

Research Article

Implementation Cost of A Community-Based Colorectal Cancer Screening Enhancement Program: Against Colorectal Cancer in our Neighborhoods (ACCION)

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Abstract

Background: ACCION is a community based program for educating the under/uninsured Hispanic population to increase colorectal cancer screening in El Paso County, Texas. This paper determines the total, average and component program implementation costs for three alternative intervention strategies and group vs. individual delivery among 5,826 participants.

Methods: High risk participants were directed to a colonoscopy intervention and others were directed to a fecal immunochemical test (FIT) intervention. Participants were randomized to Video, Promotora, or Video + Promotora screening- promotion delivery modes. Implementation costs were prospectively measured by group and individual educational sessions. Costs were then simulated for alternative size target populations.

Results: There was minimal cost difference between the intervention modes. Average cost for the fecal immunochemical test (FIT) individual level intervention and the colonoscopy individual level intervention was about \$76.3 (SD: 8.75) and \$96.2 (SD: 14.55), respectively. The average cost for group level interventions was \$67 (SD: 9.21). The cost per participant was inversely related to the number of individuals in the target population.

Conclusions: ACCION successfully reached, educated, and motivated individuals for colorectal cancer screening in a low income Hispanic community. Average cost of program delivery was not affected by the components of the health education interventions but was reduced by group compared to individual sessions and by the scale of operations; important information for cancer prevention program planners and decision-makers.

Keywords: Colorectal cancer; community based cancer screening programs; implementation costs; cost assessment

Introduction

Colorectal cancer is the second leading cause of cancer death in the U.S. Colorectal cancer is the second-most common cancer diagnosis in Hispanic populations [1], and is the second and third leading cause of cancer related deaths in Hispanic men and women, respectively [2]. El Paso County has a population of 800,647 of which 81% is Hispanic [3]. The County is socioeconomically challenged. For example, 26.6 % of people in El Paso County are suffering from poverty, 36% of them are uninsured, the proportion of those with less than a high school education is almost double the US average (30.2% vs. 15.4%), and they are medically underserved [4]. Incidence and mortality rates for colorectal cancer are higher among Hispanic populations in Texas compared to Hispanics residing in SEER areas (41.1 vs. 38.4 per 100,000 for incidence and 13.6 vs. 13.0 per 100,000 for mortality, age adjusted to the 2000 US Standard population) [5] and are even higher for Hispanics in El Paso County compared to Hispanics in Texas [6]. Studies have reported that unless Hispanics were sick or had medical problems they tended not see a doctor or visit a clinic [7, 8, 9] and other experienced barriers including lack of screening access [10,11], emotional perceived barriers [10,11], low educational status [10,12] and language barriers [12,13].

Prevention is currently being addressed in El Paso County, Texas by a large community level program, Against Colorectal Cancer In Our Neighborhoods (ACCION) that aims to educate and motivate low income uninsured Hispanics to obtain regular screening for colorectal cancer. For those who screen positive, navigation is provided for follow-up diagnostic tests (which are provided at no cost) and cancer treatment (not covered by the program) when required. ACCION has demonstrated success in reaching, educating, and motivating a low income uninsured Hispanic population for cancer prevention [14].

The aim of this paper is to estimate the costs of alternative strategies that ACCION used to deliver the CRC cancer screening health education services in the community. This includes an examination of the components of cost, group vs. individual sessions and the effects of scale on the per person cost to deliver the program. Estimates of the implementation cost will inform program decision-makers for planning and budgeting similar initiatives and provide data necessary for a follow-up cost-effectiveness analysis of the alternative strategies in increasing the screening rate in the target population [15].

Methods

Recruitment and research design

The target population of the ACCION program is uninsured or underinsured 50-75 year old predominantly Hispanic residents of El Paso County that have either never been screened

for colorectal cancer or are not up to date with screening. Eligible participants were randomly assigned to one of three different health education programs delivered by a lay health worker (promotora) either alone or using a video, or the video alone without commentary from the promotora.

