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Observational Study

Willingness to pay for colorectal cancer screening in Guangzhou

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Abstract**AIM**

To measure the willingness to pay for colorectal cancer screening in Guangzhou, and to identify those factors associated with it.

METHODS

A face-to-face questionnaire survey for pre-screening population from free and non-free colonoscopy districts was used to collect information on demographic characteristics, health behaviours, the intention of the cancer screenings and willingness to pay for colorectal cancer screening. A total of 1243 participants who took part in the pre-screening for colorectal cancer in Guangzhou were collected in the study. Categorical data were compared using the χ^2 test to analyse significant differences. Non-

conditional logistic regression and multi-class logistic regression were also performed for multivariate analysis and to estimate the odds ratios.

RESULTS

The percentage of participants willing to pay for colorectal cancer screening was 91.7%. "Unnecessary" was the dominant reason that participants gave for their unwillingness, accounting for 63.1%. Of those who were willing to pay, 29.2%, 20.7%, 14.8%, 13.0% and 22.4% of participants were willing to pay less than ¥100, ¥100-¥199, ¥200-299, ¥300-¥399 and more than ¥400, respectively. Non-logistic regression analysis showed that respondents who were male, had a high level of education, were from the family with more children/older to raise, and accepted colorectal cancer screening were willing to pay for this screening. Multi-class logistic regression analysis showed that respondents with higher annual household income per capita, from government and private enterprises, government agency/institution and peasants, and less family medical expenditure were willing to pay more.

CONCLUSION

Willingness to pay for colorectal cancer screening in Guangzhou is high, but the amount of willing to pay is not much.

Key words: Colorectal cancer; Screening; Willingness to pay; Guangzhou; Factor

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Core tip: The uptake of colorectal cancer screening is very important for the screening effect. For a mass screening program, however, it is not possible to offer the screenings free of charge. This study was conducted to measure the willingness to pay for colorectal cancer screening in Guangzhou and to identify those factors associated with it. There were 1243 participants collected in the study. The percentage of participants willing to pay for colorectal cancer screening was high, but the amount of willing to pay was not much, and less than the cost of colonoscopy.

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INTRODUCTION

Colorectal cancer (CRC) is the third most commonly diagnosed cancer in males and the second in females worldwide^[1]. In urban China, the incidence of CRC ranks the third highest of all cancers, and the mortality ranks fourth^[2]. Both the crude incidence and the age-standard-

dized rate increased during the period of 2003-2007 in urban areas of China^[3,4]. The incidence and mortality were 36.46/10⁵ and 16.11/10⁵ in Guangzhou in 2013, respectively, ranking second and third of all the sites^[5].

Colorectal cancer screening could improve the early diagnosis rate and decrease the mortality of colorectal cancer^[6]. Faecal occult-blood test (FOBT) and colonoscopy are the most common screening methods in China and worldwide^[7-9]. In China, there are few cities such as Shanghai and Tianjin where population-based screening for colorectal cancer has been carried out^[10,11]. Guangzhou has carried out screening for colorectal cancer in the community since 2015^[12]. However, the compliance with colonoscopy was only 17.63% in 2015^[13]. And the uptake of colonoscopy using it in areas with free colonoscopy was higher than that in areas that charged for colonoscopy (20.27% vs 10.70%)^[13].

The uptake of colonoscopy is very important for the screening effect^[14]. For a mass screening program, however, it is not possible to offer the screenings free of charge. Accordingly, the study of a participant's willingness to pay for colorectal cancer screening is very important. Few studies about willingness to pay exist in China. This study was designed to measure willingness to pay for colorectal cancer screening in Guangzhou and to identify those factors associated with willingness to pay.

