INCREASING COLORECTAL CANCER KNOWLEDGE, AWARENESS, AND INTENT TO SCREEN IN AN UNDERSERVED AREA

A Doctor of Nursing Practice Project Report

by

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BSN, Texas A&M University-Corpus Christi, 2008
MSN, Texas A&M University-Corpus Christi, 2017

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This Doctor of Nursing Practice Project Report meets the standards for scope and quality of Texas A&M University-Corpus Christi and is hereby approved.

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ABSTRACT

Colorectal cancer (CRC) is a leading cause of cancer-related deaths in the United States that can be identified and prevented through early screening. Current screening rates do not meet existing recommendations, especially in medically underserved areas where there is reduced access to primary care services. A lack of CRC awareness and knowledge have been identified as two of the largest barriers to screening. An inflatable colon tour has been proven an effective intervention to address CRC knowledge and awareness deficits. This DNP project was designed as a community awareness initiative in an underserved area using a pre- and post-survey with the purpose of increasing colorectal cancer awareness, knowledge, and intent to discuss and complete CRC screening. This quasi-experimental study had a QI focus and used a convenience sample in a public setting who completed a pre-and post-survey assessing colorectal cancer awareness, knowledge, and intent to discuss and complete screening (n =185 persons screened with n =85 meeting inclusion criteria). Post-tour CRC awareness scores showed a statistically significant increase in mean scores at p <.001. Colorectal cancer knowledge scores showed a statistically significant increase in post-test scores at p <.001. Post-tour, there was an 82% increase in people who identified as "very likely" or "definitely" willing to discuss CRC screening with their healthcare provider and a 133% increase in people identifying as "very likely" or "definitely" likely to complete CRC screening in the next 6 months. This project is evidence that community events using inflatable models can successfully increase cancer awareness and knowledge in underserved populations.

Keywords: colorectal cancer, inflatable colon, medically underserved, community education

DEDICATION

I would like to dedicate this work to my family. To my husband, Wade, who has provided endless love and encouragement from the day I applied to the doctoral program. I could not have accomplished this without his support. To my sons, Weston, Walker, and Wyatt, who sacrificed many hours of "mom time" during my pursuit of this degree. To my parents, sister, brother-in-law, and extended family, who provided hours of babysitting so that I could spend time studying and completing my project, thank you. I love you all.

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I would like to acknowledge Laura Rivas and Okiemute (Kitay) Diejomaoh, the TAMUCC Student Nurse Association, and the Del Mar College Student Nurse Association, for their assistance in making my event a success. Most importantly, I want to acknowledge my heavenly father, who continues to provide in ways that exceed any plans I think I have for myself.

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1. INTRODUCTION

Colorectal cancer (CRC) is the second leading cause of cancer-related deaths in the United States despite being preventable through early screening (U.S. Cancer Statistics Working Group, 2021). Burdens from the disease are numerous and are influenced by the cancer's stage at diagnosis (Rahiminejad et al., 2022). Colorectal cancer is staged from 0 to IV, with 0 indicating superficial, localized cellular changes and IV signifying metastatic cancer (Rahiminejad et al., 2022). The five-year survival rate for localized cancers is 90.9% but only 15.1% for cancers diagnosed with spread to distant sites, emphasizing the importance of early detection (National Cancer Institute, 2022a). Likewise, cancer treatment costs are also related to the cancer's stage at diagnosis. The costs of treating tumors found in stages III or IV can be triple compared to those of treating tumors in stages I or II (Eaglehouse et al., 2019). In those diagnosed with CRC, individual costs range from $40,000 at diagnosis to $110,000 for the final year of life (Centers for Disease Control, 2021; National Cancer Institute, 2022b). In 2020, the total national expenditures for CRC were estimated at $24.3 billion, emphasizing the financial impact of this disease (National Cancer Institute, 2022b).

Background

The U.S. Preventive Services Task Force (USPSTF) is a national organization that publishes evidence-based recommendations on disease prevention and screening. In response to more advanced cancers being detected at a younger age, the USPSTF decreased the recommended screening age for CRC in average-risk persons from 50 to 45 years in 2021 (USPSTF, 2021). This change resulted in an additional 19 million people becoming eligible for CRC screening (Hyams et al., 2022). The age recommendation is decreased for those at high risk of CRC, further increasing the number of people requiring screening (Colorectal Cancer

Alliance, 2022; USPSTF, 2021). Recommended screening tests include a fecal occult blood test (FOBT) or fecal immunochemical test (FIT) annually, a stool DNA-FIT test every 1-3 years, a CT colonography every 5 years, a flexible sigmoidoscopy every 5 years, a flexible sigmoidoscopy every 10 years with an annual FIT, or a screening colonoscopy every 10 years (Davidson et al., 2021).

Healthy People 2030 is a national initiative addressing the most critical public health measures to improve well-being across the United States. One of the Healthy People 2030 objectives is to reduce deaths from colorectal cancer by having 74.4% of adults complete CRC screening (Office of Disease Prevention and Health Promotion, 2022). As of 2020, CRC screening rates in the United States were at 69% of the eligible population (American Cancer Society, 2020). Evidence supports that CRC burdens decrease with early screening and diagnosis, emphasizing the importance of ensuring that screening rates meet the new USPSTF and Healthy People 2030 guidelines.

Review of the Literature

A review of the literature indicated that the gap between screening recommendations and completion rates must be addressed to affect change and meet current guidelines. In a group-randomized experimental trial with 109 participants, Katz et al., (2018) compared patient-level CRC screening barriers using open-ended questions and direct question probing. The most cited barrier to screening across the 10 primary clinics was a lack of knowledge regarding CRC risks, symptoms, and screening recommendations (Katz et al., 2018). Further research in primary care clinics has shown that increasing CRC education and awareness while discussing screening options correlated with increased patient knowledge and intent to complete screening (Frissora et al., 2021). A systematic review of 94 studies identified awareness as the most influencing factor

in colorectal cancer screening (Honein-AbouHaidar et al., 2016). The term awareness includes knowledge of the disease, its etiology and progression, and the role of screening in cancer prevention (Honein-AbouHaidar et al., 2016). Thus, to increase colorectal cancer screening rates, healthcare providers must address the most significant barriers: inadequate knowledge and lack of awareness (Honein-AbouHaidar et al., 2016; Katz et al., 2016; Wang et al., 2019).

The key to addressing these barriers is education. Effective health education must be both engaging and evidence based (Cutilli, 2020). A review of the literature found that participation in an interactive educational inflatable colon tour increased knowledge and awareness of CRC as well as intent to complete screening. A quasi-experimental study by Redwood et al. (2013) was the first to use an inflatable colon as an educational tool. This study was conducted at 23 community events in Alaska and Canada and included 880 adults aged 18 years and older (Redwood et al., 2013). Participants completed an unguided tour through the inflatable colon model that displayed normal and abnormal colon tissue, information on cancer prevention, and recommendations for colorectal cancer screening. The study fulfilled all objectives at statistically significant levels by increasing knowledge ($p < .05$), screening intention ($p < .001$), and social support ($p < .001$) for colorectal cancer screening (Redwood et al., 2013).

In another quasi-experimental study, Sanchez et al. (2014) displayed an inflatable colon model for 463 adult participants aged 20 years and older in a university setting. Participants were provided a guided tour that covered CRC risk factors, stages, and screening methods. The tour was effective at increasing CRC knowledge ($p < .001$), awareness ($p < .001$), and screening intention ($p < .001$), all at statistically significant levels (Sanchez et al., 2014).

Miguel et al. (2020) held inflatable colon tours at five community wellness events in Ohio. The tours included information on normal tissue, gastrointestinal conditions, and the

progression from precancerous states to cancer. Data was collected on 294 participants aged 18 years and older. This study showed statistically significant improvement in CRC knowledge, willingness to discuss CRC with others, and intention to be screened, all at $p < .0001$ (Miguel et al., 2020). As evidenced by multiple studies, an inflatable colon tour has been proven an effective intervention to address knowledge and awareness deficits, which are the primary barriers to CRC screening.