Training

Staff training for five promotoras and one navigator was held for 10 days between January 26th and February 3rd, 2012. A standard health education curriculum was delivered in conjunction with the Cancer and Chronic Disease Consortium (CCDC), a community based organization with 20 years of experience in hiring, training and supervising promotoras to conduct health education programs in El Paso County. Comprehensive training manuals covered a general overview of colorectal cancer, risk factors and symptoms of colorectal cancer, screening guidelines such as fecal immunochemical testing (FIT), colonoscopy, and sigmoidoscopy, teaching resources, referral paths, survey instruments, and contact information of all collaborating partners. The training manuals also contained an overview of the Transtheoretical model and the Health Belief model [16, 17] to assist the promotoras and navigator in conveying the appropriately tailored messages. Promotoras watched the educational intervention video and toured the endoscopy department at University Medical Center (UMC) to become familiar with colorectal cancer tests. They also were trained to demonstrate the FIT test to participants, to determine eligible participants, and to administer survey materials.

A bilingual health navigator was trained to assist patients to follow correct diagnostic pathways and referrals. The navigator was trained to track participants regarding the return of FIT kits, scheduling colonoscopy appointments, making reminder phone calls, and to help with finding financial assistance, transportation, childcare and health care coverage.

Recruitment of study participants

We visited each community partner site to investigate the best ways to recruit participants and to deliver a tailored educational intervention. For example, we arranged schedules that fit with day to day operations and available facilities at each partnering site. Health Fairs were held for advertising the ACCION program to communities and to recruit participants. Participants completed a survey to identify their eligibility for the study which included determining their risk for colorectal cancer and their prior screening history. General demographic background information was also elicited. Since the program was targeting a predominantly Hispanic population, all materials were available in both English and Spanish.

Intervention

Trained promotoras delivered individual and group education

sessions using small media, the flip chart and videos. These educational materials were culturally tailored and theory based with the Transtheoretical model and the Health Belief model [16, 17]. Participants received follow-up reminder calls and letters from a health navigator. The ACCION flow chart is presented in Figure 1. Our primary screening test was the Fecal Immunochemical Test (FIT) for average risk individuals and Colonoscopy for high risk individuals. High risk criteria included family history of colorectal cancer or hereditary polyposis/cancer syndromes or personal history of adenomatous polyps or inflammatory bowel disease. Depending on the location, participants were assigned to individual or group sessions by convenience and were then randomly assigned to one of the arms (video, promotora or promotora and video). For the Video arm, participants watched a motivational video with information about colorectal cancer and the importance of screening. The promotora arm involved the use of a flip chart for explaining the same content covered in the video. This method of delivery integrated specified interactive components with the participants. For the Video + Promotora arm, a promotora played the video and had specified pauses for standardized interactive activities.

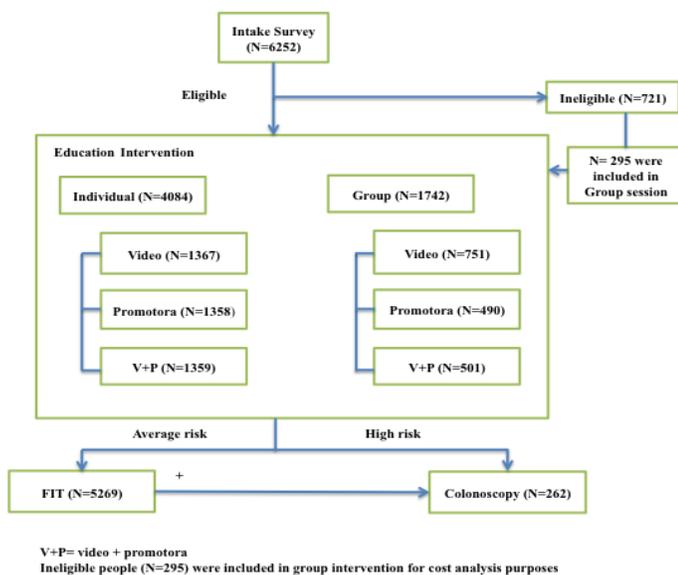


Figure 1. Flow chart of ACCION program.

Cost estimation

Micro costing methods, which involved tracking personnel time and materials, were applied to prospectively estimate implementation costs for the ACCION program. We utilized a societal perspective to estimate implementation costs in 2012 USD for this promotora delivered screening promotion intervention, and to compare costs across test types, intervention type and group or individual session.