MATERIALS AND METHODS

Data source

A face-to-face questionnaire survey for pre-screening population from free and non-free colonoscopy districts was used to collect information on demographic characteristics, health behaviours, the intention of the cancer screenings and willingness to pay for colorectal cancer screening. A total of 1243 participants who took part in the pre-screening for colorectal cancer in Guangzhou were collected in the study. The analysis included 1240 respondents. The willingness to pay for colorectal cancer screening and the factors associated with it were evaluated. In this study, colorectal cancer screening consisted of questionnaire risk assessment and FOBT, followed by colonoscopy for the positive participants.

Written informed consent to participate in the study was obtained from all participants. In addition, the individuals mentioned in this manuscript provided their written informed consent to publish their case details. The ethics committee of the Guangzhou Center of Disease Control and Prevention approved this study proposal.

Statistical analysis

Categorical data were compared using the χ^2 test to analyse significant differences. Non-conditional logistic regression and multi-class logistic regression were performed for multivariate analysis and to estimate the odds ratios (ORs). The software including Epidata 3.1 and SPSS statistics 21 (IBM SPSS software) was used for data inputting, checking and statistical analyses. A

Table 1 Demographic characteristics of participants in the pre-screening for colorectal cancer in Guangzhou

Variable	Number of participants (n = 1240)	%	Variable	Number of participants (n = 1240)	%
Gender			Marital status		
Male	430	34.7	Married	1133	91.9
Female	810	65.3	Single/divorced/widowed	100	8.1
Age (yr)			The number to be raised in family		
< 65	679	54.8	0	478	38.9
≥ 65	561	45.2	1-2	564	45.9
Education (yr)			≥ 3	188	15.3
≤ 6	312	25.2	Annual income per capita (RMB: Yuan)		
7-12	748	60.5	≤ 30000	624	50.8
> 12	177	14.3	> 30000	604	49.2
Occupation			Annual household income per capita (RMB: Yuan)		
Government and private enterprises	412	33.4	≤ 30000	688	56.9
Government agency/institution	137	11.1	>30000	521	43.1
Peasant	198	16.1	Family medical expenditure (RMB: Yuan)		
Unemployed	208	16.9	≤ 5000	728	59.4
Other	278	22.5	> 5000	498	40.6
Health care status			Acceptance of colorectal cancer screening		
The urban residents' medical insurance	388	32.3	Yes	1184	95.6
Medical insurance for public health care/urban employees	732	60.9	No	55	4.4
Other	81	6.7			

Table 2 Willingness to pay for colorectal cancer screening of participants in Guangzhou

Variable	Number of participants (n = 1240)	%
Would you like to pay for colorectal cancer screening?		
Yes	1137	91.7
No	103	8.3
Reason for "No"		
The cost is unbearable	12	11.7
Unnecessary	65	63.1
No time	7	6.8
Examination is painful	33	32
Others	7	6.8
If you want, how much would you like to pay for it? (RMB: Yuan)		
< 100	331	29.2
100-199	235	20.7
200-299	168	14.8
300-399	147	13
≥ 400	254	22.4

two-sided *P*-value < 0.05 was determined as statistically significant.

RESULTS

Characteristics of the 1240 participants are presented in Table 1. The median age of participants was 64 years (inter-quartile range: 59-68 years). A total of 34.7% and 25.2% of the participants were male and had less than 6 years of education, respectively. Additionally, 16.9% and 93.2% of the participants were from government/private enterprises and had medical insurance. In sum, 91.9% of the participants were married. A total of 38.9% of participants had no children/older to raise. The medians of the annual income per capita, annual household income per capita and family medical expenditure were

30000 (inter-quartile range: 15000-45000), 27500 (inter-quartile range: 15000-40000) and 5000 (inter-quartile range: 2000-10000), respectively. The acceptance for colorectal cancer screening was 95.6%.

The portion of participants willing to pay for colorectal cancer screening was 91.7% (Table 2). "Unnecessary" was the dominant reason given for unwillingness, accounting for 63.1%. The next was "Examination is painful", accounting for 32.0%. In addition, 29.2%, 20.7%, 14.8%, 13.0% and 22.4% of participants were willing to pay less than ¥100, ¥100-¥199, ¥200-¥299, ¥300-¥399 and more than ¥400, respectively.

