

COLORECTAL CANCER EDUCATION: UTILIZATION OF AN INFLATABLE COLON  
AND SMALL MEDIA AT A HEALTH FAIR IN CENTRAL NORTH DAKOTA

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**Title**

Colorectal Cancer Education: Utilization of an Inflatable Colon and Small  
Media at a Health Fair in Central North Dakota

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## ABSTRACT

Colorectal cancer is a prevalent and deadly disease, claiming thousands of lives each year. In the United States alone, over 150,000 individuals were diagnosed with colorectal cancer in 2022, and tragically, nearly 53,000 succumbed to its impact (National Cancer Institute [NCI], 2022). Notably, North Dakota faces a unique scenario, with incidence rates per capita surpassing the national average, yet colorectal cancer screening rates lag behind. This disconcerting situation in North Dakota emphasizes a need for targeted public health interventions, increased awareness campaigns, and improved access to colorectal cancer screening services.

Early detection through screening is a pivotal tool in the battle against colorectal cancer, often identifying the disease in its precancerous or early stages, thereby significantly reducing mortality rates. Technologies are available and offer non-invasive, painless, cost-effective, and practical manners that can sometimes be tailored to the individual's preferences. Despite these advancements, the United States and North Dakota fall short of the 80% CRC screening benchmark established by the National Colorectal Cancer Roundtable. Shockingly, in 2020, only 63% of eligible North Dakotans underwent colorectal cancer screening, which is 10% below the national average and well below the national benchmark. High incidence rates, mortality rates, and increasing incidence of early-onset CRC indicate a need for immediate action.

Efforts to bridge the gap between increasing incidence rates and low screening rates are essential to save lives and reduce the burden of colorectal cancer in North Dakota. This evidence-based scholarly project aimed to assess the impact of an educational intervention on colorectal cancer awareness and screening intent. The intervention involved scripted guided tours of a larger-than-life inflatable colon, a PowerPoint presentation set on loop, and educational handouts all strategically deployed during a health fair sponsored by the Missouri Valley YMCA

in Bismarck, ND. Participants, ranging from 18 to 75 years old, engaged with the educational initiative, with the primary goal of enhancing their knowledge of colorectal cancer and influencing their intent to undergo screening. Additionally, the co-investigator sought to uncover and address perceived barriers to colorectal cancer screening within this specific demographic.

## ACKNOWLEDGMENTS

I owe thanks and deep gratitude to many individuals and organizations for the contribution of their expertise in the development of this project. Without each of them, this project would still be an idea. Because of them, many individuals now have greater knowledge of various aspects of colorectal cancer. Perhaps, some even participated in screening and became more proactive members in their health maintenance due to the education received through this project.

The first person I owe my gratitude to is Dr. Kerri Benning. Dr. Benning offered her guidance, encouragement, expertise, time, and insightful feedback through the entire process—from the discussion and selection of potential topics to implementation and evaluation. Dr. Benning was always positive and encouraging—especially when I needed it most. Saying thank you does not seem like enough.

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Nikki Medalen of Quality Health Associates of North Dakota was instrumental in connecting me with other agencies with similar interests such as the North Dakota Health Department, North Dakota Colorectal Roundtable, and the North Dakota Cancer Coalition. Through this project and Nikki's influence, I have become a member of the North Dakota Colorectal Cancer Roundtable and the North Dakota Cancer Coalition. Various members of these agencies also aided in this project's implementation. For their assistance and support, I am thankful.

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## DEDICATION

I dedicate this dissertation project to the most precious gifts God has ever given me:

my faith, my husband, and my children.

My faith was the constant that helped me persevere through this program. Without it, I would have surely fallen. There were times when I struggled to make time for Him, but it seemed that the right verse or reading always found me when I needed it most. God works in the best ways.

Trever, words cannot adequately express how much I thank you for being my teammate in life and parenthood and for helping me actuate my professional and personal dreams. I truly could

not have done it without you, nor would I have wanted to. You have worked long hours providing for the boys and I and we have never gone without. You have prioritized my mental

health, even when I did not. Thank you for your patience, understanding, and love.

Boys, thank you for allowing me to make school a priority, but never a priority over you. You have grown so much during this time, even more than I have. It is an honor to be your mother. I

hope that you have watched me through these years and have realized that you should always push on toward your dreams—even when there are bumps in the road and even if it takes longer

than expected.

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## LIST OF ABBREVIATIONS

ACS .....	American Cancer Society
AICF .....	American Indian Cancer Foundation
CRC .....	colorectal cancer
CTC .....	computed tomography colonography
FAP .....	familial adenomatous polyposis
HBM .....	Health Belief Model
HIS .....	Indian Health Service
NCI .....	National Cancer Institute
NDCRC SI .....	North Dakota Colorectal Cancer Screening Initiative
US .....	United States
USPSTF .....	United States Preventative Services Task Force
WCRFI .....	World Cancer Research Fund International

## **CHAPTER 1: INTRODUCTION**

### **Background and Significance**

Colorectal cancer (CRC) is a condition that reaches across the entire globe. Worldwide, it is the third most common cancer in men and second most common cancer in women (World Cancer Research Fund International [WCRFI], 2022). In 2020, there were 1.9 million new cases of CRC diagnosed and 935,173 deaths worldwide (World Cancer Research Fund International [WCRFI], 2022). High incidence and mortality are not limited to low-income and middle-income countries. The United States also has high incidence and mortality rates from CRC. In 2022, it was estimated that there were 151,030 persons diagnosed with CRC and 52,580 deaths in the United States from colorectal cancer (National Cancer Institute [NCI], 2022). CRC has become the fourth most common form of cancer and the second most deadly in the United States (Imperiale et al., 2021).

In North Dakota, the CRC incidence rates are higher per capita than the national average. The incidence rate of CRC in white males in North Dakota is 54.4 per 100,000 (Schwartz et al., 2019). Within the 53 counties in North Dakota, there is almost a threefold difference in incidence rates, suggesting that there is a potential for many factors to affect the incidence of CRC (Schwartz et al., 2019).

Many potential indications for the increased incidence of CRC in North Dakota are present. North Dakota is primarily a rural state. Despite being the 19<sup>th</sup> largest state by landmass, it is the second lowest in the population (Health Resources and Services Administration [HRSA], 2020). Thirty-six of North Dakota's 53 counties are considered frontier, meaning six or fewer persons per square mile. Farms and ranches comprise 90% of North Dakota's landscape (Rural Economic Area Partnership Investment Board [REAP], 2013). However, only 29% of North

Dakota's population lives in these rural areas, leading to an unequal distribution of goods and services. The unavailability of goods and services impacts CRC screening and incidence rates. Factors potentially affecting CRC incidence and screening rates include lack of transportation, long distances to providers and services, low education level, lower income, lower rates of health insurance coverage, lack of education of and access to CRC screening and treatment options, lower health literacy, inadequate number of available providers, and environmental exposures (Davis et al., 2020; Schwartz et al., 2019; Sutton et al., 2021).

Some geographical areas in the United States have higher incidence and mortality rates than others. The South, Midwest, and Appalachia have historically had the highest CRC incidence and mortality rates in the United States (American Cancer Society, 2023). Interestingly, these areas suffer from many of the same disparities as North Dakota. North Dakota has among the highest incidence and mortality rates in the Midwest at 39% and 13.2%, respectively.

In addition to high incidence rates, CRC is being diagnosed at younger ages than ever before. A 63% increase in the diagnosis of CRC before age 50 was seen between 1988 and 2015 in the United States (Murphy et al., 2021). Other high-income countries are also noting this trend (Stoffel & Murphy, 2020). A shift in lifestyle and environmental factors are believed to be the cause (Murphy et al., 2021). When individuals are diagnosed with CRC before the recommended screening age, their disease is typically symptomatic and well-progressed, leading to decreased survival rates (Edelman et al., 2018; Green & Meenan, 2020).

Because CRC can be detected in the early stages of the disease, survival rates can be increased. CRC is very treatable when found early. The rate of 5-year-survivability can be increased by at least 76% if CRC is discovered early in the disease process (Edelman et al.,



2018). Screening protocols for early detection have existed for many years, and the modalities and techniques used to complete CRC screening have evolved. Colonoscopy is the gold standard for CRC screening and has been shown to reduce CRC-related mortality by 68% (Kamba et al., 2021). Other less invasive techniques, such as computed tomography colonography (CTC) or various stool-based kits used at home, are now available. In countries where population-based CRC screening programs have been initiated, mortality rates have been shown to have decreased by up to 52% (Schliemann et al., 2021).

Despite the high prevalence of CRC and many available screening options, many adults go unscreened. The screening benchmark set by the National Colorectal Cancer Roundtable is 80% yet only 73% of eligible adults in the United States have completed CRC screening (Green & Meenan, 2020). Screening rates are even lower in rural areas, including North Dakota. Nearly one-third of eligible adults in North Dakota are unscreened for CRC (Schwartz et al., 2019).

Many groups have studied and identified potential barriers and gaps with the goal of increased screening compliance and decreased mortality. CRC screening barriers can be generalized as patient-oriented and provider-oriented (Katz et al., 2018; Wang et al., 2019). Multiple barriers may exist and vary for each patient and provider. Once identified, barriers must be addressed, and shared decision-making utilized to guide the individual toward a decision regarding CRC screening. Only then can benchmarks be reached, and lives saved.

### **Problem Statement**

Colorectal cancer poses a significant threat to world health, with high incidence and mortality rates as well as a concerning rise in early-onset cases, underscoring the urgency for immediate intervention. While advanced technologies exist for the non-invasive, painless, cost-effective, and efficacious detection of colorectal cancer, North Dakota is unfortunately falling

short of national screening standards. Of the North Dakotans who are eligible for routine CRC screening in 2020, only 63% of them have been screened for CRC, trailing 10% behind the national average and falling well below the 80% benchmark set by the National Colorectal Cancer Roundtable (American Cancer Society, 2023; National Colorectal Cancer Roundtable, 2020).

This evidence-based scholarly project is designed to educate individuals aged 18 to 75 living in a central North Dakota town regarding CRC screening guidelines, available screening options, and potential barriers and to gauge the individual's intent to be screened for CRC. The Missouri Valley YMCA's Spring Health Fair was strategically chosen as the implementation site, leveraging its well-established relationship with the local community and emphasis on healthy living practices. The ample space at the Missouri Valley YMCA building easily accommodated the size of the inflatable colon, which is a priority intervention in this evidence-based scholarly project. Situated in a larger town in North Dakota, the Missouri Valley YMCA provides a unique opportunity to reach a broader audience during the health fair, maximizing the overall impact of the initiative.

### **Purpose**

The goal of this evidence-based scholarly project was to deliver impactful education on colorectal cancer, enhance awareness of CRC, and discuss screening options available for CRC to North Dakotans aged 18 to 75 years old. To achieve this objective, an engaging scripted guided tour of an oversized inflatable colon, a dynamically looping PowerPoint presentation, and educational handouts were displayed at a health fair sponsored by the Missouri Valley YMCA in Bismarck, North Dakota. This strategic initiative aimed not just to inform but to make a lasting impact on the understanding and awareness of colorectal health in the Bismarck community.

## **Objectives**

1. Evaluate participants' perceived knowledge of colorectal cancer and the available screening methods in central North Dakota.
2. Identify perceived barriers and benefits of colorectal cancer screening experienced in central North Dakota.
3. Assess participants' intent to undergo colorectal cancer screening after receiving targeted and relevant education.

## **CHAPTER 2: THEORETICAL FRAMEWORK AND LITERATURE REVIEW**

Chapter 2 includes a description of the Health Belief Model, Iowa Model of Research-Based Practice to Promote Quality Care Revised, and a review of the literature on colorectal cancer education and its screening in general and rural populations. The review of literature is divided into the following sections: (a) Epidemiology (b) Risk Factors (c) Signs and Symptoms (d) National Screening Guidelines and (e) Screening Methods and (f) Barriers to Screening.

### **Theoretical Framework**

Many nursing theories, models, and frameworks have been applied to colorectal screening promotion. Several were considered for the application of this evidence-based practice project. The nursing theory selected for this project was the Iowa Model Revised and the nursing model chosen was the Health Belief Model.

#### **Iowa Model Revised**

The Iowa Model of Research-Based Practice to Promote Quality Care (Iowa Model) was developed by nurses in the early 1990s to translate research findings into patient care and provider practice to improve patient outcomes and was later revised in 2017 (Buckwalter et al., 2017). The Iowa Model Revised has seven steps. The first step is to identify triggering issues and opportunities. Next, determine the purpose of the project or state the question to be answered and determine if the topic is a priority. If the topic is not determined to be a priority, the user should consider another issue or opportunity. If the topic is a priority, a team should then be formed to gather and appraise current literature and evidence. If the evidence is strong enough to support a practice change, the team then develops an appropriate process for practice change and pilots the project. Post-pilot data should then be collected and evaluated to determine if the change is appropriate for permanent adoption into practice. If the change is not appropriate, alternative

methods can be considered, and the project can be piloted again. Once the pilot project displays relevant results, the process can be permanently integrated into practice. The project results will then be disseminated for more widespread improvement in patient outcomes.

Permission was obtained to utilize (Appendix F) the Iowa Model Revised for application to this evidence-based scholarly project. The prevalence of CRC in the US, noted increase in CRC incidence rates, and North Dakota's lack of meeting national benchmarks despite screening methods being available were triggering issues for this project. A team was formed that initially included the co-investigator and dissertation committee. The team later expanded to include members from the Missouri Valley YMCA, North Dakota Colorectal Cancer Roundtable, Quality Health Associates of North Dakota, North Dakota Cancer Coalition, and the North Dakota Department of Health. A literature review was completed to examine existing evidence regarding CRC screening and determined that knowledge and adherence are valuable barriers to address (Dominitz, 2021; Honein-AbouHaidar et al., 2016; Wang et al., 2019). This is most effectively accomplished through education. The project was designed with the help of the project team. Upon completion of the project, the project was evaluated using statistical analysis of the post-education survey. The results were then disseminated to stakeholders and affiliates of NDSU School of Nursing.

### **Health Belief Model**

The Health Belief Model (HBM) was developed in the 1950s by behavioral scientists working for the US Public Health Service (Green et al., 2020; LaMorte, 2019; Sohler et al., 2015). Behavioral scientists noticed a failure of the population to adopt disease prevention strategies and implement screening practices into their health maintenance practices. Still, they struggled to understand the reasons and influences of these failures. The behavioral scientists

developed the HBM to identify, understand, and eventually predict the multiple factors that influence an individual's health-related decision-making and to identify points of leverage where educators could exert influence to improve screening rates.

The HBM is centered on the individual, much like the Social Cognitive Theory and Stages of Change Model. The HBM holds two assumptions. First, an individual wants to avoid illness or get well if already ill. Second, specific actions are effective at preventing and/or curing illness. It has four basic cognitive constructs based on the individual's perception: perceived susceptibility, perceived severity, perceived barriers, and perceived benefits. The HBM was later expanded to include cues to action and self-efficacy (Glanz et al., 2008).

As it relates to CRC screening, a person must believe they are *susceptible* or at risk of developing CRC at some point in their lifetime before they choose to undergo screening (Glanz et al., 2008; Lau et al., 2020). The incidence and risk factors increasing CRC incidence need to be understood. Screening is not likely to be performed by those who do not believe they are at risk. Those who perceive themselves to be at elevated risk for CRC are more likely to undergo screening and to engage in other preventative measures such as tobacco cessation, increased activity, and a healthy diet.

The individual must consider the *severity* of CRC and its consequences. Severity can be thought of as what can happen if the individual chooses not to undergo screening. Individuals must be made aware of all potential implications of CRC, including the risk of fatality, and apply them to their lives to assess its impact. Severity is often simultaneously compared to the *benefits* of screening or what can be avoided or gained by undergoing screening. Commonly perceived benefits associated with CRC screening include early detection leading to a high cure rate,

reduction in worry and peace of mind, longer life, and control over health prevention and maintenance.

Regardless of the thoughts towards susceptibility, severity, and benefits, perceived barriers may exist to screening for CRC. Many barriers may exist, but common barriers include cost, fear of harm, inconvenience, embarrassment, or fear of finding poor results. Barriers must be identified before they can be overcome.

Finally, there is typically a cue to action. Cues to action can have many sources including a recommendation from the individual's health care provider, family, or friends, low or no-cost screening, or discovering a loved one has been diagnosed with CRC. In some situations, the lack of a cue to action can be a barrier itself, as in the case when a provider has never discussed CRC screening with their patient. Other times, the cue to action is a method to overcome another barrier, such as when no-cost or low-cost screening is provided to a person without health care coverage.

Self-efficacy refers to an individual's confidence in overcoming obstacles to undergo screening and their willingness to take the required steps toward screening completion (Glanz et al., 2008). Self-efficacy is a strong predictor of CRC screening completion (Lau et al., 2020; Topaloglu & Gordes Aydogdu, 2021). Those with stronger self-efficacy feelings are more likely to adhere fully to screening guidelines. Some individuals may not be confident in their ability to carry out CRC screening and may require more coaching from the provider than others. These individuals may be more prone to anxiety and require more one-on-one time with the provider, assistance scheduling tests or acquiring supplies, and verbal reassurance.

## **Literature Review**

A literature review was conducted to better understand existing literature on colorectal cancer, available screening methods, patient barriers and beliefs regarding completion of screening, and the effectiveness of various patient education methods. Several databases were searched, including PubMed, CINAHL, Web of Science, and Cochrane. The exact keywords were used in all databases and include “colorectal cancer screening,” “barriers to colorectal cancer screening,” “increase colorectal cancer screening rates,” “patient education colorectal cancer,” and “colorectal cancer screening rural.” Collectively, PubMed yielded 96,023 results. These results were filtered by the dates of 2017 to present. Additional filters such as Free Full Text and Systematic Review and Meta Analysis, were added to reduce the number of results enough to be hand sorted. A review using the same keywords in CINAHL yielded 19,247 results. The filters of “within five5 years,” Full Text, and USA were applied, and the results were hand-sorted for applicability to the project. Web of Science was also searched using the same keywords. This search produced 59,730 results. Filters applied in Web of Science included “within 5 years,” USA, and highly cited papers. Cochrane was utilized using the same keywords but results of Cochrane Reviews and Trials were recorded separately. A keyword search in Cochrane Reviews yielded 33 results while Trials yielded 4,951 results. A filter of “within 5 years” was applied to Cochrane Trials results. Over 175,000 articles resulted before adding filters between PubMed, CINAHL, Web of Science, and Cochrane Reviews and Trials. A general internet search was also performed which included sources such as the CDC and American Cancer Society.



## **Epidemiology**

CRC is a prevalent but detectable cancer. It is the third highest cause of cancer death in men and women individually in the United States (Siegel et al., 2020). When men and women are combined, its place holding increases to second. In 2022 in the United States, 151,030 individuals were diagnosed with CRC and 52,580 died of it (National Cancer Institute [NCI], 2022). CRC incidence rates increased between 1975 and the mid-1980s, then gradually decreased from the mid-1980s to the present day (Siegel et al., 2020). This steady decline is believed to be the culture shift promoting the cessation of tobacco products, removing a major risk factor for CRC and clinicians increasingly recommending CRC screening.

After the year 2000, a sharper decrease in CRC incidence rates was seen. The sharp decrease in incidence rates is supported by the increased utilization of screening colonoscopies that were noted in that time, from 20% of those 50 years old and older in 2000 to 61% in the same age group in 2018. The increase in the number of colonoscopies utilized from 2000 to 2018 is in part attributed to the expansion of Medicare benefits in 2001 to include colonoscopies for all beneficiaries (Siegel et al., 2020).

In 50–64-year-olds, the incidence decreased by 2-3% per year from 2000 to 2010 (Siegel et al., 2020). However, in 2011, CRC incidence in 50–64-year-olds increased by 1% per year. This is attributed to a robust birth cohort effect in both the United States and other high-income countries, suggesting that those in this age group experienced similar factors that influenced their disease risk based on the generation in which they were born (Stoffel & Murphy, 2020).

In addition to increasing incidence, the average age of those diagnosed with CRC is trending downward. Since the mid-1990s, incidence rates of CRC have been increasing in those less than 50 years old, which was the initial age of screening onset at that time (Siegel et al.,

2020). In 2001-2002, the median age of diagnosis was 72 years old as compared to 66 years old in 2015-2016. The trend of decreasing age of diagnosis has also been noted in several other high-income countries, including the United Kingdom, Germany, Canada, and Australia (Siegel et al., 2020). Austria has recommended CRC screening for those 40 years old and beyond since the 1980s. Interestingly, Austria is noticing an increase in CRC in those 20-39 years old but a decrease in CRC in the 40-49 age group. Austria's data may suggest the impact screening recommendations have on the incidence of a disease and its eventual impact. The increase in early-onset CRC is believed to be primarily due to lifestyle changes. Lifestyle changes will be discussed in more depth later in this project.

CRC in those less than 50 are typically more advanced than those found in individuals aged 50 and older. Individuals less than 50 years old were more likely to have Stage III or IV and higher rates of lymph node involvement and metastasis than those diagnosed with CRC after age 50 (Virostko et al., 2019). Morbidity rates have also been found to be higher in those whose CRC was initially diagnosed in an advanced stage, regardless of age.

### ***North Dakota***

Incidence and screening rates of CRC vary from state to state with lower screening rates and higher incidence rates observed in less densely populated states (Siegel et al., 2020). North Dakota ranks the 4<sup>th</sup> lowest in population in the United States yet ranks high in CRC incidence rates per capita (Schwartz et al., 2019). North Dakota places number two among white males diagnosed with CRC in the United States per capita and number three among white females. In 2019, the most recent data available, there were 464 new cases of CRC and 138 deaths in North Dakota (US Cancer Statistics Reporting Group [USCS], 2021). North Dakota's screening rate

(63%) was 10% lower than the national average (73%) and far below the national benchmark of 80%.

Great variation is seen between CRC incidence and screening rates between counties within North Dakota. CRC incidence varies from 29.2 per 100,000/year in Renville County to as high as 86.4 per 100,000/year in Oliver County (Schwartz et al., 2019). Higher incidence of CRC has been found when a rural area has a low population and prevalent poverty levels as compared to urban areas with the same factors (Zahnd et al., 2018). A community's classification as rural or urban could be attributed to some of the variations in incidence between counties. Rural populations also suffer from other disparities such as decreased access to care and screening services, the increased distance to travel and cost of travel, decreased access to healthy lifestyle options, and higher levels of uninsured individuals. These factors can lead to detrimental effects on an individual's screening, treatments, and outcomes.

### **Risk Factors**

Any given individual can have many risk factors. Assessing for, addressing, and reducing known modifiable risk factors of CRC can decrease the incidence and mortality rate of CRC. Some risk factors are considered modifiable (lifestyle) while others are not modifiable (age, race/ethnicity, family history). The assessment of the number of risk factors presents and therefore, the level of risk must be measured by the provider and individual to determine the appropriateness of screening and the type of screening to be conducted.

### ***Age***

Age is the primary risk factor considered when screening for CRC and is not modifiable (Davidson et al., 2021). CRC incidence rates gradually increase as an individual's age increases and is lowest in those ages 50-54 (Joseph et al., 2020). All but approximately 6% of new CRC

cases are seen in those greater than 45 years of age (Davidson et al., 2021). Providers of individuals older than 45 should strongly encourage individuals to complete CRC screening at the age of 45 regardless of the presence or absence of other risk factors.

