RESEARCH COMMUNICATION

Differences in Behavioral Outcomes Between First-Year and Second-Year Participants in a Community-based Colorectal Cancer Education Intervention

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Abstract

Introduction: Colorectal cancer (CRC) is the third most prevalent cancer in China, and the fifth most lethal among all cancers. Community-based health education is helpful for health planners to promote cancer screening, yet relatively few studies tapped the temporal pattern of intervention effectiveness in a multiyear CRC education program. Using data from a two-year CRC community education, this study was aimed at exploring whether the health education intervention effectiveness differs between first-year and the second-year participants. Method: A two-year health education intervention was carried out in four communities in Shanghai, China. The health education focused on raising awareness about CRC, the principles of fecal occult blood test (FOBT) screening, and instruction about use of the FOBT kit. Local community health service centers conducted the lectures once a month. All adult residents were invited to attend these lectures. At the end of the first year and the second year, structured in-person interviews were conducted for the residents who attended the lectures. There were 205 enrollees who completed the first-year interviews and 836 enrollees who completed the second-year interviews. Logistic regression was used to compare the attitudinal and behavioral outcomes of enrollees in years 1 and 2. Result: Of the 1041 respondents, 24.5% had received FOBT during the program period, while 12% had received colonoscopy check, both substantially higher than the background screening rate in Shanghai. Respondents in year 2 were less willing to take FOBT than those in year 1 (O.R.=0.618, p<0.01), but there was no significant difference in terms of willingness to take colonoscopy after adjustment for covariates in logistic regression. Multiple logistic regression also showed that respondents in year 2 were significantly less likely to take FOBT than those in year 1 (O.R. = 0.263, p<0.01) and a similar tendency was noted for colonoscopy (O.R.=0.600, p=0.074). Conclusion: The CRC screening rate after the health education compared favorably with the background screening rate, yet the decline in screening rate in year 2 indicates that further study is needed to understand the determinants of intervention effectiveness.

Keywords: Health education - colorectal cancer - screening - China

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Introduction

Colorectal cancer (CRC) is the one of the most commonly diagnosed cancers and the second or third highest cause of cancer mortality in some developed countries (Department of Health and Human Services, USA, 2007; Hewitson et al., 2008). In China, according to China Cancer Center, the incidence of CRC was 29.62 per one hundred thousand in 2007, the third most prevalent cancers, and the death rate was 14.15 per one hundred thousand, rated the fifth leading killer among all cancers (China Ministry of Health, 2008). With the dietary pattern becomes high-fat and low-fibre, the incidence and mortality of this disease in China has increased considerably in the past few years (Liu and Kong, 2008). Especially in south-east area of China, the incidence of CRC has increased sharply, getting close to that of lung cancer (Zheng and Cai, 2003).

A population-based screening program for colorectal cancer has been introduced as a cost-effective program to increasing detection of early-stage CRC (Edwards et al., 2010). Now, the common screening programs for CRC are fecal occult-blood testing (FOBT) and colonoscopy. Some studies showed that annual fecal occult-blood testing significantly reduced the incidence and mortality of CRC (Mandel et al., 1993; Mandel et al., 2007; Segnan et al., 2007). Despite these recommendations, CRC screening is still significantly underused. In USA, only 50% -60% of age-eligible adults obtained CRC screening within recommended time frames (Shapiro et al., 2008; Centers for Disease Control and Prevention, 2008). In Spain, the screening rate was only 17.2% to 22.3% (Peris et al., 2007). In China, there have been no statistics showing the screening rate in average-risk population (Liu and

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Table 1 . Demographic Characteristics of 4 Districts (2009)