Problem Description

Nueces county was targeted for this project because it had a higher CRC incidence rate at 39.5 per 100,000 people than state (37.4) or national (36.3) averages (National Cancer Institute, 2022c). In addition, as of 2021, only 55.3% of the eligible population were current with CRC screening (U.S. Cancer Statistics Working Group, 2022). This county was designated as medically underserved, which has been correlated with reduced uptake and quality of cancer screening due to limited primary care access, reduced income, and lack of health coverage (Ioannou et al., 2021; Wong, 2015). Residents in these areas also experience socioeconomic and cultural barriers to healthcare (Health Resources and Services Administration, 2022). In consideration of the target area being medically underserved with reduced access to primary care services, this DNP project was developed as a community-based initiative (Health Resources and Services Administration, 2022). Community-based educational programs have been proven to increase knowledge and reduce barriers to cancer screening, making it an ideal method for this DNP project (Fang et al., 2019).

Project Purpose and Aims

As an underserved area with an increased CRC incidence, this location lacked the knowledge and resources to achieve the recommended screening rates. The clinical question

guiding this DNP project was: In adults aged 35-75 years who are not current on colorectal cancer screening, what is the effect of a guided tour through an inflatable colon on colorectal cancer awareness, knowledge, and intent to complete recommended screening compared to pre-tour levels? There were three specific aims developed for the project. Aim #1 was to increase participants' awareness of CRC by a statistically significant level as determined by comparing the number of correct answers on pre-and post-tour questionnaires. Aim #2 was to increase participants' knowledge of CRC by a statistically significant level as determined by comparing the number of correct answers on a pre- and post-tour questionnaire. The goal of aim #3 was to increase participants' intention to discuss and complete CRC screening by 50% as determined by comparing pre- and post-tour questionnaires.

The American Association of Colleges of Nursing (AACN) and the National Organization of Nurse Practitioner Faculty (NONPF) have established fundamental principles for DNP education, and these competencies were applied to project development (Waldrop et al., 2014). This project aligned with AACN Essential VII, Clinical Prevention and Population Health for Improving the Nation's Health, by advancing health promotion and risk reduction through knowledge and awareness of preventive screening for CRC (American Association of Colleges of Nursing, 2006). This project aligns with NONPF Competency 3, quality, and DNP Essential III, Clinical Scholarship and Analytical Methods for Evidence-Based Practice, by using evidence to improve the quality of care (American Association of Colleges of Nursing, 2006; National Organization of Nurse Practitioner Faculty, 2007). By implementing an evidence-based intervention to promote cancer screening, this project fulfilled the competencies of both AACN and NONPF.

Guiding Frameworks

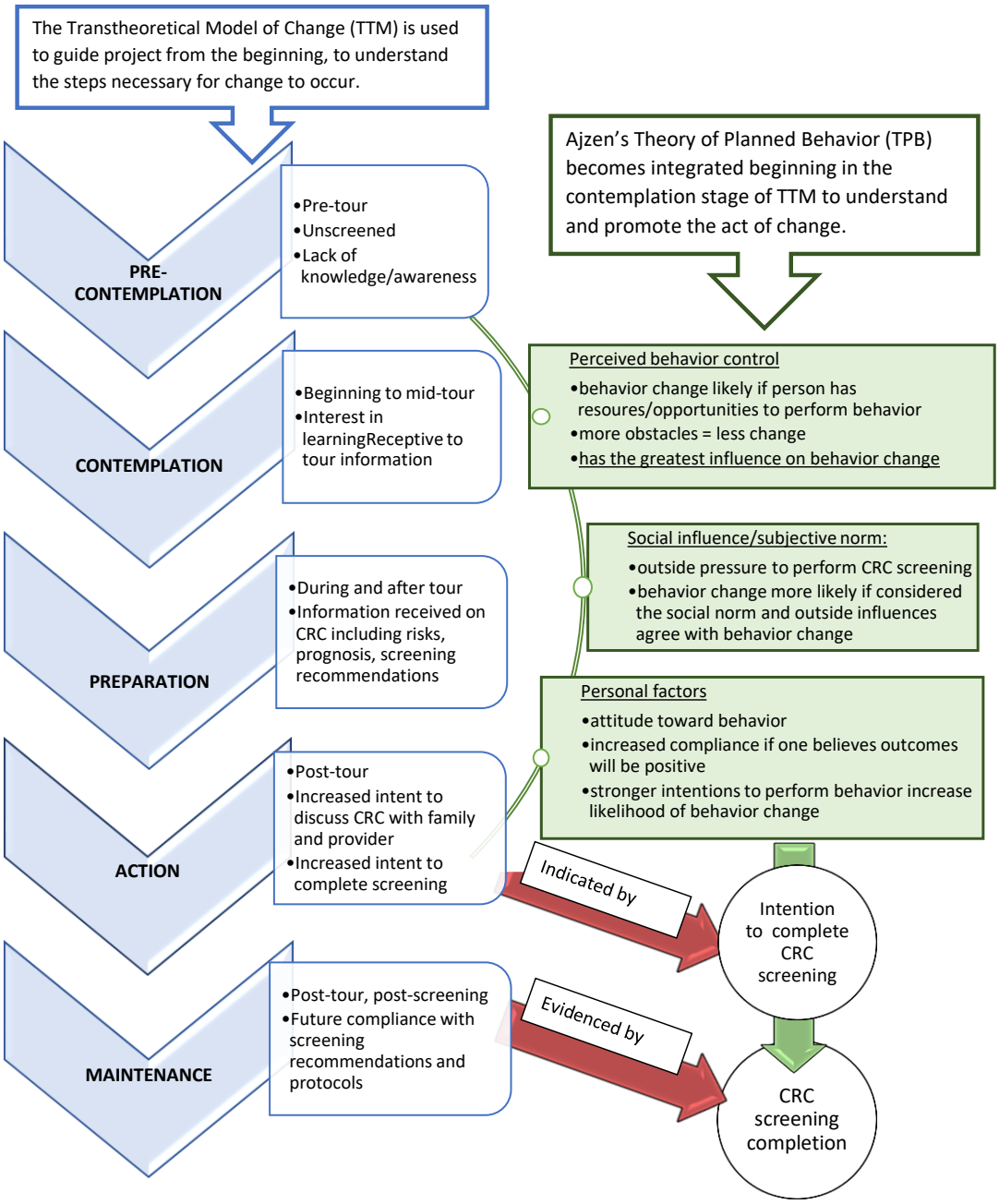
Conceptual and theoretical frameworks guided the development of this project. Prochaska and DiClemente's (1982) Transtheoretical Model of Change (TTM) is a five-stage model that outlines the steps necessary to produce behavior change. It was developed from the integration of psychotherapy and behavior change theories to assist in helping patients make decisions that promote healthy behaviors (Prochaska, 2008). The five stages include pre-contemplation, contemplation, preparation, action, and maintenance (Prochaska & DiClemente, 1982). The TTM model is ideally suited to promote behavior change in patient populations who are noncompliant, unmotivated, or unready for change (Prochaska, 2008). The TTM model guided development of this inflatable colon project to promote CRC knowledge, awareness, and screening intention.

Ajzen's Theory of Planned Behavior (TPB), which postulates that actions are goal driven and influenced by intentions, was used as the theoretical guide for this project (Ajzen, 1985). The Theory of Planned Behavior explains that a person's intentions are influenced by three elements: personal factors, social influence, and control (Ajzen, 1985). These three factors are weighed differently for each individual. Personal factors include one's attitude toward the behavior, such as the positive and negative aspects of CRC screening (Ajzen, 2005). The second element, social influence, is the outside pressure to perform or complete the specific behavior, including whether this behavior is accepted as a social norm (Ajzen, 2005). People who believe their influences (family, social circle, medical providers) would agree with this behavior change are more likely to comply with behavior modification. The theory identifies the third element, behavior control, as the most influential to change (Ajzen, 2005). Ajzen (1991) describes this concept as people believing they have the resources and opportunities to perform a certain behavior. The more

obstacles that are present, the less likely one is to complete the behavior in question. TPB has been successfully applied to increase screening rates for both cervical and prostate cancers (Roncancio et al., 2015; Sarra et al., 2015). The TTM model was used to guide project development, and Ajzen's theory was integrated to promote progression from the contemplation to the action stage of behavior change (see Figure 1).

