Improvement in Hispanics' CRC Knowledge and Awareness using the Inflatable Caribe Colon

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Objective: Colorectal cancer (CRC) is the most common cause of cancer death in Puerto Rico (PR). CRC screening rates among PR Hispanics aged ≥ 50 years (57.5%) are below the Healthy People 2020 recommendations (70.5%). Low screening rates can be attributed to lack of education, and beliefs and knowledge about CRC screening procedures. This study evaluated the effectiveness of the Caribe Colon inflatable colon model in two community events as an educational tool to increase CRC knowledge, awareness, and intention to undergo CRC screening.

Methods: Participants (aged ≥ 40 years and with no previous CRC history) completed a pre- and post- questionnaire, and took the tour of the Caribe Colon. Results were analyzed using Exact McNemar's test and paired t-test. Multivariable logistic regression models were used to identify factors associated with likelihood to get screened.

Results: After completing the tour, survey responses (n=154) revealed a significant increase in CRC knowledge and awareness (p<0.0001). Multivariable logistic regression models showed that fear of CRC screening procedures was the primary independent factor for not getting screened after adjusting for age, gender, education, regular visits to a primary care physician, insurance, and history of CRC screening (p=0.006).

Conclusion: Future studies should focus on understanding and reducing barriers to CRC screening including fear. Patients more knowledgeable about CRC screening procedures may have less fear for CRC screening. Furthermore, educational strategies need to be reinforced to reduce fear; this may lead to an increase in CRC screening rates among Hispanics. [*P R Health Sci J 2019;38:176-180*]

Key words: Colorectal cancer, Hispanics, Three-dimensional colon model, Patient education, Cancer prevention and control

Colorectal cancer (CRC) is a preventable disease with adherence to CRC screening; early diagnosis and treatment is associated with high survival rates (1). In the United States (US) is the third most commonly diagnosed cancer and third cause of cancer mortality (1). In Puerto Rico (PR) is the second most commonly diagnosed cancer and primary cause of cancer death (2). PR Hispanics ages 40-59 have higher incidence and mortality rates compared to US Hispanics (3). Also, a study reported that CRC patients with the PR government health insurance are diagnosed at late stages and have worse survival compared to patients without the government health insurance (4). Factors associated with CRC delay diagnosis included having first visit to diagnosis for CRC through the emergency room and diagnostic delay of > 59 days from the start of symptoms (5).

The American College of Gastroenterology recommends screening for average-risk individuals beginning at age 50 (6). In PR, since 2015, screening for average-risk CRC is recommended starting at age 40 using fecal immunochemical testing (type of occult blood test) as result that most cases are diagnosed at advanced stages (66%) and around 10% are diagnosed before age 50 (7). Still, screening rates among PR Hispanics (57.5%) (8) is below Healthy People 2020 target (70.5%) (9). This could be attributed to multiple factors including socio-demographic factors, health system performance (4) and lack of CRC knowledge (10-12) among others.

Compared to text materials, three-dimensional (3D) tools with text/audio have been more effective in increasing CRC

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The author/s has/have no conflict/s of interest.

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knowledge and comprehension which may lead to increase in screening (13). Caribe Colon is a 3D model designed to engage individuals by walking through an inflatable colon that demonstrates progression from colonic polyps to neoplasia. Studies have revealed that this interactive tool is associated with increased in CRC knowledge, awareness, and screening intentions (6, 14-15). Present study aimed to evaluate for the first time in PR the effectiveness of the Caribe Colon inflatable as an educational tool to increase CRC knowledge, awareness, and screening intentions. Furthermore, we examined potential barriers to CRC screening including knowledge of disease and awareness of available CRC screening methods.

Methods

A convenience sample of 154 Hispanics ≥ 40 years without previous CRC diagnosis were recruited at two community cancer awareness events (Colorectal Cancer 5K and Relay for Life) in San Juan, PR in 2015. Before entering the tour through the Caribe Colon inflatable, participants voluntarily completed the informative sheet and pre-questionnaire. After completing the tour participants completed a post-questionnaire. During tour, trained staff provided oral explanations about findings observed during a colonoscopy, cancer facts including CRC symptoms, and screening procedures which reflected questions assessed. Staff administered the pre/post-questionnaires. Participants received a bag with printed CRC information as incentive for participation. Study was approved by the Institutional Review Board of UPR Medical Sciences Campus (Protocol number: A2210215).