Demographic characteristics	District A	District B	District C	District D
Geography				
Location	South-east	South-west	North-west	North-east
Size (Square kilometer)	54.76	371.68	604.67	29.18
Total amount of population	110.40	180.47	118.99	76.03
Numbers of community health service center	13	12	14	9
Economy (RMB)				
GDP of district (billions)	83.27	123.64	75.70	35.06
Annual growth rate of GDP (%)	10.10	10.30	6.30	11.00
Share of Shanghai GDP (%)	5.53	8.22	5.03	2.33
GDP per capital (10 thousand)	7.54	6.85	6.36	4.61
Health				
Mortality of top 10 cancers (per 10^5)	225.62	186.48	216.96	191.35
Male (per 10^5)	270.69	227.76	281.96	238.84
Female (per 10^5)	181.04	152.35	196.34	152.45

Source: author's analysis of 2010 district health statistics

Cao 2009).

Community-based health education is helpful for health planners to promote cancer screening (Breslow et al., 2008; Baron et al., 2008). Some of these community education programs target the client (Morrow, 2009; Ma et al., 2009; Lewis et al., 2010), some focus on the provider (Tu et al., 2006; Khankari et al., 2007; Price-Haywood, 2009), and some are aimed at both (Nguyen et al., 2010). The common model of health education is personal education by phone instruction (Walsh et al., 2010; Simon et al., 2010), mailed educational materials (leaflet, letter and video) (Hart et al., 1997; Hewitson et al., 2011), online information (Jerant et al., 2007; Menon et al., 2008), etc.

In China, health education in communities is generally organized by local community health service centers, and supervised by Center of Disease Control (CDC) of local districts. Health education is usually carried out as a collective education model composed of lectures, posters, seminars, etc., where providers show the relative information directly to residents in a public place (like community centers and classrooms). The aim is to improve residents' knowledge of CRC, influence their attitude toward CRC screening, and then increase the screening rate (Wang et al., 2009; Wang and Feng., 2009). Several studies have already demonstrated the effectiveness and applicability of such special health education model (Fang et al., 2010; Li et al., 2011).

Under metropolitan settings where population density is high, many such community CRC education interventions take more than one year to implement a communitywide health promotion, and thus it is important to understand the temporal pattern in intervention outcomes. For example, is the intervention outcome of early enrollees better than that of late enrollees due to the fatigue effect among health care professionals, or are late enrollees more likely to benefit from the intervention because health educators polish their teaching skills over the time? A good understanding of the temporal pattern in intervention effectiveness could help us improve and strategize future interventions, e.g., assigning those most at-risk enrollees to time slots when the intervention effectiveness is the best.

Using a two-year intervention outcome data from a CRC community education, this study is aimed at examining the period effect on intervention effectiveness, i.e. whether the effectiveness of CRC education differs between people who received the intervention in the first year and those who received the intervention in the second year. To the best of our knowledge, this is the first empirical exploration of the period effect in a multi-year community intervention of CRC screening.

Materials and Methods

Design and setting

The project, on which this paper is based, took place in Shanghai (autonomous city). Shanghai locates in East China and its GDP per capita ranks the first among all provinces in China ($11,452 dollars in 2009) (China Ministry of Health, 2010). CRC in Shanghai is the second most prevalent cancers, with 54.28 per one hundred thousand in 2007 (much higher than China average level), and the annual increasing rate is more than 5% (Gong et al., 2011).

This project was from May 2008 through May 2010. Based upon geographic location and economic development level, 4 districts in Shanghai were selected as research sites, with demographic characteristics shown in Table 1. From each of these 4 districts, one community (one that has the best performance of routine health education according to the administrative report in the local district) was selected as the intervention site.

Education Intervention

This education intervention focuses on the risks, risk factors, prevention and early detection of CRC. Local community health service centers conducted monthly lectures in their local community recreation centers. The instructors were health workers from district CDC and public hospitals, who walked door to door to invite local residents to attend the lectures. After the lectures, those health workers gave enrollees information leaflets and free FBOT kits and encourage them to screen for CRC. Totally, there was 8981 person-times attending these lectures.