### ***Early-onset CRC***

While the overall incidence of CRC has declined by 37% between 1975 and 2015, and deaths related to CRC have decreased by 50%, there is an alarming increase in CRC in adults below the previously recommended minimum screening age of 50 (Murphy et al., 2021). Between 1988 and 2015, CRC rates in those under 50 years old rose by 63%, from almost 8 cases per 100,000 to 13. However, this increase is not isolated to the United States. It has also been recorded in other high-income countries such as Canada, Germany, Sweden, and Australia. Screening guidelines in most of these countries begin at 50 years old.

Those younger than the recommended screening age of 50 seek care after they are symptomatic and, consequently, in a more advanced stage of the disease. Therefore, they are at higher risk of metastasis and death. The five-year survival rates for Stage I CRC are estimated to be at 90% but only 14% for Stage IV (Edelman et al., 2018; Green & Meenan, 2020). Some project that the incidence of early-onset CRC will increase by 130% by 2030 (Murphy et al., 2021). Nearly 5,000 fewer lives could be lost if CRC were detected before it has metastasized (Edelman et al., 2018). This is one of the reasons that the American Cancer Society (ACS) chose to decrease the age of initial CRC screening from 50 to 45 in asymptomatic adults in 2018 with the USPSTF following suit in 2020 (Davidson et al., 2021; Wolf et al., 2018).

The increase in early-onset CRC has occurred over a fairly short period of time so it is not believed to be due to genetic factors. The cause of this phenomenon is unknown but is more likely to be related to lifestyle changes and environmental exposures (Ahnen et al., 2014;

Akimoto et al., 2021; Murphy et al., 2021). Factors believed to be related to the increase of CRC in younger adults include obesity, frequent antibiotic use, diabetes, physical inactivity, and an unhealthy diet. Prenatal, perinatal, and neonatal influences could also exist, such as the use of alcohol, tobacco, and antibiotics as well as maternal diabetes, cesarean delivery, and lack of breastfeeding. All of these factors are believed to alter the genetics of the colon and affect the microbiome of the gut (Akimoto et al., 2021). The features of early-onset and later-onset CRC vary in epidemiology, clinical presentation, pathology, and molecular makeup.

Some theories suggest that exposures experienced during early life could also increase the risk for CRC. In the 1950s to 1980s the “Western lifestyle” began, which consisted of tobacco use and exposure, obesity, high caloric intake, high alcohol and red meat consumption, low consumption of fiber and fruits/vegetables, low calcium intake, and physical inactivity (Akimoto et al., 2021; Wolf et al., 2018). A rise in early-onset CRC in young children or young adults has been seen during this time (Akimoto et al., 2021). Most current data sets focus on risk factors encountered in adulthood but do not account for potential childhood risk factors. Known potential childhood risk factors for CRC include childhood obesity and decreased caloric intake, as exhibited by children who experienced the Dutch Hunger Winter in the 1940s. A more thorough investigation into the relationship between childhood causative factors and the incidence of early-onset CRC is needed.

### ***Race and Ethnicity***

Overall, incidence rates of CRC have decreased for all ethnic groups between 2014-2018 except American Indian/Alaska Native men and women and Hispanic women, which remained consistent (Cronin et al., 2022). However, that does not mean that there are no other notable trends based on ethnicity. Among differing races and ethnic backgrounds in the United States,

non-Hispanic Blacks have the highest incidence and mortality rates from CRC, while Asian/Pacific Islanders have the lowest (Davidson et al., 2021). Per 100,000 cases between 2013 and 2017, the incidence rate of CRC for non-Hispanic Blacks was 43.6 cases, and American Indian/Alaska Natives were not far behind with 39 cases. Asian/Pacific Islanders have the fewest at 31.8 cases per 100,000 during the same time. Mortality rates per 100,000 for the same groups were 18 deaths for non-Hispanic Blacks and 15.1 for American Indian/Alaska Natives as compared to 9.4 for Asian/Pacific Islanders.

The disparities observed cannot be attributed to a single primary cause but rather stem from multifaceted factors. Ethnicity is not considered the sole determinant for the higher risk within these groups. The underlying causes are thought to be associated with reduced access to healthcare, utilization of screening practices, and adherence to quality screening protocols. (Davidson et al., 2021; Zahnd et al., 2018). These populations are less likely to undergo timely screening and follow-up testing, which causes their higher rates of mortality (Siegel et al., 2020). Non-Hispanic Blacks and American Indian/Alaska Natives are more likely than Whites to live in poverty and have a lower socioeconomic status, affecting the group's education level and access to healthcare as well as the prevalence of other risk factors such as tobacco and alcohol use, poor diet, and obesity.

The lack of health coverage negatively affects screening rates. In those without health insurance, the screening prevalence has been found to be only 32.6% (Joseph et al., 2020). Inversely, higher income positively affects screening prevalence. In those with incomes greater than \$75,000 annually, the screening rate is more than double that of those without health insurance at 70.8%. Similarly, data suggests that as the education level and income increase, CRC screening rates also increase.

A person's geography can also affect screening rates. Alaska Natives have a profound disparity in their access to endoscopic services based on geography (Siegel et al., 2020). Those in rural areas have farther to travel for healthcare services adding to the out-of-pocket cost of care, have fewer facilities available and have higher poverty rates. Also, they are uninsured at a higher rate than their urban counterparts and have higher levels of high-risk behaviors such as tobacco and alcohol use, inactivity, and obesity (Zahnd et al., 2018). Most of the screenings utilized by Indian Health Service (IHS) are stool-based tests which require more frequent testing and follow up screening for positive results (Siegel et al., 2020). These positive results demand strict follow up by the provider and individual completing the test. In low-resource settings such as IHS, individuals and their screening statuses are not able to be followed as closely as they may in other settings, thus likely affecting incidence and mortality rates. Based on current evidence, the USPSTF does not recommend clinicians to make CRC screening recommendations based on race and ethnicity but does promote clinicians to strongly encourage that those with certain ethnicities or disadvantages to undergo screening for CRC and to implement policies that support adherence (Davidson et al., 2021).

### ***Lifestyle***

Lifestyle is a significant predictor of risk level in developing CRC. Factors include excess body weight, poor Western Diet, sweetened foods, alcohol use, tobacco product use, and physical inactivity (Dashti et al., 2018; Rock et al., 2020; Siegel et al., 2020; Stoffel & Murphy, 2020). A strong association is present between diet quality and the incidence of CRC, particularly early-onset high risk adenoma rates (Murphy et al., 2021). The Western Diet is considered poor and often consists of red meats, processed meats, high sugar consumption, and little fruit and vegetable intake, all known to increase the risk for CRC. The Western Diet is also

associated with the prevalence and severity of obesity, a significant risk factor of CRC. A diet high in fiber, whole grains, fruits, and vegetables has been associated with a lower risk of the development of CRC.

Some evidence suggests that childhood obesity may be a factor to consider in increasing early-onset CRC. Childhood obesity rates rose 200% from 60 years ago and there has also been an increase in early-onset CRC since then (Stoffel & Murphy, 2020). Further longitudinal research is required to determine the true association. However, it has been recognized that there is a strong association with adult-onset obesity, particularly the accumulation of abdominal fat, and CRC. The CRC risk level fluctuates with weight. The risk increases with an increase in weight and decreases with a decrease in weight. Fortunately, this means with a reduction in weight, there is a decrease in CRC risk.

Alcohol has been classified by the International Agency for Research on Cancer (IARC), a subsidiary of the World Health Organization (WHO), as a Class I carcinogen (LoConte et al., 2018). The IARC found sufficient evidence that alcohol use, even in moderate amounts, increases the risk of all types of cancer with an increase in alcohol use increasing the risk for cancer (Rock et al., 2020). Alcohol use is associated with an increased chance of prolonged hospitalizations, frequent surgical interventions, prolonged recovery time, higher health care costs, and higher risk of mortality in those diagnosed with cancer (LoConte et al., 2018). Tobacco use has a similar effect on the incidence of cancer. The incidence of all cancers increases with increased tobacco use and exponentially with concurrent tobacco and alcohol use (Rock et al., 2020).

Physical inactivity is linked to an increase in CRC, but less to other forms of cancer (Rock et al., 2020). The World Cancer Research Fund/American Institute for Cancer Research



(WCRF/AICR) and Physical Activity Guidelines Advisory Committee reported a significant relationship between increased physical activity levels and decreased CRC risk in 2018.

Interestingly, physical inactivity is beginning to be measured separately from sedentary time or sedentary lifestyle. With an increase in readily available technology, screen time has increased. It is estimated that more than half (53%) of the time individuals spend away from work or school is spent on screen time and very often this time is spent stationary. Additionally, this statistic also does not account for those occupations requiring screentime and sedentary work during the workday. An increase in sedentary time also leads to other comorbid conditions such as type two diabetes, cardiovascular disease, and premature death.

### ***Family History and Past Medical History***

When screening for specific diseases, such as colorectal cancer, it becomes crucial to consider both family and personal medical histories. Significant family and personal medical history factors to consider for CRC include first degree relatives (parents, siblings, children) with a history of CRC, personal history of inflammatory bowel diseases, inherited gene mutations, type two diabetes mellitus, history of cholecystectomy, history of chemotherapy or abdominal radiation, and long-term immunosuppression (Ahnen et al., 2014; Brenner et al., 2017; Edelman et al., 2018; Grodstein et al., 1998).

Individuals who have a first-degree relative with CRC are two to four times more likely to receive a CRC diagnosis themselves (Ahnen et al., 2014; Edelman et al., 2018). At least 1 in 10 Americans have a first-degree relative with a history of CRC (Ahnen et al., 2014). Risk for CRC development increases if they have multiple first-degree relatives diagnosed with CRC and are also dependent on the relative's age at initial diagnosis of CRC (Edelman et al., 2018). Screening for individuals with a first-degree relative with a history of CRC should begin 10

years earlier than the youngest age of the first-degree relative with CRC (Ahnen et al., 2014). Often, family history is not specific or thorough enough for the clinician to assess an individual's risk. A review of patient electronic charts in primary care found that less than 4% of patient's charts had adequate family history information that could aid in assessing risk (Edelman et al., 2018).

Accurate family history assessment is critical when attempting to detect early-onset CRC. In those diagnosed with early-onset CRC, 14% have at least one first degree relative diagnosed with CRC (Edelman et al., 2018). It is important that all family members are listed. The individual should be asked of each family member systematically to assess for all forms of cancer, multiple forms of cancer, age of cancer onset, presence of metastasis, completion of genetic testing, and ethnicity and ancestry. A detailed family medical and cancer history should be made by the age of 20 to allow for adequate time to conduct genetic counseling, test to confirm diagnosis, and perform screening tests as indicated (Brenner et al., 2017).

When a family history of CRC is compounded with certain personal past medical histories, the risk of the development of CRC is increased. A personal past medical history of inflammatory bowel diseases and inherited gene mutations such as Lynch syndrome (also known as hereditary non-polyposis colorectal cancer or HNPCC) and familial adenomatous polyposis (FAP) increases the individual's risk for the development of CRC (Brenner et al., 2017; Grodstein et al., 1998). Those with inflammatory bowel conditions, such as Crohn's disease or ulcerative colitis, should be screened for CRC with colonoscopy initially upon diagnosis and 8 years after their initial diagnosis date (Brenner et al., 2017). Stool-based tests are not a valid option for this population. Other medical conditions that have been found to increase CRC risk include type 2 diabetes mellitus, history of cholecystectomy, history of chemotherapy or

abdominal radiation, and long-term immunosuppression. However, these factors do not currently influence screening recommendations.

### ***Alterations in Normal Intestinal Flora***

The health of the intestines relies on a delicate balance of microbes to maintain the homeostasis and health of the individual. Alterations in the microbiome of the intestines have been shown in multiple studies to increase the risk of CRC (Fong et al., 2020). Diet, antibiotic use, some environmental exposures, and prenatal, perinatal, and neonatal exposures can change the balance of microbes and induce cellular changes, DNA damage, gene expression abnormalities, tumor proliferation, tumor protection from immune system susceptibility, and inflammation leading to increased risk of CRC (Akimoto et al., 2021; Fong et al., 2020; Sanidad et al., 2022; Stoffel & Murphy, 2020; Yueh & Tukey, 2016). These exposures prove difficult to study and science has only begun to understand the complex nature of the intestinal microbiota. Many current studies call for prospective and longitudinal data collection for better understanding of the alteration of intestinal microbiome and CRC.

### ***Antibiotic Use***

Antibiotics are one of the primary modes in which the alteration of normal intestinal flora occurs and have been associated with advanced adenomas and CRC across all age groups (Akimoto et al., 2021; Stoffel & Murphy, 2020). Triclosan, a broad-spectrum antibiotic, was added to many common consumer products through the 1970s, including toothpastes, soaps, cutting boards, toys, textiles, deodorants, and cosmetics as well as medical grade products such as surgical scrubs, sutures, and catheters (Sanidad et al., 2022; Yueh & Tukey, 2016). Triclosan was used to eradicate MRSA in healthcare settings, as it is bacteriostatic at very low concentrations, but became overused over the counter. Triclosan can be found in wastewater

treatment plants worldwide and in many natural waterways, including drinking water sources. It can also be detected in aquatic life and food crops. Triclosan is so widely used that current epidemiological studies have found it present in the bodily fluids of individuals of all ages. Research regarding Triclosan's effect on CRC is primarily based on animal studies. These animal studies supported the theory that Triclosan increased the risk of inflammatory bowel disease and inflammatory bowel disease associated colon cancer through intestinal barrier dysfunction and alteration of intestinal microbiota (Sanidad et al., 2022; Stoffel & Murphy, 2020).

In the 1980s, the use of oral and intravenous broad-spectrum antibiotics surged. In many of these cases, broad-spectrum antibiotics were inappropriately used for minor infections such as ear and upper respiratory infections in children (Stoffel & Murphy, 2020). Use of antibiotics in childhood, pre and perinatally, and while breastfeeding can alter the microbiome balance early in life allowing for early alterations of biological pathways increasing the susceptibility to CRC later in life. A variety of studies have found a correlation between the number of antibiotic courses taken, the number of days the antibiotics were prescribed, and class of antibiotics with the risk of CRC (Dik et al., 2016). Antibiotic stewardship practices should be made a priority.

### ***Helicobacter pylori***

*Helicobacter pylori* (*H. pylori*) is a bacterium that negatively affects the microbial of the gastrointestinal tract. *H. pylori* infections cause chronic gastritis, peptic ulcer disease, and gastric carcinomas and may be associated with an increased risk of CRC (Knudsen et al., 2021; Zuo et al., 2020). A 2020 systematic review involving more than 17,416 colorectal cancer cases and 55,811 control cases spanning Europe, the United States, and Asia found a positive association between *H. pylori* infections and the risk of colorectal cancer (Zuo et al., 2020). *H. pylori* may

promote the formation of CRC through inducing and maintaining an inflammatory response, altering the intestinal microbiome, and the release of toxins. Not enough evidence is available to determine if *H. pylori* is a causative agent, however, and further research is required to investigate the relationship between *H. pylori* and CRC.

### ***Water***

Geographical studies focusing on environmental carcinogens have proven lucrative in the past, as with a study determining the causative relationship between asbestos exposure in shipbuilders and the presence of mesothelioma (Schwartz et al., 2019). A 2019 study conducted in North Dakota found that well water use was the only factor that had a direct relationship with CRC incidence (Schwartz et al., 2019). Those areas with lower population densities had higher rates of well water use and CRC incidence which coincides with findings from other rural areas of the United States. However, the counties found to have the highest rates of well water use were also the counties at highest risk of CRC based on other factors such as geography and median income. The study suspected that the higher CRC incidence may be associated with lower rates of CRC screening practices. However, there was no direct association between high CRC incidence rates and the use of CRC screening practices. The high rate of radon and uranium found in North Dakota soil and groundwater was considered as a factor as they have been found to increase the rate of gastric and lung cancers but found no direct correlation between radon, uranium, and CRC.

### ***Periodontal Disease***

The oral cavity is rich in microbes and pathogens. Periodontal disease modestly increases the risk of developing CRC based on the pathogen involved in the disease process (Stoffel & Murphy, 2020). Periodontal infections associated with pathogens such as *Fusobacterium*

nucleatum, a known carcinogenic pathogen, may increase CRC incidence rates. As with the investigation into the intestinal microbiome, more studies are needed.

### **Signs and Symptoms**

CRC manifests no signs or symptoms during its initial stages, making it imperceptible without proper screening. Failure to undergo screening poses a critical risk, especially in those younger than 45 to 50 years old (Ahnen et al., 2014). When symptoms finally present themselves, the disease is typically in the advanced stages. Thus, emphasizing the urgency of early and routine screening in individuals at average risk with no signs or symptoms for the detection of CRC in early, more treatable stages.

Symptoms of CRC may include persistent rectal bleeding, unexplained anemia, abdominal pain, a change in bowel habits, unexplained weight loss, feeling of incomplete bowel emptying, pencil-thin stools, frequent bloating and cramping, fatigue, and nausea and vomiting (Ahnen et al., 2014; National Cancer Institute [NCI], 2021). In those who present with symptoms, colonoscopy is the preferred method of adenoma and CRC detection.

### **National Screening Guidelines**

The previously recommended age of initial CRC screening was 50 years old and to continue through 75. However, these guidelines have recently changed. The CDC, United States Preventative Services Task Force (USPSTF), American Cancer Society (ACS) and the American College of Gastroenterology (ACG) currently recommend initiating screening for CRC in average-risk individuals with no signs or symptoms of CRC at age 45 with high sensitivity stool-based tests or direct visualization tests (Centers for Disease Control and Prevention, 2022; Davidson et al., 2021; Edelman et al., 2018; Shaukat et al., 2021; Wolf et al., 2018). The American Cancer Society published this recommendation in their 2018 CRC guideline updates,

but it took a couple of years for the other organizations to complete their own literature review and follow suit. The USPSTF did not change their recommendation to begin at 45 until late 2020.

The shift in recommendation by these agencies stems from the accumulating evidence indicating the onset of colorectal cancer before the age of 50. This change is prompted by the recognition that screening this age group carries minimal risks while offering substantial benefits (Davidson et al., 2021; Edelman et al., 2018). Screening earlier in life can increase life-years gained and decrease incidence and mortality. Moreover, CRC can be found through contemporary screening methods during early stages, prior to the onset of symptoms. Across all the methods of screening, one more death can be averted for every 100 persons screened by beginning screening for colorectal cancer at the age of 45 as opposed to the age of 50 (Davidson et al., 2021). Furthermore, it is estimated that if every person over 50 years old was routinely screened through their lifetime, more than 35,000 lives per year could be spared from CRC related death (Sharma et al., 2022).

Recent updates in CRC screening recommendations have not affected the guidance for individuals aged 76 to 85. Literature has outlined that continuing to screen individuals over the age of 75 who have undergone previous screening and are not exhibiting any signs or symptoms of colorectal cancer offers few benefits (Davidson et al., 2021). However, if the individual is 76-85, asymptomatic, and has never been screened, there are still benefits to screening. Before deciding whether screening is to be performed and selecting the screening method, the condition of the individual's overall health, life expectancy, comorbid conditions, and preferences should be considered. Anyone showing signs or symptoms of CRC should be screened using a colonoscopy, regardless of age.

Previously, there was concern about adequate insurance coverage for screening tests for those aged 45 to 50 because insurance companies lag behind the recommendations by several years. Governing agencies recognize that the change in health insurance policy changes following the implementation of new guidelines is a process that can span several years and is a valid concern and consideration for the individual completing the screening. The Affordable Care Act passed in 2010 required all health insurance agencies to cover the costs of CRC screening tests (American Cancer Society, 2023, March 20). However, the definition of screening is often debated. Many insurance agencies argue that a colonoscopy following a positive result from another form of screening is considered diagnostic. Because the colonoscopy is no longer for screening at this point, the insurance agencies may not cover the cost of the procedure in full.

Recognizing this as a barrier, many groups lobbied for diagnostic colonoscopies following positive screening tests to be a covered service. As of January 2023, coinsurance for colonoscopies following positive stool-based results is to be gradually reduced through the year 2030, at which time there is to be no coinsurance for this service (*H.R. 1570-Removing Barriers to Colorectal Cancer Screening Act of 2020*, 2020; Medicare Learning Network, 2022). Because of changing legislation and its effect on the individual, the person should always be advised to verify the cost with the insurance company.

### **Screening Methods**

A variety of methods for screening for CRC are available today, including stool-based tests, direct visualization tests, serum testing, double contrast barium enema, digital rectal examination with single test guaiac-based fecal occult stool tests (gFOBT), urine tests, and capsule endoscopy (American Cancer Society, 2023, March 9; Davidson et al., 2021; Issa &



Noureddine, 2017; National Cancer Institute [NCI], 2021; Schliemann et al., 2021; Shaukat et al., 2021). Each varies in cost, ease of use, sensitivity, and specificity. Shared decision-making should be utilized by the provider and the individual undergoing the test to determine the appropriate screening method for the individual.

### ***Stool-based Tests***

Stool-based tests are one of two basic types of screening for colorectal cancer—the other are direct visualization tests. Guaiac-based fecal occult stool tests, fecal immunochemical tests (FIT/iFOBT), and fecal immunochemical tests-deoxyribonucleic acid tests (FIT-DNA) are the three types of stool-based CRC screening methods available in the United States today (American Cancer Society, 2023, November 9; Davidson et al., 2021; Jodal et al., 2019; National Cancer Institute [NCI], 2021; Schliemann et al., 2021; Shaukat et al., 2021). Stool-based tests examine the stool for microscopic amounts of blood, though they use different methods to do so (Davidson et al., 2021; National Cancer Institute [NCI], 2021). Stool-based tests are to be used for those who are at average risk for colorectal cancer—which is defined as the individual has no personal or family history of CRC or adenomas, no active colorectal cancer symptoms, no personal history of inflammatory bowel disease, and no personal or family history of genetic conditions that increase their lifetime risk of colorectal cancer (American Cancer Society, 2023, November 9; Davidson et al., 2021). Other factors that can create a false positive through all the tests include active menstruation and hemorrhoidal bleeding.

The provider should utilize shared decision-making with the individual to determine the preferred method of screening by the individual. Stool-based tests are great options for patients with limited access to healthcare facilities, who desire an at-home method of screening, or do not wish to undergo the rigors of a direct visualization test (Shaukat et al., 2021). These forms of

tests are noninvasive and carry no risk of complications in themselves. However, stool-based tests are considered a two-step test because they may warrant a direct visualization test, such as a flexible sigmoidoscopy or a colonoscopy, in the event of a positive result (Schliemann et al., 2021).

Stool-based testing can dramatically increase adherence rates to CRC screening with a similar reduction in CRC incidence and CRC related mortality (Shaukat et al., 2021). These benefits are only amplified by consistent use but require adherence to current colorectal cancer guidelines (Davidson et al., 2021). However, the handling of one's own feces can be off-putting for some and enough for them to choose an alternative method of screening or delay screening significantly.