Figure 1

Conceptual and Theoretical Frameworks: Applying the TTM Model and TPB



The interweaving of both theories was necessary for this project, as the team was unable to measure if CRC screening was completed by the participants post-tour. The TPB provided the means for the project team to predict if this behavior change would likely occur since it was not directly measurable.

2. METHODS

Ethical Considerations

This project plan was reviewed by the Texas A&M University-Corpus Christi Institutional Review Board (IRB) for project/study classification and received a determination of exempt and permission to proceed (see Appendix A). This project did not obtain personal health information; thus, HIPAA permissions were not required. The study did take place in a public location, but participation was voluntary. Surveys were offered via paper or electronic format and were anonymous, with no identifiable information collected. Researchers were unable to identify or contact participants after survey completion. An opportunity for participants to ask questions was provided privately post-tour to protect confidentiality, and individual tours were offered if requested. Survey data was only accessible by the DNP team. The project facility supported the conducting of this project (see Appendix B).

Project Design

This DNP project was designed as a community awareness initiative with a pre- and post-survey to meet a knowledge deficit in an underserved area with the objective of increasing CRC awareness and knowledge. Medically underserved regions have underlying barriers to care, resulting in higher incidences of preventable disease and increased mortality rates (Adepoju et al., 2021). An inflatable colon model was chosen as the method of education because it has been proven to be an innovative and successful means to increasing knowledge rates compared to more traditional forms of education (Portilla-Skerrett et al., 2019). The primary barrier to this project was funding of the inflatable model. The DNP chair procured a generous grant awarded to non-profit organizations that address educational and healthcare needs for the underserved.

This grant provided the funds to initiate production of the inflatable colon. Additional grant and scholarship money was awarded to the DNP student to support full funding of this project.

As a community initiative, a central, public location was chosen as the project setting. This provided the team with the ability to reach a sample that was a true representation of the local population. Though this model was an eye-catching form of recruitment, it possibly deterred participants who preferred more private education. A risk assessment was completed with risks mitigated by the non-inclusion of personal identifiers, the ability of participants to skip any distressing questions, and appropriate safety precautions taken to secure the physical model (see Table 1).

Table 1

Inflatable Colon Tour Project Risk Assessment Table

Risk	Impact	Countermeasure	Resources	Barriers
1. Breach of Confidentiality:	Intrusion into participant privacy, affects trust and rapport of healthcare professionals, compromise data and integrity of project.	Remove all personal identifiers from survey; data forms under constant supervision and control of team member; store information in lock box and password protected computer; for electronic surveys, use Qualtrics system provided by university	Discuss waiver of consent with TAMUCC IRB, as consent would be the only identifiable information linking participants to project.	Events will be taking place in public location where people may identify participants
2. Psychological Risk: distress due to the nature of information collected	Incomplete questionnaires, participant distress, inaccurate data due to partial survey completion	To mitigate this, participants will be informed before the tour that participation is voluntary, and they are not required to answer any question(s) that make	Questionnaires to be reviewed by DNP team as well as TAMUCC IRB to minimize risk of emotional effects	Some participants may not be aware of triggering topic or questions until participating in tour.

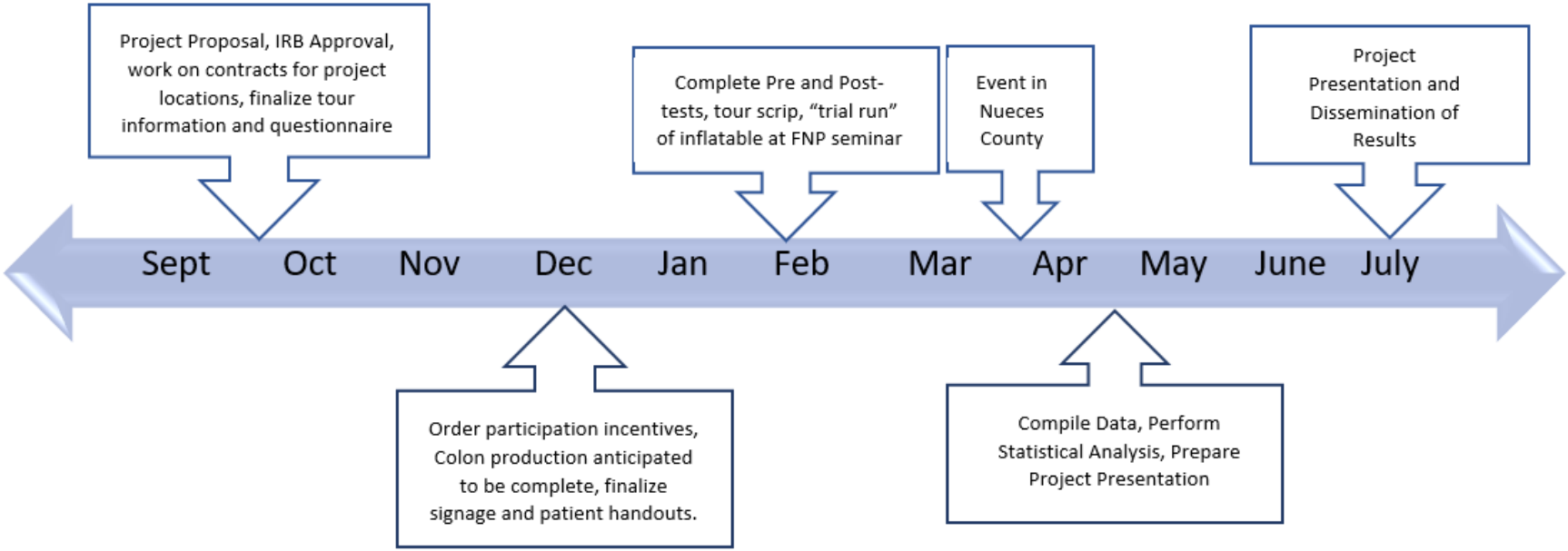
Risk	Impact	Countermeasure	Resources	Barriers
		them uncomfortable or cause distress		
3. Physical Risk: participants will be required to physically walk or move (via wheelchair) through the tour of an inflatable, tunnel-like structure	Participants with claustrophobia may be discouraged from participating; tunnel may be insufficiently aired or may shift in position	To mitigate this, the tunnel will be secured properly per manufacturer recommendations. If participants are claustrophobic, can provide tour information outside of the tunnel, not requiring participant to walk through	Landmark Creations is the tunnel manufacturer and will be a resource to ensure physical safety related to the structure	Environmental factors, such as wind, to be considered during outdoor events.

Intervention

The DNP project team consisted of the DNP student, the DNP project chair, and the DNP project advisor. The DNP student was responsible for project and material development, data collection, statistical analysis, and project presentation. The DNP project chair was responsible for the inflatable colon tool and approving all resources created by the DNP student. The project advisor was responsible for project and content guidance and approval of project resources. An additional two DNP students and several undergraduate student nurses were available to assist with project execution. This educational intervention was scheduled as a one-day event, on a Saturday, to be conducted from the hours of 8am to 4pm. A project timeline guided project development and completion (see Figure 2).

Figure 2

DNP Project Timeline



Prior to project implementation, a script was developed to guide the tour through the inflatable model (Appendix C). The model itself was a tunnel-like structure measuring 20 ft x 10 ft x 12 ft. It included information on benign and malignant colon conditions. Banners were displayed at the end of the tunnel that emphasized information on CRC risk factors and screening recommendations. Team members were educated on the information. The event was promoted on social media by the DNP student, a local healthcare organization, and the event setting. On the morning of the event, project materials were transported by the DNP student. The inflatable colon model was set up, and participants were recruited on-site by verbal recruitment and signage. Inclusion criteria were adults aged 35-75 years, and exclusion criteria were participants up to date with CRC screening or those with a personal history of CRC. Since this was a community initiative, no people were turned away from the tour. However, only those meeting inclusion/exclusion criteria were asked to complete the pre- and post-test questionnaires. The tests evaluated CRC awareness, knowledge, and intent to discuss and complete CRC screening before and after the scripted tour (see Appendix D and E).