Personnel cost

The research personnel, including faculty, research scientists, project coordinators, graduate research assistants, and administrative assistants reported their time spent on the intervention by electronic or paper time logs. These time logs were collected monthly. Annual salaries, fringe benefit rates, adjusted productivity, and actual work time were used to calculate adjusted salary per minute for each staff member for determining personnel time costs [18].

Material cost

Material costs included general material cost, FIT cost, and Colonoscopy cost. General material cost included supplies, mileage, printing, and gift cards. FIT material costs included FIT kit and FIT processing cost. Colonoscopy material costs included the taxi fare for traveling to and from the clinic and GoLYTELY® bowel prep supplies. Participants used different materials depending on whether they were high risk and therefore were assigned to receive colonoscopy or average risk and therefore directed to receive the FIT test. The cost of colonoscopy is not included in the cost of the screening promotion intervention whereas the cost of the FIT kit is included. Inclusion of the FIT kit is an inducement to screen and the cost is incurred whether or not the person follows through. The cost of the colonoscopy is only incurred if the individual follows through with the screening. The outcome measure in our planned cost-effectiveness evaluation is whether or not participants get screened, regardless of the screening modality. Thus, we want to measure and compare the cost of getting them to that point with the alternative screening promotion strategies. We are not comparing the cost-effectiveness of colonoscopy vs. FIT. That comparison would require inclusion of all costs of the screening promotion strategies and the tests and the effectiveness of the tests in increasing years of life saved. Many CEA studies have addressed that overall question and they find that several colorectal cancer screening methods are cost-effective compared to conventional willingness to pay per year of life saved criteria, but no screening test is clearly most cost effective [19]. Thus, the question is how do we most efficiently encourage people to get to the point of screening, regardless of the screening test?

Overhead cost

Allocation of full overhead costs to specific activities were not obtainable. Therefore, an estimated overhead rate of 30% of direct costs was used to estimate total overhead [18, 20]. Overhead costs included general administration, space and house-keeping, phone service, and utilities.

Sensitivity analysis

Sensitivity analysis was conducted to address uncertain parameters including the indirect cost rate, minimum wage ap-

plicability for missing income information, and number of participants. The base value for the overhead rate was 30% of direct cost with a range of 25% to 35%, which was based on the preventive health care literature [20, 21] assumed minimum wage rate was compared to a zero wage rate for the 2161 individuals who did not provide household income level.

Results

From March 2012 to December 2013, 5826 participants were assigned to the FIT and Colonoscopy interventions based on baseline risk assessment. There were 3902 participants placed in the individual FIT screening educational sessions and 1367 allocated to the group FIT education intervention. Demographics characteristics, mean risk assessment and intervention times for participants are presented in Table 1.

Unit costs estimates

Unit personnel costs are described in Table 2. Adjusted salary rates per minute ranged from \$0.37 for outreach health workers to \$2.44 for senior research scientists. Wage rates for participants who refused to report their income were based on 2012 minimum federal wage of \$7.25 per hour [22].

Total and average cost estimates

Average costs per person based on the sessions and their baseline risks are described in Table 3. The average cost per participant receiving FIT education from the individual video, promotora, or video + promotora interventions was \$75

Characteristics		Participant N.	Percentage/Mean (SD)
Mean Age		5826	57 (SD: 5.6)
Gender			
	Male	1486	25.54%
	Female	4340	74.46%
Group (%)			
	Female, Age 50-59	3045	52.23%
	Female, Age 60-69	1127	19.34%
	Female, Age 70-75	168	2.88%
	Male, Age 50-59	986	16.93%
	Male, Age 60-69	435	7.50%
	Male, Age 70-75	65	1.12%
Income			
	none	14	0.25%
	less than \$10,000	2172	37.26%
	\$10,000-\$15,000	695	11.92%
	\$15,000-\$20,000	366	6.27%
	\$20,000-\$25,000	204	3.5%
	\$25,000-\$35,000	126	2.16%
	\$35,000 or more	62	1.06%
	don't know	1585	27.19%
	refuse to answer	300	5.16%
	missing	302	5.2%
Mean Risk Assessment Time			
Individual	Average risk V	1311	24.72(min, SD:21.49)
	Average risk P	1298	24.00(min, SD:21.45)
	Average risk V+P	1293	24.00(min, SD:8.65)
	High risk V	56	23.63(min, SD:10.44)
	High risk P	60	22.85(min, SD:7.47)
	High risk V+P	66	26.08(min, SD:9.49)
Group	V	751	35.55(min, SD:23.65)
	P	490	40.82(min, SD:18.12)
	V+P	501	44.35(min, SD:22.01)
Mean Intervention Time ^a			
Individual	Average risk V	1311	18.29(min, SD:4.89)
	Average risk P	1298	23.06(min, SD:21.63)
	Average risk V+P	1293	22.12(min, SD:6.06)
	High risk V	56	18.77(min, SD:5.31)
	High risk P	60	21.87(min, SD:5.92)
	High risk V+P	66	21.71(min, SD:5.56)
Group	V	751	19.37(min, SD:9.37)
	P	490	24.48(min, SD:11.70)
	V+P	501	24.79(min, SD:11.64)