Stool-based tests are quick, simple, and can be utilized at home. The individual can obtain the testing kit directly from the company with a provider's order or from their clinic. Everything needed to complete the testing is contained within the kit, and the stool sample can be collected at the individual's convenience. The sample is then submitted to the company's laboratory. The laboratory will publish the results to the patient within several weeks of receiving the sample. Positive results dictate a follow up diagnostic colonoscopy.

The potential harm with any test should be assessed. Colorectal cancer screening tests are no different. There are no studies that report the direct harm elicited from stool-based tests (Davidson et al., 2021). Harms associated with stool-based tests originate from the risks associated with false positive or false negative results and follow up colonoscopy after a positive stool-based test. Refer to "colonoscopy" to learn more of the risks related to colonoscopy.

The use of all CRC screening tests, but especially stool-based tests, require sensitive system management and informatic systems to identify patients qualifying for CRC screening,

order the individual's preferred test, track those orders through completion of the test, and follow up with any abnormal test results (Brenner et al., 2017). To reduce mortality, screening tests must be completed to the full extent of the current guidelines.

### ***Guaiac-based fecal occult blood test***

Guaiac-based fecal occult blood tests (FOBT/gFOBT) are stool-based tests that chemically detect the presence or absence of blood, from any source, in the stool (Davidson et al., 2021). Guaiac-based FOBT results can be altered by food and medications and are not specific to human blood; therefore, dietary and medication restrictions are required before utilization of the test for the most accurate results. Because it is not specific to human blood, any meat consumed within three days could produce a false positive result. Other dietary restrictions before screening include foods containing ascorbic acid or those that have peroxidase activity such as cabbage, carrots, spinach, celery, squash, potatoes, onions, green beans, and leeks (Bangaru & Agrawal, 2019). Guaiac-based FOBT are not able to differentiate blood originating from a neoplastic source from a benign source such as anticoagulants, anti-platelets, and nonsteroidal anti-inflammatory drugs. These drugs should be avoided prior to testing as to not produce a false positive result. gFOBT also requires that all contents from three separate bowel movements be submitted and is required yearly (Davidson et al., 2021). gFOBT was previously the most utilized stool-based test before the development of fecal immunochemical tests (FIT) (American Cancer Society, 2023, November 9) but there is growing concern regarding the ease of use and accuracy of even high-sensitivity gFOBT compared to FIT and FIT-DNA (Davidson et al., 2021).

Guaiac-based FOBT are available in varying sensitivities, but it is recommended that only the highest sensitivities be used (American Cancer Society, 2023, November 9). The

sensitivity of gFOBTs is 61.5-79.4%, and specificity is 86.7-96.4%. As of 2018, only one brand of gFOBT, the Hemocult II Sensa (HSgFOBT), was shown to meet performance standards in large population-based studies even though other tests have high sensitivities (Wolf et al., 2018). The sensitivity and specificity of HSgFOBT was found to be 62-79% and 87-96%, respectively. Because of tests with varying degrees of sensitivity available on today's market, the dietary and medication restrictions involved, and substantial number of stool samples required for accurate results, other stool-based tests are typically first-line (Davidson et al., 2021).

### ***Fecal immunochemical tests***

Fecal immunochemical tests (FIT/iFOBT) are also a stool-based test examining the presence of blood in the stool using antibodies to be used by those at average risk for colorectal cancer (American Cancer Society, 2023, November 9). FIT functions are similar to guaiac based FOBT but are specific to human blood. FITs do not require dietary or medication restrictions and only one stool sample is needed thus increasing adherence rates (Bangaru & Agrawal, 2019; Shaukat et al., 2021). FIT is recommended yearly in conjunction with colonoscopy every 10 years. Results can be quantified, and the sensitivity of the test be adjusted based on population risk, but the Food and Drug Administration (FDA) requires that only false and positive readings be given. When used for several years annually, FIT has an 80% CRC detection rate.

Several types of FIT are available for use in the United States but can vary in sensitivity and specificity. The sensitivity of Hemocult-ICT is estimated to be as low as 23.2-81.8% while OC Light S Fit is estimated at 78.6-97% (American Cancer Society, 2023, November 9). Specificity rates range between 74.9% and 96.9%. Both iFOBT and FIT sensitivity for detecting advanced adenomas is lower, which is thought to be the reason for the wide ranges seen in the

sensitivities above (Davidson et al., 2021). Specificity rates remain similar between the different FIT tests.

### ***Multitargeted stool DNA testing***

Multitargeted stool DNA testing, also known as fecal immunochemical tests-deoxyribonucleic acid tests (FIT-DNA), look for the same qualities as the FIT tests do with the addition of cancer DNA biomarkers (American Cancer Society, 2023, November 9). DNA biomarkers are found when adenomas and colorectal cancer shed their cells and are released into the stool. In large studies, FIT-DNA has been found to be more accurate in detecting CRC, advanced adenomas, and large sessile serrate lesions than FIT alone (Shaukat et al., 2021). However, its specificity decreases as the individual's age advances. Cologuard is the only FIT-DNA test available in the United States currently (American Cancer Society, 2023, November 9). Cologuard FIT-DNA has a high rate of sensitivity and specificity, 92.3% and 89.8%, respectively, and only one stool sample is required for adequate testing. FIT-DNA is recommended to be performed every 3 years (Davidson et al., 2021).

### ***Direct Visualization Tests***

Colonoscopy, flexible sigmoidoscopy, and computed tomography (CT) colonography are the three types of direct visualization tests (Davidson et al., 2021; National Cancer Institute [NCI], 2021). As the name implies, they allow the inside of the colon and rectum to be seen and evaluated for the presence of abnormalities. Direct visualization tests require bowel preparation prior to the procedure and must be performed at a medical facility. The bowel prep carries risks of electrolyte imbalances and dehydration, which increases with age and comorbid conditions (Davidson et al., 2021). Anesthesia is required for colonoscopy and flexible sigmoidoscopy, and thus post-procedure transportation arrangements must be made by the individual beforehand. In

general, direct visualization tests allow for more time between screening intervals than stool-based tests.

### ***Colonoscopy***

Using colonoscopy, the entire colon is able to be visualized directly via a colonoscope (Davidson et al., 2021; National Cancer Institute [NCI], 2021). A colonoscope is a long flexible tube with a light and viewing lens one the end. During colonoscopy, any visualized adenomas can typically be removed via the colonoscope for further testing. A colonoscopy is recommended every 10 years for those at average risk with negative screening results. The recommended screening interval may change based on results of previous screening colonoscopies. Sensitivity of colonoscopies for finding adenomas greater than 10 mm (about 0.39 in) in size have been found to be 89-95% with a specificity of 89% (Davidson et al., 2021).

However, colonoscopies are operator dependent, meaning that they are only as accurate as the gastroenterologist implementing them. The rate of a clinician missing an adenoma on colonoscopy is 9-26% (May & Shaukat, 2020). Approximately 2-7% of these adenomas develop into CRC prior to the next recommended screening interval. For this reason, Centers for Medicare and Medicaid Services created Merit-based Incentive Payment System in which providers are paid according to quality indicators. Therefore, higher quality colonoscopies with fewer complications and miss rates results in higher pay for the provider and facility (May & Shaukat, 2020).

While colonoscopies are highly accurate, they do involve some risk. Risks include serious bleeding events and bowel perforations but have been found to be lower in screening colonoscopies versus colonoscopies following positive stool-based tests (Davidson et al., 2021). This is believed to be because there is a lower rate of biopsies taken and adenomas removed

during screening colonoscopies versus colonoscopies following positive stool-based tests (diagnostic). Per 10,000 colonoscopies performed, there were 14.6 and 17.5 serious bleeding events for screening colonoscopies and diagnostic colonoscopies, respectively, and 3.1 and 5.4 bowel perforations for screening colonoscopies and diagnostic colonoscopies, respectively. The use of sedation required during a colonoscopy also increases the risk of cardiopulmonary events, though the exact risk level must be further studied for quantification. Less common risks associated with colonoscopy include infection, electrolyte imbalances, and dehydration.

### ***Flexible Sigmoidoscopy***

Flexible sigmoidoscopy utilizes direct visualization of the rectum, sigmoid colon, and descending colon via a sigmoidoscope (Davidson et al., 2021; National Cancer Institute [NCI], 2021). A sigmoidoscopy is a thin, flexible tube with a camera on the end to allow for visualization of the colon mucosa (National Cancer Institute [NCI], 2021). If abnormalities are found during a flexible sigmoidoscopy, a colonoscopy is recommended. When used independent of other screening methods, flexible sigmoidoscopy is recommended every 5 years. If paired with yearly FIT, it is recommended every 10 years.

Risks of flexible sigmoidoscopy include bleeding and perforation of the bowel, though these risks are significantly lower with flexible sigmoidoscopy than with colonoscopy. Per 10,000 cases, there were 0.5 significant bleeding events in initial screening via flexible sigmoidoscopy and 0.2 perforations (Davidson et al., 2021). In cases where flexible sigmoidoscopy requires follow-up with colonoscopy, these risks are increased. The risk for perforation was increased to 20.7 significant bleeding events and 12.0 perforations per 10,000 colonoscopies following abnormal flexible sigmoidoscopies.

### ***Computed Tomography Colonography***

Computed Tomography (CT) colonography is considered a direct visualization test that creates detailed images using series of x-rays of the entire colon to visualize irregularities of the intestinal mucosa (Davidson et al., 2021; National Cancer Institute [NCI], 2021). A colonoscopy is required if abnormalities are found on CT colonography. It is recommended to be completed every 5 years. Sensitivity of CT colonography ranges from 86% to 100% and varied by the sample population, study design, and the radiologist's level of experience and their reading protocols used. Specificity is not reported.

The risks associated with CT colonography are presumed to be like those of flexible sigmoidoscopy requiring diagnostic colonoscopy, but exact results have not been thoroughly studied (Davidson et al., 2021). Extracolonic findings requiring extra medical work up, cost, and increased risk are found in 1.3-11.4% of cases on CT colonography with approximately 3% of these requiring medical treatment. Some literature suggests that these findings may be more common in advanced age and with multiple comorbid conditions.

Because CT colonography is a radiologic procedure, some, though truly little, exposure to radiation is required. The estimated radiation dose of CT colonography is from 0.8 to 5.3 mSv, comparable to that experienced annually per person by background radiation in our environment.

### ***Miscellaneous Forms of Screening***

Other forms of screening are available; however, they are not typically recommended by agencies within both the United States and Europe due to extremely limited evidence of sensitivity, specificity, and reduction of mortality (Davidson et al., 2021; Issa & Nouredine, 2017). These screenings include blood-based DNA testing also known as liquid biopsy, double contrast barium enema, single specimen gFOBT obtained by digital rectal examination, urine



testing, capsule endoscopy, and risk scoring (Davidson et al., 2021; Issa & Nouredine, 2017; National Cancer Institute [NCI], 2021) .

### **Barriers and Facilitators to Screening**

CRC screening has been shown to be an effective measure of detecting CRC early in the course of the disease, offering a pivotal opportunity for timely intervention. Despite its demonstrated efficacy, approximately one third of eligible adults are not screened (Davidson et al., 2021; Joseph et al., 2020). Awareness of CRC has been identified as both a facilitator and a barrier to CRC screening. When a person is aware of CRC and its screening practices, they have been found to be more likely to be screened (Honein-AbouHaidar et al., 2016). They are also more likely to possess positive beliefs towards CRC such as the belief that screening would allow the discovery of CRC early and provide better treatment options. Inversely, the lack of awareness can be a barrier. The lack of awareness of CRC prevalence, mortality, prevention, and screening practices can lead people to believe that CRC screening is not important. Many studies have found that poor understanding of CRC has led to low screening rates. Those with limited awareness of CRC were less motivated to screen for CRC and more likely to have a negative attitude towards screening. Awareness, therefore, is a prerequisite to every other aspect of CRC. One cannot participate in an activity until they are aware of it.

Awareness of CRC as a disease, its causes, its signs and symptoms, risk factors, and screening practices and modalities must first be accomplished through education. Education through “small media” such as handouts, videos and invitation letters have been found to have a positive, though minimal, impact on CRC screening (Dominitz, 2021; Wang et al., 2019). The impact of community events and mass media interventions, such as health fairs, are difficult to

accurately determine. However, because these events increase awareness, it is likely that these events can improve CRC screening rates through education.

Knowledge barriers to CRC screening also exist. Many individuals believe they are not at risk for CRC unless they are symptomatic, pointing to a gross misunderstanding of CRC and its signs, symptoms, risk factors, and screening needs (Dominitz, 2021; Wang et al., 2019). Some even believe that CRC treatment is unsuccessful so believe there is no use in screening for it. They view CRC as their fate. An increase in education of CRC, screening methods, screening intervals, signs and symptoms, and treatment outcomes are very impactful at influencing an individual's decision to screen for CRC (Wang et al., 2019). The individual can receive education via many modes, including one-on-one conversation with a health care provider, informational handouts, population health campaigns, and media outreach. Celebrity spokespersons can also be a powerful influence as exhibited by the increase in screening colonoscopies seen after Katie Couric lost her husband to early-onset CRC and she created her own public service campaign (Dominitz, 2021).

Utilization of a giant inflatable colon has only begun in the last 20 years and is not very widespread (Redwood et al., 2013). Because the product itself is so new, less than one dozen studies exist examining their value in educating the public regarding CRC (Miguel et al., 2020). However, the studies that have been done are very promising. In a study performed in an urban area of Ohio, 99.5% of the participants found that scripted tours through an inflatable colon to be an effective educational tool and positively affected the intent to be screened of the participants. This study was also valuable because nearly half of the participants were younger than 45 years old. This age group is an important age to target as CRC in this age group is typically found in more advanced stages than those older than 45 years of age. If the intent to be screened for CRC

can be altered in this age group, it may create an increase in future screening rates and reduce CRC related morbidity and mortality in the coming years. The same study also found that the inflatable colon was especially effective at encouraging those in vulnerable populations to undergo CRC screening. Other education methods, such as small media and population health campaigns, have found it difficult to target vulnerable populations, however, the inflatable colon seems to have found a way to overcome this barrier.

Barriers to CRC screening have been identified as patient-oriented and provider or clinic-oriented (Katz et al., 2018; Wang et al., 2019). Identifying the barriers to screening completion must be done to address the barriers and improve patient outcomes. While many barriers and beliefs exist that may affect an individual's decision-making process regarding CRC screening, it has been found that some of the most common patient-oriented barriers are related to awareness, the testing process, knowledge or attitude, finances, and interpersonal barriers.

The cost of screening is defined as a barrier in nearly all studies and has interestingly been identified as a barrier to CRC completion by both patients and clinicians (Katz et al., 2018; Wang et al., 2019). Patients may have no health insurance, high deductible plans, or plans that poorly cover services related to screening. There may be added financial stressors such as unemployment, low income, inflated cost of transportation to services, and lack of paid time off to complete screening practices. Patients delay or neglect being screened for CRC because of the perceived prohibitive cost of screening. Providers are sometimes hesitant to recommend colonoscopy due to hesitancy to accrue out-of-pocket costs to their patients. This is especially true in rural areas with lower median income and health insurance coverage than their urban counterparts.

The enactment of the Affordable Care Act in 2010 aimed to address this obstacle by introducing policies that facilitated affordable access to preventative services, including colorectal cancer screening (Mackey, 2018). However, this did not lead to increased CRC screening as anticipated. This may be because positive results found on screenings other than colonoscopy require a diagnostic colonoscopy. Once a colonoscopy is deemed diagnostic, it no longer must be covered in full by Medicare and private insurances. Many providers and patients are fearful of the need of a diagnostic colonoscopy and the cost implications for the patient. In 2019, US Representative Donald Payne Jr. introduced H.R. 1570 to the House of Representatives to propose cost-sharing requirements for all CRC screening tests and subsequent diagnostic colonoscopies. H. R. 1570 took effect January 1, 2023, and will be implemented over a 7-year span, gradually phasing out costs to the patient until 2030, at which time costs would be covered 100%.

Before the US House of Representative acted, the North Dakota state legislature ruled to fund the North Dakota Colorectal Cancer Screening Initiative (NDCRCSI) in 2016 (BCBS of ND, 2016). NDCRCSI aims to reduce the common barriers to CRC screening of cost and awareness. The NDCRCSI program facilitates CRC screening through fully covering the cost of CRC screening to eligible North Dakota residents with a focus on those with low incomes, who are uninsured or underinsured, and meet ACS screening guidelines. The NDCRCSI program is currently in effect and is simple for the provider, patient, or provider on behalf of the patient to apply for online. NDCRCSI covers at home stool-based screening, the office visit at which the stool-based test was ordered, colonoscopy following positive stool-based test, initial colonoscopy, pre-operative visit, associated laboratory workup, bowel preparation medication,

and analysis of biopsies and/or polypectomies taken during the colonoscopy (North Dakota Colorectal Cancer Screening Initiative [NDCRCSI], 2022).

Embarrassment and fear can be present regarding various aspects of CRC and the CRC screening process and are common barriers to CRC screening (Wang et al., 2019). Speaking of the colon, rectum, and stool are typically taboo topics and many are reluctant to freely discuss them. Those living in rural areas were more likely to identify embarrassment as a barrier to screening as they are more likely to be personally acquainted with the medical staff and personnel present during the procedure.

Some studies suggest that the level of anxiety experienced prior to a colonoscopy is like that experienced prior to a major surgery (Yang et al., 2018). Potential fears and anxieties include the potential for pain and discomfort, required lengthy dietary restrictions, bowel preparation, potential for complications, and anxieties towards screening results. Some may even be hesitant to handle their own stool and be embarrassed to submit it for others to analyze (Katz et al., 2018).

Pre-procedure, preferably upon ordering of the procedure by the provider, the root of the patient's fear and anxiety needs to be identified to tailor interventions, accordingly, reduce anxieties, and increase likelihood of screening completion (Yang et al., 2018). Providing thorough information leading up to CRC screening has been shown to significantly reduce anxiety levels prior to screening completion. The method of information dissemination should be via the patients preferred format in accordance with their learning style. Options include one on one discussion with a health care provider, brochures and handouts, audio clips, and videos.

Patients are highly likely to listen to or consider their clinician's recommendations. However, when a clinician fails to recommend CRC screening or recommends it insufficiently,

the patient believes that it is not important or that they are not at risk for development of CRC (Dominitz, 2021; Wang et al., 2019; Yang et al., 2018). Provider recommendations can help or hinder screening results. That is, if the recommendation *is not made*, the screening is not likely to be completed. Whereas, if the recommendation *is made*, the screening is much more likely to be carried out to completion. Clinicians must make a recommendation for CRC screening to improve adherence rates. Additionally, when the provider and their institution have implemented patient navigation and built in clinician and patient reminders to track screening results and completion rates, CRC screening completion may increase by as much as 13% (Dougherty et al., 2018). Considering that North Dakota's CRC completion rate is 68%, this one intervention can provide significant movement towards the 80% benchmark.

Shared decision-making is one of the most important factors in CRC screening adherence. Those who are allowed to choose the method of CRC screening were almost twice as likely to complete screening as those who were only given the option of colonoscopy (Mackey, 2018). It is more important for screening to be completed—by any method—than to have screening not to be completed at all.

## **CHAPTER 3: METHODS**

### **Overall Project Design**

This DNP evidence-based scholarly project was designed with the overarching goal of enhancing awareness about colorectal cancer and screening options among individuals aged 18 to 75 in North Dakota. The project also aimed to assess the impact on participants' willingness to undergo colorectal cancer screening and to identify any prevalent barriers to screening within the North Dakota population. To achieve these objectives, the project implemented a multifaceted approach, incorporating a guided tour through an oversized inflatable colon, a dynamically looping PowerPoint presentation, and informative handouts at a health fair in central North Dakota. The outcomes of the project were not only geared towards increasing knowledge but also towards determining whether these engaging activities could effectively influence participants' intent to be screened for colorectal cancer while identifying and addressing potential barriers to screening.

Evaluation of these objectives was performed by a comprehensive data collection, encompassing descriptive, quantitative, and qualitative data gathered through surveys completed by volunteer adult subjects aged 18 to 75 in Bismarck, North Dakota. The project was meticulously developed through a synthesis of insights from the literature review, collaboration with the dissertation committee, and consultation with key stakeholders such as the North Dakota Department of Health, the North Dakota Colorectal Cancer Roundtable, Quality Health Associates of North Dakota, the North Dakota Cancer Coalition, and the Missouri Valley YMCA.

A dedicated space was reserved at a health fair for an educational booth, featuring a looped PowerPoint presentation on a large monitor and educational handouts about CRC.

Additionally, scripted guided tours of an inflatable colon were conducted by the co-investigator. Notably, participation in all these activities was voluntary for health fair attendees, who were drawn from a convenience sample of adults aged 18 to 75 in central North Dakota. Subsequent surveys were administered post-education, and the collected data underwent thorough evaluation using descriptive statistics.

### **Implementation Plan**

The project's implementation design adhered to the Iowa Model of Research-Based Practice to Promote Quality Care, also known as the Iowa Model Revised. Additionally, the Health Belief Model served as a valuable framework aiding in the identification, comprehension, and prediction of factors influencing participants' health decisions. This model also helped pinpoint strategic leverage points for exerting influence. The ensuing steps outline the procedural aspects of this approach.

#### **Steps 1-3: Identify Triggering Issues, State the Question or Purpose, Form a Team**

Several issues triggered the development of this project. First, North Dakota continues to fail to reach CRC screening benchmarks (American Cancer Society, 2023, March 27; National Colorectal Cancer Roundtable, 2020). This is a priority because screening for CRC reduces morbidity and mortality. Second, there is concern for a rising number of early-onset CRC cases being seen (Davidson et al., 2021; Murphy et al., 2021; Wolf et al., 2018). In reaching these populations early, the hope was to reduce the risk of metastasis and death.

A dissertation committee was then formed. A relationship was also established with the Missouri Valley YMCA, North Dakota Department of Health, North Dakota Colorectal Cancer Roundtable, Quality Health Associates of North Dakota, and the North Dakota Cancer Coalition,



and the goals of the project were identified. Committee members and stakeholders influenced the design of the project.

#### **Step 4: Assemble, Appraise and Synthesize the Evidence**

A literature review was conducted to investigate existing evidence and indicated that awareness of CRC is a prerequisite to participation in any CRC screening method (Honein-AbouHaidar et al., 2016). A person cannot partake in a preventative activity they have no knowledge of. Education of CRC as a disease and its cause, risk factors, signs and symptoms, and screening modalities, and the identification and reduction of barriers were meaningful methods of increasing the rates of CRC screening in multiple studies (Bachman et al., 2018; Honein-AbouHaidar et al., 2016; Katz et al., 2018; Mackey, 2018; Schliemann et al., 2021; Sutton et al., 2021; Wang et al., 2019).

Inflatable replications of the human colon are new yet impactful methods of CRC education. Scripted tours through inflatable colons could increase personal CRC knowledge and increase the likelihood of screening (Miguel et al., 2020; Redwood et al., 2013). This project integrated the use of several education methods to increase participants' knowledge of multiple facets of CRC and assessed for barriers and facilitators to screening to increase the rate of intent to be screened for CRC.

