



Scripted tours through a giant inflatable colon: An innovative and effective educational tool in urban communities

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ABSTRACT

Colorectal cancer (CRC) is the second leading cause of cancer-related death among men and women in the US and mortality rates are increasing among young adults. Although CRC is largely preventable with screening and often curable when detected at an early stage, many age-appropriate individuals remain unscreened or are not currently up-to-date with screening. We aimed to examine the impact of providing guided, scripted tours through an inflatable colon on three domains: CRC knowledge, likelihood of communicating about CRC with others, and the intention to be screened for CRC in a diverse, urban population. The inflatable walk-through colon was exhibited at five community events in Franklin County, Ohio between March 2015 and August 2016. A pre and posttest research design and composite scores were stratified into three age groups (<45 years, 45–49 years and ≥ 50 years of age). Descriptive statistics were used to describe and compare demographic characteristics. Logistic regression was used to examine potential associations between demographic factors and the three outcomes of interest. These tours led to statistically significant increases in CRC knowledge, communication, and intention to undergo CRC screening among participants in all three age cohorts. In addition, the intention of undergo screening after a tour among individuals <45 years of age were nearly three times that of those older than 50 (OR = 2.66; 95%CI = 1.49–4.75). Overall, this study supports the use of scripted tours through an inflatable colon exhibit as a potentially effective intervention to increase age-appropriate CRC screening uptake.

1. Introduction

Colorectal Cancer (CRC) is the second leading cause of cancer-related deaths for both men and women in Ohio and in the United States (Siegel et al., 2019). In Franklin County, Ohio, the 2011–2015 incidence rate was 39.1 per 100,000 population, similar to the US rate of 39.4 per 100,000 population, and the mortality rate is 15.3 per 100,000 population, surpassing that of the US (14.5 per 100,000) ([2]).

However, CRC is largely preventable with screening and is curable when detected early (Roncucci and Mariani, 2015; Hewitson et al., 2007; Manser et al., 2012). Until recently, it was widely accepted that screening for average-risk individuals should begin at age 50. As of May 2018, the American Cancer Society (ACS) recommends starting screening at age 45. This was in response to increasing CRC incidence and mortality among adults younger than 50 years of age (Wolf et al., 2018; American Cancer Society, xxxx2018). In light of this recent

change, and given the trend of increased CRC incidence and mortality among individuals ≤ 50 years of age, the need to promote screening and early detection in this younger age group is vital (Peterse et al., 2018; Pignone et al., 2002; Siegel et al., 2009). Unfortunately, many age-appropriate individuals remain unscreened or are not up-to-date with their screening (Peterse et al., 2018; Pignone et al., 2002; Siegel et al., 2009; Berkowitz et al., 2018; Klabunde et al., 2011). Notably, according to the CDC, the screening rate among individuals 50–75 years old in Ohio is 67% which is comparable with that of the US at 67.3% (Center for Disease Control and Prevention (CDC), 2016). More specifically, in Franklin county, the screening uptake is estimated at 66.9–69.7% (Center for Disease Control and Prevention (CDC), 2016). Evidence-based screening interventions that are effective in influencing screening behavior are needed to reach the national goal of 80% (American Cancer Society, 2019).

Evidence-based CRC screening interventions have traditionally

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utilized physician and patient reminder systems, small (letters, brochures and videos) and mass (television, radio, newspaper, and billboard) media, and mailed stool-based testing to influence cancer knowledge and screening behavior (Berkowitz et al., 2015; Baker et al., 2014; Dietrich et al., 2006; Levin et al., 2018; Sequist et al., 2009; Gimeno Garcia et al., 2014; Breslow et al., 2008). Educational approaches such as one-on-one education by trained lay individuals (*promotoras* or Community Health Workers) or patient navigators that relay information about the benefits, indications and strategies to overcoming screening barriers, as well as provide motivation to participants have been used among low-income communities and/or among racial and ethnic minorities (Percac-Lima et al., 2009; Sunny and Rustveld, 2018; Myers et al., 2019; Bernardo et al., 2019; Dougherty et al., 2018). Systematic reviews of educational, public health and public policy interventions reveal the utility in a multilevel approach — addressing the patient, provider and delivery-system — to increasing CRC awareness and screening (Breslow et al., 2008; Berkowitz et al., 2015; Baker et al., 2014; Dietrich et al., 2006; Levin et al., 2018). However, little is known about how interactive exhibits impact these outcomes.