^a Mean intervention time includes only the average time spent by the participants. The promotoras spent less time per participant in the group compared to the individual mode of delivery.

Table 1. Demographics and characteristics of ACCION participants.

	Base Annual Salary (\$)	Fringe Rate	Salary and Fringe (\$)	Salary per Min.(\$)	Non-intervention Related Training Hours	Non-intervention Related Meeting Hours	Vacation and Holiday Hours	Annual Hours at Work	Annual Hours Available for Tasks	Prop. of Paid Time Available for Tasks	Adj. Salary per Minute (\$)
Professors	200,000	0.189	237,852.20	1.91	10	24	132	1914	1626.9	0.782	2.44
Gastroenterologist	200,000	0.189	237,852.20	1.91	10	24	204	1842	1565.7	0.752	2.53
Statistician	130,000	0.237	160,856.40	1.29	10	24	96	1950	1657.5	0.797	1.62
Data manager	81,000	0.238	100,250.64	0.80	10	24	120	1926	1637.1	0.787	1.02
MD collaborator	142,000	0.226	174,055.68	1.39	10	24	120	1926	1637.1	0.787	1.77
Project coordinator	42,000	0.384	58,134.00	0.47	10	24	120	1926	1637.1	0.787	0.59
Research Associate	42,240	0.194	50,434.56	0.40	10	24	108	1938	1647.3	0.792	0.51
Graduate assistants	30,717	0.247	38,297.88	0.31	10	24	120	1926	1637.1	0.787	0.39
Promotoras	23,400	0.591	37,222.70	0.30	N/A	N/A	96	1984	1686.4	0.811	0.37
Health navigator	23,400	0.591	37,222.70	0.30	10	10	96	1964	1669.4	0.803	0.37
Data entry specialist	25,000	0.564	39,105.00	0.31	10	24	96	1950	1656.5	0.797	0.39

^aAssumptions: Total hours per year: 2080; productivity rate: 0.85; Non-intervention related training and meeting hours.

Table 2. Annual Salaries, Fringe Benefit Rates, and Adjusted Salary per Minute by ACCION program staff ^a

			Training (\$)	Recruitment (\$)	Intervention Personnel Time (\$)	Other Personnel time ^a (\$)	Material ^b (\$)	Total direct cost (\$)	Overhead ^c (\$)	Total cost (\$) (SD)
Individual	Average risk	V	2.76	10.48	7.74	12.03	24.64	57.65	17.30	74.95 (8.76)
		P	2.76	10.21	9.7	12.03	24.64	59.34	17.80	77.14 (8.75)
		V+P	2.76	10.21	9.37	12.03	24.64	59.01	17.70	76.71 (8.75)
	High risk	V	2.76	10.53	8.36	12.03	39.71	73.39	22.02	95.41 (14.55)
		P	2.76	9.84	9.4	12.03	39.71	73.74	22.12	95.86 (14.53)
		V+P	2.76	11.13	9.2	12.03	39.71	74.83	22.45	97.28 (14.52)
Group ^d	V	2.76	7.39	3.81	12.03	25.53	51.52	15.46	66.98 (9.21)	
	P	2.76	7.26	3.84	12.03	25.36	51.25	15.38	66.63 (9.14)	
	V+P	2.76	7.57	3.8	12.03	25.53	51.69	15.51	67.20 (9.21)	

V: video, P: promotora, V+P: video + promotora

^a Other personnel time costs include program monitoring, intervention packet management, promotora management, weekly update tasks, reminder calls, FIT results management, administration, data management, case management, and meetings (program monitoring time cost was considered an implementation cost because feedback from the evaluation affected changes in the intervention implementation).