#### **Step 5: Design and Pilot of the Intervention**

The co-investigator reserved booth space at a health fair at the Missouri Valley YMCA and space and electrical supply for the inflatable colon. Small media handouts were obtained with permission from the CDC and North Dakota Colorectal Cancer Screening Initiative in conjunction with Quality Health Associates of North Dakota. These handouts were evaluated by the dissertation committee members prior to use. A PowerPoint presentation (Appendix L) was

created by the co-investigator and set on loop at the informational booth. The PowerPoint was evaluated and approved by the project chair before use. A scripted guided tour of the inflatable colon was provided by the co-investigator to voluntary participants. The information covered in the scripted guided tour of the inflatable colon and the PowerPoint presentation was very similar. Input from the dissertation chair and committee members was utilized throughout the implementation process.

### **Steps 6 and 7: Integrate and Sustain the Intervention and Disseminate the Results**

Steps 6 and 7 of the Iowa Model Revised involve integrating and sustaining the practice change and disseminating the project results. These steps were completed post-implementation and will be further discussed in Chapter 5.

#### **Setting**

To reach a broader demographic, a county in North Dakota with a higher population density was deliberately chosen. This strategic decision aimed to maximize the potential impact of this initiative by targeting areas where a larger number of individuals could be reached and engaged in the project's objectives. The selection of a site within a more densely populated county increased the initiative's visibility and facilitated the dissemination of valuable information to a potentially more diverse audience.

The project unfolded in Bismarck, North Dakota and was hosted by Missouri Valley YMCA. The Missouri Valley YMCA was strategically chosen due to its accessibility in a densely populated area, amplifying the project's impact. North Dakota, the state with the second lowest population in the United States, has 36 out of 52 counties categorized as "frontier," signifying a population density of six or fewer individuals per square mile (Health Resources and Services Administration [HRSA], 2020).

In addition to its location in a county with higher population density, the Missouri Valley YMCA further stood out as an implementation site due to its esteemed reputation for fostering holistic and healthy lifestyle choices within the community. Notably, the YMCA's expansive facilities were instrumental in accommodating the substantial size of the inflatable colon featured at their health fair. The event, promoted by the Missouri Valley YMCA, welcomed both members and non-members, offering free admission. Embracing an "open house" format, the health fair unfolded from 9:00 a.m. to 12:00 p.m. on May 22, 2023.

During project implementation, a captivating inflatable colon took center stage in the Missouri Valley YMCA's gymnasium, creating a visual focal point. Adjacent to the gymnasium, a strategically positioned sign in a high-traffic area announced regular short, guided tours occurring every 15 minutes, inviting health fair attendees to explore this unique exhibit at their convenience. Reinforcing the educational component, an informative booth positioned near the exit of the inflatable colon featured a looping PowerPoint presentation displayed on a monitor atop the booth's table. Attendees and passersby alike were furnished with valuable informational handouts, contributing to a comprehensive and engaging experience at the health fair.

### **Bismarck, ND**

The implementation of this project took place in Bismarck, North Dakota. As of the 2020 Decennial United States Census, Bismarck had a population of 74,138 (United States Census Bureau, 2023). Bismarck is primarily comprised of non-Hispanic white persons (85.7%). The following largest ethnic groups include American Indians and African Americans at 4.9% and 2.7%, respectively. Just over 60% of Bismarck's population are aged 18 to 64 (Census Reporter, 2021). Bismarck is in Burleigh County and is the largest town in that county. Burleigh county has the second highest population in North Dakota at 98,458 in 2020 (North Dakota Department

of Commerce, 2021). Burleigh County has many individuals who participate in health behaviors negatively affect their risk of CRC (University of Wisconsin Population Health Institute, 2023).

Note these health behaviors in the table below.

**Table 1**

*Burleigh County Health Behaviors*

Health Behavior	Percentage of Population Participating
Obesity	32%
Smoking	17%
Physical Inactivity	26%
Excessive Drinking (alcohol)	22%
Uninsured	6%
Unemployed	4.4%

*Note: Data retrieved from the University of Wisconsin Population Health Institute, 2023.*

The Bismarck area boasts access to two robust hospitals, each with a capacity exceeding 200 beds, along with many independent clinics. At many of these healthcare facilities, knowledgeable providers stand ready to engage in discussions about colorectal cancer (CRC) and prescribe appropriate screening methods. Notably, three of these establishments are equipped with skilled gastroenterologists who specialize in performing colonoscopies, contributing to the comprehensive and accessible healthcare landscape in the region.

**Sample/Recruitment**

Convenience sampling was utilized for this project, targeting adults aged 18-75 who attended a health fair at Missouri Valley YMCA on May 22<sup>nd</sup>, 2023, from 9:00 am to 12:00 pm. The health fair was promoted through various channels, courtesy of the Missouri Valley YMCA, including their website, social media, facility flyers, and a billboard near the venue. No promotional efforts or funding were contributed by the co-investigator.

Inclusion criteria consisted of adults aged 18 to 75 years who can understand, read, and write in English. Exclusion criteria consisted of those under 18 years of age, 76 years of age or older, and the inability to understand, read, and write in English. Participation in the education and the post-education survey was entirely voluntary. The post-education survey was administered only after participants acknowledged its voluntary nature through a consent form, granting permission for the co-investigator to utilize the data for the project. Vulnerable populations were not intentionally sought but were not excluded if they met the criteria previously outlined and volunteered to participate.

Advertising of the event was coordinated and paid for by the Missouri Valley YMCA. Pamphlets, funded by the Missouri Valley YMCA, featuring brief descriptions of each booth were dispersed to attendees of the health fair by the Missouri Valley YMCA staff and volunteers. Event attendees were attracted through pamphlets and by a sign promoting short, guided tours of an inflatable colon by the co-investigator. Due to the success of the event, more informational booths from other agencies were in attendance than the organizers had initially anticipated. Because of this and the inflatable colon's large size, the inflatable colon and informational booth was housed in a gymnasium adjacent to the main gymnasium separate from the other informational booth. To attract attendees to the inflatable colon, a striking sign (Appendix N) advertising the inflatable colon was placed near the sign-in booth outside the gymnasium where the inflatable colon and booth were set up. Parts of the informational booth, PowerPoint presentation, and inflatable colon were able to be viewed from the sign-in table.

However, attendees were not required to sign-in at the table by event organizers but were incentivized to do so through door prizes sponsored by the Missouri Valley YMCA. Tour participants were asked to consider participation in the educational booth and the post-education

survey. The inflatable colon and educational booth were also available to passersby, but these individuals were not asked to complete the post-education survey. To incentivize survey completion, the co-investigator purchased three \$15 Scheels gift cards for every 15th survey participant.

Before implementation, this project was approved by the co-investigator's committee. Approval was also sought from the Institutional Review Board (IRB) of North Dakota State University (NDSU). Approval was received by the IRB of NDSU prior to the implementation of this project. This was done to comply with the rules and bylaws of NDSU and to ensure the protection of the participants' rights, safety, and welfare. No participant identifiers such as name, date of birth, phone number, or address were obtained by the co-investigator. Informed consent was obtained from the participants before the post-education survey.

### **Inflatable Colon/Educational Booth/Handouts/Post-education Survey**

An inflatable colon nicknamed "The Rollin' Colon" was reserved from the North Dakota Department of Health and erected in the gymnasium of the Missouri Valley YMCA. The inflatable colon boasts substantial dimensions, measuring 13 feet in width, 20 feet in length, and standing at a height of 10 feet. A visually appealing, freestanding chalkboard was positioned by the gymnasium entrance providing information to health fair attendees about guided tours led by the co-investigator every 15-minutes. A script for a short, guided tour of the inflatable colon was developed by the co-investigator. The tour was limited to five minutes with additional time dedicated to dialogue between the co-investigator and attendees.

All health fair attendees had the chance to experience a guided tour of the inflatable colon, explore the exhibit without guidance, and peruse informative handouts on colorectal cancer for personal reference. The attendance counts for those opting for a guided tour were

meticulously recorded using a mechanical clicker counter. Subsequently, each participant selecting the guided tour received a handout thoughtfully crafted by the co-investigator to augment their understanding of the inflatable colon and colorectal health.

During the guided tour, attendees were extended an invitation to participate in the post-education survey if they met the inclusion criteria. They were informed that a review of the associated consent form and the completion of the survey would necessitate an additional 5-10 minutes of their time and were assured of its voluntary nature. Furthermore, participants were informed that those who completed these steps stood a chance to win a \$15 gift card to Scheels, with such incentives being awarded to every 15th person completing the post-education survey. The participants were intentionally kept unaware of the cumulative survey count. To gauge interest in the project, the number of attendees who entered the gymnasium to observe the inflatable colon, peruse the informational booth, and/or engage with the PowerPoint presentation but chose not to partake in the scripted guided tour were systematically tallied using a separate mechanical clicker counter, diligently operated by a volunteer.

The post-education survey was conveniently accessible through both traditional paper forms and a QR code seamlessly connecting respondents to a Qualtrics version of the survey. Separate handouts were also available with this QR code printed on them with simplified instructions on how to use a QR code. Those using the QR code had to sign the consent form electronically through Qualtrics before they could access the post-education survey. Participants choosing the paper version of the post-education survey were provided with the same consent form and required to sign it. The QR code was active for three days after the event. Those who chose to use the QR code were not eligible for the gift card incentive, however, and those who

took the QR code were informed of this. It was also stated in the consent form and on the QR code handout.

A PowerPoint presentation (Appendix L) was developed by the co-investigator and played on loop on a monitor placed on a booth in the space designated by the health fair organizers but adjacent to the inflatable colon. This PowerPoint presentation highlighted several aspects of CRC including its prevalence, risk factors, signs and symptoms, lifestyle modifications, screening methods available locally, and how to overcome some barriers to screening. During the PowerPoint presentation, it was encouraged that each participant discusses further action with their primary care provider. This PowerPoint was displayed to reinforce the information presented in the guided inflatable colon tours and present it to passersby who chose not to encounter it.

Several small media handouts were available to participants in the guided tours and to passersby. All handouts were free for them to take home. Permission has been obtained from Quality Health Associates of North Dakota and ScreenND to print and disperse these handouts (Appendix J). Additional handouts were obtained from the CDC. Sources from the CDC are part of the *Screen for Life* campaign (Appendix I). Permission to download, print, and disperse these handouts is publicly granted on the CDC website (Appendix H). Printing could be performed on a home printer or through a printing facility. The co-investigator also developed a handout for use during the guided tour of the inflatable colon (Appendix M). This handout was developed using information and statistics found during a review of current literature.

Prior to implementation, three \$15 gift cards to Scheels were purchased by the co-investigator. The gift cards were used as an incentive for participants to take part in the post-education survey. The number of attendees who completed the guided tour of the inflatable



colon, consent form, and post-education survey were tracked by the co-investigator and/or project assistant using a mechanical clicker counter. It was predetermined that every 15<sup>th</sup> attendee who completed the tour of the inflatable colon, consent form, and post-education survey would receive one \$15 gift card to Scheels. Attendees were not made aware of the number of participants who had already completed the post-education survey.

The post-education survey did not collect any identifying information. It asked for general demographic information such as age, gender, and ethnicity. Other questions on the post-education survey were in the formats of yes or no, circle all that apply, multiple choice, and Likert scale. The post-education survey was modeled after a similar project completed by a NDSU DNP student and was used and altered with permission from this student (Appendix B). The post-education survey will be used to evaluate Objective One, Objective Two, and Objective Three.

### **Budget**

The co-investigator supplied the funding for this project. No outside sources of funding were utilized. The inflatable colon was free to rent through the North Dakota Department of Health, but because of its generous size, required a truck, trailer, pallet mover, and labor to transport it to the implementation site. The pallet mover was provided by the North Dakota Department of Health. Assistance of Missouri Valley YMCA staff was also required to transport the inflatable colon into the building. The inflatable colon was housed in a box measuring 4 feet wide by 4 feet deep by 4 feet tall. It could not fit in any of the doors of the YMCA so the metal middle brace of one of the doors was removed by Missouri Valley YMCA maintenance staff. The box could then be easily moved into the building using a pallet mover.

The truck and trailer were owned by the co-investigator's husband. The fuel cost for transportation of the inflatable colon was \$30. This cost was absorbed by the co-investigator. Labor was provided by the co-investigator, and contacts of the co-investigator, and the Missouri Valley YMCA and was free of charge.

Downloading the handouts was free of charge but printing costs were involved. The handouts were printed in color to maintain their visual appeal and printed two sided to reduce the quantity of papers participants will be inundated with. One hundred fifty copies of the consent form and post-education survey were printed. One hundred twenty-five copies of the "*Screen for Life*" handout from the CDC were printed (Appendix I). There was an additional "*Screen for Life*" handout from the CDC titled "*Screening Tests At-A-Glance*" (Appendix I). One hundred of these were printed. One hundred copies of "*Which Colorectal Cancer Screening Is Right for Me?*" (Appendix K). To potentially address any expressed barriers regarding affordability of screening, fifty copies of NDCRCSI program highlights were made available (Appendix K). The QR code to the post-education survey and QR code use instructions were printed on half sheets of paper with a total of 120 half sheets (Appendix D). The cost to print all materials was \$289.50 and was paid for by the co-investigator. The co-investigator also provided a small treat bowl with an approximate cost of \$15. The co-investigator provided three \$15 gift cards to Scheels as incentive to complete the post education survey. The project cost was about \$379.50 and was paid for by the co-investigator.

### **Timeline**

The project was implemented once on May 22<sup>nd</sup>, 2023, in Bismarck, ND from the hours of 9: 00 am to 12:00 pm. The timeline for the creation and implementation of the project is as follows:

- August 2022 to December 2022—Literature review and synthesis
- November 2022—Approval of committee
- January 2023 to April 2023—Proposal development
- April 2023 to May 2023—IRB Approval
- May 22, 2023—Implementation of project
- June 2023 to December 2023—Compile assessment results
- January to February 2024—Submit dissertation to committee, defend dissertation, and share results and recommendations with stakeholders
- May 2024—Present results via poster presentation to NDSU faculty and DNP students and submit dissertation to nursing program chair and graduate school

### **Evaluation/Outcomes/Data Analysis**

An NDSU statistician was consulted to perform a thorough statistical analysis of the post-education survey. The analysis involved a detailed examination of the post-education survey results in relation to each objective. Additionally, potential correlations between the outcomes and interventions were also examined to determine if the project goals were met, partially met, or not met. The NDSU statistician was consulted to provide a comprehensive recognition of the project's impact and assess the effectiveness of the interventions associated with the project's objectives.

After the conclusion of the guided tour through the inflatable colon, attendees were prompted to voluntarily engage in the post-education survey after careful review of the consent form. The consent form noted in enlarged, bolded, and underlined letters that, by completing the post-education survey, the participant was consenting to participation in the research for this

project. A set quantity of educational handouts was readily available to both casual observers and active participants. Monitoring the remaining handouts served as a method to assess the project's interest and overall impact.

Given that these handouts were available to everyone, even those who did not interact with the inflatable colon, a more accurate gauge of attendee interest was the number of post-education surveys completed and the number of recorded attendees. Mechanical clicker counters were used to count the number of attendees participating in various aspects of the project. The number of attendees who participated in the scripted guided tour were counted using a black mechanical clicker counter. Attendees that chose to explore the colon at will and not attend the scripted guided tour were tabulated on an orange mechanical clicker counter. Initially, a white mechanical clicker counter was used to catalog those who entered the gym but did not walk through the inflatable colon at all, but there were no attendees that did so. All those who entered the gym showed interest in the inflatable colon and at least walked through it voluntarily. Mechanical clicker counters were discrete, easy to use, and provided a straightforward assessment of attendee interest and the potential for knowledge gain, especially in those who opted not to partake in the post-education survey.

### **Objective One**

**Evaluate participants' perceived knowledge of colorectal cancer and the available screening methods in central North Dakota.** Several questions on the post-education survey were aimed at evaluating this objective. These questions include *“did you know that screening for colorectal cancer should start when you turn 45 years old,” “did you know that colonoscopy is not the only option for screening for colorectal cancer,” “did you know that you may be able to complete screening in the privacy of your own home with a stool-based testing kit and not at a*

hospital,” *“have you ever thought about your risk factors for developing colorectal cancer,”* *“what personal risk factors do you have,”* and *“did you know that colorectal cancer has no signs or symptoms until it is in the later stages of the disease.”*

## **Objective Two**

**Identify perceived barriers and benefits of colorectal cancer screening experienced in central North Dakota.** Barriers to screening vary from person to person. To measure this, a question addressing barriers to screening for CRC was added to the post-education survey. These questions included *“circle any or all of the following that might keep you from screening for colorectal cancer.”* Options for this question included *“it costs too much to be screened,” “I do not think I am at risk,” “I am nervous about what the results could be,” “I am nervous about the testing process,” “I do not want to talk about bowel habits or colon cancer,” “I don’t want to go to the hospital for screening,” “I do not have health insurance,” “I have poor health insurance coverage,” “it is difficult to get to a facility to be screened,” “I am not sure of my screening options,” “my primary care provider has never talked to me about it,” “I would not want to treat colon cancer so do not want to screen for it,” “none of these-nothing is keeping me from screening,”* and a fill in the blank area titled *“other.”* One question was included to measure perceived benefits of screening. This question read *“what benefits do you think screening for colorectal cancer would give you.”* Options included *“prevent colon cancer,” “detect colon cancer early,” “treat colon cancer early,” “peace of mind,” “not sure,”* and *“other.”* There is a space next to the word *“other”* to indicate that the participant should elaborate if that option is chosen.

### Objective Three

**Assess participants' intent to undergo colorectal cancer screening after receiving targeted and relevant education.** Several questions on the post-education surveys have been added to measure the change in intent to be screened. Two Likert Scale questions are included. The first was *“How likely are you to start colorectal cancer screening”* with the optional answers including *“not likely at all,” “somewhat likely,” “likely,” “very likely”* and *“not applicable—I have already started screening for colorectal cancer.”* The second was *“how likely are you to continue colorectal cancer screening”* with optional answers including *“not likely at all,” “somewhat likely,” “likely,” “very likely”* and *“not applicable—I have not started screening for colorectal cancer.”*

An additional multiple-choice question was used on the post-education survey to evaluate objective three. This read *“Did the information presented today influence your intent to screen for colorectal cancer.”* Optional answers for this question were *“yes, it did”* and *“no, it did not.”* Space was left at the end of the post-education survey for the participant to describe why or why not regarding this question. Space was left for the participants to leave open-ended comments about why they did or did not choose certain responses and to write differing responses to the question posed if a desired response was not available. This option was chosen to provide the participant with autonomy to express their thoughts and potentially facilitate a deeper understanding of the post-education results.

## CHAPTER 4: RESULTS

The data collected was both quantitative and qualitative. Three surveys were incorporated, accessible through a QR code, while an additional 22 paper surveys were diligently completed by participants, resulting in a comprehensive total of 25 surveys. Two paper surveys were omitted due to participants' ages exceeding the exclusion criteria of being older than 75 years. A total of 23 surveys were completed in entirety and met all inclusion and exclusion criteria. A summary of the data can be found in Table 2, detailed below. To determine if each objective was met, descriptive statistics were utilized. A NDSU statistician was also utilized to determine if there was an opportunity for additional data considerations. The NDSU statistician determined that there was not an opportunity for further statistical analysis due to the small sample size. The Qualtrics versions of the post-education survey included a consent provision, allowing the co-investigator to gather and analyze data from the participants in question one. On the paper edition of the post-education survey, question one served as a reminder for participants to carefully review the attached consent form associated with their survey. This approach ensured alignment between all questions on both the Qualtrics and paper versions.

**Table 2**

*Survey Results*

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>2. What is your age range?</b>		
18-44	1	4.3
45-49	0	0
50-75	22	95.7
<b>3. What is your biological gender?</b>		
Male	1	4.3
Female	20	87
Prefer not to say	2	8.7

**Table 2. Survey Results (continued)**

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>4. Please indicate the ethnicity that best describes you.</b>		
Caucasian	22	95.7
American Indian/Alaska Native	0	0
Hispanic/Hispanic Black	0	0
African American	0	0
Asian/Pacific Islander	0	0
Other	1	4.3
<b>5. What parts of the project were you able to participate in? Choose ANY that apply to you.</b>		
I read the handouts on the table.	6	26
I watched the presentation on the table	4	17.4
I walked through the inflatable colon myself	3	13
The student guided me through the inflatable colon	23	100
<b>6. Have you ever been screened for colorectal cancer?</b>		
Yes, and I believe I am up to date with screening	19	82.6
Yes, but I believe I am due to be screened again soon	2	8.7
No, I have never been screened for colorectal cancer	2	8.7
<b>7. If yes to the previous question, what type of test did you use to complete screening?</b>		
Stool based test performed at home and mailed in for testing	1	4.8
Direct visualization test (colonoscopy, flexible sigmoidoscopy, CT colonography)	14	66.7
I have used both of these in the past	6	28.5
<b>8a. Did you know that screening for colorectal cancer should start when you turn 45 years old?</b>		
No, I just learned this when reading this question	0	0
Yes, I just learned this today, at the health fair	12	52.2
Yes, I knew this before participating in this health fair	11	47.8
<b>8b. Did you know that colonoscopy is not the only option for screening for colorectal cancer?</b>		
No, I just learned this when reading this question	1	4.3
Yes, I just learned this today, at the health fair	6	26.1
Yes, I knew this before participating in this health fair	16	69.6



**Table 2. Survey Results (continued)**

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>8c. Did you know that you may be able to complete screening in the privacy of your own home with a stool-based testing kit and not at a hospital?</b>		
No, I just learned this when reading this question	0	0
Yes, I just learned this today, at the health fair	7	30.4
Yes, I knew this before participating in this health fair	16	69.6
<b>8d. Did you know that colorectal cancer has no signs or symptoms until it is in the later stages of the disease?</b>		
No, I just learned this when reading this question	4	17.4
Yes, I just learned this today, at the health fair	12	52.2
Yes, I knew this before participating in this health fair	7	30.4
<b>9. Have you ever thought about your risk factors for developing colorectal cancer?</b>		
No, I have not thought about them	2	8.7
Yes, I have thought about them, but am not sure about my total risk	5	21.7
Yes, I have considered them	16	69.6

**Table 2. Survey Results (continued)**

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>10. The following are all risk factors for developing colorectal cancer. What personal risk factors do you have? Choose ANY or ALL that apply to you.</b>		
I eat red meat or smoked meat at many of my meals	9	39.1
I don't eat a lot of fiber or fresh fruits and vegetables	8	34.8
I don't get 30 minutes of exercise per day	5	21.7
I am overweight	15	65.2
I am 45 years old or older	22	95.7
I grew up with or still drink well water as my primary source of water	10	43.5
My meals often consist of processed foods, dairy products, fatty animal products, deep fried foods, fast food, and convenience foods	9	39.1
I have been on 6 or more rounds of antibiotics in the last 3 years	2	8.7
I have a history of ulcerative colitis, Crohn's Disease, Lynch Syndrome or familial adenomatous polyposis	3	13
I have used tobacco products in the last 5 years	0	0
I have one or more alcoholic drinks per day on most days	1	4.3
I have a blood relative that has been diagnosed with colorectal cancer	4	17.4
None of these	0	0

**Table 2. Survey Results (continued)**

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>11. Choose ANY or ALL that might affect your choice to screen for colorectal cancer.</b>		
I think it costs too much to be screened	0	0
I do not have health insurance	0	0
I have poor health insurance coverage	0	0
I don't think I am at great risk of getting it	3	13
I am nervous about what the results could be	0	0
It is difficult to get to a facility to be screened	0	0
I am nervous about the testing process	1	4.3
I am not sure of my screening options	0	0
I do not want to talk about bowel habits or colon cancer	0	0
My primary care provider has never talked to me about it	0	0
I don't want to go to the hospital to get screened	1	4.3
I would not want to treat colon cancer so do not want to screen for it	0	0
None of these	19	82.6
Other	1	4.3
<b>12. What benefits do you think screening for colorectal cancer would give you? Circle ANY or ALL that apply to you.</b>		
Prevent colon cancer	15	65.2
Detect colon cancer early	20	87
Treat colon cancer early	17	73.9
Peace of mind	19	82.6
Not sure	1	4.3
Other:	0	0
<b>13. How likely are you to start colorectal cancer screening? Please choose ONLY ONE.</b>		
Not likely at all	0	0
Somewhat likely	2	8.7
Likely	2	8.7
Very likely	2	8.7
Not applicable—I have <u>already started</u> screening for colorectal cancer	17	73.9

**Table 2. Survey Results (continued)**

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>14. How likely are you to continue colorectal cancer screening? Please choose ONLY ONE.</b>		
Not likely at all	0	0
Somewhat likely	3	13
Likely	2	8.7
Very likely	16	69.6
Not applicable—I have <u>not started</u> screening for colorectal cancer	2	8.7
<b>15. How likely are you to tell others about what you learned today?</b>		
Not likely at all	0	0
Somewhat likely	3	13
Likely	10	43.5
Very likely	10	43.5
<b>16. Did the information presented today influence your intent to screen for colorectal cancer?</b>		
Yes, it did	21	91.3
No, it did not	2	8.7
<b>17. Please describe why or why not (regarding question 16)</b>	See Table 6	

## Objective One

**Evaluate participants' perceived knowledge of colorectal cancer and the available screening methods in central North Dakota.** Objective One was evaluated using questions eight a, eight b, eight c, eight d, nine, and 10. See Table 3 below for a summary of the results of these selected questions. The total number of individuals that attended the event was not able to be counted. Organizers of the event estimated that there were more than 100 attendees. Additionally, 57 individuals chose to attend the guided tour of the inflatable colon and 16 individuals viewed the inflatable colon without attending the guided tour. Thirty-nine individuals chose to receive the "Colorectal Cancer Stats" handout (Appendix M) created by the co-investigator. A total of 102 copies of the handouts (Appendix I, Appendix K, and Appendix M) were voluntarily taken by the attendees. The number of attendees that watched the PowerPoint presentation set on loop was not able to be tracked. The attendance and number of handouts received by attendees provided an opportunity to increase attendee knowledge of CRC in central North Dakota.