The present study examined the impact of guided, scripted tours through an inflatable colon on CRC knowledge, willingness to discuss CRC with others, and intention to be screened among a diverse, urban population in Franklin County, Ohio.

2. Methods

2.1. Setting

This study was performed at five community-sponsored wellness events throughout Franklin County, OH from March 2015 to August 2016. Specifically, our events were held at the YMCA March Madness Health and Wellness Exposition on March 7th, 2015 and March 6th, 2016; the University Hospital East Community Health Day on April 25th, 2015; and the Livingston Park African American Male Walk on August 8th, 2015 and August, 13th 2016. Each event was free and open to the public and intentionally marketed to the African American community who reside near these locations. All community members were eligible to participate in the tour; however, only adults 18 years of age and older were eligible to complete surveys. According to the Ohio Development Services Agency County Profiles (2017), Franklin County, OH is a diverse county comprised of individuals who identify as White (68.8%) as well as a racial minority (34.2%), including African-American/Black (21.3%), Native American (0.2%), Asian (4.3%) and those who identify as “other” or as of mixed race (1.7%, 3.6%, respectively). Within the county, the age-groups are split between individuals who are ≤ 44 (65.2%) and ≥ 45 years of age (34.8%). The median household income is \$52,341 and an estimated 8.5% of people live below 50% of the poverty level. Approximately 90.8% of people aged 0–64 have health insurance (private or Medicaid) ([27]). Additionally, in Franklin County, the CRC screening rate is below 70% (Center for Disease Control and Prevention (CDC), 2016).

2.2. Intervention

Scripted walking tours were led by volunteers trained to discuss a standard set of educational points at each of the six stations within the inflatable colon including normal colon tissue, benign polyp, Crohn’s disease, malignant polyp, colon cancer, and advanced colon cancer. The inflatable colon was 10 feet high, 12 feet wide, and 20 feet long (Fig. 1). The average time required to complete the tour was 7 min. This intervention was chosen as a way to directly engage community members in discussions about CRC and CRC screening in a culturally-sensitive manner that could be tailored to the health literacy of the individual participants.



Fig. 1. Giant inflatable colon.

2.3. Survey measurements

Pre and post surveys were used to assess potential changes in CRC knowledge, willingness to discuss CRC, and intention to undergo screening. If an individual indicated that he/she did not want to complete the survey, he/she was still able to take part in the educational tour. Completion of the surveys signified each participant’s consent to participate in the research study. Each pre and post-survey contained the location and date of the event, participant initials, and date of birth. In addition, at the beginning of each survey, there was an explanation of the purpose of the study, and a disclosure that individuals did not need to complete the survey to participate in the tour and that they could skip any question they did not feel comfortable answering. Each participant was also provided with “Fact Sheets” that contained the same information. Each survey took approximately 5 min to complete. The protocol and surveys used for this study were approved by the Institutional Review Board (IRB) at The Ohio State University.

Pre surveys included a question about insurance status (private, Medicaid, Medicare, other or none), gender identification (male or female), screening history (stool-based testing, sigmoidoscopy and colonoscopy) and the date of their last CRC screening test to determine if age-appropriate individuals were following screening guidelines. In addition, surveys completed after August 2015 included questions about race from which the participants could choose from White/Caucasian, Black/African American, Asian, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, mixed race and other. (This added question, in addition to a question concerning Hispanic ethnicity, resulted in having race and ethnicity information for only a subset of participants.)

The pre surveys also included two “yes/no” questions about whether or not they had spoken to their health care provider about CRC and if they had been recommended for one of the screening tests in the past. The pre and post surveys asked a series of “yes/no” questions to assess CRC knowledge by asking if the respondent knew what a colon polyp was, what colon cancer was, if they knew if most patients survived CRC if it is found early and removed, and whether or not they have participated in a guided tour through an inflatable colon before. Both surveys also used “yes/no” questions to assess whether or not the participants knew what a CRC screening test was, and the different types of CRC screening tests. Additionally, participants were asked about their knowledge (unknowledgeable, somewhat knowledgeable or very knowledgeable) of CRC and how CRC progresses. Participants were asked how likely (not likely, somewhat likely or very likely) they were to

communicate with their doctor, relatives, peers, community members and at risk individuals about CRC and their likelihood to get screened both before and after their guided tour through the inflatable colon.