Univariate analysis showed that respondents who were male, had a high level of education, were from a government agency/institution, were married, had more children/older in the household, and accepted colorectal cancer screening were more willing to pay for colorectal cancer screening (Table 3). Univariate analysis also showed that respondents who were male, had a high level of education, were from a government agency/institution, had medical insurance for public health care/urban employees, had more annual income per capita, and had more annual household income per capita were willing to pay more for colorectal cancer screening (Table 4).

Non-logistic regression analysis showed that female respondents, respondents with other professions compared with unemployed, and those who were reluctant to accept colorectal cancer screening were unwilling to pay for colorectal cancer screening. Those with a high level of education and from the family with more raised persons were willing to pay for colorectal cancer screening (Table 5).

Multi-class logistic regression analysis showed that respondents with less annual household income per ca-

Table 3 Factors influencing willingness to pay for colorectal cancer screening of participants in Guangzhou

Variable	Willing to pay <i>n</i> (%)	Not willing to pay <i>n</i> (%)	χ^2	<i>P</i> value
Gender			4.41	0.036
Male	404 (94.0)	26 (6.0)		
Female	733 (90.5)	77 (9.5)		
Age (yr)			1.25	0.264
< 65	628 (92.5)	51 (7.5)		
≥ 65	509 (90.7)	52 (9.3)		
Education (yr)			11.53	0.003
≤ 6	272 (87.5)	39 (12.5)		
7-12	690 (92.6)	55 (7.4)		
> 12	169 (95.5)	8 (4.5)		
Occupation			26.56	< 0.001
Government and private enterprises	386 (93.7)	26 (6.3)		
Government agency/institution	134 (97.8)	3 (2.2)		
Peasant	181 (91.4)	17 (8.6)		
Unemployed	194 (93.3)	14 (6.7)		
Other	236 (84.9)	42 (15.1)		
Marital status			4.71	0.03
Married	1045 (92.2)	88 (7.8)		
Single/divorced/widowed	86 (86.0)	14 (14.0)		
Health care status			2.93	0.231
Urban residents' medical insurance	363(93.6)	25 (6.4)		
Medical insurance for public health care/urban employees	665 (90.8)	67 (9.2)		
Other	76 (93.8)	5 (6.2)		
The number to be raised in family			12.63	0.002
0	422 (88.3)	56 (11.7)		
1-2	527 (93.4)	37 (6.6)		
≥ 3	179 (95.2)	9 (4.8)		
Annual income per capita (RMB: Yuan)			2.12	0.146
≤ 30000	570 (91.3)	54 (8.7)		
> 30000	565 (93.5)	39 (6.5)		
Annual household income per capita (RMB: Yuan)			0.30	0.587
≤ 30000	632 (91.9)	56 (8.1)		
> 30000	483 (92.7)	38 (7.3)		
Family medical expenditure (RMB: Yuan)			3.49	0.062
≤ 5000	663 (91.1)	65 (8.9)		
> 5000	468 (94.0)	30 (6.0)		
Acceptance of colorectal cancer screening			63.33	< 0.001
Yes	1102 (93.1)	82 (6.9)		
No	34 (61.8)	21 (38.2)		

pita were willing to pay less than ¥200 rather than more than ¥400, and the participants from government and private enterprises, government agencies/institutions and peasants were willing to pay more than ¥400 rather than ¥200 compared with unemployed. It also showed that respondents with less annual household income per capita, less annual income per capita, and other professions were willing to pay ¥200-¥399 rather than more than ¥400, and the participants with less family medical expenditure were willing to pay more than ¥400 rather than ¥200-399 (Table 6).