**Table 3**

*Survey Results Supporting Objective One*

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>8a. Did you know that screening for colorectal cancer should start when you turn 45 years old?</b>		
No, I just learned this when reading this question	0	0
Yes, I just learned this today, at the health fair	12	52.2
Yes, I knew this before participating in this health fair	11	47.8
<b>8b. Did you know that colonoscopy is not the only option for screening for colorectal cancer?</b>		
No, I just learned this when reading this question	1	4.3
Yes, I just learned this today, at the health fair	6	26
Yes, I knew this before participating in this health fair	16	69.6

**Table 3** *Survey Results Supporting Objective One (continued)*

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>8c. Did you know that you may be able to complete screening in the privacy of your own home with a stool-based testing kit and not at a hospital?</b>		
No, I just learned this when reading this question	0	0
Yes, I just learned this today, at the health fair	7	30.4
Yes, I knew this before participating in this health fair	16	69.6
<b>8d. Did you know that colorectal cancer has no signs or symptoms until it is in the later stages of the disease?</b>		
No, I just learned this when reading this question	4	17.4
Yes, I just learned this today, at the health fair	12	52.2
Yes, I knew this before participating in this health fair	7	30.4
<b>9. Have you ever thought about your risk factors for developing colorectal cancer?</b>		
No, I have not thought about them	2	8.7
Yes, I have thought about them, but am not sure about my total risk	5	21.7
Yes, I have considered them	16	69.6

**Table 3** *Survey Results Supporting Objective One (continued)*

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>10. The following are all risk factors for developing colorectal cancer. What personal risk factors do you have? Choose ANY or ALL that apply to you.</b>		
I eat red meat or smoked meat at many of my meals	9	39.1
I don't eat a lot of fiber or fresh fruits and vegetables	8	34.8
I don't get 30 minutes of exercise per day	5	21.7
I am overweight	15	65.2
I am 45 years old or older	22	95.7
I grew up with or still drink well water as my primary source of water	10	43.5
My meals often consist of processed foods, dairy products, fatty animal products, deep fried foods, fast food, and convenience foods	9	39.1
I have been on 6 or more rounds of antibiotics in the last 3 years	2	8.7
I have a history of ulcerative colitis, Crohn's Disease, Lynch Syndrome or familial adenomatous polyposis	3	13
I have used tobacco products in the last 5 years	0	0
I have one or more alcoholic drinks per day on most days	1	4.3
I have a blood relative that has been diagnosed with colorectal cancer	4	17.4
None of these	0	0

## Objective Two

**Identify perceived barriers and benefits of colorectal cancer screening experienced in central North Dakota.** Objective Two was evaluated using two multiple choice “select all that apply” style questions—questions eleven and twelve. The results of these questions are summarized in Table 4 below. Only one qualitative response was received for these questions. In response to question 11, the participant stated, *“I am happy to be screened!”*

**Table 4**

*Survey Results Supporting Objective Two*

Question	Answer/Response (N=23)	Mean (%)
<b>11. Choose ANY or ALL that might affect your choice to screen for colorectal cancer.</b>		
I think it costs too much to be screened	0	0
I do not have health insurance	0	0
I have poor health insurance coverage	0	0
I don't think I am at great risk of getting it	3	13
I am nervous about what the results could be	0	0
It is difficult to get to a facility to be screened	0	0
I am nervous about the testing process	1	4.3
I am not sure of my screening options	0	0
I do not want to talk about bowel habits or colon cancer	0	0
My primary care provider has never talked to me about it	0	0
I don't want to go to the hospital to get screened	1	4.3
I would not want to treat colon cancer so do not want to screen for it	0	0
None of these	19	82.6
Other	1	4.3



**Table 4** *Survey Results Supporting Objective Two (continued)*

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>12. What benefits do you think screening for colorectal cancer would give you? Circle ANY or ALL that apply to you.</b>		
Prevent colon cancer	15	65.2
Detect colon cancer early	20	87
Treat colon cancer early	17	73.9
Peace of mind	19	82.6
Not sure	1	4.3
Other:	0	0

### Objective Three

**Assess participants’ intent to undergo colorectal cancer screening after receiving targeted and relevant education.** Objective Three was evaluated using four multiple choice questions and one qualitative question. The results of these questions are displayed in Table 5 and Table 6 below.

**Table 5**

*Survey Results Supporting Objective Three*

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>13. How likely are you to start colorectal cancer screening? Please choose ONLY ONE.</b>		
Not likely at all	0	0
Somewhat likely	2	8.7
Likely	2	8.7
Very likely	2	8.7
Not applicable—I have <u>already started</u> screening for colorectal cancer	17	73.9
<b>14. How likely are you to continue colorectal cancer screening? Please choose ONLY ONE.</b>		
Not likely at all	0	0
Somewhat likely	3	13
Likely	2	8.7
Very likely	16	69.6
Not applicable—I have <u>not started</u> screening for colorectal cancer	2	8.7
<b>15. How likely are you to tell others about what you learned today?</b>		
Not likely at all	0	0
Somewhat likely	3	13
Likely	10	43.5
Very likely	10	43.5

**Table 5** *Survey Results Supporting Objective Three (continued)*

<b>Question</b>	<b>Answer/Response (N=23)</b>	<b>Mean (%)</b>
<b>16. Did the information presented today influence your intent to screen for colorectal cancer?</b>		
Yes, it did	21	91.3
No, it did not	2	8.7

**Table 6**

*Qualitative Data from Question Seventeen on Post-education Survey: “Please describe why or why not (regarding question #16)”*

<b>Question</b>	<b><i>Qualitative Data</i></b>
<b>17. Please describe why or why not (regarding question 16)</b>	<p>“Reinforced what I knew.”</p> <p>“I have already had w colonoscopies.”</p> <p>“The presenter informed us that Stage 1 &amp; 2 have no symptoms but can be detected with screening.”</p> <p>“Too many of my friends &amp; loved ones are going through colon cancer treatment &amp; my brother died of colon cancer—diagnosed at 58.”</p> <p>“It confirmed what I believe about screenings.”</p> <p>“Excellent Program!”</p> <p>“The increased cure rate for this cancer when found early is impressive. Also, the statistic of 1/3 of NDakotans diagnosed in 2019 died within the same year is shocking to me!”</p> <p>“Have been screened for many years.”</p>

## CHAPTER 5: DISCUSSION AND RECOMMENDATIONS

### Summary

The purpose of this evidence based scholarly project was to increase awareness of CRC and to determine whether the use of an inflatable colon, multiple handouts, and a PowerPoint presentation set on loop was an effective means to increase participants' perceived knowledge of CRC and its screening methods, identify barriers to screening experienced by central North Dakotans, and assess the participants' intent to be screened for colorectal cancer following the interventions. At the conclusion of the project, the three objectives were met or partially met. Important findings include heightened awareness of the recommended age for initial screening, enhanced understanding of the signs and symptoms associated with colorectal cancer, identification of personal risk factors and barriers to screening, and a positive intent to screen for colorectal cancer in the future.

An additional review of literature from 2023 was completed after the project's implementation to evaluate and utilize updates in the literature. Most new literature supported the previously completed literature review. One interesting article discussed barriers and facilitators of CRC screening using the 5As framework—access, affordability, awareness, acceptance, activation, and sociodemographic (Agunwamba et al., 2023). This framework should not be confused with the 5 As of the Behavior Change Model (assess, advise, agree, assist, and arrange) which is often utilized to encourage changes in behavior such as smoking cessation (Vallis et al., 2013). A systematic review was completed of articles published since 2017 that discussed barriers and facilitators to CRC screening adherence then applied to the 5As framework (Agunwamba et al., 2023). The study concluded that a multilevel approach is required to improve CRC screening adherence. Measures need to be taken to address individual-level

characteristics, healthcare system factors, and sociocontextual factors. Also illustrated in the literature is that interventions aimed at individual level characteristics have been noted to be very impactful strategies to increase screening rates. Examples of these strategies include improving an individual's knowledge of CRC, increasing knowledge of screening modalities, providing population specific educational material, and increasing self-efficacy. This project worked to address individual level characteristics by increasing participant knowledge of various aspects of CRC, its screening modalities, providing several types of educational material, and providing information of how to get screened for CRC.

## **Discussion**

### **Objective One**

The first objective was to evaluate participants' perceived knowledge of colorectal cancer and its screening methods available in central North Dakota. Because it was not feasible to measure participants' baseline knowledge of colorectal cancer prior to education, expansion of knowledge could not be measured in this project. To account for this, the answers to some post-education survey questions were worded to compare preexisting and new knowledge. These included questions eight a, eight b, eight c, and eight d in which the options for answering included, *"No, I just learned this when reading this question,"* *"Yes, I just learned this today, at the health fair,"* and *"Yes, I knew this before participating in this health fair."* Results for question 10 could not be proven that knowledge was gained, only assumed.

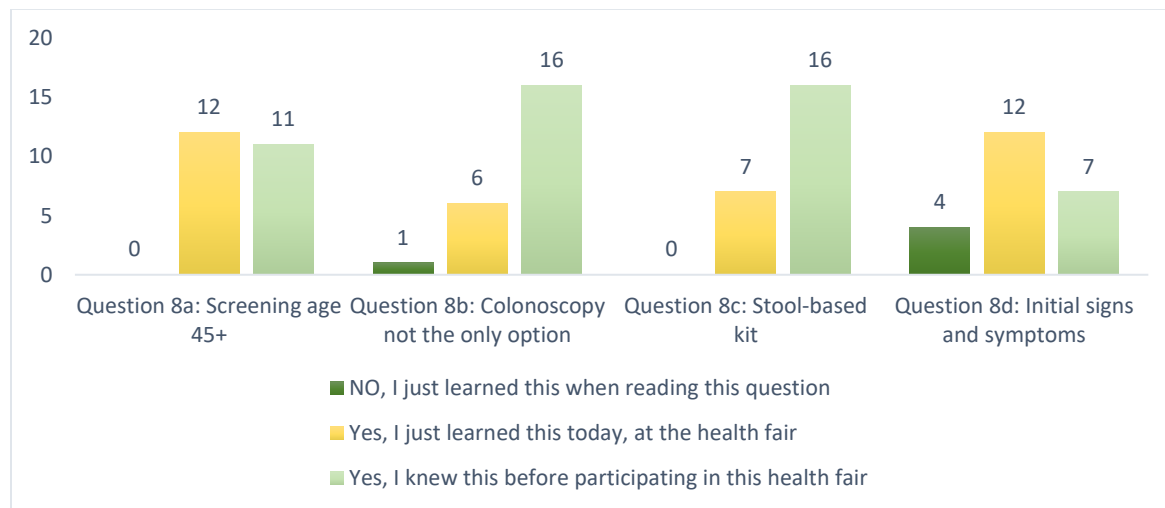
Objective One was determined to be met by examining the quantitative data of questions eight a, eight b, eight c, eight d, nine and 10 as seen in Table 3, Figure 1, and Figure 2. At the health fair, approximately half of the participants (n=12) recognized that screening for colorectal cancer should now begin at the age of 45 while 11 (47.8%) participants reported this as prior

knowledge. Sixteen (69.6%) participants reported that they were aware that there are at-home versions of screening and colonoscopy is not the only option available for screening. This knowledge could be attributed to many of the participants already being of screening age and had reportedly participated in at least one form of screening prior to the project. New knowledge was gained by seven (30.4%) participants that at-home versions of screening are available and colonoscopy is not the only option.

One of the most impactful data points was exhibited by question eight d. Results of this question revealed that 69.6% (n=16) of participants learned that colorectal cancer has no signs or symptoms until later stages of the disease while 30.4% (n=7) were aware of this fact prior to participating in the health fair. Some participants also noted this fact in question 17 (Table 6). When asked if the information presented at the health fair influenced their intent to screen for colorectal cancer in question 17, one participant referenced the information covered in question eight d and said, “*The presenter informed us that Stage 1 and Stage 2 have no symptoms but can be detected with screening.*”

**Figure 1**

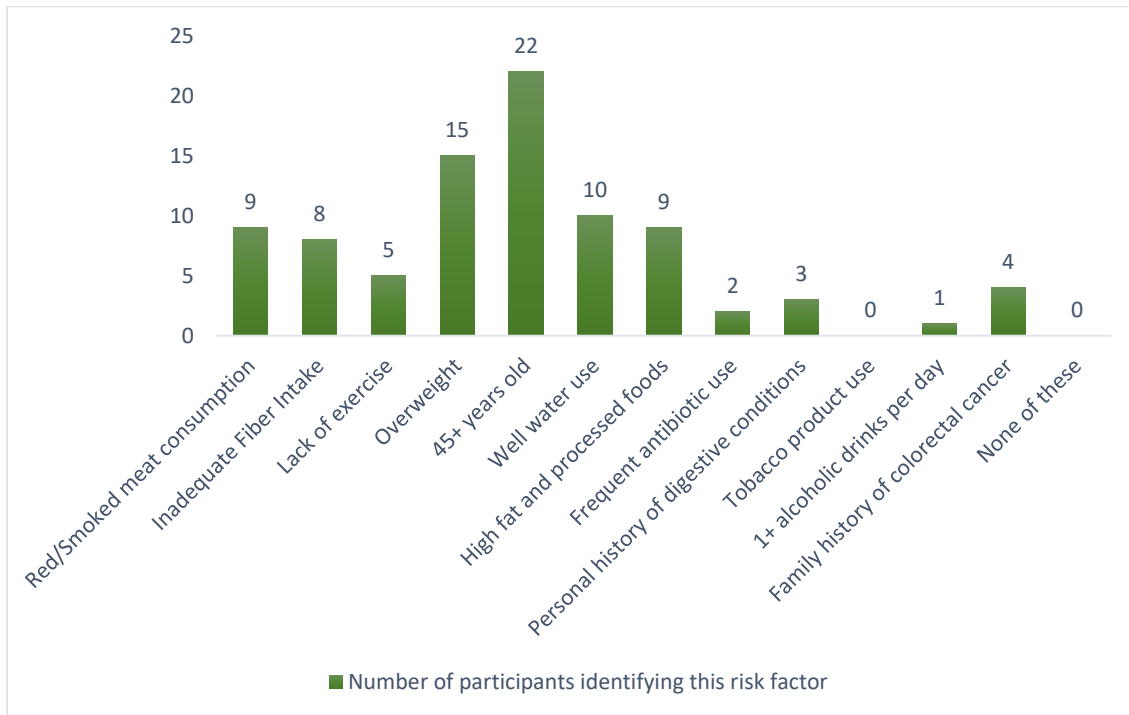
*Question Eight: Perceived Knowledge of Colorectal Cancer*



An assessment of risk and identification of personal risk factors can be an important motivator towards screening. In the post-education survey as demonstrated in Figure 2, participants were prompted in question 10 to self-identify their individual risk factors, aiming to raise awareness about the various factors that may contribute to their overall risk. Every participant identified at least one risk factor. An average of three risk factors were identified by participants. The most common risk factor identified was age greater than 45 years followed by being overweight and other diet related factors. Interestingly, there were also no participants that identified tobacco product use in the last 5 years as a risk factor.

**Figure 2**

*Question 10: CRC Risk Factor Self-Identification*



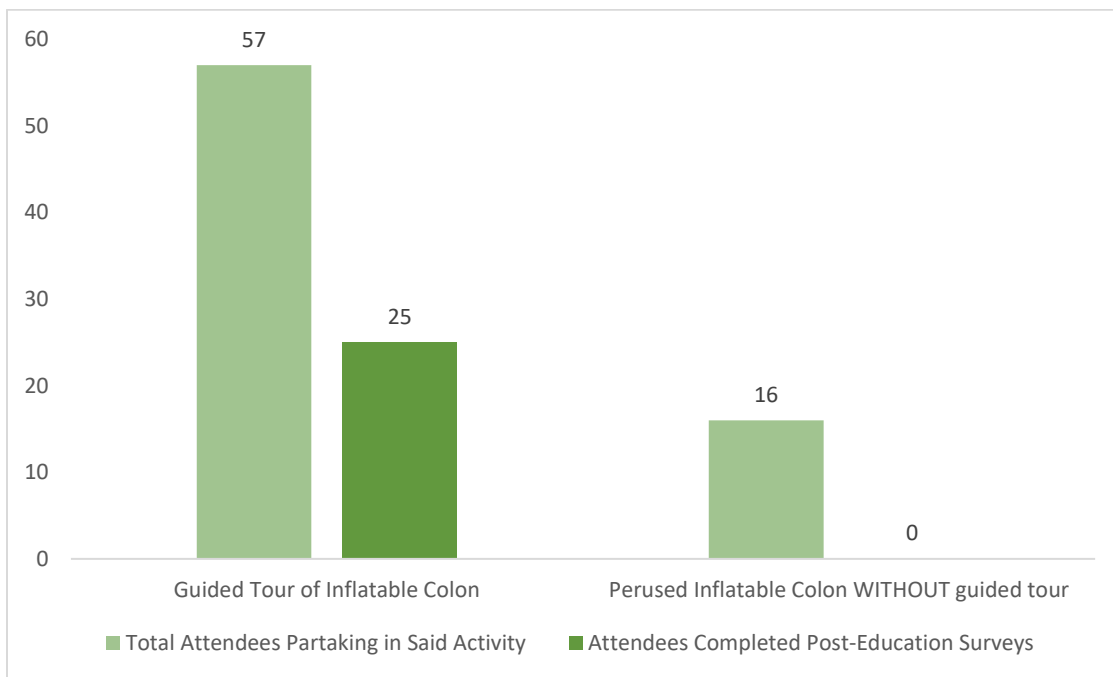
*Note: Participants were allowed to select more than one answer.*

In addition to tracking the distribution of the post-education survey, the number of individuals choosing to attend the guided tour of the inflatable colon and the number of handouts

distributed were also tracked. The YMCA health fair organizers estimated that there were just over 100 individuals that attended the health fair. As portrayed in Figure 3, the scripted guided tour of the inflatable colon was opted for by 57 attendees, out of which 25 willingly participated in the post-education survey. Two surveys were excluded due to exceeding the age requirements of the exclusion criteria, leaving 23 surveys for analysis. Sixteen attendees chose to independently explore the inflatable colon without a guided tour, and none of them completed a post-education survey.

**Figure 3**

*Attendee and Participant Counts*



*Note: The number of attendees of the health fair was not included because they could not be accurately determined by health fair organizers.*

Several handouts were available on a table near the exit to the inflatable colon. A total of 102 copies of the handouts (Appendix I, Appendix K, and Appendix M) were voluntarily received by the attendees. The number of attendees that watched the PowerPoint presentation set



on loop was not able to be tracked. However, multiple chairs were set up in front of the PowerPoint presentation to facilitate viewing and provide a comfortable place to sit while completing the post-education survey.

## **Objective Two**

The second objective was to identify perceived barriers and benefits of colorectal cancer screening experienced by those living in central North Dakota. More than one in five participants identified at least one barrier. The most identified barrier was *“I don’t think I am at great risk of getting it”* followed by *“I don’t want to go to the hospital to get screened”* and *“I am nervous about the testing process.”* However, 19 participants stated that none of the barriers listed applied to them and one selected *“Other.”* The participant that selected *“Other”* stated *“I am happy to be screened.”* All the participants noting barriers were female. The participant that noted the barriers of *“I don’t think I am at great risk of getting it”* and *“I am nervous about the testing process”* was below the recommended screening age of 45. Because most participants noted no barriers, most were above the recommended screening age of 45, and most stated that they had already completed some form of screening in the past, the lack of barriers identified by participants could potentially be contributed to the prior screening experiences of the participants. Surprisingly however, the lack of self-identification of barriers is consistent with the literature. In at least one study focused on the utilization of the Health Belief Model in assessing benefits and barriers to CRC screening, results indicated that the participants self-identified very few barriers to the use of current screening methods and far more benefits (Williams et al., 2018).