After completion of the pre-test, a member of the project team guided participants through the inflatable model while discussing key points. Upon conclusion of the tour and exiting the model, participants were provided a completion incentive and an informational sheet from the Centers for Disease Control (Appendix F). Participants were provided additional time to ask questions and complete the post-test. If needed, participants were also provided with information on local primary care clinics that provide low-cost medical services.

Data Collection

All participants were encouraged to complete pre- and post-test questionnaires. The survey was available via paper format or accessed electronically using a QR code through

Qualtrics, a university-provided survey tool. The pre-test questionnaire requested information on age, gender, race, ethnicity, and county of residence. In addition, the pre-test included three questions about a person's history with CRC, including personal and family history of colon cancer and personal history of CRC screening. Historical CRC information was reviewed to determine exclusion criteria. The pre- and post-tests also included four questions evaluating CRC awareness, nine questions evaluating CRC knowledge, and two questions assessing CRC discussion and screening intentions (See Appendix D and E). The project team collected data from these tests before and after each tour. The electronic survey data were automatically organized into Qualtrics, and the paper survey data was manually entered by the DNP student into the Qualtrics system. This data set was compiled and organized for statistical analysis upon completion of the event. Completed paper questionnaires were stored in a secured cabinet. The digital data set was stored on a laptop secured with a passcode and up-to-date McAfee protection software.

Measurement Tools

The pre- and post-test questionnaires were developed to measure knowledge, awareness, and CRC screening intention. The awareness portion of the questionnaire consisted of four questions, and the knowledge portion consisted of nine. Knowledge and awareness questions were reproduced with permission and previously found both valid and reliable (Aga et al., 2021). Intention questions were reproduced with permission from Sanchez et al. (2014). The two intention questions consisted of 4-point Likert scales and were scored as follow: 1 for "not likely," 2 for "somewhat likely," 3 for "very likely," and 4 for "definitely." No reliability or validity testing had been performed on these. However, Likert scales are widely used to evaluate attitudes and perceptions. Researchers had previously used similar Likert scale questions to

assess CRC screening intention (Baassiri et al., 2020; Boutsicaris et al., 2021; Molina et al., 2018; Redwood et al., 2013; Whitaker et al., 2020). No identifying information was included on the questionnaires.

Data Analysis

The project data analysis was conducted using Intellectus software. Descriptive statistics were used to analyze sociodemographic data, including category percentages for age, gender, race, and ethnicity. The county of residence data was not analyzed as part of this project. Scores were calculated for the number of correct answers regarding CRC knowledge and awareness before and after the inflatable colon tour. This data was assessed for normal distribution using the Shapiro-Wilk test. To determine if aim #1 and #2 were met, paired pre- and post-test scores were evaluated using parametric (paired *t*-test) or non-parametric (Wilcoxon signed rank) tests as indicated by data distribution. Pre- and post-test scores were analyzed to determine if a statistically significant difference was attained after participants completed the inflatable colon tour.

Descriptive statistics were used to summarize the data obtained from the Likert-scale response questions assessing intent to discuss CRC screening and the likelihood of completing CRC screening within the next six months. Frequencies for Likert-scale responses were determined for pre- and post-test questionnaires. Percent change was then calculated between pre- and post- test questionnaires for the answer frequencies of “very likely” and “definitely.”

3. RESULTS

Implementation

As a one-day community event, the DNP team was prepared for possible obstacles. In the days leading up to implementation, the team was notified that a children's holiday photo event was scheduled simultaneously with this DNP project. This resulted in the inflatable colon being moved to an alternate location in the facility that was less central than planned. Considering this, and anticipating a much younger adult population being present, an amendment was submitted for IRB approval to decrease the minimum participant age from 45 to 35 years. Adequate space and a power source were present in the new location, and IRB approval was obtained to change the sample age prior to implementation. The physical setup of the project otherwise went as planned and took place from 8 am – 4 pm.

Some participants finished both the pre- and post-test surveys before completion of the educational tour. To address the issue, we made real-time edits to the electronic survey and added a survey break with the word "stop" prompting participants to proceed with the tour upon completion of the pre-test. We also included the word "stop" at the end of the pre-test on the paper surveys. This helped to resolve most of the problems encountered during survey completion. Overall, the data collection process proceeded as intended.

Findings

A total of 211 people interacted with the project team at the event, and 185 participants were screened for project participation. Of these, 93 met inclusion criteria (aged 35 – 75 years and not current with CRC screening). Two of the 93 surveys were excluded due to not answering the question assessing personal history of CRC, and 6 were excluded for being incomplete. This left 85 completed surveys for analysis.

Demographics

Descriptive statistics were used to evaluate age, ethnicity, race, and both personal and family history of CRC. Approximately 94% percent of participants had never been screened for CRC, while 5.88% were previously screened but not up to date. Most participants had no family history of CRC (see Table 2).

Table 2

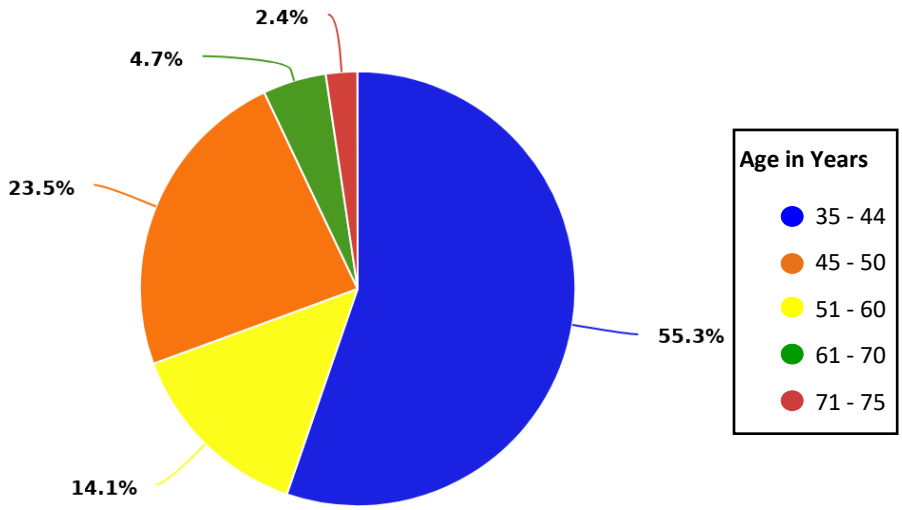
Historical Questions

Question	*n*	*%*
Previous CRC Screening		
Yes	5	5.88
No	80	94.12
Family History of CRC		
No	76	89.41
Yes	8	9.41
No Response	1	1.18

Of the five age categories, most participants were 35-44 years (55.3%). The second largest group was comprised of participants 45-50 years (23.5%). The remainder were 51-60 years (14.1%), 61-70 years (4.7%), and 71-75 years (2.4%) (See Figure 3).

Figure 3

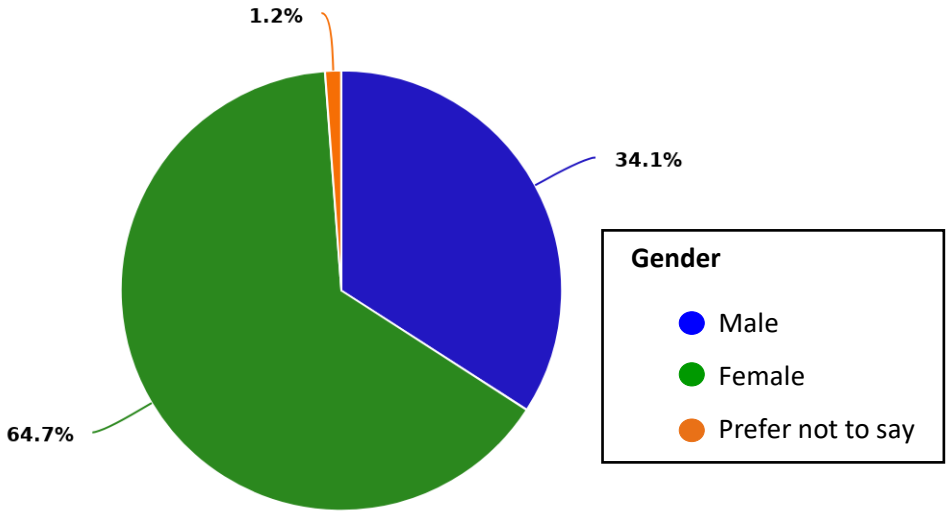
Age of Participants



Gender percentages showed a greater number of female (64.7%) than male (34.1%) participants (see Figure 4). A total of 1.2% did not declare male or female and selected "prefer not to say."