A questionnaire was used to evaluate CRC knowledge, awareness, and screening intentions. Questions were adapted from previous studies, which evaluated effectiveness of the inflatable colon (6, 14). Pre-questionnaire included items on: sociodemographic (n=8), knowledge (n=12), awareness (n=5), and screening intentions (n=13). Post-questionnaire included items on: knowledge (n=12), awareness (n=5), screening intentions (n=13), and evaluation (n=3) of the Caribe Colon. Measures for CRC knowledge (statistics, definition, who affects, preventability, risks), awareness (polyp definition and screening procedures) and screening intentions (fear cancer diagnosis, comfortable talking about CRC, likelihood to screening, and reasons for not screening) were administered before/after the tour. Demographics included: age, gender, education level, annual family income, and health insurance. Medical history included: CRC family history, previous CRC screening, primary care physician visits and reasons for not screening.

Descriptive analysis of sociodemographic characteristics included frequency distributions for categorical variables and summary measures for quantitative. Paired McNemar's test was used to explore differences between knowledge and screening items before/after the tour. Each correct answer scored 1 point, incorrect answer, 0. Mean knowledge and awareness scores were computed by summing correct responses to total scale (0 to 12 points for general knowledge and 0 to 5 for awareness). Paired t-test or Wilcoxon signed-rank test was used to explore differences between mean knowledge and awareness scores before/after touring. Multiple-logistic regression models were used to identify factors associated with likelihood (defined as very or somewhat likely) to CRC screening post-tour. Statistical analyses were performed using STATA 14.0 (STATA Corp.).

Results

A total of 154 participants, 60% aged ≥ 50 and 84% with ≥ 12 years of education, completed the inflatable colon tour. Eighty-two percent had private health coverage, 52% annual family income < $35,000 and 53% previously screened (77% colonoscopy and 20% FOBT; data not shown). Most frequently reported barriers were lack of physician/nurse recommendation (31%) and 28% "other" (not age-eligible, don't feel is necessary, fear, and laziness).

Table 1. Clinical characteristics of study participants (n = 154)

Characteristics	n (%)
Regular visit to physicians	
No	36 (23)
Yes	116 (75)
Family History of CRC	
No	116 (75)
Yes	38 (25)
History of CRC screening	
No	72 (47)
Yes	82 (53)
Types of CRC screening (n = 81)	
Colonoscopy/sigmoidoscopy	62 (77)
FIT/FOBT	16 (20)
Reasons for not having CRC (n = 72)	
Physician/nurse have never mentioned/recommended	22 (31)
It's too expensive	1 (1)
I'm too busy/I don't have time	4 (6)
I feel ashamed	2 (3)
I keep postponing it	14 (19)
I don't know or don't remember	8 (11)
I refuse to answer	1 (1)
Other	20 (28)

CRC knowledge significantly increased ($p<0.001$) after touring. Statistically significant increase was observed for specific items: CRC mainly affects males ($p<0.0001$), CRC is a tumor that affects the large intestine ($p<0.0001$), and colonoscopy should be done at age 50 and at age 40 if there is family history of CRC ($p=0.003$) (data not shown). Analysis confirmed an increase in awareness post-tour ($p<0.001$), and increase in patients planning to talk to their physician about CRC ($p<0.05$). Forty-four percent reported fear of CRC diagnosis and 14% fear screening procedures (Table 2). Fear to CRC screening procedure was the primary independent factor associated to "unlikely" undergoing screening (POR = 0.10; 95% CI, 0.02-0.52, p=0.006) (Table 3).

Table 2. Pre- and post- test results for the intentions to screening for CRC (n = 154)

Item	Pre-test N (%)	Post-test N (%)	p-value
1. Do you fear being diagnosed with CRC?			.109
Yes	74 (48)	68 (44)	
No	80 (52)	86 (56)	
2. Do you plan on talking to your doctor about CRC?			.035
Yes	139 (90)	146 (95)	
No	15 (10)	8 (5)	
3. Do you fear CRC screening procedures?			.655
Yes	21 (14)	22 (14)	
No	133 (86)	132 (86)	
4. Fear to CRC procedures (n=22) *			
Colonoscopy/Sigmoidoscopy	16 (76)	14 (64)	.999
FIT/FOBT	2 (10)	4 (18)	.083
5. If answered yes to "do you fear CRC screening procedures?" Specifically, what do you fear?			
Antipathy	1 (6)	1 (6)	
Cancer diagnosis and/or results	5 (28)	4 (24)	
Procedure and/or preparation	7 (39)	5 (29)	
Pain	1 (6)	0 (0)	
Never have been screened	1 (6)	1 (6)	
6. How comfortable are you talking about CRC screening?			.221
Very uncomfortable/ Somewhat uncomfortable/Neutral	26 (17)	20 (13)	
Very comfortable/Somewhat comfortable	128 (83)	134 (87)	
7. How likely are you to get screened for CRC?			.999
Very unlikely/ Somewhat unlikely/Neutral	10 (6)	10 (6)	
Very likely/Somewhat likely	144 (94)	144 (94)	
8. If answered "somewhat likely or very likely", subjects planned on getting screened with: (n=144)			
Colonoscopy/Sigmoidoscopy	67 (47)	62 (43)	.297
FIT/FOBT	49 (34)	51 (35)	.194