^b Material cost for the Group intervention was based on the average weighted cost for low and high risk participants.

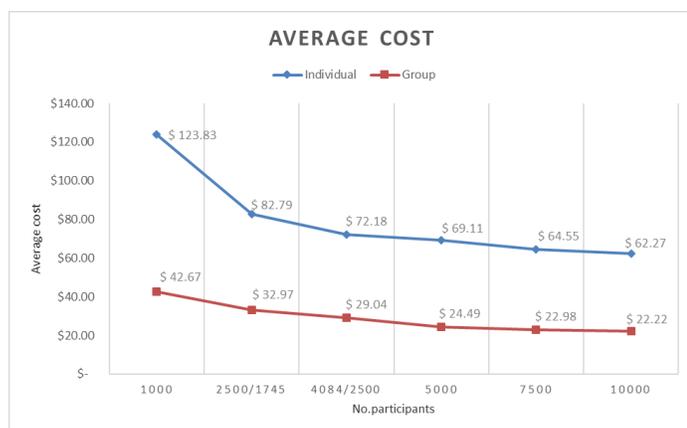
^c An estimated overhead rate of 30% of direct cost was used to estimate overhead costs.

^d Group level interventions include a mix of high risk (4.6%), average risk (78.1%), and educational purpose (17.4%) individuals. There was no effort to segregate them in the group sessions.

Table 3. Intervention implementation cost per participant.

(SD: 8.76), \$77.1 (SD: 8.75), \$76.7 (SD: 8.75), respectively and the average cost per participant receiving colonoscopy education from the individual video, promotora, or video + promotora interventions was \$95.4 (SD: 14.55), \$95.9 (SD: 14.53), \$97.3 (SD: 14.52), respectively. The average cost per participant assigned to group video, promotora, or video + promotora interventions was about \$67 (SD: 9.21; 9.14; 9.21) for each subgroup. Detailed activities of personnel are shown in Table 3. They included direct intervention activities of the promotora and “other” personnel time devoted to various aspects of program monitoring and management, including program meeting time. For the individual level FIT education interventions training and recruitment represented about 5 percent and 20 percent of direct cost, respectively whereas personnel time cost represented about 30 percent of direct cost. Materials cost was about 50 percent of direct cost due to the cost of the FIT kits and bowel prep that were provided to the participants to encourage follow through with screening. There was a similar distribution of direct cost for the group sessions. The total cost for all interventions was \$430,338 of which \$188,530 was for personnel time cost.

Figure 2. describes how scale of program has an important impact on the average cost of the interventions; average cost per participant was estimated for a cohort of 4,084 for individual, and 1,745 for group participants as a base case, with a range of 1,000 to 10,000 participants in both the individual and group sessions. The average cost per participant in different sessions ranged from \$124 to \$62 for individual level interventions, and from \$43 to \$22 for group level interventions for simulated cohorts that ranged from 1,000 to 10,000 persons in the target population.



Note: There were 1745 group participants and 4084 individual participants.

Figure 2. The average cost of individual and group sessions for all interventions combined.

Sensitivity analysis

Sensitivity analysis results are presented in Table 4. The amortized costs per participant for the alternative interventions were not highly sensitive to the overhead rate estimate or the assumption regarding the wage rate for individuals without reported income data. When the highest overhead rate was applied, the average increase in the intervention cost per participant was \$2.70 and the average increase in cost was only \$2.33 when comparing the assumption of zero wage rates to the minimum wage for those with unknown income data.