Survey

In May 2009 (one year after the project began) and May

2010 (two years after the project beginning), structured face-to-face interviews were conducted for the residents who attended the lectures, to assess the effectiveness of this health education intervention. Based on cluster random sample, we respectively recruited 240 enrollees in the 2009 interview (60 residents from each district), and 1000 enrollees in the 2010 interview (250 residents from each district). Using the same questionnaire, the health workers from the district's CDC conducted these two interviews.

The questionnaire was designed based on the principle of KAP (Knowledge, Attitude and Practices) study (Kaliyaperumal, 2004), to explore outcomes in the knowledge, attitude and practice of the residents on CRC screening. Besides, the satisfaction of residents on this intervention program was evaluated also. The contents of questionnaire were as follows (see Table 2): 1) Knowledge: knowledge of the symptoms of CRC during the early stage; 2) Attitude: perception of the importance of screening, willingness to receive FOBT per year, willingness to receive colonoscopy per 5 years, and willingness to pay for a CRC checkup out of the respondent's own pocket; 3) Practice: receiving the FOBT or not, receiving the colonoscopy check or not; 4) Satisfaction: the degree of satisfaction on the content, frequency, instructor, material, environment of the education intervention, and so on (very good, good, fair, not so good, bad, and the score from 4 to 0 respectively).

Data Analysis

Questionnaire data were entered and coded with Epidata 3.0 software, and analyzed by using SPSS 13 software. The data were analyzed using simple and multiple regression techniques. T-tests and the Pearson's Chi-square tests were used to compare the characteristics of Year 1 enrollees and Year 2 enrollees. In addition, five logistic regressions were performed to examine the independent effect of timing of intervention (received intervention in Year 1 vs. received intervention in Year 2, being in the second year=1) on intervention outcomes. The dependent variables (y) for these five logistic regressions were: 1) Willingness to receive the CRC screening by FOBT; 2) Willingness to receive the colonoscopy check; 3) Willingness to pay for a CRC checkup out of the respondent's own pocket; 4) Whether received CRC screening by FOBT; 5) Whether received the screening by colonoscopy.

In our logistic regression models, we adjusted for variables that could be associated with CRC screening behavior, including gender, age (continual variable), education level, marital status (not married=0), knowledge of CRC symptoms ("don't know"=0), perceived importance of screening ("not important"=0), times of attending lectures (continual variable), satisfaction (continual variable), and the district of residence.

Research Ethics review

Informed consent of each respondent was obtained. Respondents were provided with adequate information so that they could make an informed and voluntary decision as to whether or not to participate in the study. The interviewers were responsible for explaining to the respondents the study's purpose, procedures, and potential risks and benefits.

Table 2. Descriptive Statistics of Respondents (%)

Characteristic	Total Sample (N=1041)	1-year period (N=205)	2-year period (N=836)	P value
Gender				0.006**
Female	61.6	53.2	63.8	
Male	38.2	46.8	36.2	
Age				0.000***
<50	39.5	14.7	45.7	
50 - 59	18.3	15.7	19.1	
60 - 69	25.6	38.7	22.5	
>=70	16.2	30.9	12.7	
Marital Status				0.000***
Single	15.4	3.4	18.4	
Married	84.1	96.6	81.6	
Education				0.000***
Less than high school	38.4	55.4	34.5	
High school graduate	27.7	36.3	25.8	
College graduate and beyond	33.3	8.3	39.7	
Knowing the symptoms of CRC				0.402
No	32.2	35.0	31.9	
Yes	66.8	65.0	68.1	
Perceiving the importance of screening				0.081
No	4.2	2.0	4.8	
Yes	95.6	98.0	95.2	
Willingness to receive FOBT				0.000***
No	48.1	30.5	53.0	
Yes	50.9	69.5	47.0	
Willingness to receive colonoscopy				0.037*
No	57.8	52.7	60.9	
Yes	39.7	47.3	39.1	
Willingness to pay for checkup out of pocket				0.428
No	42.0	45.3	42.0	
Yes	56.5	54.7	58.0	
Receiving the FOBT				0.000***
No	75.0	44.1	83.1	
Yes	24.5	55.9	16.9	
Receiving the colonoscopy check				0.000***
No	87.4	79.9	89.9	
Yes	12.0	20.1	10.1	
Times of lectures attended (mean)	2.82	3.25	2.71	0.001**
Degree of satisfaction (mean)[1]				
Satisfaction of administration	2.99	2.95	2.99	0.353
Satisfaction of content	3.01	2.93	3.02	0.077
Satisfaction of instructor	3.08	3.02	3.10	0.075