Figure 4

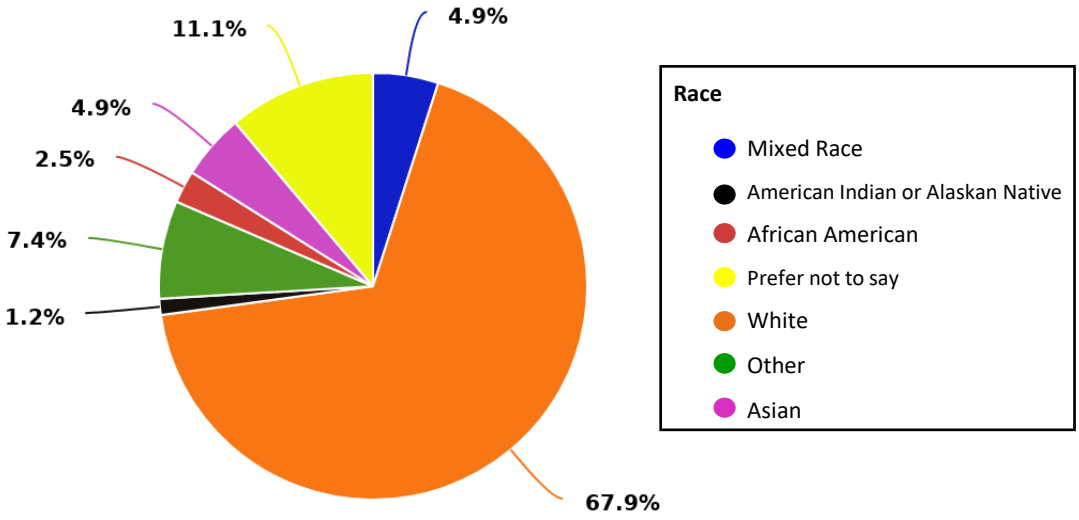
Gender of Participants



Percent distributions were calculated for participants' races and ethnicities. White participants made up most of the sample at 67.9% (see Figure 5). The second largest category was "prefer not to say" (11.1%), followed by "other" (7.4%), mixed race (4.9%), Asian (4.9%), African American (2.5%), and American Indian/Alaskan Native (1.2%).

Figure 5

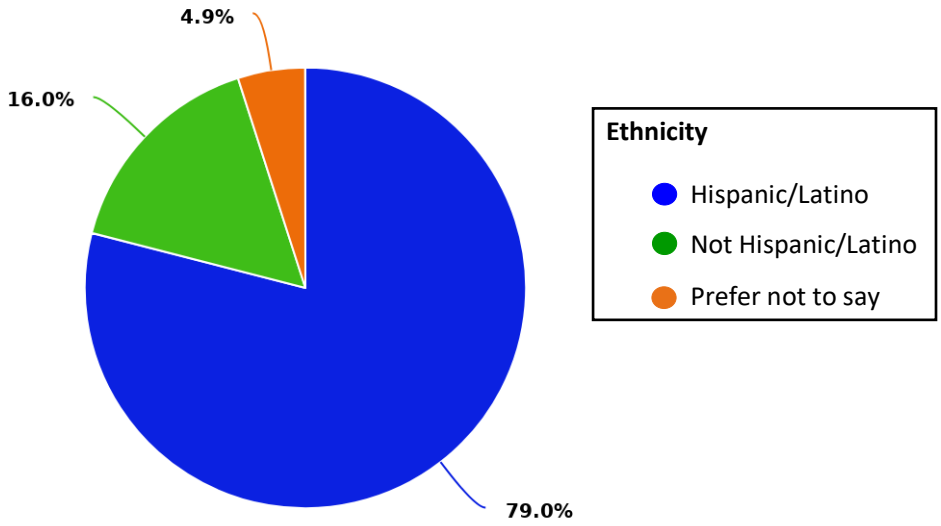
Self-identified Race of Participants



Most participants identified as Hispanic/Latino ethnicity (79.0%). The remainder were either not Hispanic/Latino (16%) or selected "prefer not to say" (4.9%) (See Figure 6).

Figure 6

Ethnicity of Colon Tour Participants



Aim #1

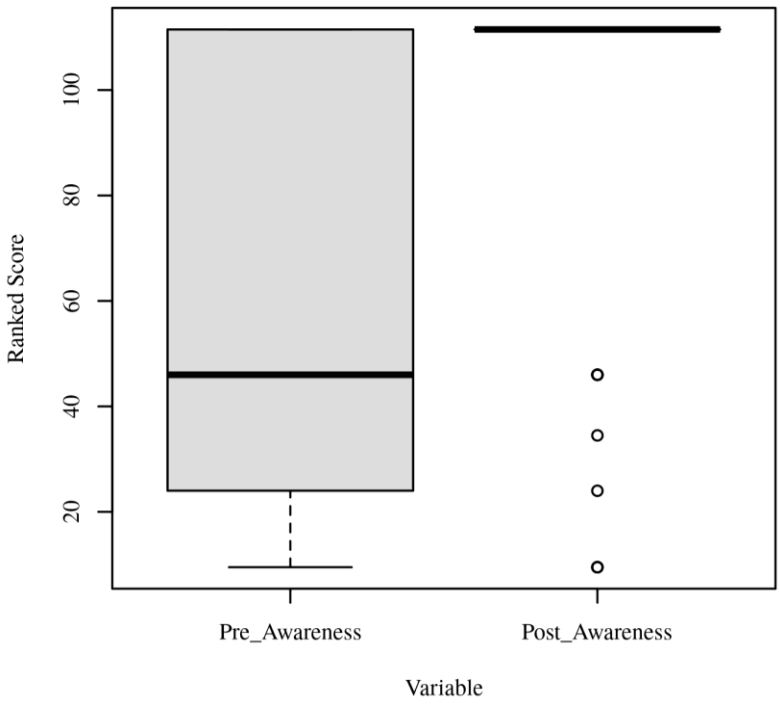
To evaluate if aim #1 was met, scores for the four CRC awareness questions were analyzed for a statistically significant difference between pre-and post-tour surveys. Prior to analysis, a Shapiro-Wilk test was conducted to determine whether a normal distribution could have produced the differences (Rowe, 2016). The results of the Shapiro-Wilk test were significant based on an alpha value of .05, $W = 0.78$, $p < .001$. This suggested that the differences in pre-tour and post-tour awareness scores were unlikely to have been produced by a normal distribution, violating the normality assumption.

Thus, a two-tailed Wilcoxon signed rank test, which does not assume a normal distribution of the sample, was performed (Rowe, 2016). The two-tailed Wilcoxon signed rank test results were significant based on an alpha value of .05, $V = 14.00$, $z = -5.44$, $p < .001$. This indicated that the differences between pre-tour and post-tour awareness were not likely due to

random variation. The median of pre-tour awareness scores (M = 75) was significantly lower than the median of post-tour awareness scores (M = 100). Figure 7 presents a boxplot of pre- and post- awareness data.

Figure 7

Ranked Values of Pre-Tour and Post-Tour Awareness Scores



Aim #2

The evaluation of aim #2 was completed by analyzing the difference between pre- and post-tour scores of CRC knowledge for a statistically significant change. The results of a Shapiro-Wilk test were not significant based on an alpha value of .05, $W = 0.97$, $p = .057$, which indicated normal distribution. A paired t-test was conducted, and results were statistically significant based on an alpha value of .05, $t(84) = -7.31$, $p < .001$. This indicated that the difference in CRC knowledge between pre- and post-tour was statistically significant from zero (see Table 3).

Table 3

Paired Samples t-Test for the Difference Between Pre- and Post-Tour Knowledge

Pre-tour Knowledge		Post-tour Knowledge				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
62.35	24.13	81.18	21.10	-7.31	< .001	0.79

Note. $n = 85$. Degrees of Freedom for the *t*-statistic = 84. *d* represents Cohen's *d*.