Uncertain parameters			Overhead % of Direct Cost			Wage rate assumption	
			25% (\$)	30% (\$)	35% (\$)	\$0.0 (\$)	Minimum wage rate \$7.25/hr. (\$)
Individual	Average risk	v	72.06	74.95	77.83	74.95	77.16
		p	74.18	77.14	80.11	77.14	79.85
		v+p	73.76	76.71	79.66	76.71	79.14
	High risk	v	91.74	95.41	99.08	95.41	97.66
		p	92.18	95.86	99.55	95.86	97.76
		v+p	93.54	97.28	101.02	97.28	99.03
Group	v	64.40	66.98	69.55	66.98	69.00	
	p	64.06	66.63	69.19	66.63	70.08	
	v+p	64.61	67.20	69.78	67.20	70.67	

V: video, P: promotora, V+P: video + promotora

2161 number of cases (don't know, refuse to answer, missing) with 0 household income data

Table 4. Average cost by selected cost determinants.

Discussion

We estimate the implementation cost of a multicomponent community based colorectal cancer prevention screening program in El Paso, Texas. Studies of colorectal cancer screening promotion cost for low income Hispanic groups are rare. Smith et al. investigated cost-effectiveness of an automated telephone intervention in a pragmatic randomized controlled trial setting from a managed care perspective [23]. Average costs per patient in the intervention group were \$37 and \$52 in 2008 USD at 6 months and 9 months, respectively. They did not include participant time cost. Misra et al. conducted a cost effectiveness analysis of tailored and web-based interventions for improving colorectal cancer screening adherence [24]. Average costs per participant for the web-based and tailored interventions were \$40 and \$45 in 2004 USD, respectively.

The Colorectal Cancer Screening Demonstration Program (CRCSDP), initiated by The Centers for Disease Control and Prevention (CDC), reported the costs of planning and implementing this program across 5 sites in the United States [25]. Nearly \$11.3 million were expended during the implementation peri-

od between 2006-2008), 41% of which was for clinical service delivery costs, the second and third largest cost components were service delivery support/patient support and program management and administration, which comprised 18% and 10% of total cost, respectively [24]. The total per-person cost was \$1856 over the 4-year period of the program [25], which is much higher than our results. It is not directly comparable to our study because the CDC program comprised all of the start-up and implementation costs including clinical service delivery (41%) [25]. However, our total cost was similar to the total cost of the CDC program for the subset of similar activities in the ACCION program (\$398,382 vs. \$430,338.43). This study and previous research clearly shows that substantial costs were incurred in recruiting minority populations, assessing baseline risks, assessing participant eligibility, and applying the health education interventions [15, 23-26]. Our report and prior studies demonstrate that community level cancer prevention programs require substantial upfront investments in planning, assessing the needs and best methods for educating the target population, and identifying and recruiting the eligible populations to the interventions. Scaling up the programs that spread the fixed costs over more participants can lower the cost per participant. Additionally, using group sessions with videos and lay community health workers can lower the average intervention delivery cost by 15 to 30 percent. However, group sessions will only be more efficient if they are effective in increasing the screening rate. These issues will be explored in future cost effectiveness analyses.

Limitations should be considered when interpreting our study. First, staff reported intervention implementation related time monthly on a web-designed time log. Approximately 10% of staff time logs were estimated retrospectively. This self-reporting method is easy to report and costs less than staff monitoring however individuals may under or overestimate time they spent on activities. Since the majority of the time cost in the program is from the participants and promotoras whose times in the implementation stage were written day to day, the measurement error would be minimal. Second, some participants were reluctant to report their income on the survey, so we estimated the participants' time value by the federal minimum wage to approximate the missing values. Since our target population was primarily underinsured/uninsured, they were likely to be low income individuals, or unemployed. The income of the study population had a very small variance, and therefore our estimate of the missing cases should represent a good approximation of the actual time cost. Third, the results of the study may not be generalizable to other studies that might have different target populations and locations with different environments. We applied El Paso area wage rates and fringe benefits to estimate time cost. However, the methods and the order of magnitude of costs may guide other efforts to assess community-based intervention implementation costs.

Conclusion

In conclusion, the study provides the first detailed estimate of the time and implementation cost of a community based intervention to increase colorectal cancer screening adherence for low income uninsured predominantly Hispanic populations. The average cost per participant for the above average risk group (Colonoscopy individual arms) was higher than for those who were average risk (FIT individual arms). The average costs of the three different intervention delivery methods were similar within each test type. The average cost per participant in the group level sessions was considerably less costly compared to individual level sessions.

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