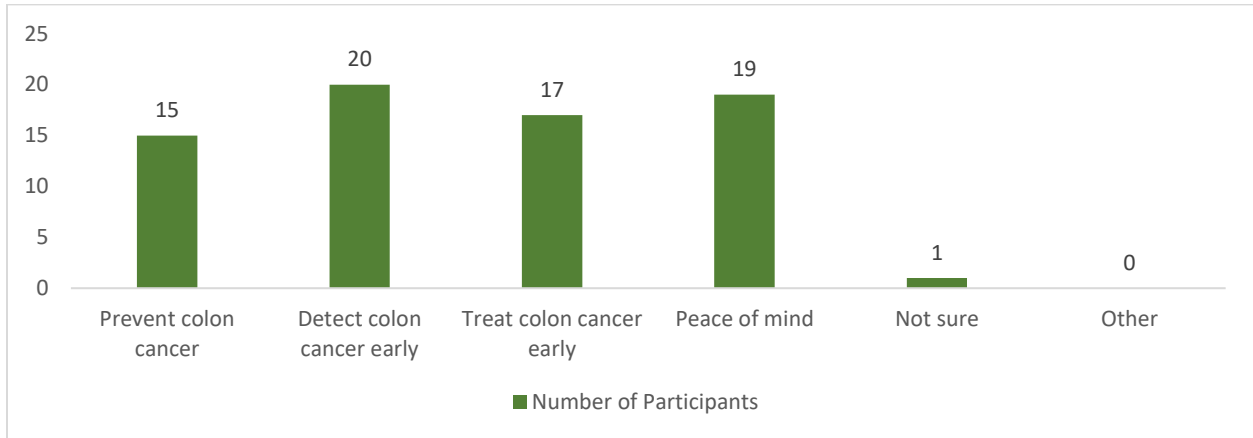
Question 12 of the post-education survey asked the participants to self-identify the benefits of screening for colorectal cancer. The most common benefit the participants identified

was the ability to detect colon cancer early through screening followed by peace of mind.

However, eleven participants noted all four benefits listed in the survey as being beneficial to them. All but one participant identified at least two benefits to screening for colorectal cancer.

**Figure 4**

*Perceived Benefits of Colorectal Cancer Screening*



*Note: Participants were allowed to choose more than one answer.*

Objective two has been deemed partially met due to the large number of participants that self-identified no barriers to screening but did self-identify several benefits.

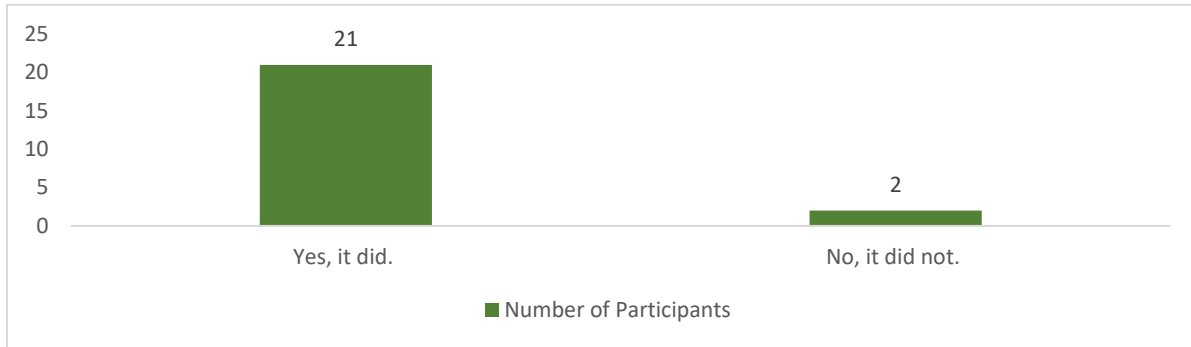
### **Objective Three**

The third objective was to assess the participants' intent to undergo colorectal cancer screening after receiving targeted and relevant education at the health fair. This objective was met as evidenced by 91.3% (n=21) of the participants marking "Yes, it did" on question 16 of the post-education survey asking if the information presented at the health fair influenced their intent to screen for colorectal cancer. Two participants (8.7%) marked "No, it did not." Question 17 asked the participant to describe why they answered the question the way they did. The two participants that chose "No, it did not" commented in the following ways: (1) "I have already had w colonoscopies" and (2) "Have been screened for many years." This suggests that the

education did not influence their intent to screen for CRC because they had already begun screening in the past.

**Figure 5**

*Influence of the Project on Participants' Intent to Screen for Colorectal Cancer*



Question 14 of the post-education survey asked, “*How likely are you to continue colorectal cancer screening?*” Thirteen percent (n=3) stated they were “*somewhat likely,*” 8.7% (n=2) reported that they were “*likely,*” and 69.6% (n=16) reported that they were “*very likely*” for a total of 91.3% of participants reporting that they were at least somewhat likely to continue screening for colorectal cancer.

Question six of the post-education survey asked, “*Have you ever been screened for colorectal cancer?*” Two participants (8.7%) reported, “*No, I have never been screened for colorectal cancer.*” Later in the post-education survey, these same two participants reported that they were “*likely*” and “*somewhat likely*” to begin screening for colorectal cancer in the future. Additionally, 100% (n=23) of participants reported that they were at least somewhat likely to tell others about the information they learned at the health fair regarding colorectal cancer and its screening practices—13% (n=3), 43.5% (n=10), and 43.5% (n=10) stated they were “*somewhat likely,*” “*likely,*” and “*very likely,*” respectively.

## **Recommendations**

Achieving superior outcomes in a similar project hinge on adopting successful strategies and ideas that proved effective in this endeavor. First, this project would not have been possible without collaboration with several agencies such as the North Dakota Department of Health, Quality Health Associates of North Dakota, the North Dakota Colorectal Cancer Roundtable, North Dakota Cancer Coalition, and the Missouri Valley YMCA. Agencies such as these have access to many resources. These agencies also boast a trusted reputation and passion for improving the level of health of those in their communities, which is a shared mission of this project. Because of the wide breadth of these agencies, there is a potential to impact many populations. By collaborating with these agencies, the co-investigator was able to utilize the existing trust in these agencies to educate and impact attendees.

A limitation of this project was the large number of participants in the 50–75-year-old age group and only one in the 18-44-year-old age group. This limitation could largely be attributed to the time and location of the event. This project was held on a weekday morning in May. As such, most attendees would be considered “retirement age” and very few “working age.” The co-investigator recommends attempting to identify an event occurring at a time suitable for most age groups and in a more accessible location. This would help draw in people from different age groups and might result in a more accurate reflection of the general population. Examples may include implementation at a public shopping space on a weekend or an outdoor public event such as a 5k run, vendor event, or a music festival. This project could also be implemented alongside other events aimed at health maintenance and screening such as traveling mammography, immunization clinics, and biometric screening.

Another method to engage a younger audience could involve utilizing more advanced technology, such as producing a video showcasing a virtual colon along with the concepts and suggestions outlined in this project. The video could be used as an adjunct to the inflatable colon or as a stand-alone intervention and shared in a multitude of ways. It could be used in the public health setting using social media or posted on the public health department's website. The video could also be used as an intervention to improve a clinic's CRC screening uptake and shared via the electronic health record with patients approaching screening age, as a QR code placed in the patients after visit summary or posted around the clinic or run on loop on the clinic's televisions.

Implementing a project like this during the month of March, which is National Colorectal Cancer Awareness Month, may also be beneficial. During March, there are many campaigns to support screening for colorectal cancer which could spur community members to come to such events. Other agencies with similar missions may welcome a project like this one to be implemented alongside their efforts. In other studies, events that hosted inflatable colon tours and distributed free fecal occult blood test (FOBT) kits found that participants were more likely to become screened for CRC (Briant, Espinoza, et al., 2015). Distributing free FOBT kits during the event would have been an ideal way to overcome a common barrier to screening. However, FOBT kits are costly and would not be feasible without assistance from an outside agency. If a sponsoring agency could be identified or a grant received to supply free FOBT kits, the distribution of free FOBT kits could yield interesting results. Providing free FOBT kits moves awareness and education to a change in behavior.

Inflatable colons have also been utilized to target specific underserved populations such as Native Americans, Hispanics, and those living in rural areas (Briant, Espinoza, et al., 2015; Briant, Wang, et al., 2015; Miguel et al., 2020). These populations are considered high risk for

colorectal cancer, often encounter many barriers to screening, and have lower screening rates (Agunwamba et al., 2023). Guided tours of an inflatable colon and other methods used in this project could be utilized to target specific counties or populations in North Dakota in which there is high incidence of CRC or known need for CRC education.

Finally, the infographic handout created by the co-investigator, incorporating facts and statistics from the review of literature (Appendix M), received widespread approval by the attendees and project committee. Several participants referenced statistics from it in the qualitative data collection. This infographic can be used across multiple platforms to raise awareness about CRC. It could be distributed in printed form, as it was in this project, or used in social media outreach, other health fairs, and in various educational environments.

### **Dissemination**

Findings of this and any project can only be utilized to improve the health of a larger population if they are shared with other appropriate entities. Once shared, those entities can improve on the methods and implement similar projects or strategies to increase other individual's knowledge of CRC, address barriers to screening, and influence the individual's intent to screen for CRC. As such, the co-investigator presented a poster at the 2023 North Dakota Nurse Practitioner Association Pharmacology Conference and will present the poster at the NDSU College of Health Professionals Poster Conference to be held in May 2024. This project's findings were also presented in an Executive Summary (Appendix O) shared with the North Dakota Department of Health, Quality Health Associates of North Dakota, North Dakota Colorectal Cancer Roundtable, North Dakota Cancer Coalition, and Missouri Valley YMCA. The co-investigator plans to create and submit a three-minute doctoral dissertation video to be submitted to the NDUS Graduate School. The co-investigator is also considering submitting

articles to several journals including the *Journal of Clinical Oncology Nursing*, *Journal of American Cancer Society*, and *Clinical Colorectal Cancer*.

### **Relation to Health Belief Model**

The Health Belief Model (HBM) was developed in the 1950s by behavioral scientists to identify, understand, and predict factors that influence a person's health-related decision-making (Green et al., 2020; LaMorte, 2019; Sohler et al., 2015). The behavioral scientists that developed the HBM wished to identify points of leverage and areas of intervention that could be used to improve screening rates and health statuses. Utilization of the HBM helped develop this project by guiding education areas and points of leverage within the project.

First, a person must believe they are *susceptible* or at risk of developing CRC before they would choose to undergo screening (Glanz et al., 2008; Lau et al., 2020). Through the education received in this project, attendees of the health fair and participants in the project were informed of incidence of CRC and personal modifiable and nonmodifiable risk factors. When incidence and personal risk is understood, a belief and decision regarding screening for CRC can then be made.

Second, the individual must consider the *severity* of CRC and its consequences in their lives (Glanz et al., 2008; Lau et al., 2020). They must consider the risks and *benefits* of choosing to be screened for CRC versus choosing not to be screened for CRC. Through the education received in this project, attendees of the health fair and participants in the project were informed of the stages of CRC, survival rates of the stages of CRC, and potential benefits of being screened for CRC. The post-education survey also assessed personal beliefs held regarding the benefits of CRC screening. The attendees and participants weighed the severity, consequences,

risks, and benefits of screening for CRC to make an informed decision about their future health status.

Thirdly, the HBM acknowledges that many *barriers* may still exist regardless of a person's thoughts regarding susceptibility, severity, and benefits (Glanz et al., 2008; LaMorte, 2019; Lau et al., 2020). There are many, varied barriers to screening for CRC. In this project, barriers were identified by the participants in the post-education survey. Resources were available to all attendees and participants about how to address common barriers noted in literature such as cost and access to a screening facility.

The fourth element of the HBM is a cue to action (Glanz et al., 2008; LaMorte, 2019; Lau et al., 2020). Often, it is difficult to accurately identify a cue to action without further tracking of the participant. However, this project incorporated several elements that are noted to be key cues to action such as screening recommendation by another person, education and increased awareness of the condition, publicity, and small media use (Glanz et al., 2008).

The last element of the HBM is *self-efficacy* (Glanz et al., 2008; LaMorte, 2019; Lau et al., 2020). Self-efficacy, as related to CRC screening, is the individual's confidence in overcoming barriers to screening and successfully taking the necessary steps to complete the screening process. This project measured the likelihood that the participants would start screening for CRC or continue screening for CRC and overcome their personal barriers to screening. Such behavior displays self-efficacy. This project also provided education and training in a specified area, identified the goal of screening and a reduction in mortality rates, provided verbal reinforcement to attendees, and attempted to reduce anxiety surrounding screening for CRC which has been identified as methods to increase a person's self-efficacy (Glanz et al., 2008).



### **Relation to Iowa Model Revised**

The Iowa Model of Research-Based Practice to Promote Quality Care (Iowa Model) was developed in the early 1990s by nurses to integrate research findings into patient and provider practice (Buckwalter et al., 2017). The Iowa Model was revised in 2017 and is now called the Iowa Model Revised. There are seven primary steps included in the Iowa Model Revised. The project began with the identification of an issue and the Iowa Model Revised guided the project through the next steps, concluding with dissemination of the results.

### **Limitations and Strengths**

Several of the limitations in this project were due to the date and site of implementation. The event was held on a Monday morning during normal business hours. It could be presumed that an event held during a weekday morning would have fewer participants from those in a working age group than those from an age group that is typically retired. This could be why there were more participants involved in the project in the 50-75 and 76 and older age groups than in the 18-44 and 45-49 age groups. Also, because of the small sample size, the results were not statistically significant.

Because the project took place at a health fair, it is likely that attendees already possessed an interest in enhancing their health status, actively assuming responsibility for their health by attendance of the event. Attendees of a health fair could have a stronger knowledge base in health which may differ from the general population and could have affected the data. Additionally, because most of the participants in the project were of screening age for CRC, prior experience may have affected their knowledge base.

The inflatable colon was a very eye-catching tool and drew in many passers-by to receive education, but it cannot be utilized in many settings. It requires a large, open area upon inflation.

It does have straps to fasten it to the ground for outdoor events, but if there is any inclement weather, it cannot be used. Because the co-investigator wished to use the inflatable colon, potential implementation sites were restricted to only sites that could accommodate the inflatable colon's size.

Organizers of the health fair estimated that there were just over 100 participants and 27 information booths at the event. Organizers reported that there had been less than 20 booths at prior health fairs and had initially arranged layouts of the booths and inflatable colon according to previous numbers. The co-investigator was notified upon arrival to set up the inflatable colon that the inflatable colon was to be inflated in an adjoining gym, independent of other booths due to the greater number of booths at this event. To combat this limitation, the event sign-in table was placed just outside of the gym housing the inflatable colon by the event organizers, a large sign invited attendees to view the inflatable colon (Appendix N), and the inflatable colon was positioned as to be visible from the event's sign-in table. The staff at the event's sign-in table also highlighted the presence of the inflatable colon to attendees checking in at the table.

Much of the data collected in this project was self-reported and as such, there is no way to verify its accuracy and validity. A few examples of this exist in the data. First, 82.6% of participants reported that they were up to date with the recommended CRC screening. However, it was not possible to verify this belief. Second, there were 6 participants that responded to Question 13 "*How likely are you to start colorectal cancer screening?*" with "*somewhat likely*" "*likely*" or "*very likely*" suggesting that there should have been 6 participants that reported that they have never been screened for CRC in the past. This conflicts with the data from question six that reports that only two participants were not screened for CRC before the event. Interestingly, the data for question 14— "*How likely are you to continue colorectal cancer screening?*" --

matches the data of question six— *“Have you ever been screened for colorectal cancer?”* Third, because the information was self-reported and a one-time questionnaire, there was no way to verify if participants carried out screening in the future.

The conflicting data between these questions may suggest that question 13 was confusing to the participants or there was a limitation in using paper generated surveys. The co-investigator suggests removing or rewording this question in the future or utilizing only computerized questionnaires that can be programmed to provide the appropriate questions based on the previous responses of the participant.

Because the style of this project did not allow for pre-education surveys, prior knowledge and growth of knowledge could not be accurately assessed. To account for this, the answers to some questions were worded to attempt to calculate existing knowledge versus gained knowledge. For example, the multiple-choice options for questions eight a, eight b, eight c, and eight d were *“No, I just learned this when reading this question,” “Yes, I just learned this today, at the health fair,”* and *“Yes, I knew this before participating in the health fair.”* This distinction proved to be beneficial in analyzing the results of the post-education survey data.

The project design also did not allow for measurement of retention of information among participants. The post-education survey was administered immediately after the participants had been exposed to the information. While this method effectively gauged the immediate impact and initial understanding of the content, it missed the opportunity to track the retention of knowledge and sustained impact over time. In future projects, it would be beneficial to incorporate follow-up assessments later to measure retention of information and sustained impact, leading to a more thorough evaluation of the project’s methods.

No project is without limitations. Despite this project's identified limitations, it exhibited strengths in many areas. First, this project was a result of collaboration and partnership with several agencies including the Missouri Valley YMCA, North Dakota Colorectal Cancer Roundtable, Quality Health Associates of North Dakota, North Dakota Cancer Coalition, and the North Dakota Department of Health. These agencies supplied space for implementation, use of the inflatable colon, and use of many educational materials. Members of these agencies also fostered the co-investigator's professional growth and knowledge within the nursing role and prevention of colorectal cancer. Without the participation of members of each of these entities, the project would not have been as successful.

Second, adding qualitative data to quantitative data allowed for further evaluation of the quantitative data, preventing potential misinterpretations. By providing participants with the autonomy to express their thoughts through choices, additional space, and a dedicated question for elaboration, the research design facilitated a deeper understanding of the underlying nuances within the data. The inclusion of qualitative elements allowed for a more holistic assessment, ensuring that the research findings captured the subtleties and complexities inherent in participant's perspectives and experiences. Notably, most post-education surveys were completed within minutes of participants receiving the educational content, ensuring the information remained fresh in their minds.

Additional strengths included visually engaging and captivating materials, effectively drawing attendees to the space where information and education were accessible. Incentives, ranging from enticing treats for attendees to the prospect of qualifying for a gift card for participants, served as compelling motivators. The provision of free education coupled with personalized interactions further contributed to the project's appeal. Robust recruitment efforts,

facilitated through strategic facility advertising and proactive invitations extended to facility staff, fortified the project's reach.

### **Application to Practice**

A nurse practitioner not only diagnoses, treats, and prescribes but also plays a pivotal role in educating both patients and their families. Indeed, enhancing the health literacy and self-efficacy of patients emerges as a central aspect of the nurse practitioner's primary responsibilities. This project has effectively pinpointed specific areas within colorectal cancer (CRC) education that warrant reinforcement. The good news is that this strengthening can be seamlessly integrated into community-based initiatives, like the one presented here, as well as individualized one-on-one visits, such as those conducted in a nurse practitioner's office.

In this project, participants showed a significant lack of awareness about recent guideline changes that lowered the minimum screening age for CRC to 45 years old. To address this knowledge gap, it is imperative for nurse practitioners to engage in discussions with their patients proactively, preferably well before the patient reaches the minimum age for screening. At least at annual wellness exams, the nurse practitioner should systematically evaluate the patient for risk factors of CRC. At times, episodic visits may be the only opportunity to evaluate health maintenance practices, so it may be essential for the nurse practitioner to capture these situations. Regardless of the type of visit, the nurse practitioner should emphasize that CRC typically progresses without noticeable signs or symptoms until it is in advanced stages. It is imperative to inform the patient about potential signs or symptoms that warrant vigilance.

Significant family history should be reviewed and updated at every patient visit. A thorough collection of family history should list all family member(s), the patient's relation to those member(s), the age of onset of the condition, presence of metastasis, genetic testing

completion, ethnicity of the family member, and whether the member(s) are alive or deceased (Edelman et al., 2018). At least at every wellness visit, it is crucial for the nurse practitioner to reiterate to the patient that colorectal cancer screening should begin either 10 years before the age of diagnosis of the youngest affected relative with a history of CRC or when the patient turns 45 years old, whichever comes first. This underscores the importance of initiating early and proactive screening measures.

A nurse practitioner is pivotal in the recognition of personal medical conditions that may heighten the risk of CRC, especially when combined with the patient's family history. Inflammatory bowel diseases and inherited gene mutations significantly increase the risk of developing CRC. These conditions also restrict screening options available to the patient. Therefore, the nurse practitioners' use of their knowledge and expertise becomes influential in navigating this intricate web of factors.

Additionally, nurse practitioners should elicit shared decision-making regarding screening options. This involves engaging patients in discussions about their medical and family history, risk factors, and the presence or absence of signs and symptoms. Furthermore, consideration of the patients' personal preferences and beliefs becomes integral to this approach. Embracing shared decision-making empowers healthcare providers and patients to collaboratively engage in health maintenance practices, leading to the development of a more personalized plan of care.

Through the implementation of this project, valuable experience was gained in the process of identifying an opportunity for improvement, collecting essential information, collaborating with peers, deploying a practice change, and adapting the project, as necessary. In the role of a Doctor of Nursing, the same steps will be indispensable in effecting change within

the nursing profession in alignment with evidence-based practice guidelines for the improvement of patient care. Additionally, this project met several curriculum standards, essentials, and core competencies outlined by the NDSU DNP program and the American Association of Colleges of Nursing (Chism, 2021). NDSU DNP Essential VIII: Advanced Nursing Practice was met by the completion of the project. NDSU DNP Essential I: Scientific Underpinnings for Practice was met by performing an in-depth review of the literature to review the current science and knowledge of CRC and methods of education. A population health approach was used to inform the community of CRC and its screening to improve its health. Therefore, NDSU DNP Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health was met.

During this project, the co-investigator worked in partnership with organizations such as the North Dakota Department of Health, Quality Health Associates of North Dakota, the North Dakota Colorectal Cancer Roundtable, the North Dakota Cancer Coalition, and the Missouri Valley YMCA. In working with these agencies, the co-investigator was invited to join the North Dakota Colorectal Cancer Roundtable Action Team and the North Dakota Cancer Coalition. The North Dakota Colorectal Cancer Roundtable and North Dakota Cancer Coalition consist of key stakeholders in North Dakota who share the vision of improving patient health outcomes through policy and awareness. NDSU DNP Essential V: Health Care Policy for Advocacy in Health Care and NDSU DNP Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes were met.

The standards, essentials, and core competencies set forth by the NDSU Doctor of Nursing Practice program play a pivotal role in equipping DNP students with the skills and knowledge necessary for interdisciplinary practice, quality improvement, information systems, and patient safety. The implementation of this project has served as a practical application of

these program standards. By engaging in this evidence-based quality improvement initiative, the co-investigator applied the principles learned through the DNP program and established a foundation for future similar projects. This project allowed the co-investigator to sharpen the skills of problem recognition, assembling of evidence, project planning and implementation, and evaluation, aligning with the program outcomes of fostering advanced practice nursing.

In addition to alignment with the program outcomes of the NDSU DNP program, this program laid a foundation for the co-investigator to contribute to evidence-based quality improvement initiatives in future practice. This integration of academic principles and real-world application is emblematic of the program's dedication to producing competent and forward-thinking nursing leaders.

### **Conclusion**

Colorectal cancer (CRC) is the third leading cause of cancer deaths worldwide (World Cancer Research Fund International [WCRFI], 2022). In the United States in 2021, more than 150,000 individuals were diagnosed with colorectal cancer, and nearly 53,000 individuals died of CRC (National Cancer Institute [NCI], 2022). Alarming, North Dakota faces disproportionately high incidence rates and distressingly low screening rates, creating a pressing public health concern (Schwartz et al., 2019). Despite the availability of non-invasive, painless, cost-effective, and efficacious screening technologies only 63% of North Dakotans have undergone screening for CRC, lagging significantly behind national benchmarks and ambitious goals set by the National Colorectal Cancer Roundtable (Green & Meenan, 2020).