Study data were collected and managed using Research Electronic Data Capture (REDCap). REDCap is a secure, web-based application designed to support data capture for research studies (Harris et al., 2009).

2.4. Statistical analyses

A pre and post-test research design was used to assess changes in CRC knowledge, willingness to discuss CRC, and intention to undergo screening. Descriptive statistics (i.e. proportions) were used to describe demographic characteristics of participants and to compare factors of interest (age, gender, race, insurance status) according to changes in self-reported knowledge, likelihood of communicating about CRC cancer to selected groups (relatives, peers, etc.), and intent to be screened for CRC. Logistic regression was used to examine potential associations between factors of interest and three outcomes (knowledge, communication and intent to screen). In univariate logistic regressions, odds ratios were calculated for relationships between factors of interest and one of the three outcomes. Multivariate logistic regression was used to build a model of predictors of each outcome separately. For example, we examined self-reported increase in CRC knowledge using a univariate analysis with odds ratios (OR) and 95% confidence intervals (CI). Additionally, we utilized logistic regression to identify participant characteristics that were associated with a change in response from “unknowledgeable” to “somewhat knowledgeable” or “very knowledgeable” or from “somewhat knowledgeable” to “very knowledgeable”. Similar to knowledge, increased likelihood was measured by at least one positive increase (unlikely to somewhat likely; somewhat likely to very likely; unlikely to very likely).

Models were initially built backwards, initially including all potentially important factors of interest and, one by one, removing factors that were not associated with outcomes and did not substantively alter associations between additional factors in the model and the outcome. Removal of factors stopped when all factors in the final model were at least marginally statistically significant. Then, factors which were removed earlier in the model building process were reconsidered for model inclusion, to be certain that removal from the model had not been based only on order of removal. Alpha was set at 0.05 for two-sided hypothesis tests. Statistical analyses were conducted using SAS Software version 9.4.

3. Results

Between March 2015 and August 2016, scripted tours were given to 580 individuals through the inflatable colon exhibit at five community wellness events in Franklin County, OH. Among this cohort, 294 (50.6%) were eligible to participate and completed both pre and post surveys. Demographic characteristics of the participants are described in Table 1. Although 294 eligible participants completed both pre and post surveys, missing information resulted in varying sample sizes for multiple variables; for example, 288 of the 294 participants provided their age and, as noted above, information about race and Hispanic ethnicity was available for only 64 and 58 participants, respectively. In addition, due to missing both pre and post survey information, sample sizes varied for questions concerning CRC knowledge (pre survey $n = 284$, post survey $n = 289$), likelihood of communicating with peers (pre survey $n = 282$, post survey $n = 287$), relatives (pre survey $n = 282$, post survey $n = 287$), community members (pre survey $n = 280$, post survey $n = 288$), and high-risk individuals (pre survey $n = 279$, post survey $n = 288$) about CRC screening, and intention to screen for CRC (pre survey $n = 276$, post survey $n = 288$).

Of note, the majority of our participants identified as female, African American and as having private insurance. Additionally, our data reveal

Table 1
Participant Demographic Characteristics (N = 294).

