-1.42)
Businessman	2.49	12.4	0.61	2.64	8.16	0.83	0.94	1.52	0.73
	(0.88-7.07)	(2.32-66.35)	(0.11-3.22)	(0.93-7.49)	(1.80-37.06)	(0.15-4.64)	(0.38-2.32)	(0.34-6.89)	(0.23-2.32)
Other	2.18	5.8	1.06	1.51	3.94	0.74	1.44	1.47	1.44
	(1.17-4.06)	(1.99-16.94)	(0.47-2.38)	(0.82-2.77)	(1.39-11.21)	(0.33-1.63)	(0.93-2.25)	(0.76-2.85)	(0.79-2.62)
Gender									
Male	1.00			1.00			1.00		
Female	0.62			0.71			0.87		
	(0.37-1.04)			(0.43-1.17)			(0.58-1.32)		
P for heterogeneity	0.009			0.01			0.80		

[1]OR1: Odds ratio for case *versus* control 1; OR2: Odds ratio for case *versus* control 2; OR3: Odds ratio for comparison between two control groups; 95% CI means 95% confidence interval. [2]OR's in all means only occupation and gender factors were single in the models, or called a single OR.

administration, technician/professional, businessman, and other occupations. Where the difference between case and controls groups differed by gender, white-collar males tended to be more willing to participate in the colorectal cancer screening program than blue-collar men, but females were not (Table 2).

More people in the case group than in the two control groups thought that: 1: colorectal cancer is a common cancer [The adjusted odds ratio for the answer of "I don't know colorectal cancer is a common cancer" was 0.22 (95% CI: 0.09-0.56) for case versus control 1 and 0.24 (0.10-0.54) for case versus control 2 compared to the reference group of answering "certainly know"]; 2: screening will help improve the consciousness of health; 3: screening can find an early stage of colorectal cancer; and 4: it is necessary to conduct the colorectal cancer screening in the community (Table 3). However, there was no difference in their knowledge of the existence of this screening program between cases and controls. A Kruskal-Wallis test was used to analyze one-direction data. Based on the results from the Kruskal-Wallis test, people in the case group had more knowledge of colorectal cancer and its screening, and were defined as "good". Control group 1 was defined as "fair" and control group 2 as "poor". Overall, there was no significant difference in knowledge of colorectal cancer and its screening between the two control groups.

There were no significant differences in the inclination to attend colorectal cancer screening between the case and control groups if using self-paid FOBT as a screening test (Table 4). However, if using colonoscopy as a screening test, the percentage willing to participate in the screening program was higher among cases than controls under the same payment method. The rate of willingness to attend a colonoscopy was higher if the colonoscopy was free than if it was self-paid. The rate was 82.0% among control group 1 and 87.1% among control group 2 if the colonoscopy was free, whereas it declined to 56.3% and 53.1%, respectively, if the colonoscopy was self-paid.

Finally, we investigated why people refused a colonoscopy. There were no significant differences in reasons for refusing a colonoscopy between two control groups with Mann-Whitney *U* test ($Z = 2.51$, $P = 0.11$), so we combined the two control groups together. Approximately 46.4% of people who declined to participate in the screening program reported that they lacked time. Approximately 20.8% of people were unwilling or unable to pay for a colonoscopy and future therapy. Fear of bowel preparation (5.0%) and pain (11.1%) were also major reasons. Only 7.5% of people reported that the screening test is included in their routine health examination and 4.6% refused a colonoscopy because they thought it was of no significance. Approximately 4.3% of people reported no interest.

DISCUSSION

Our study investigated the barriers to conducting a colorectal cancer screening program in an urban population, aged between 40 and 74 years, in China. We found that white-collar men tended to be more willing to participate in the screening program than blue-collar men. Poor awareness of colorectal cancer and its screening program, the characteristics of the screening tests, lack of time, and financial issues were important factors that affected the attendance rate of colorectal cancer screening programs. Education and household income did not affect the screening rate in this senior urban population.

Our results are reliable and generally applicable because this is a community-based case-control study with two sets of control groups and high quality assurance and control, which nested in a free population-based colorectal cancer screening program conducted in the same area. The participation rate, 91.5%, was high. All subjects completed a questionnaire when interviewed in person by well-trained interviewers. All data were recoded, numerically transformed into computer files at least three

Table 3 Status of knowledge about colorectal cancer and its screening between case and control groups