DISCUSSION

Colorectal cancer screening is a significantly effective method of decreasing the mortality from colorectal cancer^[6]. Currently, many countries around the world have carried out population-based colorectal cancer screening programs^[15-17]. However, the rate of participating in the screening was relatively low, which significantly influences the effect of screening^[18-19]. It is very im-

portant for population-based colorectal cancer screening to improve compliance. However, it is unrealistic for a mass population to be screened free of charge, and willingness to pay for colorectal cancer screening was quite an important influencing factor of compliance. Our study regarding willingness to pay was necessary in this context.

Our study determined that the percentage of people willing to pay for colorectal cancer screening was 91.7%. It was higher than Shi's study reporting 85.5% in urban China^[20], Kwak's 76% in women in Korea^[21], Mohd Suan's 37.5% in Malaysia^[22], and Ho's 30% in Boston^[23]. And it was similar to Harewood's study in Ireland^[24]. It appeared that willingness to pay for colorectal cancer screening in Guangzhou was relatively high. But only 35.4% of participants would be willing to pay more than ¥300, and only 22.4% of participants would pay more than ¥400. However, the cost of a hospital colonoscopy is typically over ¥350. And the cost of screening includes the cost of colonoscopy, questionnaire survey, and FOBT. Therefore, the amount that respondents were willing to

Table 4 Factors influencing fees to pay for colorectal cancer screening of participants in Guangzhou

Variable	< 200 Yuan <i>n</i> (%)	200-399 Yuan <i>n</i> (%)	≥ 400 Yuan <i>n</i> (%)	χ^2	<i>P</i> value
Gender				7.74	0.005
Male	177 (43.8)	127 (31.4)	100 (24.8)		
Female	389 (53.2)	188 (25.7)	154 (21.1)		
Age (yr)				2.41	0.121
< 65	327 (52.2)	165 (26.3)	135 (21.5)		
≥ 65	239 (47.0)	150 (29.5)	119 (23.4)		
Education (yr)				20.53	< 0.001
≤ 6	150 (55.1)	74 (27.2)	48 (17.6)		
7-12	350 (50.9)	190 (27.6)	148 (21.5)		
> 12	61 (36.1)	51 (30.2)	57 (33.7)		
Occupation				38.85	< 0.001
Government and private enterprises	163 (42.2)	108 (28.0)	115 (29.8)		
Government agency/institution	54 (40.3)	37 (27.6)	43 (32.1)		
Peasant	104 (57.8)	39 (21.7)	37 (20.6)		
Unemployed	121 (62.4)	46 (23.7)	27 (13.9)		
Other	119 (50.6)	85 (36.2)	31 (13.2)		
Marital status				0.25	0.618
Married	518 (49.7)	287 (27.5)	238 (22.8)		
Single/divorced/widowed	43 (50.0)	28 (32.6)	15 (17.4)		
Health care status				21.57	< 0.001
Urban residents' medical insurance	217 (59.9)	83 (22.9)	62 (17.1)		
Medical insurance for public health care/urban employees	298 (44.9)	195 (29.4)	171 (25.8)		
Other	34 (44.7)	26 (34.2)	16 (21.1)		
The number to be raised in family				3.21	0.201
0	200 (47.5)	116 (27.6)	105 (24.9)		
1-2	260 (49.4)	150 (28.5)	116 (22.1)		
≥ 3	97 (54.2)	49 (27.4)	33 (18.4)		
Annual income per capita (RMB: Yuan)				39.46	< 0.001
≤ 30000	328 (57.6)	156 (27.4)	85 (14.9)		
> 30000	236 (41.8)	159 (28.2)	169 (30.0)		
Annual household income per capita (RMB: Yuan)				86.03	< 0.001
≤ 30000	385 (61.0)	160 (25.4)	86 (13.6)		
> 30000	172 (35.7)	147 (30.5)	163 (33.8)		
Family medical expenditure (RMB: Yuan)				0.13	0.722
≤ 5000	333 (50.2)	173 (26.1)	157 (23.7)		
> 5000	231 (49.6)	140 (30.0)	95 (20.4)		
Acceptance of colorectal cancer screening				2.37	0.124
Yes	545 (49.5)	304 (27.6)	251 (22.8)		
No	20 (58.8)	11 (32.4)	3 (8.0)		