*p<0.05; **p<0.01; ***p<0.001; [1]the full value of satisfaction is 4

Results

Respondent characteristics

Altogether 1240 residents who entered the health education program were recruited to this survey, 1041 respondents (96.4 percent) completed the survey and then were included in the analysis. In this sample, 19.7% were surveyed at the end of the first year of the education intervention, and 80.3% surveyed at the end of the second year. Almost 62 percent of the respondents were female, while 84 percent of the respondents were married. The

Table 3. Logistic Regressions of Attitudes Toward Colorectal Cancer Screening

Independent Variable	Willingness to receive FOBT		Willingness to receive colonoscopy		Willingness to pay for the checkup out of pocket	
	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value
Intervention Time(cf 1year)	0.618 (0.394, 0.971)	0.037*	0.865 (0.566, 1.322)	0.504	1.726 (1.099, 2.708)	0.018*
Gender (cf female)	0.925 (0.680, 1.258)	0.618	0.947 (0.700, 1.281)	0.723	0.980 (0.721, 1.332)	0.896
Age	0.994 (0.981, 1.008)	0.420	0.998 (0.984, 1.011)	0.722	0.999 (0.985, 1.013)	0.869
Marital Status(cf single)	2.546 (1.584, 4.092)	0.000***	1.643 (1.022, 2.642)	0.040*	2.056 (1.302, 3.246)	0.002**
Education (cf less then high school)						
High school graduate	1.085 (0.704, 1.673)	0.712	1.321 (0.862, 2.026)	0.202	1.409 (0.908, 2.186)	0.126
College graduate and beyond	1.155 (0.756, 1.763)	0.506	1.175 (0.773, 1.785)	0.450	1.421 (0.924, 2.186)	0.109
Knowing CRC symptoms (cf "no")	1.417 (1.025, 1.960)	0.035*	1.070 (0.775, 1.477)	0.680	1.033 (0.744, 1.434)	0.845
Times of lectures attended	1.094 (1.009, 1.186)	0.029*	1.108 (1.027, 1.195)	0.008**	1.136 (1.046, 1.234)	0.003**
Satisfaction of administration	1.007 (0.676, 1.501)	0.972	1.008 (0.680, 1.495)	0.968	1.025 (0.686, 1.529)	0.905
Satisfaction of content	0.912 (0.613, 1.357)	0.649	1.272 (0.859, 1.884)	0.230	1.207 (0.807, 1.805)	0.360
Satisfaction of instructor	1.141 (0.765, 1.703)	0.518	0.781 (0.525, 1.160)	0.221	0.857 (0.572, 1.283)	0.453

*p<0.05; **p<0.01; ***p<0.001; We controlled the "district", "importance" as covariate