Item[1]	Case	Control 1	Control 2	OR1 (95% CI)[2]		OR2 (95% CI)[2]		OR3 (95% CI)[2]	
				Single	Multiple	Single	Multiple	Single	Multiple
Question 1									
Yes, certain	57	84	68	1.0	1.0	1.0	1.0	1.0	1.0
Heard of it	14	30	77	0.69 (0.34-1.41)	0.50 (0.21-1.17)	0.22 (0.11-0.42)	0.15 (0.07-0.33)	3.17 (1.87-5.38)	2.90 (1.62-5.21)
I don't know	15	50	68	0.44 (0.23-0.86)	0.22 (0.09-0.56)	0.45 (0.24-0.84)	0.24 (0.10-0.54)	1.68 (1.03-2.73)	1.49 (0.80-2.80)
Question 2									
Yes, a lot	65	88	78	1.0	1.0	1.0	1.0	1.0	1.0
Yes, some	20	71	131	0.38 (0.21-0.68)	0.25 (0.12-0.54)	0.18 (0.10-0.32)	0.13 (0.06-0.27)	2.06 (1.35-3.13)	2.06 (1.21-3.50)
No	0	5	3	-	-	-	-	0.67 (0.15-2.89)	0.52 (0.11-2.56)
Question 3									
Yes, certain	41	55	54	1.0	1.0	1.0	1.0	1.0	1.0
Yes, possible	45	94	151	0.64 (0.37-1.10)	0.71 (0.36-1.39)	0.40 (0.24-0.67)	0.38 (0.20-0.72)	1.61 (1.02-2.53)	1.77 (1.04-3.02)
No, impossible	0	15	7	-	-	-	-	0.47 (0.18-1.23)	0.43 (0.14-1.38)
Question 4									
Yes	79	138	153	1.0	1.0	1.0	1.0	1.0	1.0
No	0	7	6	-	-	-	-	2.50 (1.41-4.43)	2.11 (1.12-3.99)
Don't care	7	19	53	0.64 (0.26-1.60)	0.58 (0.20-1.70)	0.26 (0.11-0.59)	0.25 (0.10-0.62)	0.77 (0.25-2.34)	0.68 (0.21-2.23)
Question 5									
Community	81	160	197	1.0	1.0	1.0	1.0	1.0	1.0
News media	4	3	9	2.65 (0.58-12.13)	2.52 (0.44-14.49)	1.07 (0.32-3.56)	1.22 (0.32-4.60)	2.48 (0.66-9.33)	2.79 (0.67-11.58)
Both	1	1	5	1.99 (0.12-32.19)	2.43 (0.08-75.03)	0.40 (0.05-3.38)	0.40 (0.03-4.54)	4.97 (0.59-41.70)	4.11 (0.47-36.29)

[1]Question 1: Do you think colorectal cancer is a common cancer? Question 2: Do you think this screening will help you improve your awareness of health? Question 3: Do you think this screening can find an early stage of colorectal cancer? Question 4: Do you think it is necessary to conduct the colorectal cancer screening in your community? Question 5: How do you know this screening program? Community means community screening center; [2]All single OR's means without adjustment for any other factors in the model, and all multiple OR's means with adjustment for the following factors including age (0 = < 45, 1 = 45-49, 2 = 50-54, 3 = 55-59, 4 = 60-64, 5 = 65-69, and 6 = ⩾ 70), gender (0 = male and 1 = female), occupation (0 = worker, 1 = official/administrator, 2 = technician/professional, 3 = businessman, and 4 = others), interaction term between gender and occupation, and annual personal income (0 = < ¥10 000, 1 = ¥10,000-< 20 000, and 2 = ⩾ ¥20 000); all variables were treated as dummy variables in the logistic regression model.

Table 4 Attendance inclination of colorectal cancer screening with different payment methods between case and control groups

Inclination to attend	Case	Control 1	Control 2	OR1 (95% CI)		OR2 (95% CI)		OR3 (95% CI)	
				Single	Multiple	Single	Multiple	Single	Multiple
If FOBT self-paid									
Yes	45	84	99	1.0	1.0	1.0	1.0	1.0	1.0
No	37	73	107	0.95 (0.55-1.62)	0.98 (0.53-1.79)	0.76 (0.46-1.27)	0.66 (0.37-1.19)	1.24 (0.82-1.89)	1.37 (0.86-2.19)
Refused[1]	4	7	7						
If free colonoscopy									
Yes	81	132	162	1.0	1.0	1.0	1.0	1.0	1.0
No	2	29	24	0.11 (0.03-0.48)	0.10 (0.02-0.45)	0.17 (0.04-0.72)	0.14 (0.03-0.65)	0.67 (0.37-1.21)	0.70 (0.36-1.35)
Refused[1]	3	3	27						
If colonoscopy self-paid									
Yes	57	85	93	1.0	1.0	1.0	1.0	1.0	1.0
No	23	66	82	0.52 (0.29-0.93)	0.50 (0.26-0.97)	0.46 (0.26-0.81)	0.43 (0.23-0.80)	1.14 (0.73-1.76)	1.12 (0.68-1.83)
Refused[1]	6	13	38						

[1]Refers to those who refused to answer this question; results in this row not concluded in statistical analysis.

times, and their reliability was confirmed for analysis. Data analyses were performed blindly by two analysts. However, the sample size is limited by the low colorectal cancer screening rate in the general population.