Table 5 Non-logistic regression analysis of unwillingness to pay for colorectal cancer screening of participants in Guangzhou

Variable	B	SE	Wals	<i>P</i> -value	OR (95%CI)
Gender					
Male					1.00
Female	0.60	0.28	4.49	0.034	1.82 (1.05-3.15)
Education (yr)					
≤ 6					1.00
7-12	-0.82	0.29	7.92	0.005	0.44 (0.25-0.78)
> 12	-0.91	0.49	3.45	0.063	0.40 (0.16-1.05)
Occupation					
Unemployed					1.00
Government and private enterprises	0.52	0.41	1.59	0.208	1.67 (0.75-3.74)
Government agency/institution	-0.96	0.81	1.38	0.240	0.38 (0.08-1.90)
Peasant	-0.15	0.46	0.10	0.750	0.86 (0.35-2.13)
Other	1.33	0.39	11.42	0.001	3.78 (1.75-8.18)
The number to be raised in family					
0					1.00
1-2	-0.69	0.26	7.00	0.008	0.50 (0.30-0.84)
≥ 3	-0.88	0.39	5.04	0.025	0.41 (0.19-0.89)
Acceptance of colorectal cancer screening					
Yes					1.00
No	2.02	0.36	31.85	< 0.001	7.52 (3.73-15.16)

Table 6 Multi-class logistic regression analysis of payment fees for colorectal cancer screening of participants in Guangzhou

Variable	B	SE	Wals	P-value	OR (95%CI)
< 200 (RMB: Yuan)					
Occupation					
Unemployed					1.00
Government and private enterprises	-0.87	0.29	8.85	0.003	0.42 (0.24, 0.74)
Government agency/institution	-0.81	0.36	5.23	0.022	0.44 (0.22, 0.89)
Peasant	-1.15	0.34	11.59	0.001	0.32 (0.16, 0.61)
Other	-0.17	0.33	0.27	0.607	0.84 (0.44, 1.61)
Annual household income per capita (RMB: Yuan)					
> 30000					1.00
≤ 30000	1.18	0.20	33.31	0.000	3.25 (2.18, 4.85)
200-399 (RMB: Yuan)					
Family medical expenditure (RMB: Yuan)					
> 5000					1.00
≤ 5000	-0.40	0.19	4.65	0.031	0.67 (0.47, 0.96)
Occupation					
Unemployed					1.00
Government and private enterprises	-0.15	0.33	0.21	0.647	0.86 (0.45, 1.64)
Government agency/institution	-0.19	0.39	0.24	0.622	0.82 (0.38, 1.78)
Peasant	-0.63	0.39	2.65	0.103	0.53 (0.25, 1.14)
Other	0.74	0.36	4.20	0.040	2.11 (1.03, 4.29)
Annual household income per capita (RMB: Yuan)					
> 30000					1.00
≤ 30000	0.47	0.22	4.47	0.035	1.60 (1.04, 2.48)
Annual income per capita (RMB: Yuan)					
> 30000					1.00
≤ 30000	0.56	0.23	5.73	0.017	1.75 (1.11, 2.76)

pay was lower than the actual cost of screening.

This study showed that respondents of male gender and those with a high level of education were more willing to pay for colorectal cancer screening and would pay more than female respondents and those with a low level of education. In addition, the participants from government agencies/institutions and those with higher income and less family medical expenditure were willing to pay more for colorectal cancer screening. Generally, males were willing to spend more than females. In addition, the awareness of health was much better among people with more education and those who were working in a government agency/institution. Furthermore, the status of household income and expenditure significantly affected commodity purchasing power. These findings were similar to Frew's study in which those with higher income and of male gender were more willing to pay for screening^[25] and Kwak's study in which as the status of education and income were higher, the average amount that women were willing to pay became much more, but old age was associated with a lower willingness to pay^[21]. However, Moreno showed that there was no statistically significant difference in the responses of males and females, or in the responses of individuals of different races or different ages regarding test features^[26]. Respondents who accepted the screening were more willing to pay for colorectal cancer screening. The acceptance was a prerequisite for the willingness to pay.