The urgency to address this critical situation is further emphasized by the ability of screening to detect CRC in precancerous or initial stages of the disease, thus decreasing rates of mortality (American Cancer Society, 2023, November 9; Davidson et al., 2021; Issa &



Noureddine, 2017; Lou & Shaukat, 2021; National Cancer Institute [NCI], 2021; Schliemann et al., 2021). However, the persistently high incidence rates, elevated mortality rates, rising incidence of early-onset CRC, and suboptimal screening rates in North Dakota and the United States indicate a need for immediate and targeted action.

The overarching purpose of this project was to provide comprehensive education on CRC and its available screening options to attendees of a health fair held in Bismarck, North Dakota, report the participants' perceived knowledge of CRC and its screening options available locally, identify barriers to screening for colorectal cancer, and assess participant's intent to be screened for CRC after receiving said education. The project not only successfully enhanced participants' understanding of CRC but also identified crucial barriers, emphasizing the need for tailored interventions to foster self-efficacy and health literacy.

Through this project, several barriers to colorectal cancer screening that are experienced by residents of central North Dakota were identified. The barriers identified in this project are not unlike those found in similar evidence-based scholarly projects. Even so, the barriers identified in each community may vary, and interventions should be tailored as such. To overcome barriers, self-efficacy, and health literacy must be fostered. The identification of barriers can be used by future and current nurse practitioners to identify points of leverage to increase CRC screening rates, decrease mortality, and improve the outcomes of the individual, community, and nation.

The nurse practitioner emerges as a pivotal ally in this battle, equipped to implement evidence-based interventions, address barriers at multiple levels, and pilot meaningful change in CRC prevention and management. Equipped with the requisite training, nurse practitioners implement evidence-based practice interventions, evaluate the interplay of risk factors and

family and personal histories, provide education, recommend timely screening, order testing, and continually assess and address barriers at the individual, community, and national levels. When these recommendations are performed effectively, a positive impact can be made on CRC-related morbidity and mortality.

This project serves as a call to action, urging a collaborative effort among healthcare professionals, communities, and individuals to overcome barriers, increase screening rates, and improve outcomes for individuals, communities, and the nation at large. The nurse practitioner serves as a cornerstone in this transformative process, with the potential to pilot meaningful change in colorectal cancer prevention and management. By supporting increased awareness of CRC, minimizing barriers to screening, and advocating for proactive health initiatives, this call to action manifests a collaborative effort that moves beyond individual actions to impact the broader population. The nurse practitioner is an essential conduit in this process, using their unique training in evidence-based practice, advanced practice nursing, leadership, and policy development to foster community engagement and inspire individuals to prioritize their colorectal health.

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## APPENDIX A: IRB APPROVAL



04/24/2023

Dr. Kerri D Benning  
Nursing, Sanford Bismarck

Re: IRB Determination of Exempt Human Subjects Research:  
Protocol #IRB0004770, "Colorectal Cancer Education: Utilization of an Inflatable Colon and Small Media at a Health Fair in Central North Dakota"

NDSU Co-investigator(s) and research team:

- Kerri D Benning
- Faune Himmelspach
- Lisa Marie Montplaisir
- Allison Evelyn Peltier
- Kolby Lee Schaeffer Fraase

Approval Date: 04/24/2023

Expiration Date: 04/23/2026

Study site(s): The research will be conducted in the gymnasium of the Missouri Valley YMCA located in Bismarck, ND on May 22, 2023 from 9:00 am to 12:00 pm.

Funding Source:

The above referenced human subjects research project has been determined exempt (category 1) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, *Protection of Human Subjects*).

Please also note the following:

- The study must be conducted as described in the approved protocol.
- Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Promptly report adverse events, unanticipated problems involving risks to subjects or others, or protocol deviations related to this project.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.

*NDSU has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.*

**RESEARCH INTEGRITY AND COMPLIANCE**

NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | [ndsuhresearch@ndsuh.edu](mailto:ndsuhresearch@ndsuh.edu)

Shipping Address: Research 1, 1735 NDSU Research Park Drive, Fargo ND 58102

NDSU is an EO/AAE university

**APPENDIX B: PERMISSION TO USE AND ALTER KARISSA GLADEN'S POST-  
EDUCATION SURVEY**

3/27/23, 1:29 PM Mail - Himmelspach, Faune - Outlook

**Re: Your dissertation**

Gladen, Karissa [REDACTED]  
Mon 3/27/2023 12:50 PM  
To: Himmelspach, Faune [REDACTED]  
Hi Faune,

Yes, absolutely - please feel free to use my survey and adapt to meet your project needs.

Let me know if I can help with anything else.

Thanks,  
Karissa Gladen DNP APRN FNP-C  
Get [Outlook for Android](#)

---

**From:** Himmelspach, Faune [REDACTED]  
**Sent:** Wednesday, March 15, 2023 2:29:07 PM  
**To:** Gladen, Karissa [REDACTED]  
**Subject:** Re: Your dissertation

Hello Karissa,

In writing this almost one year later, I am realizing that I did not write you back. I am so sorry for that! I appreciated your email and insight more than you know!

I am implementing a project much like yours but with a twist in education methods--I am using a huge inflatable colon! It is literally 20 feet long, 13 feet wide, and 10 feet tall. I will be implementing on May 22<sup>nd</sup> at the Bismarck YMCA.

I am writing to determine if I can use your questionnaire as the basis of my post-education survey and change it as needed to fit my project.

Thank you again for your assistance. I really appreciate it!

Faune Himmelspach

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## APPENDIX C: PARTICIPANT CONSENT FORM

**NDSU**

**North Dakota State University**

Department of Nursing  
512 N Seventh Street  
Bismarck, ND, 58501  
701.224.3800

### **Colorectal Cancer Education: Utilization of an Inflatable Colon and Small Media at a Health Fair in Central North Dakota**

Dear Health Fair Attendees:

My name is Faune Himmelspach. I am a graduate student in the Doctorate of Nursing Practice Program at North Dakota State University, and I am conducting a research project to increase colorectal cancer (CRC) awareness and screening in the community of Bismarck, North Dakota. It is our hope that with this research, we will learn more about ways to increase knowledge of CRC, influence your intent to screen for CRC, and understand barriers to receiving CRC screening.

Because you are between the ages of 18 to 75, you are invited to take part in this research project. Your participation is entirely your choice. You may change your mind or stop participating at any time with no penalty to you.

It is not possible to identify all potential risks in research procedures, but we have taken reasonable safeguards to minimize any known risks. These known risks include feeling emotional distress or discomfort.

By taking part in this research, you may benefit by having an increased knowledge and understanding of CRC and the importance of getting screened. Additionally, you may benefit from winning a gift card. However, you may not get any benefit from being in this study.

Completion of the questions in the post-education survey should take about 5 minutes of your time. It is available on paper and via QR code. You may choose to use either method. You may hand in the paper version of the post-education survey at the information booth. After handing in the completed post-education survey, you will receive a ticket for a gift card drawing. Keep this ticket, as all winners will need to show the winning ticket prior to picking up their gift card at the information booth. The expected probability of winning is 1 in 10 chances.

However, if you choose to use the QR code, you will not be eligible for the gift card drawing.

This study is anonymous. That means that no one, not even the members of the research team, will know that the information comes from you. All results will be kept solely for the project. **By completing this survey on paper or via QR code, you give consent to participate in the research for this project.**

If you have any questions about this project, please contact me at

Faune Himmelpach, RN-BSN, DNP-Student

[REDACTED]

[REDACTED]

Or contact my advisor at Dr. Kerri Benning: [REDACTED]

You have rights as a research participant. If you have questions about your rights or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program at 701-231-8995, toll-free at 1-855-800-6717, by email at [ndsu.irb@ndsu.edu](mailto:ndsu.irb@ndsu.edu), or by mail at: NDSU HRPP Office, NDSU Dept. 4000, P.O. Box 6050, Fargo, ND 58108-6050.

Thank you for taking part in this research. If you wish to receive a copy of the results, please contact either myself, or my advisor Dr. Kerri Benning via the contact information listed above.

Faune Himmelpach, RN-BSN, DNP-Student

## APPENDIX D: QR CODE PARTICIPANT HANDOUT

**You may access the post-education survey by typing the link below into your browser OR scanning the QR code.**

<https://ndstate.co1.qualtrics.com/jfe/form/SV8CJETiytrjp48p8>



How to use a QR code:

1. Open your phone's camera.
2. Point the camera at the QR code and hold it steady.
3. Tap the link that pops up on your screen.
4. Follow the instructions to complete the survey.

**Thank you for choosing to participate in my project!**

**You may access the post-education survey by typing the link below into your browser OR scanning the QR code.**

<https://ndstate.co1.qualtrics.com/jfe/form/SV8CJETiytrjp48p8>



How to use a QR code:

1. Open your phone's camera.
2. Point the camera at the QR code and hold it steady.
3. Tap the link that pops up on your screen.
4. Follow the instructions to complete the survey.

**Thank you for choosing to participate in my project!**

## APPENDIX E: POST-EDUCATION SURVEY

### Colorectal Cancer (CRC) Screening Post-Education Survey:

1. Please be sure to complete the consent form before proceeding.
2. Please circle your age range: Circle ONE.
  - a. Under 18
  - b. 18-44
  - c. 45-49
  - d. 50-75
  - e. 76 or older

**If you are younger than 18 OR 76 or older, please stop taking this survey. THANK YOU!**

3. Please circle your biologic gender: Circle ONE.
  - a. Male
  - b. Female
  - c. Prefer not to answer
4. Please circle one ethnicity that best describes you: Circle ONE.
  - a. Caucasian
  - b. American Indian/Alaska Native
  - c. Hispanic/Hispanic Black
  - d. African American
  - e. Asian/Pacific Islander
  - f. Other
5. What parts of this project were you able to participate in? Circle ANY that apply to you.
  - a. The student guided me through the inflatable colon.
  - b. I walked through the inflatable colon myself.
  - c. I watched the presentation on the table.
  - d. I read the handouts available on the table.
6. Have you ever been screened for colorectal cancer? Circle ONE.
  - a. Yes, and I believe I am up to date with screening.
  - b. Yes, but I believe I am due to be screened again soon.
  - c. No, I have never been screened for colorectal cancer.
7. If yes to question 5, what type of test did you use to complete screening? Circle ONE.
  - a. Stool based test performed at home and mailed in for testing.
  - b. Direct visualization test (colonoscopy, flexible sigmoidoscopy, CT colonography)
  - c. I have used both of these in the past

8. Please **CHOOSE ONE** answer for each of the following questions (a-d).

	Yes, I <u>knew this</u> <u>before</u> participating in this health fair	Yes, I <u>learned this today</u> , at the health fair	No, I <u>just learned this</u> when reading this question
a. Did you know that screening for colorectal cancer should start when you turn 45 years old?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Did you know that colonoscopy is not the only option for screening for colorectal cancer?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Did you know that you may be able to complete screening in the privacy of your own home with a stool-based testing kit and not at a hospital?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Did you know that colorectal cancer has no signs or symptoms until it is in the later stages of the disease?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9. Have you ever thought about your risk factors for developing colorectal cancer? Circle ONE.

- Yes, I have considered them.
- Yes, I have thought about them, but am not sure about my total risk.
- No, I have not thought about it.

10. The following are all risk factors for developing colorectal cancer. What personal risk factors do you have?

CIRCLE ANY OR ALL THAT APPLY TO YOU.

- I eat red meat or smoked meat at many of my meals.
- I don't eat a lot of fiber or fresh fruits and vegetables.
- I don't get 30 minutes of exercise per day.
- I am overweight.
- I am 45 years old or older.
- I grew up with or still drink well water as my primary source of water.
- My meals often consist of processed foods, dairy products, fatty animal products, deep fried foods, fast food, and convenience foods.
- I have been on 6 or more rounds of antibiotics in the last 3 years.
- I have a history of ulcerative colitis, Crohn's disease, Lynch Syndrome, or familial adenomatous polyposis.
- I have used tobacco products in the last 5 years.
- I have one or more alcoholic drinks per day on most days.
- I have a blood relative that has been diagnosed with colorectal cancer.
- None of these.

11. Circle ANY OR ALL of the following that might affect your choice about screening for colorectal cancer.
- I think it costs too much to be screened.
  - I do not have health insurance.
  - I have poor health insurance coverage.
  - I don't think I am at great risk of getting it.
  - I am nervous about what the results could be.
  - It is difficult to get to a facility to be screened.
  - I am nervous about the testing process.
  - I am not sure of my screening options.
  - I do not want to talk about bowel habits or colon cancer.
  - My primary care provider has never talked to me about it.
  - I don't want to go to the hospital to get screened.
  - I would not want to treat colon cancer so do not want to screen for it.
  - None of these.
  - Other \_\_\_\_\_
12. What benefits do you think screening for colorectal cancer would give you. CIRCLE ANY OR ALL THAT APPLY TO YOU.
- Prevent colon cancer
  - Detect colon cancer early
  - Treat colon cancer early
  - Peace of mind
  - Not sure
  - Other \_\_\_\_\_
13. How likely are you to start colorectal cancer screening? Please circle ONLY ONE.
- Not likely at all
  - Somewhat likely
  - Likely
  - Very Likely
  - Not applicable—I have already started screening for colorectal cancer.
14. How likely are you to continue colorectal cancer screening? Please circle ONLY ONE.
- Not likely at all
  - Somewhat likely
  - Likely
  - Very Likely
  - Not applicable—I have not started screening for colorectal cancer
15. How likely are you to tell others about what you learned today? Please circle ONLY ONE.
- Not likely at all
  - Somewhat likely
  - Likely
  - Very likely
16. Did the information presented today influence your intent to screen for colorectal cancer? Circle ONE.
- Yes, it did.
  - No, it did not.

Please describe why or why not (regarding question #16)

**APPENDIX F: PERMISSION TO USE IOWA MODEL REVISED: EVIDENCE-BASED  
PRACTICE TO PROMOTE EXCELLENCE IN HEALTH CARE**

3/16/23, 8:50 AM

Mail - Himmelspach, Faune - Outlook

**Permission to Use The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care**

Kimberly Jordan - University of Iowa Hospitals and Clinics <survey-bounce@survey.uiowa.edu>

Thu 3/16/2023 8:49 AM

To: Himmelspach, Faune <faur[REDACTED]>

You have permission, as requested today, to review and/or reproduce *The Iowa Model Revised: Evidence-Based Practice to Promote Excellence in Health Care*. Click the link below to open.

[Iowa Model - 2015.pdf](#)

Copyright is retained by University of Iowa Hospitals and Clinics. **Permission is not granted for placing on the internet.**

**Reference:** Iowa Model Collaborative. (2017). Iowa model of evidence-based practice: Revisions and validation. *Worldviews on Evidence-Based Nursing*, 14(3), 175-182. doi:10.1111/wvn.12223

In written material, please add the following statement:

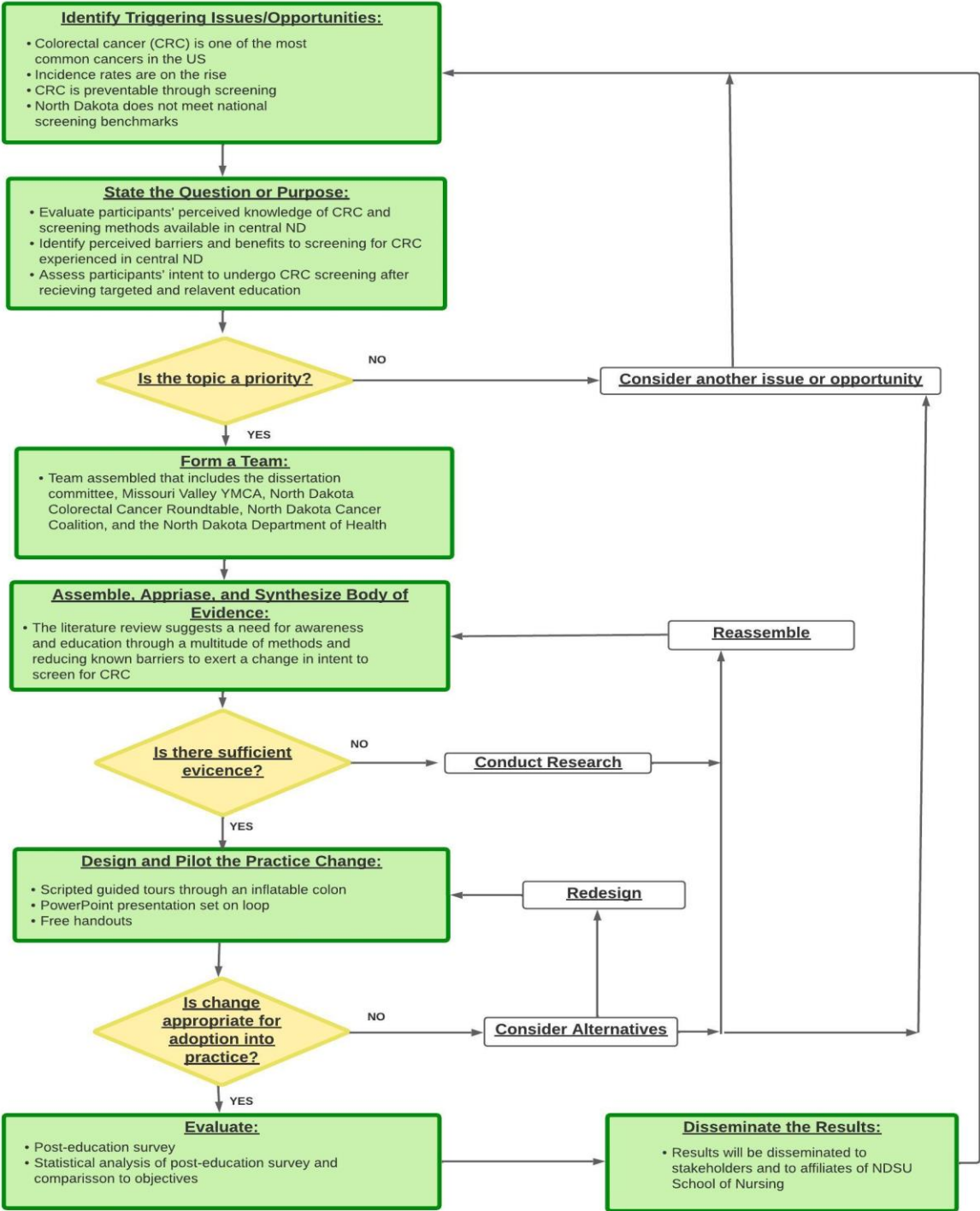
*Used/reprinted with permission from the University of Iowa Hospitals and Clinics, copyright 2015. For permission to use or reproduce, please contact the University of Iowa Hospitals and Clinics at 319-384-9098.*

Please contact [UIHCNursingResearchandEBP@uiowa.edu](mailto:UIHCNursingResearchandEBP@uiowa.edu) or 319-384-9098 with questions.

**APPENDIX G: IOWA MODEL REVISED APPLIED TO “COLORECTAL CANCER  
EDUCATION: UTILIZATION OF AN INFLATABLE COLON AND SMALL MEDIA  
AT A HEALTH FAIR IN CENTRAL NORTH DAKOTA”**



**THE IOWA MODEL REVISED APPLIED TO "COLORECTAL CANCER EDUCATION: UTILIZATION OF AN INFLATABLE COLON AND SMALL MEDIA AT A HEALTH FAIR IN CENTRAL NORTH DAKOTA"**



# APPENDIX H: PERMISSION TO USE HANDOUTS FROM THE CENTERS FOR DISEASE CONTROL AND PREVENTION

The screenshot shows the CDC website page for Colorectal (Colon) Cancer. At the top left is the CDC logo with the text "Centers for Disease Control and Prevention" and "CDC 24/7: Saving Lives. Protecting People™". At the top right is a search bar. Below the header is a dark teal banner with the text "Colorectal (Colon) Cancer". Underneath is a breadcrumb trail: "CDC > Cancer Home > Colorectal Cancer > Resources to Share".

On the left side, there is a navigation menu with the following items: "Colorectal Cancer" (with a home icon), "Basic Information" (+), "Screening Stories" (+), "Statistics" (+), "What CDC Is Doing", "Colorectal Cancer Quiz", "Resources to Share" (-), "Videos", "Print Materials" (highlighted), "Social Media Posts and Images", "Screen for Life Campaign", "Colorectal Cancer Screening Continuing Education", and "Stay Informed" (with social media icons for Twitter and Email).

The main content area is titled "Colorectal Cancer Print Materials" and includes a link for "Español (Spanish) | Print". Below this, there is a paragraph explaining that the materials were developed by the [Screen for Life campaign](#) for the general public, health care providers, campaign partners, and health organizations. It states that users can download and print these materials at home or at a local print shop, and provides a link to [CDC-INFO on Demand](#) for ordering printed copies.

A note follows, stating that content developed by CDC's [Screen for Life campaign](#) is available for public use exactly as it is found on CDC's web site, without being changed in any way. It also provides contact information: call 1 (800) CDC-INFO (800-232-4636) or [contact CDC-INFO](#).

There are two main sections for print materials:

- Fact Sheets:** This section features a thumbnail image of a human torso with the digestive system highlighted. It lists four fact sheets:
  - [Colorectal Cancer Screening](#) [PDF-539KB] (2 pages, 8.5 inches wide and 11 inches tall)
  - [Colorectal Cancer Screening Saves Lives](#) [PDF-235KB] (2 pages, 8.5 inches wide and 11 inches tall)
  - [Colorectal Cancer Screening Tests at a Glance](#) [PDF-113KB] (11 inches wide and 8.5 inches tall)
  - [Colorectal Cancer Risk Factors and Symptoms](#) [PDF-56KB] (8.5 inches wide and 11 inches tall)
- Brochure:** This section features a thumbnail image of a man and a woman smiling. It lists one brochure:
  - [Colorectal Cancer Screening Saves Lives](#) [PDF-1MB] (6 pages, 8.5 inches wide and 11 inches tall)

**APPENDIX I: HANDOUTS AVAILABLE TO ATTENDEES OF HEALTH FAIR  
OBTAINED FROM THE CENTERS FOR DISEASE CONTROL AND PREVENTION**

**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.

**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.

**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**

- ▶ **Guaiaac-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.**

**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.

**Resources**

For more information:  
Visit <https://www.cdc.gov/cancer/colorectal/>  
Call 1-800-CDC-INFO (1-800-232-4636)  
For TTY, call 1-888-232-6348.

CDC Publication #99-6948, Revised February 2022

# Screening Tests At-A-Glance

Colorectal Cancer Screening Saves Lives



**The U.S. Preventive Services Task Force, a group of medical experts, recommends that men and women 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.

Each test has advantages and disadvantages. Talk to your health care provider about the pros and cons of each test, and how often to be tested.