Five randomized intervention studies demonstrated that screening could reduce colorectal cancer mortality[3-7]. However, screening rates in the general population are low. In the USA, only 32% of adults over age 50 years has had a FOBT in the past two years and only 34% say they have ever had either a sigmoidoscopy or colonoscopy for some reason[22]. In our pilot study, the screening rate at the primary stage reached 50% and at secondary stage (colonoscopy) it was nearly 20%. Overall, completion in all tests used in colorectal cancer screening are not satisfactory[23]. Why people refuse colorectal cancer screening is of great importance to improving the efficacy of colorectal cancer screening.

In our study, we found that education and household income did not affect the screening rate. Some social characteristics such as low education are risk factors in ovarian cancer and breast cancer screening[24,25]. Occupation tended to be a risk factor that affected the screening rate more for men than for women. White-collar men might have higher awareness of colorectal cancer and its screening and less of a financial issue than blue-collar men. Our results indicated that poor

knowledge of colorectal cancer screening was a major barrier to improving the screening rate, which is supported by reports that poor knowledge of colorectal cancer screening is a prognostic factor of screening rates in Chinese communities in Singapore[16,17]. Public education about colorectal cancer, risk factors, and potential benefits from colorectal cancer screening should be performed. Access to screening programs was similar in the three groups. The screening program center played a major role in screening invitations.

In this community-based study, the attendance rate of colorectal cancer screening was affected by multiple factors including characteristics of the screening test, financial issues, fear of pain and bowel preparation, lack of time, and poor awareness of risk factors, screening guidelines and screening importance. If an FOBT was used as a screening test, the screening rates were similar between case and control groups whether this screening was free or not. Attendance rate declined if a colonoscopy was used as a screening test. The attendance rate declined more if the colonoscopy was self-paid. FOBT is a cheap, painless, and convenient test. The screening rate would increase in China if a painless colonoscopy were used in screening programs. Integration of colorectal cancer screening into primary care practice or the Medicare system could also facilitate colorectal cancer screening, which is suggested in both our study and other studies[18,19].

In the two step colorectal cancer screening program, neither the first nor the second step is indispensable. A FOBT is more adaptable than a colonoscopy and a flexible sigmoidoscopy in colorectal cancer screening[20], mainly because any endoscopies need bowel preparation and have some degree of discomfort. The attendance rate for colonoscopies is relatively low compared to that of FOBTs in China. The attendance rate of colonoscopies is high in the USA[23]. This might be due to the recent U.S. national Medicare coverage and wide application of a painless colonoscopy in USA.

In summary, by improving public health education of cancer, integrating colorectal cancer screening into the Medicare and or primary care systems, and applying anesthesia in colonoscopies, there would be an increase in the colorectal cancer screening rate, leading to a possible decrease in the mortality rate of colorectal cancer in the long-term.

COMMENTS

Background

Recently, strong evidence from several randomized intervention studies indicated that colorectal cancer screening is effective in reducing its mortality. However, the reported compliance of colorectal cancer screening in the general population, including China, varies widely and is generally low. It is not clear why people are unwilling to attend the colorectal cancer screening program in China.

Innovations and breakthroughs

The impact of occupation on willingness to attend a colorectal screening program differs by gender. Poor awareness of colorectal cancer (CRC) and its screening program, characteristics of screening tests, and lack of time were important factors affecting the screening rate in the community. Financial support and fear of pain and bowel preparation were important barriers to a colonoscopy as a screening test. Raising public awareness of CRC and its screening, integrating CRC screening into health care system, and applying a painless colonoscopy would increase the screening rate.

Terminology

Fecal occult blood is a term for blood present in the faeces that is not visibly apparent. In medicine, a fecal occult blood (FOBT) test is a check for hidden (occult) blood in the stool. FOBT testing can provide clues as to subtle blood loss in the gastrointestinal tract, anywhere from the mouth to the colon. Positive tests warrant further investigation for peptic ulcers or a malignancy (such as colorectal cancer or gastric cancer).

Peer review

This is an important paper looking at barriers to CRC screening. It is interesting to note that financial considerations in China seem to be much more important than in the US. This might be due to the fact that many Chinese patients have to pay for screening procedures out of their pockets. The results imply that improving health education and expanding the coverage of Medicare and primary care systems could increase the colorectal cancer screening rate, and could decrease the mortality of colorectal cancer in the long-term.

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