Table 4. Logistic Regressions of Colorectal Screening Behavior

Independent Variable	Receiving FOBT		Receiving Colonoscopy check	
	OR (95% CI)	P Value	OR (95% CI)	P Value
Intervention Time (cf 1year)	0.263 (0.160, 0.430)	0.000***	0.600 (0.342, 1.051)	0.074
Gender (cf female)	0.711 (0.474, 1.067)	0.100	1.012 (0.640, 1.600)	0.960
Age	1.034 (1.015, 1.053)	0.000***	1.026 (1.006, 1.047)	0.013*
Marital Status (cf single)	1.568 (0.741, 3.320)	0.240	1.748 (0.727, 4.201)	0.212
Education (cf less then high school)				
High school graduate	0.736 (0.423, 1.282)	0.279	0.975 (0.541, 1.755)	0.932
College graduate and beyond	1.190 (0.690, 2.050)	0.532	0.614 (0.328, 1.151)	0.128
Knowing the symptoms of CRC (cf "no")	1.996 (1.273, 3.130)	0.003**	2.589 (1.476, 4.540)	0.001**
Times of lectures attended	1.052 (0.960, 1.153)	0.280	1.157 (1.042, 1.285)	0.007**
Satisfaction of administration	1.823 (1.091, 3.046)	0.022*	1.120 (0.637, 1.970)	0.694
Satisfaction of content	0.882 (0.530, 1.466)	0.626	1.225 (0.688, 2.178)	0.491
Satisfaction of instructor	1.070 (0.642, 1.783)	0.797	1.092 (0.621, 1.919)	0.761

*p<0.05; **p<0.01; ***p<0.001; We controlled the "district", "importance" as covariate

average age of total sample was 53 year old, and about35 percent of the respondents were 50 years or younger; 48.2% were between ages 50- 69 years; 16.2% were 70 years or older. Thirty-eight percent of the respondents had not attended high school; 28% had completed only a high school education and 33% had completed college or beyond education.Table 2 also compares the detail characteristics of respondents in the two waves. As to the demographic characteristics, 45.7 percent of respondents in the 2-year period survey are younger than 50 years, while the percentage of their counterpart is only 14.7(P=0.000; <0.05). Almost 40% of respondents in the 2-year period survey had completed college or beyond education, and only 8.3% of respondents in the 1-year period survey (P=0.000; <0.05).

Attitudinal and behavioral outcome of respondents

As to the knowledge, 67% of all respondents knew the symptoms of early stage CRC, and the respondents of two groups had the similar awareness (P=0.402). Seventy percent of respondents from Year 1 are willing to receive FOBT, higher than the percentage of Year 2 (47%). Forty-seven percent of respondents in the 1-year period survey are willing to receive colonoscopy check, also higher than 40% of respondents in the 2-year period survey.

As for the screening behavior, of the 1041 respondents, 24.5% had received FOBT during the program period, while 12% had received colonoscopy check. About 56% of respondents from Year 1 had received FOBT, much higher than those in Year 2 (17%). And 20% of respondents in Year 2 had received colonoscopy check, which compares favorably with those in Year 2 (10%).

The satisfaction of education intervention

The first-year participants attended 3.25 lectures on average as compared with the average attendance rate of 2.71 lectures among the second-year participants. As for the respondents' satisfaction on this program, the evaluating score for instructor was 3.08 (full score is 4), slightly higher than the score for administration and content (3 separately), with no significant difference.

Logistic regression of attitudinal and behavioral outcomes in CRC screening

For the willingness to receive the FOBT, the odds ratio for intervention time (being in the second year of intervention) was 0.618 in our logistic regression model (95% CI: 0.394, 0.971), indicating that the odds for those in Year 2 to be willing to receive the FOBT is about half of the odds for those in Year 1. For the willingness to receive the colonoscopy check, the odd ratio of intervention time was 0.865, with no statistical significance (p =0.504). As to the willingness to pay for the checkup out of pocket, the odd ratio of intervention time was 1.726 (95% CI: 1.099,

2.708), including that those in Year 2 to be willing to pay for the checkup out of pocket is close to 2 times higher than those in Year 1. Marital status and times of lectures attended were associated with respondents' willingness to receive CRC screening (ee Table 3)

For the actual behavior of receiving the FOBT, the odds ratio for intervention time was 0.263 in our logistic regression model (95% CI 0.160, 0.430; p<0.001), indicating that the enrollees in Year 1 have almost four times as big odds of having received an FOBT as those in Year 2 (see Table 4). While for the behavioral outcome of the screening by colonoscopy check, the odds ratio of being in Year 2 was 0.600 with only borderline significance (P=0.074).