Note: *Responses with "yes" or "no."

Table 3. Post-test self-reported likelihood of intent to be screened for CRC by selected characteristics

Characteristic	POR$_{unadjusted}$ (95% CI)	POR$_{adjusted}$* (95% CI)	POR$_{adjusted}$** (95% CI)	POR$_{adjusted}$*** (95% CI)
Age in years				
<50	1.0	1.0	1.0	1.0
≥50	0.64 (0.16-2.56)	0.54 (0.12-2.41)	0.63 (0.13-3.04)	0.51 (0.10-2.59)
Gender				
Female	1.0	1.0	1.0	1.0
Male	1.54 (0.42-5.70)	1.11 (0.27-4.57)	0.99 (0.23-4.21)	1.02 (0.24-4.35)
Years of education				
≥12	1.0	1.0	1.0	1.0
<12	1.71 (0.21-14.16)	3.14 (0.33-29.60)	5.82 (0.50-68.31)	5.69 (0.50-64.32)
Health care coverage				
Private/Medicare	1.0	---	1.0	1.0
Public/No plan	0.49 (0.12-2.04)	---	0.29 (0.05-1.55)	0.34 (0.06-1.91)
History of CRC screening				
Yes	1.0	---	---	1.0
No	2.84 (0.71-11.41)	---	---	2.22 (0.45-11.07)
Regular visit to physician				
Yes	1.0	---	1.0	1.0
No	2.94 (0.36-24.07)	---	2.46 (0.26-23.01)	2.44 (0.26-22.47)
Fear being diagnosed with CRC				
No	1.0	---	---	---
Yes	0.92 (0.26-3.32)	---	---	---
Fear to CRC screening procedures				
No	1.0	1.0	1.0	1.0
Yes	0.13 (0.03-0.48)	0.10 (0.03-0.43)	0.08 (0.02-0.37)	0.10 (0.02-0.52)

Notes: *Adjusted for age, gender, and education. **Adjusted for age, gender, education, regular visit to physician, and insurance status. ***Adjusted for age, gender, education, regular physician, insurance status, and history of CRC screening.

Discussion

Participation in the inflatable Caribe Colon Tour was associated with increase in CRC knowledge and awareness among sample of PR Hispanics. Post-tour, 95% of the participants plan to talk to doctor about CRC and over 80% reported being "somewhat/very comfortable" talking to others about CRC screening. Barriers associated with lack of screening included: fear to screening procedures and lack of recommendation by healthcare provider; however, lack of recommendation by healthcare provider was not significant in multivariable analysis. Our results underscore the need to develop strategies to address gaps in knowledge among the general population and healthcare providers.

Previous studies among Hispanics have shown that education about CRC and CRC screening can encourage individuals to take action towards screening (14, 16). While printed materials are used for cancer education (17), using interactive models, such as the inflatable colon, is a more effective tool among groups with different literacy/awareness levels (6, 14-15). Sánchez et al. reported intentions to CRC screening improved post-tour (6). Briant et al. distributed 300 FOBT kits post-tour amongst age-eligible participants (76% Hispanics) and 75.3% of the FOBT kits were returned for examination (14). Moreover, Redwood et al. showed that after preventive activities, including the inflatable colon tour, there was an increase in CRC screening intent (62% to 65%) (15). Thus, participation in the inflatable colon tour has been consistently associated with an increase in intentions to complete CRC screening (6, 15).

In our study, 76% (n=62) of participants aged ≥ 50 had undergone CRC screening (above PR reported average). After participation in the inflatable Caribe Colon Tour, 94% of the study population reported "somewhat/very likely" to undergo screening. Interestingly, screening rates among individuals between the

ages 40-49 was 24% (n = 20), which may be explained by other factors not collected such as a positive family history of CRC. Several studies have demonstrated that CRC education among individuals < 50 years may increase screening intentions once age-eligible (6, 14, 18).