In general, willingness to pay for colorectal cancer screening in Guangzhou was high, but the amount that participants were willing to pay was low. To move forward with the population-based screening, it is necessary to

strengthen publicity, increase awareness of screening and contemplation of participation. On the other hand, it was suggested that the government should raise the budget for the colorectal cancer screening program, subsidise the participants and bring the colorectal cancer screening into the outpatient medical insurance system, thereby increasing the intake rate of screening.

The present study has some limitations. First, the respondents were from the population taking part in colorectal cancer primary screening. The representation of the sample was not very good. Second, the amount that participants were willing to pay was semi-quantitative. It may influence the quantitative assessment and needs to improve in future research.

ARTICLE HIGHLIGHTS

Research background

Colorectal cancer was the third most commonly diagnosed cancer in males and the second in females worldwide. And colorectal cancer screening could improve the early diagnosis rate and decrease the mortality of colorectal cancer. However, the compliance of screening was lower than 20%. And the uptake of colonoscopy in areas with free colonoscopy was higher than that in charged colonoscopy area. For mass screening program, it was not possible to be free of charge. Accordingly, the study of willingness to pay for colorectal cancer screening was very important.

Research motivation

Because previous studies of willingness to pay for colorectal cancer are few in China, the study of willingness to pay for colorectal cancer screening is very important for further health economics evaluation. The main topics of our study were to measure willingness to pay for colorectal cancer screening in Guangzhou, and to identify those factors associated.

Research objectives

The objective of our study was to figure out the willingness to pay for colorectal cancer screening, and to analyze those factors associated. This is very important for improving the uptake of colorectal cancer and developing screening strategies for the government

Research methods

A total of 1243 participants who took part in the prescreening of colorectal cancer in Guangzhou were collected in the study. A face-to-face questionnaire survey for pre-screening population from free and non-free colonoscopy districts was used to collect information on demographic characteristics, health behaviours, the intention of the cancer screenings and willingness to pay for colorectal cancer screening. A total of 1240 respondents were included in the analysis. The willingness to pay for colorectal cancer screening and the factors associated with it were evaluated.

Research results

The portion of willingness to pay for colorectal cancer screening in Guangzhou was 91.7%. "Unnecessary" was the dominant reason of unwillingness, accounting for 63.1%. There were 29.2%, 20.7%, 14.8%, 13.0% and 22.4% of participants who were willing to pay less than ¥100, ¥100-¥199, ¥200-¥299, ¥300-¥399 and more than ¥400, respectively. Non-logistic regression analysis showed that respondents of male, with a high level of education, from the family with more raised persons, and accepting colorectal cancer screening were willing to pay for colorectal cancer screening. Multi-class logistic regression analysis showed that respondents with higher annual household income per capita, from government and private enterprises, government agency/institution and peasants, and with less family medical expenditure were willing to pay more.

Research conclusions

The study has concluded that willingness to pay for colorectal cancer screening in Guangzhou was high, but the amount of willing to pay was low, and less than the cost of colonoscopy. In order to move forward the population-base screening, it was necessary to strengthen publicity, increase awareness of screening, raise the budget of screening program for government and bring the colorectal cancer screening into outpatient medical insurance system.

Research perspectives

In this study, the respondents were from the population taking part in colorectal cancer primary screening. The representative of the sample was not very good, and the amount of willing to pay was semi-quantitative. It may influence the quantitative assessment. These need to be improved in the later research, measure the quantitative value of willingness to pay for Chinese, and improve parameters for health economics evaluation of colorectal cancer screening.

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