Aim #3

To evaluate aim #3, descriptive statistics were used to summarize the data obtained from the questions assessing intent to discuss CRC screening with a medical provider and the likelihood of completing CRC screening within the next six months. Frequencies for Likert-scale categories were displayed in tabular format comparing pre- and post-test responses (see Table 4).

Table 4

Frequency Table: Intention to Discuss and Complete Screening

Variable	*n*	*%*
Pre-Tour Intent to Discuss Screening		
1: Not Likely	15	17.65
2: Somewhat Likely	35	41.18
3: Very Likely	17	20.00
4: Definitely	18	21.18
Post-Tour Intent to Discuss Screening		
1: Not Likely	4	4.71
2: Somewhat Likely	17	20.00
3: Very Likely	35	41.18
4: Definitely	29	34.12
Pre-Tour Intent to Complete CRC Screening		

Variable	*n*	*%*
1: Not Likely	23	27.06
2: Somewhat Likely	38	44.71
3: Very Likely	12	14.12
4: Definitely	12	14.12
Post-Tour Intent to Complete CRC Screening		
1: Not Likely	10	11.76
2: Somewhat Likely	19	22.35
3: Very Likely	30	35.29
4: Definitely	26	30.59

Note. Due to rounding errors, percentages may not equal 100%.

Prior to the tour, the most frequently observed category for intent to discuss CRC with a medical provider was 2, somewhat likely (n = 35, 41.18%). Post-tour, the most frequently observed category for intent to discuss CRC with a medical provider was 3, very likely (n = 35, 41.18%). Post-tour, there was an 83% increase in people who identified as "very likely" or "definitely" willing to discuss CRC with their healthcare provider compared to pre-tour levels.

Pre-tour, the most frequently observed category of intent to complete CRC screening in the next six months was 2, somewhat likely (n = 38, 44.71%). The most frequently observed category for intent to screen post-tour was 3, very likely (n = 30, 35.29%). Post-tour, there was a 133% increase in people who identified as "very likely" or "definitely" likely to complete CRC screening in the next 6 months compared to pre-tour levels.

4. DISCUSSION

Summary

The purpose of this DNP project was to evaluate the effect of a guided tour through an inflatable colon on colorectal cancer awareness, knowledge, and intent to discuss and complete recommended CRC screening. The project successfully met all aims. The increase in CRC awareness and knowledge was statistically significant, indicating that the inflatable colon tour was an effective educational tool. In addition, a post-tour increase was seen in participants' likelihood to discuss CRC screening with a medical provider or complete CRC screening within six months. This signifies that more participants left the tour with the intention of conducting recommended screening than when they started. These results indicate that a large-scale event can reach participants in a medically underserved area, where they may not have adequate access to primary care services.

Relation to Other Evidence

The findings of this project were consistent with previous studies using an inflatable colon model for education. Gray et al. (2015) saw a statistically significant difference in pre- and post-tour CRC knowledge and intent to discuss CRC screening with a provider after a community event providing a guided tour through an inflatable colon model. Baassiri et al. (2020) also offered guided tours through an inflatable colon at community events and found a statistically significant increase in CRC knowledge and likelihood of getting screened. In a third study, Briant et al., (2014) saw increased familiarity with CRC and increased intention to be screened after providing guided tours through an inflatable colon model. The Briant et al. (2014) study is noteworthy because the authors provided CRC test kits after their event and had a 75.3% test completion rate.

Limitations

There were restrictions on the advertising used to promote this event. A larger sample could have been recruited had broader forms of advertising, such as local news coverage, been approved. It is unclear how early completion of both pre- and post-tour surveys prior to the actual tour affected data. In the future, this could be mitigated by incorporating more direct instructions to stop after the pre-test or a visual image on the Qualtrics survey that signals participants to stop and complete the tour. Based on the demographic results indicating a largely Hispanic sample, offering the tour in Spanish should be considered for future events. Also, the education level of participants was not assessed. The DNP team was aware of several healthcare providers, including nurses and physicians, who participated in the tour, possibly skewing results. The survey questions were adapted from a questionnaire that had previously been determined reliable and valid. However, due to the length of the original questionnaire, only a subset of the questions was used for this project, possibly affecting the reliability of the survey questions.

Furthermore, inclusion criteria specified a minimum age of 35 years. Average-risk persons are only eligible for CRC screening beginning at age 45. The final question in the survey assessed the intention to complete CRC screening with a medical provider within 6 months. Based on the inclusion criteria, participants may have selected "unlikely" simply because they will not meet the minimum age for screening at that time. However, that question still produced a 133% post-tour increase in likelihood. It is possible that this percentage increase would have been more pronounced had those who would not be eligible within six months been removed from the analysis. Lastly, the team could not provide CRC screening kits post-tour, which would

have provided participants with a screening opportunity on site and concrete screening completion data for the DNP team.

Interpretation

Participation in the inflatable colon tour successfully advanced participants from the pre-contemplation stage to the action stage of the TTM model. This was evidenced by an increase in the intent to complete screening and the intent to discuss CRC with a healthcare provider. Following the TPB, the increase in intention to complete CRC screening should facilitate screening test completion. The Theory of Planned Behavior was integral in evaluating project results, as the team was unable to provide CRC screening tests during the event. The outcomes of this initiative were congruous with previous studies. With the primary costs of the inflatable colon already covered, the only funding needed for future events would be the purchase of additional participation incentives. The pre- and post-surveys have been adjusted to address possible confounding variables affecting results, such as assessing participant education level in the pre-test. Sustainability was established by a second event completed two weeks after this project. In addition, several organizations have expressed interest in having the inflatable colon at their events, and the intention is to hold another 2-3 events in the fall of 2023.

Conclusion

This project was evidence of the positive impact an innovative, community-held educational initiative can have on a medically unserved population. It serves as evidence that community events may be beneficial in increasing cancer awareness and screening knowledge in populations at risk for reduced access to primary care services. In reviewing these results, local healthcare providers and organizations should consider community-based initiatives for other forms of patient education. The eye-catching nature of this project was an asset to drawing in

participants, indicating that the use of large inflatable models should be explored for future educational initiatives. Further research is recommended to follow patients at future intervals to assess if CRC testing was completed. In addition, with appropriate funding, providing fecal occult cards for CRC screening post-tour would allow participants to complete screening at future events without having to schedule a medical appointment.

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APPENDIX A

IRB OUTCOME LETTER

TEXAS A&M UNIVERSITY CORPUS CHRISTI | RESEARCH & INNOVATION

Date: March 15, 2023
To: Dixie Andelman
CC: Kelli Dahlgren, Marina Martinez, Michelle Eisenman, MSc, Tammy McGarity, DNP
From: Office of Research Compliance
Subject: **Amendment Approval for Exempt Study**

Dear Dixie Andelman,

On 03/15/2023, the Texas A&M University IRB - Corpus Christi Institutional Review Board (IRB) reviewed and approved the request changes for the following study:

Type of Review:	**Protocol Submission Form**
Title of Study:	Increasing Colorectal Cancer Knowledge, Awareness, and Intent to Screen in an Underserved Region
Principal Investigator:	Dixie Andelman
IRB Number:	TAMU-CC-IRB-2022-0577 **Submission Number:** TAMU-CC-IRB-2022-0577-AMD-4.0
Risk Level:	Not Greater than Minimal Risk under 45 CFR 46 / 21 CFR 56
Change Description:	Increase the sample size to 150 participants and also alter the age ranges to include on anyone 35 years old and up. If high risk, we will mention, guidelines recommend screening 10 years earlier. Additionally, we would like to briefly discuss ulcerative colitis and familial adenoma polyposis during our tour (added to tour script).
Submission Outcome:	Amendment Approved for Exempt Study

On 03/15/2023, the IRB confirmed the study as changed continues to meet exempt category:

Category 2: Research that only includes interactions involving educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior (including visual or auditory recording) if at least one of the following criteria is met: i. The information obtained is recorded by the investigator in such a manner that the identity of the human subjects cannot readily be ascertained, directly or through identifiers linked to the subjects; ii. Any disclosure of the human subjects' responses outside the research would not reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, educational advancement, or reputation; or iii. The information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by .111(a)(7).

Approved changes may now be implemented.