Characteristics	Age Group			Total N (%)
	<45 N = 132 (46%)	45–49 N = 34 (12%)	≥50 N = 122 (42%)	
Gender				
Male	53 (18.40%)	16(5.56%)	47 (16.32%)	116 (40.28%)
Female	79 (27.43%)	18 (6.25%)	75 (26.04%)	172 (59.72%)
Race				
White/Caucasian	13 (20.63%)	1(1.59%)	4(6.35%)	18 (28.57%)
Black/African American	19 (30.16%)	6(9.52%)	17 (26.98%)	42 (66.67%)
Asian	0 (0%)	0(0%)	1(1.59%)	1(1.59%)
American Indian/ Alaskan Native	0 (0%)	0(0%)	0(0%)	0(0%)
Native Hawaiian/ Pacific Islander	0 (0%)	0(0%)	0(0%)	0(0%)
Mixed Race	1(1.59%)	0 (0%)	0 (0%)	1(1.59%)
Other	1(1.59%)	0 (0%)	0 (0%)	1(1.59%)
Hispanic Ethnicity				
Yes	0 (0%)	1(1.72%)	0(0%)	1 (1.72%)
No	34 (58.62%)	6(10.34%)	17 (29.31%)	57 (98.28%)
Insurance Type				
No Response	4 (1.36%)	0 (0%)	3(1.02%)	7(2.38%)
Private	88 (29.93%)	26(8.84%)	77 (26.19%)	191 (64.97%)
Medicare	9(3.06%)	2(0.68%)	18(6.12%)	29(9.86%)
Medicaid	18(6.12%)	3(1.02%)	7(2.38%)	28(9.52%)
None	12(4.08%)	2(0.68%)	9(3.06%)	23(7.82%)
Other	4 (1.36%)	1(0.34%)	6(2.04%)	11(3.74%)
Private and Medicare	0 (0%)	0 (0%)	3(1.02%)	3 (1.02%)
Private and Medicaid	0 (0%)	0 (0%)	1(0.34%)	1(0.34%)
Medicare and Medicaid	1(0.34%)	0 (0%)	0 (0%)	1(0.34%)

that 41% of participants with private insurance had been screened prior to their participation in the inflatable colon exhibit, as opposed to 24% of participants with none or “other” insurance.

There was a statistically significant improvement in CRC knowledge, willingness to discuss CRC with others, and intention to be screened among participants in all three age cohorts (Table 2). Specifically, our data demonstrates that after participating in the inflatable colon tour, more individuals were “very likely” to communicate with their peers, relatives, community members and high-risk individuals about CRC as compared to before the tour. Our data also revealed that more individuals were “very likely” to intend to undergo age appropriate screening than before the tour. Further, our data demonstrate that more individuals were “very knowledgeable” after than before the participating in the tour.

In regards to CRC knowledge, participants < 45 and 45–49 years of age were 46% and 59% more likely, respectively, to increase their CRC knowledge as compared to those 50 years of age (OR = 1.46; 95% CI = 0.85–2.50), (OR = 1.59; 95% CI = 0.65–3.86), albeit these are not statistically significant findings. Additionally, men were 18% more likely to increase their CRC knowledge than women (OR = 1.18; 95% CI = 0.70–1.00). Participants with Medicaid demonstrated a two-fold increase in the likelihood of increasing knowledge of CRC compared to those with private insurance (OR = 2.01; 95% CI = 0.73–5.56), as opposed to those with Medicare, whose knowledge was less likely to have increased (OR = 0.54; 95% CI = 0.24–1.19). None of the demographic characteristics were significant predictors of the improvement in knowledge (Table 3).

Participant characteristics associated with an increase in the likelihood of communicating with peers, relatives, community members, and

Table 2
Pre and Post-Survey responses to likelihood to communicate about CRC, intent to screen, and knowledge level about CRC.

	Not Likely		Somewhat Likely		Very Likely		p-value
	Pre N(%)	Post N(%)	Pre N(%)	Post N(%)	Pre N(%)	Post N(%)	
Communicate with:							
Peers	62 (21.99%)	21 (7.32%)	100 (35.46%)	70 (24.39%)	120 (42.55%)	196 (68.29%)	<0.0001
Relatives	59 (20.92%)	16 (5.57%)	90 (31.91%)	51 (17.77%)	133 (47.16%)	220 (76.66%)	<0.0001
Community Members	78 (27.86%)	24 (8.33%)	103 (36.79%)	78 (27.08%)	99 (35.36%)	186 (64.58%)	<0.0001
High-risk Individuals	56 (20.07%)	13 (4.51%)	101 (36.20%)	55 (19.10%)	122 (43.73%)	220 (76.39%)	<0.0001
Intent to Screen	41 (14.86%)	8 (2.78%)	87 (31.52%)	52 (18.06%)	148 (53.62%)	228 (79.17%)	<0.0001
	Unknowledgeable		Somewhat Knowledgeable		Very Knowledgeable		
CRC Knowledge	Pre 86 (30.28%)	Post 1 (0.35%)	Pre 162 (57.04%)	Post 112 (38.75%)	Pre 36 (12.69%)	Post 176 (60.90%)	<0.0001

Table 3
Post- survey self-reported increase in knowledge about CRC by demographic characteristics.