Test	Preparation	What Happens?
<p><b>Stool Tests</b></p> <p>Three stool tests can be done at home:</p> <ul style="list-style-type: none"> <li>• Guaiac-based fecal occult blood test (gFOBT)</li> <li>• Fecal immunochemical test (FIT)</li> <li>• FIT-DNA (or stool DNA) test</li> </ul>	<p>Your health care provider may recommend that you follow a special diet before taking the gFOBT.</p>	<p>For the gFOBT and FIT tests, you receive a test kit from your health care provider. 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.</p> <p><b>How often: Once a year.</b></p> <p>For the FIT-DNA test, you collect an entire bowel movement and send it to a lab to be checked for changes in the DNA that might suggest the presence of cancer or a precancerous polyp.</p> <p><b>How often: Every 3 years.</b></p>
<p><b>Flexible Sigmoidoscopy (Flex Sig)</b></p> <p>This is sometimes done in combination with FIT.</p>	<p>Your health care provider will tell you what foods you can and cannot eat before the test. The evening before the test, you use a strong laxative and/or enema to clean out the colon.</p>	<p>During the test, the health care provider puts a short, thin, flexible, lighted tube into the rectum. This tube allows the health care provider to check for polyps or cancer inside the rectum and lower third of the colon.</p> <p><b>How often: Every 5 years, or every 10 years with a FIT every year.</b></p>
<p><b>Colonoscopy</b></p> <p>Colonoscopy may be used for screening and may also be used as a follow-up test if one of the other screening tests finds anything unusual.</p>	<p>Before this test, your health care provider will tell you what foods you can and cannot eat. The evening before the test, you use a strong laxative to clean out the colon. Some health care providers recommend that you also use an enema. During this test you will be given medicine that will make you drowsy. Make sure you arrange for a ride to and home from the clinic, as you may not be allowed to drive for as long as 24 hours.</p>	<p>You will receive medication during this test to make you more comfortable. This test is similar to flex sig, 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.</p> <p><b>How often: Every 10 years (for people who do not have an increased risk of colorectal cancer).</b></p>
<p><b>CT Colonography (Virtual Colonoscopy)</b></p>	<p>You prepare for this test as you would for a colonoscopy. Before the test, you follow a special diet and use a strong laxative to clean out the colon.</p>	<p>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.</p> <p><b>How often: Every 5 years.</b></p>

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.



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

<https://www.cdc.gov/cancer/colorectal/>  
Call 1-800-CDC-INFO (1-800-232-4636)  
For TTY, call 1-888-232-6348

CDC Publication #21-1029, Revised February 2022



**APPENDIX J: PERMISSION TO USE HAND OUTS FROM THE NORTH DAKOTA  
COLORECTAL CANCER SCREENING INITIATIVE AND QUALITY HEALTH  
ASSOCIATES OF NORTH DAKOTA**

3/15/23, 3:06 PM

Mail - Himmelspach, Faune - Outlook

**RE: Permission to use resources**

Nikki Medale

Wed 3/15/2023 2:46 PM

To: Himmelspach, Faune

Hello Faune!

Absolutely! Please utilize any and all of our resources freely! I love knowing that you are using them , and are always willing to develop resources based on need. If you aren't finding what you are looking for, let us know and we can either direct you, or build something to suit your needs. If you have suggestions for us based on the work you are doing we would love to hear that from you too!

Are you aware of the ND Cancer Coalition and the ND Colorectal Cancer Roundtable meetings coming up? The formal invites aren't out yet, but I will insert the save the date here:

The graphic is a 'Save the Dates' announcement for the 2023 Annual Meetings. It features a purple and blue color scheme. At the top, it says 'SAVE THE DATES' in large white letters on a dark blue background, followed by '2023 Annual Meetings' in white on a purple background. Below this, there are two columns. The left column is for Tuesday, May 16, 2023, from 1:00-4:30 p.m., and is associated with the North Dakota Cancer Coalition logo (a purple ribbon) and the tagline 'Planning for a cancer-free future'. The right column is for Wednesday, May 17, 2023, from 8:30 a.m.-12:00 p.m., and is associated with the North Dakota Colorectal Cancer Roundtable logo (a blue circle with a white figure). At the bottom of the graphic, it states 'Both events will be held in the Pioneer Room at the State Capitol, Bismarck, ND' and 'Watch for registration and meeting information to be sent at a later date!'.

If you are interested in joining the ND Colorectal Cancer Roundtable and/or the Cancer Coalition's CRC Action team, please let me know!

Nikki

**APPENDIX K: HANDOUTS AVAILABLE TO ATTENDEES OF HEALTH FAIR  
OBTAINED FROM THE NORTH DAKOTA COLORECTAL CANCER SCREENING  
INITIATIVE AND QUALITY HEALTH ASSOCIATES OF NORTH DAKOTA**

## North Dakota Colorectal Cancer Screening Initiative ...at a glance

The North Dakota Colorectal Cancer Screening Initiative (Initiative) is designed to reduce colorectal cancer morbidity and mortality through early detection. This program from the North Dakota Department of Health aims to provide colorectal cancer screening, including limited diagnostic follow-up testing, where appropriate, to age and income eligible persons in North Dakota.

### Who is eligible?

- Persons ages 45-64
- Resident of North Dakota
- Uninsured or underinsured
- At an average or increased risk for colorectal cancer
- Low-income (requires your annual income to fall within 139 to 200% of the federal poverty guidelines) Visit <https://www.health.nd.gov/crc> for income guideline details
- Due or past due for CRC screening

Details for all these topics can be found in the North Dakota Colorectal Cancer Screening Initiative Health Care Provider Handbook.

### What services are reimbursed?

- Take-home stool test for individuals of **average risk** for colorectal cancer
  - Diagnostic colonoscopy for those who have had a positive stool test
- Office visit where the take-home stool test was ordered
- Colonoscopy procedure for patients considered at increased or **high risk** for colorectal cancer
- Office visit where the colonoscopy procedure was ordered
- Pre-op office visit, if determined by the physician performing the colonoscopy procedure that this office visit is needed prior to the colonoscopy
- Limited lab work with a pre-op office visit
- Bowel prep
- Analysis of any biopsies taken during the colonoscopy procedure
- Follow-up colonoscopy procedure of enrolled individuals in the NDCRCIS

### How do I become an Initiative provider?

- Complete a Provider Cooperative Agreement
- Submit evidence of licensure or certification as a physician, physician assistant, nurse practitioner, registered nurse, clinic, hospital, mammography facility or laboratory
- Establish and maintain a patient record for each enrollee seen through the Initiative
- Establish tracking and follow-up systems to encourage Initiative enrollees to receive regular screening and appropriate diagnostic treatment services
- Comply with the Initiative quality assurance standards for colorectal cancer screening



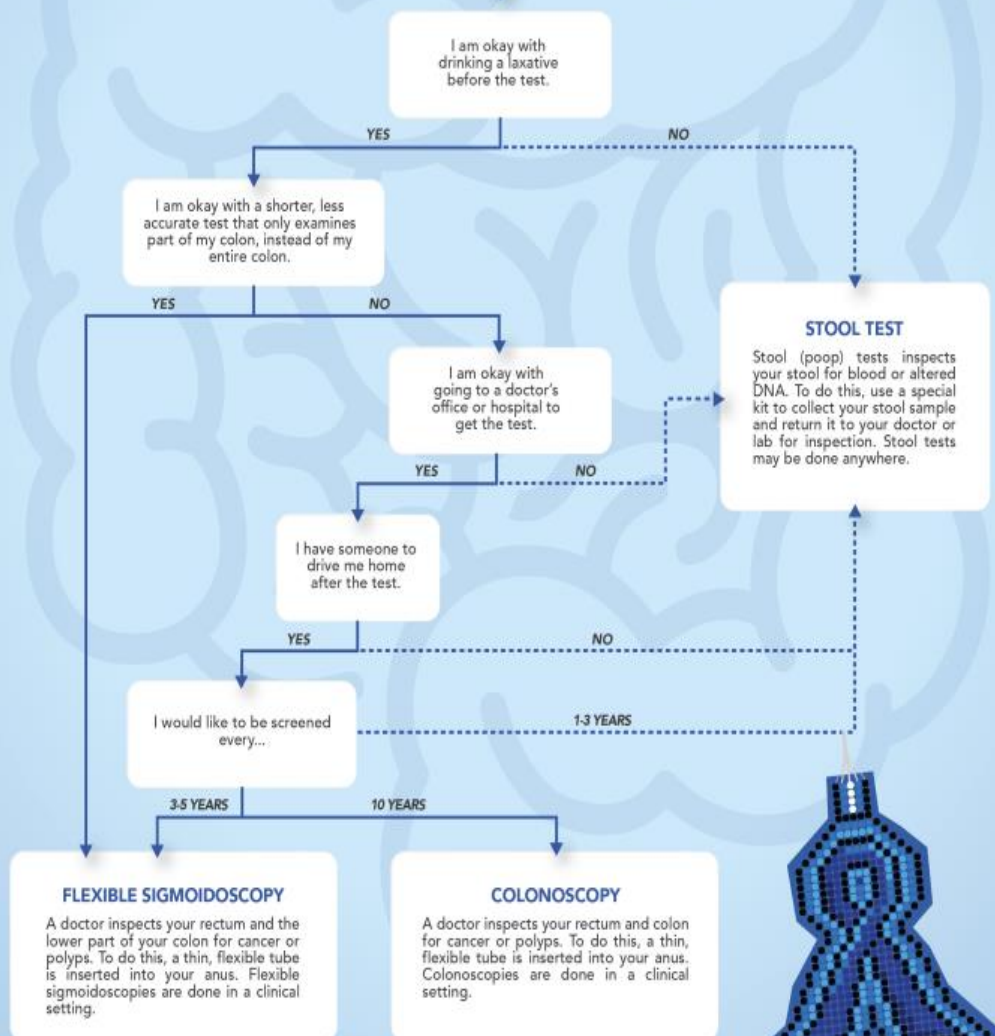
**For more information and/or to learn how to enroll to become a provider, please contact Nikki Medalen, Quality Health Associates of North Dakota, 701-989-6236, [nmedalen@qualityhealthnd.org](mailto:nmedalen@qualityhealthnd.org).**

# Which Colorectal Cancer Screening is Right for Me?

Regular colorectal cancer (CRC) screening saves lives by detecting pre-cancerous growths, or polyps, in the early stages when they are most treatable. **Most Indigenous people should begin regular colorectal cancer screenings at age 45.** The three tests that most accurately identify CRC are the colonoscopy, flexible sigmoidoscopy, and the stool test, but **the best screening test is the one that gets done!** Below is a chart to help you and your doctor determine which option is best for you.



I am ready to take care of my health for me and my Kwahjji:yä.\*



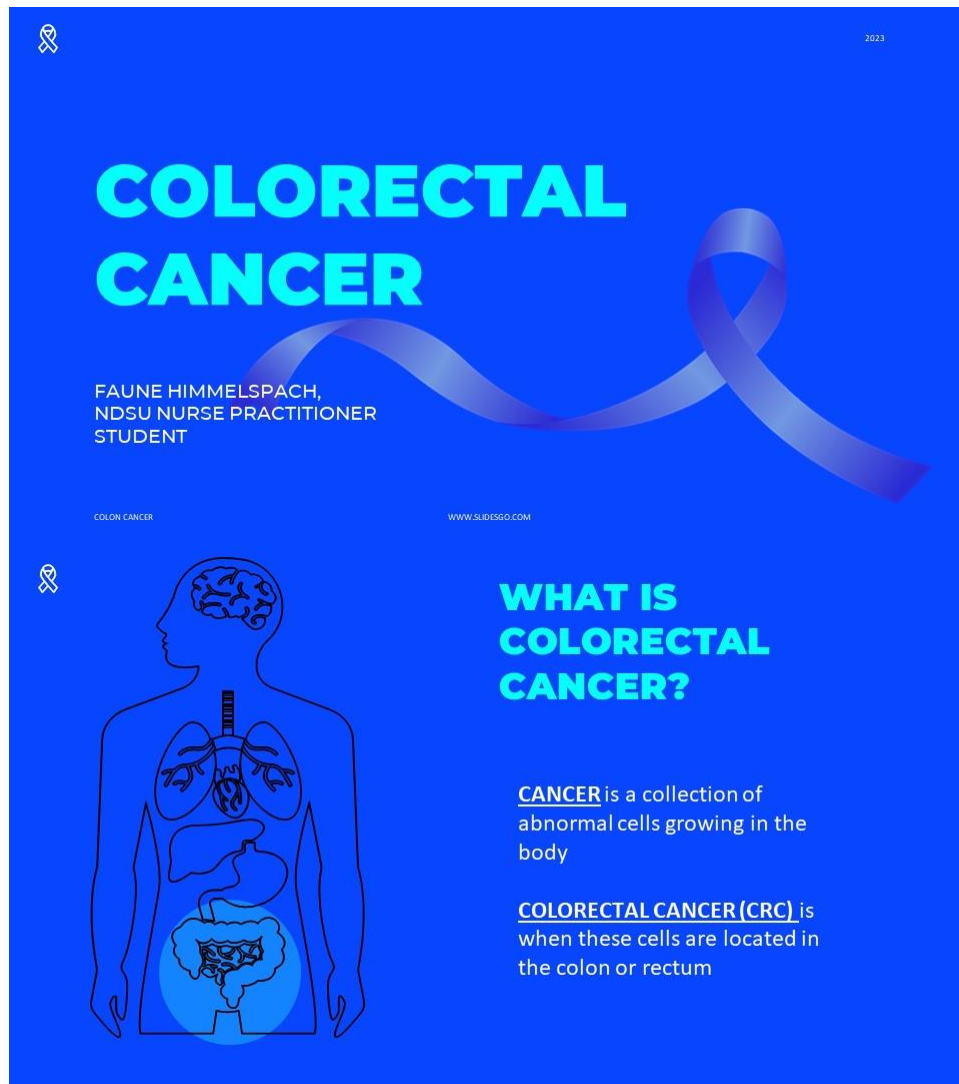
\*"Kwahjji:yä" means relatives in the Ojibwe language (Great Hill People or Seneca) language.



www.AmericanIndianCancer.org



**APPENDIX L: POWERPOINT PRESENTATION AVAILABLE TO ATTENDEES OF  
HEALTH FAIR**



2023

# COLORECTAL CANCER

FAUNE HIMMELSPACH,  
NDSU NURSE PRACTITIONER  
STUDENT

COLON CANCER

WWW.SLIDESGO.COM

## WHAT IS COLORECTAL CANCER?

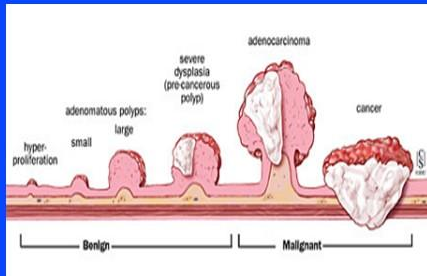
CANCER is a collection of abnormal cells growing in the body

COLORECTAL CANCER (CRC) is when these cells are located in the colon or rectum





## WHAT IS COLORECTAL CANCER?



American College of Gastroenterology. (n.d.). Colorectal cancer: You can prevent it (American College of Gastroenterology). ScreenND. <https://screennd.org/resource/colorectal-cancer-you-can-prevent-it/>

Colorectal cancer starts as noncancerous growths on the inside of the colon or rectum called *polyps*.

Polyps are common and most do not become cancerous—but some do.

Some polyps grow into colorectal cancer.

Polyps and colorectal cancer can be found early through several different types of screening.



# Not all polyps turn into cancer, but all colon cancers start as polyps.



## WHAT MAY PUT YOU AT **HIGHER RISK** FOR COLORECTAL CANCER?

- Age over 45
- Male
- American Indian or African American descent
- Tobacco use
- Alcohol use
- Physical inactivity
- Excess body weight
- Family history of colorectal cancer
- Personal history of inflammatory bowel disease (ulcerative colitis or Crohn's Disease)
- Diet
  - High fat and/or Low fiber
- Frequent antibiotic use
- Well water use



## WHAT ARE THE SIGNS AND SYMPTOMS OF COLORECTAL CANCER?

*There are NO SIGNS OR SYMPTOMS in the early stages of the disease!*

*This is why SCREENING FOR COLORECTAL CANCER is so important.*



## LATER SIGNS AND SYMPTOMS OF COLORECTAL CANCER MAY INCLUDE:

- A change in your normal bowel pattern
  - More constipated or experiencing diarrhea
- Narrow stool—“pencil thin stools”
- Blood in your stool
  - Bright red or darker brown than normal
- Bloating
- Cramping
- Abdominal pain
- Feeling like you have to have a bowel movement, even though you just went
- Weakness
- Fatigue
- Unexplained weight loss

The 5-year survival rate for Stage 1 colon cancer is 90% and only 14% for Stage 4.





## WHAT CAN I DO?

## GET SCREENED FOR COLORECTAL CANCER!



### TALK TO YOUR PROVIDER ABOUT YOUR SCREENING OPTIONS

Several options exist for screening for colorectal cancer. Talk to your provider to find out what is best for you.



### CHANGE YOUR RISK FACTORS

Your risk can be lowered by adopting certain habits—get lots of fiber, reduce your fat intake, reduce your weight, don't use tobacco or alcohol, start an exercise routine.

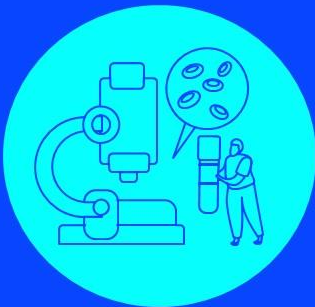


### TELL OTHERS

Tell others about what you have learned about colorectal cancer. It could save a life.



**If you are 45 to 75 years old, you should get screened for colorectal cancer.**



**Screening can catch colorectal cancer before it starts.**



## OPTIONS FOR SCREENING FOR COLORECTAL CANCER



### STOOL BASED TESTS



### COLONOSCOPY



### FLEXIBLE SIGMOIDOSCOPY



### CT COLONOGRAPHY



## STOOL BASED TESTS

- Used for those at average risk of colorectal cancer
- Looks for blood in your stool and sometimes altered DNA

### PROS

- Testing kit is sent to your home
- Testing can be done AT HOME at your convenience
- Less travel cost
- Might be cheaper than colonoscopy
- Less invasive than colonoscopy

### CONS

- **If the test is positive, a colonoscopy is required**
- False positives can happen
- Testing required every 1-3 years



## COLONOSCOPY

For anyone, but especially those showing signs of colorectal cancer, history of inflammatory bowel disease or CRC, or who desire a one step test

### PROS

- **Most polyps can be removed during the test**
- It is considered a 1 step test—no other testing is required afterwards
- If normal, screening only has to be done **every 10 years**

### CONS


- More invasive
- Requires you to be on a special diet the day prior to the procedure
- Requires a strong laxative
- Anesthesia is used: increases risk and you need someone to drive you home



**The best  
test is the  
one that  
gets done!**







## Colorectal Cancer Stats

### No But(t)s About It—Screening is Important!

In 2019, there were **1,900,000** cases of colorectal cancer worldwide and **935,173 deaths**.

Colorectal cancer is the **3<sup>rd</sup> most common** cancer in the US but the **2<sup>nd</sup> most deadly**.

There will be 150,000+ new cases of colon cancer and 52,000+ deaths this year in the US.

**Colorectal cancer can be prevented through screening!**

North Dakota's rate of screening for colon cancer is more than 10% below the national average.

**Those born around 1990 have TWICE the risk of colon cancer and FOUR TIMES the risk of rectal cancer than those born around 1950.**

There has been a 63% increase in colon cancer in those less than 50 years old since 1988.

1 in 23 men and 1 in 25 women will get colorectal cancer in their life.

**The 5-year survival rate for STAGE 4 colorectal cancer is only 14%—compared to 90% with STAGE 1. GET SCREENED BEFORE YOU HAVE SYMPTOMS!**

**The best screening test is the one that gets done!**

- Screening is recommended to begin at age 45—or earlier if you have a family history of colon cancer.
- There are no symptoms of colon cancer until it is in later stages
- Screening should happen when you have no symptoms in order to catch colon cancer early
- Many options for screening exist

© TemplateLab.com

APPENDIX N: PHOTOS FROM THE HEALTH FAIR









## APPENDIX O: EXECUTIVE SUMMARY

### INCREASING AWARENESS OF COLORECTAL CANCER SCREENING

#### Introduction

Colorectal cancer (CRC) is a prevalent and potentially deadly disease, ranking as the third leading cause of cancer deaths worldwide. In the United States in 2022, more than 150,000 individuals received a colorectal cancer diagnosis and nearly 53,000 individuals died of it. North Dakota exhibits higher per capita incidence rates than the national average and ranks among the lowest in screening rates despite the availability of non-invasive, painless, cost-effective, and efficacious detection technologies. Alarming, only 63% of eligible North Dakotans have been screened for CRC--which is 10% below the screening average of other states and well below the national benchmark of 80% set by the National Colorectal Cancer Roundtable. Screening can detect CRC in precancerous or early stages of the disease thus decreasing mortality. The rising incidence and mortality rates of CRC paired with subpar screening rates indicate a need for immediate action.

#### Purpose

This project sought to provide education of CRC and its available screening options to North Dakotans aged 18 to 75 years old, report participants' perceived knowledge of CRC and its screening options available locally, identify barriers to screening for colorectal cancer, and assess participant's intent to be screened for CRC after receiving said education.

#### Project Design and Implementation

Space was reserved at a health fair held in Bismarck, North Dakota organized by and held at the Missouri Valley YMCA. Advertising for the event took place on the Missouri Valley YMCA's website and social media pages, flyers at the facility, and on a billboard outside their building on a busy street. Scripted guided tours of a larger-than-life inflatable colon were provided to voluntary attendees of the health fair. Also available were educational handouts and a PowerPoint presentation set to loop continuously. After participating in the scripted guided tour, attendees were asked to voluntarily complete a post-education survey. They were informed that completion of the survey would make them eligible for a \$15 Scheels gift card. Responses from the post-education survey were collected and analyzed.

#### Findings

- 52.2% learned that screening should begin at age 45
- 30.4% learned that there are multiple options for screening completion
- 52.2% learned that CRC has no signs or symptoms until in later stages
- 91.3% of participants stated that the information presented influenced their intent to screen for CRC
  - The remaining 8.7% stated that they were already screened and would continue to screen.
- Personal risk factors were identified; age, being overweight, and diet related factors were the most common
- 82.6% of participants stated that they had no barriers to screening completion

#### Recommendations for Further Action

- Continued collaboration with trusted community agencies to implement educational health programs.

## INCREASING AWARENESS OF COLORECTAL CANCER SCREENING

- Utilize existing resources of education from agencies such as the Centers for Disease Control and Prevention, North Dakota Department of Health, Quality Health Associates of North Dakota, the North Dakota Colorectal Cancer Roundtable, and the North Dakota Cancer Coalition.
  - These agencies may also have the means to increase screening rates through promotion during National Colorectal Cancer Awareness Month in March of every year and/or by providing free FOBT kits at an event.
- Utilize the inflatable colon to target specific underserved populations such as Native Americans, Hispanics, and those living in rural areas.
- Practitioners can:
  - Offer screening at each encounter.
  - Offer educational handouts in clinic.
  - Educate patients of CRC signs and symptoms, risk factors, and the screening options available to them.
  - Continually assess for barriers and facilitators the patient may experience. Work to overcome patient related barriers, provider related barriers, and community barriers.
  - Recommend that the screening be completed in a timely manner.
- Further research is required to assess the influence of these educational methods on screening outcomes.