If you have any questions or concerns please contact us at irb@tamucc.edu.

Rebecca Ballard, JD
Office of Research Compliance

APPENDIX B

FACILITY CONTRACT

Advertiser/Sponsor:
Screen for Health South Texas
Kelli Dahlgren
8901 Marauder Drive, Corpus Christi, TX 78414
Phone: 361.701.1030
Kdahlgren04@yahoo.com

Owner:
Corpus Christi Retail Venture, LP, Agent for La Palmera
Amanda Sanchez
General Manager La Palmera
5488 South Padre Island Dr., Corpus Christi, TX
Phone: 361.991.3755; Fax: 361.993.5631

The parties have executed this Agreement on the day and year first above written.

Advertiser/Sponsor:

Signature: Kelli Dahlgren

Print Name: Kelli Dahlgren

Title: —

Date: 9/7/22

Owner:

Corpus Christi Retail Venture, LP

By: Agent for La Palmera

By: RSanchez
Authorized Representative

Date: 9/8/2022

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APPENDIX C

INFLATABLE COLON TOUR KEY POINTS

DNP Project: Inflatable Colon Tour Script

- Welcome! Before we start the tour, make sure you have completed your Pre-tour survey and have come to the screen that says "STOP".
- We are going to be taking you through our inflatable colon, Siggy, to educate you on colorectal cancer. The colon is part of our large intestine. We are going to talk about a few diseases that can occur in the colon in addition to colorectal cancer and the importance of screening.

RIGHT WALL:

- Hanging from the right side and ceiling of our colon are Polyps: These are fleshy growths in the lining of the colon. Polyps are discovered through colonoscopies and are commonly benign (non-cancerous). However, some polyps are precursors to colon cancer. These are called malignant polyps and are displayed on the opposite wall. If these are not removed, they can develop into cancer. Polyps are the primary thing that we are looking to identify and remove during colon cancer screening.

- To the right of the colon we have Familial Adenomatous Polyposis (FAP): an inherited condition in which numerous polyps form in the lining of the colon. While these polyps start out benign, they can develop into cancer if not treated. Most patients with this condition will develop colorectal cancer if they do not have frequent cancer screening. If this runs in your family, you definitely want to discuss this with your medical provider.
- It isn't displayed here, but Lynch Syndrome is another genetic disorder that puts people at risk for colorectal cancers. If this runs in your family, you will need to talk with your doctor about more frequent screenings.

- On the left wall here in the middle we have two of the Inflammatory Bowel Diseases (IBDs), Crohn's and Ulcerative Colitis (UC). In Crohn's disease, the body's immune system starts attacking healthy cells in the lining of your digestive tract. It can cause diarrhea, pain, fatigue, and weight loss. Crohn's increases your risk for colorectal cancer. In UC, the lining of the colon becomes inflamed and develops sores/ulcers that lead to bleeding and diarrhea. UC can also increase your risk of colorectal cancer. If you have IBD, discuss when to start colorectal cancer screening with your doctor.

Toward the end of our colon here, we have colon cancer and advanced colon cancer.

- In Colon Cancer: Polyps can group together, grow larger and deeper into lining of the colon, developing into colon cancer. Once colon cancer has developed, it cannot be removed with a colonoscopy. It usually requires surgery and other treatments. The key to early detection is regular colon screenings because many people will NOT have symptoms of early-stage cancer. Most patients survive colorectal cancer if it is found early and removed, which is why we are educating everyone on colon cancer screening.

- <u>REFER TO RETRACTABLE BANNERS</u>
  - Screening recommendations: As of 2021, the recommended age to start colorectal cancer screening is now 45. For most people, screening will end at age 75.
    - Some conditions that indicate need for screening prior to age 45 include:
      - Family history of colorectal cancer or high risk adenomatous or large polyps
      - Personal history of colorectal cancer
      - Personal history of inflammatory bowel disease such as ulcerative colitis or Crohn's
      - Family history of hereditary colorectal cancer syndrome such as familial adenomatous polyposis (FAP) or Lynch syndrome
      - Personal history of radiation to the abdomen or pelvic area to treat a prior cancer.
    - Recommended screening tests include a
      - fecal occult blood test (FOBT) or fecal immunochemical test (FIT) annually
      - a stool DNA-FIT test every 1-3 years
      - CT colonography every 5 years
      - a flexible sigmoidoscopy every 5 years
      - a flexible sigmoidoscopy every 10 years with an annual FIT
      - or a screening colonoscopy every 10 years.
- Most people do not have ANY symptoms of colon cancer. Some signs and symptoms may include:
    - A change in bowel pattern or stools
    - Abdominal or rectal pain
    - Unexplained weight loss
    - Blood in your stool
    - Bloating
    - Fatigue
  - Colon cancer risk factors include:
    - LOW intake of dietary fiber
    - LOW intake of fruits and vegetables
    - Lack of exercise
    - Obesity
    - Diabetes
    - HIGH intake of red meat
    - Tobacco and alcohol use
    - Family history

Thank you for your participation in our tour. Please complete the post tour survey and then feel free to grab one of the items on the table.

APPENDIX D

PRE-TOUR QUESTIONNAIRE

~~IRB NUMBER: TAMU-CC-IRB-2022-0577~~
IRB APPROVAL DATE: 3/15/2023

PRE-TEST: BEFORE TOUR

Please skip any questions you are not comfortable answering. Remember, all your information is private and confidential.

Age: ☐ 35-44 ☐ 45-50 ☐ 51-60 ☐ 61-70 ☐ 71-75 ☐ 76+ ☐ Prefer not to say

Gender at birth: ☐ Male ☐ Female ☐ Prefer not to say

Race: ☐ White ☐ African American ☐ Asian ☐ American Indian or Alaskan Native
☐ Native Hawaiian or Other Pacific Islander ☐ Mixed Race ☐ Other ☐ Prefer not to say

Ethnicity: ☐ Hispanic/Latino ☐ NOT Hispanic/Latino ☐ Prefer not to say

County of Residence: ☐ Aransas ☐ Bee ☐ Duval ☐ Jim Wells ☐ Kleberg ☐ Live Oak ☐ Nueces ☐ Refugio
☐ San Patricio ☐ Other ☐ Prefer not to say

1) Have you ever been screened for colorectal cancer? ☐ Yes | ☐ No If yes, date/test _____
2) Have you ever been diagnosed with colorectal cancer? ☐ Yes | ☐ No If yes, when _____
3) Do you have a family history of colorectal cancer? ☐ Yes | ☐ No If yes, what age and relative _____

Awareness

1) Are you aware of colorectal cancer (CRC)? ☐ Yes | ☐ No
2) Are you aware that colorectal cancer is preventable? ☐ Yes | ☐ No
3) Are you aware of testing methods used to detect colorectal cancer? ☐ Yes | ☐ No
4) Are you aware that colorectal cancer can be cured if detected at an early stage? ☐ Yes | ☐ No

Knowledge

1) Do you think colorectal cancer is common in the United States? ☐ Yes | ☐ No
2) Which of the following do you think are risk factors of developing colorectal cancer?
   - A) High dietary intake of red meat ☐ Yes | ☐ No
   - B) High dietary fiber ☐ Yes | ☐ No
   - C) Low dietary intake of fruits and vegetables ☐ Yes | ☐ No
   - D) Lack of exercise ☐ Yes | ☐ No
   - E) Diabetes ☐ Yes | ☐ No
   - F) Obesity ☐ Yes | ☐ No
3) Do you know the age recommended for colorectal cancer screening? ☐ Yes | ☐ No
4) Do you think you ONLY need colorectal cancer screening if you are having symptoms? ☐ Yes | ☐ No

Intention

1) As of right now, how likely are you to discuss colorectal cancer screening with your medical provider?

☐ 1	☐ 2	☐ 3	☐ 4
Not likely	Somewhat likely	Very likely	Definitely

2) As of right now, how likely are you to complete colorectal cancer screening in the next 6 months?