Discussion

Improving the CRC screening rate in the population is not an easy task, as past studies have shown people's low compliance with CRC screening intervention (Garman et al., 2006; Bujanda et al., 2007; Zheng et al., 2009). The CRC post-intervention screening rate in our study of Shanghai's average-risk population is 24.5% for FOBT and 12% for colonoscopy check in the population who received the health education intervention. According to the findings of our early research at the beginning of 2008, the background CRC screening rate in Shanghai population was 11.8% by FOBT and 5.6% by colonoscopy check (Gong et al., 2011). This means that CRC screening rate had been improved after the health education intervention, which confirms the findings of previous studies in different countries (Myer et al., 1994; Ma et al., 2009; Morrow, 2009).

According to our findings, the timing of health education intervention is a critical factor influencing the CRC screening rate by FOBT. Normally, health education program is one-shot intervention, with 1 year follow-up (Ling et al., 2009; Simon et al., 2010; Walsh et al., 2010). One might expect that the effectiveness of such health education program would increase over time as health educators gain experience and improve their communication, making more behavioral change among people who came to the intervention in Year 2. However, our findings demonstrated the opposite pattern. We suspect that there might have been some fatigue effect among our educators from local CDC and hospitals in Year 2, yet the data available provide no information about how well the educators interacted with the enrollees.

In our study, nearly 40% of respondents in second-year period survey had a college degree or above, whereas only 8.3% among first-year respondents had this level of educational attainment. More educated respondents may have more prior knowledge than less educated respondents, and thus they were less likely to benefit from health education intervention (Homes, 1999). However, our multiple logistic regressions have already incorporated the covariate of educational attainment yet those second-year respondents still appear less likely to adopt the screening behavior.

The attitudes to CRC screening was a significant determinant of screening uptake (Severino et al., 2009). However, the results of our regressions showed that respondents' willingness to receive CRC screening among 2-year group were not more improved than those among 1-year group. This may be another reason to explain the less behavioral change after 2-year health education intervention.

Several studies suggested the importance of knowledge about CRC screening in CRC screening (Miller et al., 2007; Palme et al., 2007; Koo et al., 2010). We got the similar result, that knowing the symptoms of early stage CRC was an important predictor of screening by FOBT (OR = 1.996), and it was also the important predictor of screening by colonoscopy check (OR = 2.589). But after controlling for this factor as well as perceived importance of CRC screening, being in Year 2 still significant predicts less CRC screening, indicating that the screening difference between Year 1 enrollees and Year 2 enrollees cannot be solely explained by knowledge gap and attitude toward screening.

There are several limitations to our dataset. First, we collected the data about the CRC screening behavior during the program without measuring the behavior of the enrollees at the baseline, and we didn't get the 1-year or 2-year follow-up data after this program ended. So we only evaluated the short-term outcome of this intervention program. Second, we didn't design this research as a randomized trial because of the limits in funding. Future studies should include longitudinal measurement and information about control communities, as well as more details about the respondent's exposure to the intervention.

As of now, CRC screening is not yet a national preventive strategy for average risk population because of the economic and technological constraints in China. CRC screening is normally organized only as a pilot program for some small populations in a few areas. The fact that our health education program can contribute to improving the CRC screening rate is an encouraging sign for Chinese health professionals to further pursue health promotion interventions before more insurance coverage becomes available for CRC screening. However, the apparent decline in intervention effectiveness in Year 2 shows that there are still many unknown determinants in the educational process, and therefore further studies are needed to explore how to make the intervention effectiveness sustainable in future promotion efforts.

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