Increase in CRC Knowledge	Univariate OR (95% CI)
Age	
< 45	1.46 (0.85–2.50)
45–49	1.59 (0.65–3.86)
50+ (ref)	1.00
Gender	
Male	1.18 (0.70–1.99)
Female (ref)	1.00
Insurance	
Private (ref)	1.00
Medicare	0.54(0.24–1.19)
Medicaid	2.01 (0.73–5.56)
None/Other	0.98 (0.47–2.08)
Race	
Black/African-American Race	0.98(0.32–2.99)
White/Caucasian Race (ref)*	1.00

Note: * indicates only a subset of the population asked to identify race/ethnicity

high-risk individuals after participating in the scripted, guided inflatable colon tour are shown in Table 4. Similar to what we observed with increases in CRC knowledge, none of the demographic variables were significantly associated with the improvement in willingness to discuss CRC. However, there was a trend toward greater willingness to discuss CRC among individuals <45 years of age as compared to the other age cohorts.

Unadjusted and adjusted odds ratios and 95% confidence intervals are shown in Table 5 for participant characteristics associated with an improvement in intention to undergo CRC screening. Notably, age and insurance status were significant predictors of an increased intention to undergo CRC screening in both univariate and multivariate analyses. Specifically, participants < 45 years of age (OR = 2.66; 95%CI = 1.49–4.75) compared to those 50 years and older, as well as those with Medicare (OR = 2.52; CI 1.08–5.88) or with no or “other” insurance (OR = 2.14; 95%CI = 1.02–4.51) compared to those with private insurance, were significantly more likely to report increased likelihood of undergoing CRC screening after statistical adjustment for confounding.

Moreover, approximately 54% of individuals older than 45 years of age had been recommended by their physicians to be screened for CRC prior to participating in the inflatable colon exhibit. All but one of our participants (99.65%) found the guided, scripted tour through the inflatable colon exhibit to be at least somewhat effective as a tool to educate individuals about CRC.

Table 4
Post- survey self-reported likelihood to communicate about CRC by demographic characteristics.

	Univariate model Likelihood of Communicating with:			
	Peers OR (95% CI)	Relatives OR (95% CI)	Community Members OR (95% CI)	High-risk Individuals OR (95% CI)
Age				
< 45	1.24 (0.74–2.085)	1.12 (0.61–1.71)	1.07 (0.65–1.77)	1.30 (0.77–2.18)
45–49	0.58 (0.24–1.40)	0.64 (0.27–1.50)	0.69 (0.31–1.54)	0.89 (0.39–2.02)
50+ (ref)	1.00	1.00	1.00	1.00
Gender				
Male	0.69 (0.42–1.12)	0.74 (0.45–1.22)	0.73 (0.45–1.19)	0.67 (0.41–1.10)
Female (ref)	1.00	1.00	1.00	1.00
Insurance				
Private (ref)	1.00	1.00	1.00	1.00
Medicare	1.13 (0.49–2.63)	1.37 (0.61–3.17)	1.05 (0.47–2.36)	0.77 (0.33–1.82)
Medicaid	0.903 (0.38–2.12)	1.26 (0.54–2.94)	1.31 (0.58–2.98)	0.97 (0.42–2.25)
None/Other	1.38 (0.67–2.81)	1.71 (0.83–3.50)	1.31 (0.64–2.67)	0.99 (0.47–2.05)
Race				
Black/African-American	1.77 (0.42–7.44)	1.35 (0.31–5.80)	1.09 (0.33–3.62)	1.04 (0.29–3.69)
White/Caucasian (ref)*	1.00	1.00	1.00	1.00

Note: * indicates only a subset of the population asked to identify race/ethnicity

4. Discussion

In this study, we demonstrated that scripted, guided tours through an inflatable colon exhibit increased self-reported CRC knowledge, the likelihood of communicating with others about CRC and the intention to undergo CRC screening among a diverse, urban population. To our knowledge, this is the first evaluation of guided, scripted tours through an inflatable colon in diverse, urban community settings in the continental US.