Fourteen percent of participants reported they feared the procedure/preparation or fear pain during the procedure. Psychosocial barriers that have been associated with low screening rates include: fear that the exam might be painful (3, 10-12), finding cancer (10-12, 19), and fear of examination (10-12, 19). Another important barrier to screening reported by our participants was lack of health provider recommendation, reported in a third of our study participants. Consistent with our findings, other studies have reported that lack of physician recommendation (10, 16) is positively correlated with non-adherence to screening (10). Thus, educating physicians about the importance of providing information about procedure as well as the pros/cons of screening may aid in reducing fear (3, 11).

Our study has several limitations including the fact that the participants were recruited from a CRC community awareness event which may have included individuals with higher than expected average knowledge in PR. However, we did observe increased in CRC knowledge after completion of tour. Additionally, we were unable to determine whether screening intentions post-touring, actually translated into undergoing screening (beyond the scope of study).

Conclusion

Notwithstanding the abovementioned limitations, our study showed that participating in the inflatable Caribe Colon Tour increased CRC knowledge and awareness. Our study showed two main barriers to CRC screening: fear to screening procedures and/or lack of health provider recommendation. Strategies to increase screening should include implementation of evidenced-based tools to increase physician recommendations for screening, such as client reminders (10). Furthermore, the utilization of stool-based CRC screening may provide a more acceptable alternative for patients as no special preparation is required and it's non-invasive (20). Therefore, stool-based methods may decrease "fear of procedure" and potentially increase CRC screening adherence.

Resumen

Objetivo: El cáncer colorrectal (CRC) es la primera causa de muerte por cáncer en Puerto Rico (PR). Las tasas de cernimiento para CRC entre hispanos de PR ≥ 50 años (57.5%) están por debajo de las recomendaciones del Healthy People 2020 (70.5%); puede atribuirse a falta de educación, creencias y conocimientos sobre los procedimientos de cernimiento. Este estudio evaluó la efectividad del inflable Caribe Colon en dos eventos comunitarios como herramienta para aumentar el conocimiento, concienciación e intención de realizarse una prueba de cernimiento. Métodos: Los participantes, ≥ 40 años y sin historial previo de CRC, completaron un pre/post-cuestionario y tomaron el tour por el inflable. Los resultados se analizaron mediante la prueba exacta McNemar y la prueba t-pareada. El modelo de regresión logística multivariable identificó factores asociados a la posibilidad de hacerse una prueba de cernimiento. Resultados: Después del tour, los resultados (n=154) revelaron un aumento significativo en conocimiento y concienciación sobre el CRC (p<0.0001). El modelo de regresión logística multivariable mostró que el temor a los procedimientos de cernimiento es el principal factor para no realizarse una prueba luego de ajustar por edad, sexo, educación, visitas regulares a un médico e historial de cernimiento (p=0.0006). Conclusión: Estudios futuros deben enfocarse en entender y reducir las barreras para el cernimiento de CRC, incluyendo el miedo. Pacientes con mayor conocimiento sobre las pruebas de cernimiento pudieran tener menos temor. Además, es necesario reforzar estrategias educativas para reducir el temor; esto pudiera aumentar las tasas de cernimiento entre los hispanos.

Acknowledgement

"The project described in this publication was partially supported by the Award grant number# CA096297/CA096300 from the National Cancer Institute of the National Institutes of Health (NIH); and by the Award grant# 2U54MD007587 from the National Institute on Minority Health and Health Disparities (NIMHD) of the NIH. In addition, the project received support from the Puerto Rico Colorectal Cancer Coalition. Study data were managed using REDCap electronic data capture tools hosted at the Puerto Rico Clinical and Translational Research Consortium at the University of Puerto Rico Medical Sciences Campus. "The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH".

References

1. American Cancer Society. Cancer Facts & Figures. Atlanta GA: American Cancer Society. 2013. Available at: Url: http://www.cancer.org/acs/groups/content/@epidemiologysurveilance/documents/document/acspc-036845.pdf. Accessed 2015
2. Figueroa NR, Ortiz KJ, Pérez N, Villanueva E, Traverso M. Cancer in Puerto Rico, 2005-2009. Puerto Rico Central Cancer Registry. 2012;17-37.
3. Bynum SA, Davis JL, Green BL, Katz RV. Unwillingness to Participate in Colorectal Cancer Screening: Examining Fears, Attitudes, and Medical Mistrust in an Ethnically Diverse Sample of Adults 50 Years and Older. American Journal of Health Promotion 2012;26:295-300. doi:10.4278/ajhp.110113-QUAN-20.
4. Ortiz-Ortiz KJ, Ramírez-García R, Cruz-Correa M, Ríos-González MY, Ortiz AP. Effects of type of health insurance coverage on colorectal cancer survival in Puerto Rico: a population-based study. PLoS One 2014;9:e96746. doi:10.1371/journal.pone.0096746.
5. Ortiz-Ortiz KJ, Ríos-Motta R, Marín-Centeno H, Cruz-Correa M, Ortiz AP. Factors associated with late stage at diagnosis among Puerto Rico's government health plan colorectal cancer patients: A cross-