☐ 1	☐ 2	☐ 3	☐ 4
Not likely	Somewhat likely	Very likely	Definitely

APPENDIX E

POST-TOUR QUESTIONNAIRE

~~IRB NUMBER: TAMU-CC-IRB-2022-0577~~
IRB APPROVAL DATE: 3/15/2023

POST-TEST: AFTER TOUR

Awareness

1) Are you aware of colorectal cancer (CRC)? ☐ Yes | ☐ No
2) Are you aware that colorectal cancer is preventable? ☐ Yes | ☐ No
3) Are you aware of testing methods used to detect colorectal cancer? ☐ Yes | ☐ No
4) Are you aware that colorectal cancer can be cured if detected at an early stage? ☐ Yes | ☐ No

Knowledge

1) Do you think colorectal cancer is common in the United States? ☐ Yes | ☐ No
2) Which of the following do you think are risk factors of developing colorectal cancer?
   - A) High dietary intake of red meat ☐ Yes | ☐ No
   - B) High dietary fiber ☐ Yes | ☐ No
   - C) Low dietary intake of fruits and vegetables ☐ Yes | ☐ No
   - D) Lack of exercise ☐ Yes | ☐ No
   - E) Diabetes ☐ Yes | ☐ No
   - F) Obesity ☐ Yes | ☐ No
3) Do you know the age recommended for colorectal cancer screening? ☐ Yes | ☐ No
4) Do you think you ONLY need colorectal cancer screening if you are having symptoms? ☐ Yes | ☐ No

Intention

1) After the tour, how likely are you to discuss colorectal cancer screening with your medical provider?

☐ 1	☐ 2	☐ 3	☐ 4
Not likely	Somewhat likely	Very likely	Definitely

2) After the tour, how likely are you to complete colorectal cancer screening in the next 6 months?

☐ 1	☐ 2	☐ 3	☐ 4
Not likely	Somewhat likely	Very likely	Definitely

THANK YOU for your participation and don't forget to GET SCREENED!

IRB NUMBER: TAMU-CC-IRB-2022-0577
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APPENDIX F

INFORMATIONAL SHEET FOR PARTICIPANTS

Colorectal Cancer Screening

Screen for life

What Is Colorectal Cancer?

Cancer is a disease in which cells in the body grow out of control. Colorectal cancer is cancer that occurs in the colon or rectum. The colon is the large intestine or large bowel. The rectum is the passageway that connects the colon to the anus.

Screening Saves Lives

Colorectal cancer is the second leading cancer killer in the U.S. among cancers that affect both men and women. But it doesn't have to be. Routine screening for colorectal cancer beginning at age 45 can save lives!

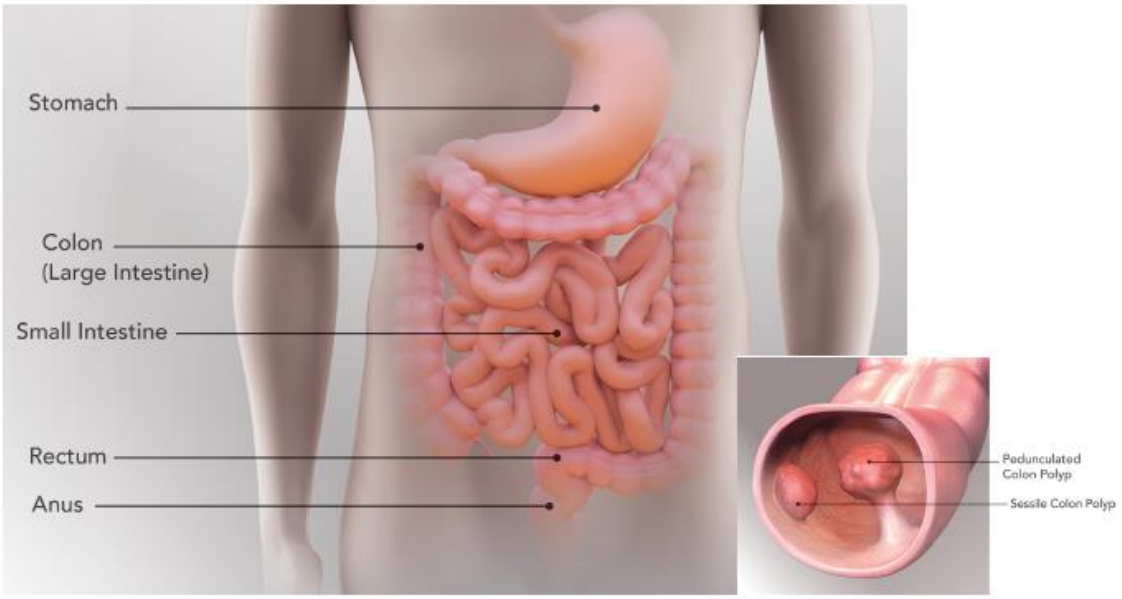
Here's how:

- Colorectal cancer usually starts from precancerous polyps in the colon or rectum. A polyp is a growth that shouldn't be there. Over time, some polyps can turn into cancer.
- Screening tests can find precancerous polyps, so they can be removed before they turn into cancer. Screening tests can also find colorectal cancer early, when treatment works best.

You May Be at Increased Risk If:

- You or a close relative have had colorectal polyps or colorectal cancer.
- You have inflammatory bowel disease, Crohn's disease, or ulcerative colitis.
- You have a genetic syndrome such as familial adenomatous polyposis (FAP) or hereditary non-polyposis colorectal cancer (Lynch syndrome).

People at increased risk for colorectal cancer may need earlier or more frequent tests than other people. If you think you may be at increased risk, talk to your health care provider about the routine screening tests that are right for you.



What Are the Symptoms of Colorectal Cancer?

Someone could have colorectal cancer and not know it. People do not always have symptoms, especially at first (or in early stages).

If there are symptoms, they may include:

- Changes in your bowel habits.
- Blood in or on your stool (bowel movement).
- Abdominal pain, aches, or cramps that don't go away.
- Unexplained weight loss.

Contact your health care provider if you notice any of these symptoms.

Types of Screening Tests

The U.S. Preventive Services Task Force, a group of medical experts, recommends that adults who are 45 to 75 years old be screened for colorectal cancer. The decision to be screened between ages 76 and 85 should be made on an individual basis. If you are older than 75, talk to your health care provider about getting screened. Several different screening tests can be used to find polyps or colorectal cancer. They include:

Stool Tests

- **Guaiac-based Fecal Occult Blood Test (gFOBT)** uses the chemical guaiac to detect blood in stool. At home, you use a stick or brush to obtain a small amount of stool. You return the test to the health care provider or a lab, where stool samples are checked for blood.
- **Fecal Immunochemical Test (FIT)** uses antibodies to detect blood in the stool. You receive a test kit from your health care provider. This test is done the same way as gFOBT.
- **FIT-DNA Test (or Stool DNA Test)** combines the FIT with a test to detect altered DNA in stool. You collect an entire bowel movement and send it to a lab to be checked for cancer cells.

Flexible Sigmoidoscopy (Flex Sig)

The health care provider puts a short, thin, flexible, lighted tube into your rectum and checks for polyps or cancer inside the rectum and lower third of the colon.

Colonoscopy

Similar to flexible sigmoidoscopy, except the health care provider uses a longer, thin, flexible, lighted tube to check for polyps or cancer inside the rectum and the entire colon. During the test, the health care provider can find and remove most polyps and some cancers. Colonoscopy may also be used as a follow-up test if one of the other screening tests finds anything unusual.

CT Colonography (Virtual Colonoscopy)

Computed tomography (CT) colonography, also called a virtual colonoscopy, uses X-rays and computers to produce images of the entire colon. The images are displayed on a computer screen for the health care provider to analyze.

Your health care provider will discuss your test results with you. Depending on your results, you may need a follow-up appointment or another screening test.

Which Test Is Right for You?

You have different screening options. Talk to your health care provider about which tests are right for you and how often you should be screened.

Insurance Coverage

Colorectal cancer screening tests may be covered by your health insurance policy without a deductible or co-pay. Check with your plan to find out which tests are covered for you.

The Bottom Line

If you're 45 or older, talk with your health care provider about getting screened.
For more information:
Visit https://www.cdc.gov/cancer/colorectal/ or call 1-800-CDC-INFO (1-800-232-4636). For TTY, call 1-888-232-6348.

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Centers for Disease Control and Prevention
National Center for Injury Prevention and Control