All but one participant (99.65%) found the tour to be an effective educational tool. This is particularly important as 132 (45.8%) participants were <45 years old, a cohort for which there is evidence of increasing CRC incidence rates, but for which current guidelines do not recommend screening (Siegel et al., 2009a, 2017b, 2017c, 2019; Abualkhair et al., 2020; Austin et al., 2014; Bailey et al., 2015). Additionally, current guidelines recommend screening begin at age 40 among high-risk individuals with a first-degree relative with CRC, however, recent studies have found that <40% of individuals between

Table 5

Post-survey self-reported likelihood to undergo CRC screening by demographic characteristics.

Intent to Screen	Univariate	Multivariate Model
	OR (95% CI)	OR (95% CI)
Age		
< 45	2.33 (1.34–4.07)	2.66 (1.49–4.75)
45–49	1.27 (0.54–2.98)	1.49 (0.62–3.58)
50+ (ref)	1.00	1.00
Gender		
Male	0.93 (0.50–1.50)	↗
Female (ref)	1.00	↗
Insurance		
Private (ref)	1.00	1.00
Medicare	2.02 (0.90–4.54)	2.52 (1.08–5.88)
Medicaid	1.17 (0.49–2.76)	1.03 (0.43–2.48)
None/Other	1.98 (0.97–4.08)	2.14 (1.02–4.51)
Race		
Black/African-American	0.92 (0.32–3.67)	↗
White/Caucasian (ref)*	1.00	↗

Note: ↗ indicates that this factor was not included in the final multivariate model. * indicates only a subset of the population asked to identify race/ethnicity

the age of 40–49 with a family history are being appropriately screened (Siegel et al., 2020). Therefore, in considering the trend towards increasing CRC incidence in younger populations and the discrepancy in screening among younger at-risk individuals, there is sufficient evidence to support efforts aimed at CRC and CRC screening education for those aged 45 and younger. Further, in light of the recent changes to the ACS guidelines in which they lowered the recommended age for average-risk individuals to begin CRC screening from 50 to 45, our findings suggest inflatable colon tours could contribute to age-appropriate screening uptake (Wolf et al., 2018; Peterse et al., 2018).

Importantly, our findings also highlight the impact of inflatable colon exhibit on vulnerable populations, specifically those who are uninsured and publicly insured. As compared to individuals with private insurance, those who reported having Medicare, no insurance, or “other” insurance were significantly more likely to report intention to be screened. We suspect that this difference is attributable to disparities in both access and lack of physician recommendation for those less visible within the healthcare system. Individuals with Medicare and with no or “other” insurance may not have known their eligibility to be screened or the availability of CRC screening tests, and therefore only reported an intention to get screened after learning about its necessity via the inflatable colon exhibit.

Additionally, our findings also contribute to the existing evidence on inflatable colon exhibits in other populations. To date, there have only been four other studies in the continental U.S. that have explored the impact of a tour through the inflatable colon on CRC knowledge and intention to undergo CRC screening (Sanchez et al., 2014; Briant et al., 2015a, 2015b; Molina et al., 2018; Redwood et al., 2013). Two of the studies were conducted in a rural, Hispanic population in Washington state (Briant et al., 2015a, 2015b). One was conducted at a university and included college-age participants (Sanchez et al., 2014). Another was conducted among residents of Alaska (Redwood et al., 2013). All studies, similar to the present study, had a female participant predominance. Redwood et al. similarly demonstrated a significant improvement in CRC knowledge, intention to be screened and comfort with discussing CRC with others among Alaskan natives and non-Native, predominately White community residents. Of note, they exhibited the colon, but did not offer guided, scripted tours. Additionally, they did not analyze differences by insurance status (Redwood et al., 2013). Briant et al. studied a primarily Hispanic population in three rural counties of Washington State and demonstrated that participants > 50 years of age and who regularly see a physician had an increased likelihood of being

screened for CRC after walking through the inflatable colon exhibit. This study also found an increase in familiarity with CRC among those < 50 years of age (Briant et al., 2015; Molina et al., 2018).