sectional study. BMC Health Services Research BMC Health Serv Res 2016;16:344. doi:10.1186/s12913-016-1590-4.
6. Sánchez JI, Palacios R, Cole A, O'Connell MA. Evaluation of the walk-through inflatable colon as a colorectal cancer education tool: results from a pre and post research design. BMC Cancer 2014;14:626. doi:10.1186/1471-2407-14-626.
7. Estado Libre Asociado de Puerto Rico, Departamento de Salud. Administrative Order No. 334. Available at: Url: http://www.colegiomedicopr.org/docs/ORDEN%20ADMINISTRATIVA%20334%20-%205%20DE%20MARZO%20DE%202015.pdf. Published March 10, 2015. Accessed 2015.
8. Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Population Health. BRFSS Prevalence & Trends Data. 2016
9. Centers for Disease Control and Prevention, B. R. F. S. S. B. s. Colorectal Cancer Incidence and Screening - United States, 2008 and 2010. 2013.
10. Hoffman RM, Rhyne RL, Helitzer DL, Stone SN, Sussman AL, Bruggeman EE, et al. Barriers to Colorectal Cancer Screening: Physician and General Population Perspectives, New Mexico, 2006. Prev Chronic Dis 2011;8:A35. Epub 2011 Feb 15.
11. Jones RM, Devers KJ, Kuzel AJ, Woolf SH. Patient-reported barriers to colorectal cancer screening: a mixed-methods analysis. Am J Prev Med 2010;38:508-516. doi:10.1016/j.amepre.2010.01.021.
12. Varela A, Jandorf L, DuHamel K. Understanding Factors Related to Colorectal Cancer (CRC) Screening Among Urban Hispanics: Use of Focus Group Methodology. J Cancer Educ 2010;25:70-75. doi:10.1007/s13187-009-0015-z.
13. Meade CD, McKinney WP, Barnas GP. Educating patients with limited literacy skills: the effectiveness of printed and videotaped materials about colon cancer. Am J Public Health 1994;84:119-121.
14. Briant KJ, Espinoza N, Galvan A, Carosso E, Marchello N, Linde S, et al. An innovative strategy to reach the underserved for colorectal cancer screening. J Cancer Educ 2015;30:237-43. doi: 10.1007/s13187-014-0702-2.
15. Redwood D, Provost E, Asay E, Ferguson J, Muller J. Giant Inflatable Colon and Community Knowledge, Intention, and Social Support for Colorectal Cancer Screening. Prev Chronic Dis 2013;10:E40. doi: 10.5888/pcd10.120192.
16. López-Charneco M, Perez CM, Soto-Salgado M, Rodríguez L, González D, Serrano R, et al. Correlates of Colorectal Cancer Screening among Hispanics: Results from the 2008 Puerto Rico Behavioral Risk Factor Surveillance System Survey. P R Health Sci J 2013;32:68-75.
17. Dreier M, Borutta B, Seidel G, Kreusel I, Toeppich J, Bitzer EM, et al. Development of a comprehensive list of criteria for evaluating consumer education materials on colorectal cancer screening. BMC Public Health 2013;13:843. doi:10.1186/1471-2458-13-843.
18. Greaney ML, Puleo E, Sprunck-Harrild K, Syngal S, Suarez EG, Emmons KM. Changes in colorectal cancer screening intention among people aged 18-49 in the United States. BMC Public Health 2014;14. doi:10.1186/1471-2458-14-90.1
19. Jibara G, Jandorf L, Fodera MB, DuHamel KN. Adherence to physician recommendation to colorectal cancer screening colonoscopy among Hispanics. J Gen Intern Med 2011;26:1124-1130. doi:10.1007/s11606-011-1727-4.
20. Rosenwasser, L, McCall, J, Weisman, C, Hillemeier, M, Perry, A, et al. Barriers to colorectal cancer screening among women in rural central Pennsylvania: Primary care physicians' perspective. Rural Remote Health 2013;13:2504.