Sanchez et al. used the Inflatable Colon Assessment Survey (ICAS) to assess knowledge and intentions to obtain CRC screening and promote CRC awareness among students, faculty and staff at New Mexico State University who toured an inflatable colon (Sanchez et al., 2014). This population was predominately comprised of college-educated, young (< 30 years old) Hispanic females. Similar to the present study, investigators demonstrated significant improvement in CRC knowledge, intention to screen and to promote CRC screening. Unlike the present study, however, in which intention to be screened was the most significant finding, the greatest gains in their study was in CRC knowledge with a significant improvement from the pre to post-test. Further, their study found gender-based differences in behavioral intentions to promote CRC education to relatives, peers, community members, and individuals at risk for CRC, whereas our study did not find any such differences in willingness to communicate about CRC among the same cohorts.

Notably, in the present study, individuals aged < 45 and between 45 and 49 years of age demonstrated a greater increase in CRC knowledge as well as a greater intention to be screened for CRC after walking through the inflatable colon exhibit as compared to the older cohort. These findings can be attributed to the fact that many of our participants who were older than 45 years old had expressed intentions of screening before participating in the inflatable colon exhibit, likely due to physician-recommendations related to age-related relative risk factors. Two studies conducted outside of the continental US examined the impact of an inflatable colon exhibit on CRC knowledge and screening intention (Portilla-Skerrett et al., 2019; Baassiri et al., 2020). One was done in Puerto Rico among participants aged 40 years and older with no prior history of CRC and found significant increases in CRC knowledge and awareness (Portilla-Skerrett et al., 2019). The other study was completed in Lebanon among participants < 50 and ≥ 50 years of age and demonstrated increases in CRC knowledge, screening intention and social engagement of the subject with peers (Baassiri et al., 2020).

5. Limitations and Strengths:

There are several limitations to this study. First, our relatively small sample size and incomplete data on race and ethnicity limits the generalizability of our findings. There are other social determinants of health that were not assessed such as income, education level, and health literacy, and these may have influenced our outcomes of interest. Family history of CRC was not assessed either and thus it is not clear if a family history of CRC may have influenced intention to be screened. Given the anonymity of the surveys, this study did not determine the percentage of participants who successfully completed a CRC screening test after the tour through the inflatable colon and did not measure retention of information over time. Additionally, the pre and post survey design is subject to response shift bias which reflects a change in participants' perspective as a result of the intervention (Drennan and Hyde, 2008). Finally, this study did not capture the impact of the inflatable colon exhibit on non-survey respondents and this study did not evaluate the comparative effectiveness of the inflatable colon to another educational tool. However, our exploration demonstrates the potential to positively impact CRC knowledge and CRC screening intention among an urban population that has not been previously studied. Notably, the inflatable colon exhibit has garnered tremendous attention from local and national organizations as well as media. It is routinely requested at wellness events in Central Ohio and has been an integral piece of our Provider and Community Engagement (PACE) Program that has received national recognition from the American College of Gastroenterology and National Colorectal Cancer Roundtable (NCCRT) (Ray, 2019; National Colorectal Cancer Roundtable, 2018).

6. Conclusions:

Guided, scripted tours through an inflatable colon exhibit have proven to be an effective interactive educational tool that can be used in diverse community settings to positively influence CRC knowledge, discussion of CRC, and intention to be screened, even among traditionally hard-to-reach populations including the uninsured and young adults. These findings are particularly poignant as the ACS now recommends CRC screening start at age 45 among the general population and many states have CRC screening rates that are far below the 80% goal that was established by the ACS and National Colorectal Cancer Roundtable (NCCRT) (Wolf et al., 2018; Klabunde et al., 2011; Data Progress, 2019). CRC is largely preventable with screening and exhibits such as the inflatable colon have the potential to improve screening uptake.

CRedit authorship contribution statement

Christine A. Miguel: Data curation, Writing - original draft, Writing - review & editing. **Electra D. Paskett:** Conceptualization, Methodology, Investigation, Supervision, Writing - review & editing, Funding acquisition. **James L. Fisher:** Formal analysis, Writing - review & editing. **Darla K. Fickle:** Investigation, Writing - review & editing. **Chasity M. Washington:** Investigation, Writing - review & editing. **Cecilia Degraffinreid:** Investigation, Writing - review & editing. **Cathy Tatum:** Investigation, Writing - review & editing. **Darrell M. Gray II:** Conceptualization, Data curation, Methodology, Investigation, Supervision, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2020.101248>.

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