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Understanding Colorectal Cancer: Increasing Screening Rates Amongst Young- and Middle-
Aged Adults by Enhancing Prevention Potential

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Abstract

As nurses, working towards the best health outcomes for our patients is critical to our care. A large aspect of this care includes being knowledgeable of risk factors and precautions to take to avoid conditions and illnesses. Colorectal cancer remains to be a highly preventable disease, yet it is one of the top five leading causes of cancer deaths in the nation. Preventing colorectal cancer requires the efficient use of screening and education, while also addressing barriers of inconvenience and affordability. This senior thesis delves deeper into colorectal cancer prevention by asking the research question: For young and middle-aged adults, does increased patient education, decision aids, and earlier reminders on colorectal cancer prevention increase the rate of screening? The literature review of this thesis found that combining practical methods of colorectal cancer screening outreach is positively associated with screening rates in underserved middle-aged and older adult populations. Patients in all collected research studies showed an increase in screening when patients were presented with interventions such as decision-aids, educational programs and presentations, as well as free and convenient testing.

Based on the literature review, the research question remains unanswered as the literature review found was only applicable to middle-aged and older adults. The younger adult population, those under the age of 45 years, are deemed to be at low risk for colorectal cancer screening compared to adults over 45 years old. A proposed study is designed to be a quantitative study that will assess participant's likelihood to screen before and after an educational intervention. The study will use a t-test to compare answers before and after the educational module. A convenience sample of adults between the ages of 25 to 45 who are not diagnosed with colorectal cancer will be recruited within the Kaiser Permanente healthcare system. A follow-up study could be performed to identify whether or not the participants

underwent screening within the stated time of 5 years. Additionally, a longitudinal study can help determine if early screening reduced the participants' risk for colorectal cancer.

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Problem Statement

According to the Center for Disease Control's (CDC) report on colorectal cancer (CRC) from 2018, CRC is one of the top 5 leading causes of cancer deaths nationally, yet the disease remains to be one of the most preventable. Risk factors such as physical inactivity, smoking, exorbitant rates of alcohol consumption are all modifiable elements that can decrease the incidence of CRC. While these risk factors continue to be a battle for many young and middle-aged adult Americans, in addition to low socioeconomic status (SES), it is the lack of advantage being taken with surveillance and screening that may explain why CRC is as prevalent despite being highly preventable. It is well known that one's risk for CRC increases as they age, emphasizing the timely matter of screening and surveillance. Past research studies show that increasing the potential of patient education, reminders, and outreach can reduce the burden and disparities of CRC (Dougherty et al., 2018. pg. 2). Nurses can help in addressing this public health concern through advocating for enhanced screening and education for young and middle-aged adults who are advancing in their risk as they grow older.

While CRC mortality and incidence rates have been decreasing over the years, screening rates for this particular cancer is lower compared to others (Volk et al., 2016. pg. 2). Screening for CRC can be performed in several different ways, such as the traditional colonoscopy, a flexible sigmoidoscopy, and fecal occult blood testing that can either be guaiac- or immunochemical-based. This arrangement of varying screening procedures allows for patient autonomy in decision making and preference, a factor that is rather deficient and may reinforce poor screening rates. Additional contributing factors that restrain improvement of screening rates are the racial, ethnic, and income disparities seen in CRC incidence and survival rates (Raber et al., 2018. pg. 1). Variations between different populations in any case emphasizes the need for

intentional patient education that acknowledges diversity in communities. Ensuring that patients are knowledgeable not only of their screening options, but also the resources available to them within their community can help increase the rates of CRC screening and therefore reduce significant numbers of cases.

Research Question

For young and middle-aged adults, does increased patient education, decision aids, and earlier reminders on colorectal cancer increase the rate of screening?

Literature Review

The research literature was collected using online databases, such as PubMed and CINAHL, through the Dominican University of California library. A total of 6 research articles that focused on interventions to improve screening rates of colorectal cancer were found and evaluated to create the literature review portion of this thesis. Searching for relevant articles was successful and made possible by using keywords such as: colorectal cancer, screening rates, at risk populations, patient education, and interventions. All articles chosen emphasize the importance of preventative screening in colorectal cancer, and implemented strategies to better screening rates in varying populations. The literature review section of this thesis will be organized into two sections: systematic reviews and meta-analyses, and randomized clinical trials. Each section will be ordered chronologically, from most recent to least recent publication date. For a summary of the research articles, see page 22.

Systematic Reviews and Meta-Analyses

Through a systematic review and meta-analysis of 73 randomized clinical trials, Dougherty et al. (2018) had the objective to, “identify interventions associated with increasing colorectal cancer screening rates and their effect sizes.” This systematic review and meta-analysis was done in hopes to answer the question: “Which interventions increase completion of colorectal cancer screening tests in the United States?” (Dougherty et al., 2018, pg. 2). Selection of studies were pooled from databases such as PubMed and CINAHL, and all had the main outcome of completion of colorectal cancer screening. Eligibility criteria required that the chosen studies performed randomized clinical trial interventions designed to enhance screening completion in average-risk adult populations. Risk of bias was also assessed, to which studies were measured as having either low, medium, or high risk of bias.

The primary review of 73 randomized clinical trials, made up of 366,766 patients at low or medium risk of bias, identified the following results: compared to usual care, fecal blood test (FBT) outreach, patient navigation, patient education, patient reminders, clinician interventions of academic detailing, and clinician reminders were all interventions associated with an increase in colorectal cancer screening completion rates. More specifically, the researchers found that, “combinations of interventions were associated with greater increases than single components,” (Dougherty et al., 2018, pg. 3). Additionally, FBTs that were mailed repeatedly with navigation and instructions were associated with an increase in annual FBT completion. Drawing from the review, patient navigation and FBT outreach were the two most frequently studied, thus having the strongest evidence base. The researchers found that each of those two interventions increased screening rates by nearly 20 percentage points, implying that expansive utilization of the interventions can increase the national screening rate.

One of the obvious strengths to this study is that it only included randomized clinical trials, however, there are limitations. While the meta-analysis only reviewed RCTs, selected studies were all from the United States of America, therefore the study is most if not only applicable to the healthcare setting in the US. In addition to the study's limitations, the review did not recognize harms associated with the interventions, such as overutilization of screening in populations with considerable comorbidities. This suggests that the review would be most effective in obtaining evidence of screening deficiencies. Lastly, the researchers urge future studies to gain a better understanding on the best ways to apply, as well as the cost-effectiveness, of the interventions.

In the context of analyzing how decision aids can affect a patient's likelihood of being screened for colorectal cancer, Volk et al. (2016) aimed to evaluate the matter through a systematic review of 23 articles that encompassed a total of 11,900 subjects. Decision aids, in any health issue circumstance, are designed to prepare patients to gain decisiveness in regards to healthcare options consistent with their own preferences. With the desired outcome of informed decision-making, patient decision aids, "provide information about options, and help patients to construct, clarify, and communicate the personal values they associate with the different features of the options," (Volk et al., 2016, pg. 2). Offering such information to patients is of utmost importance in relation to colorectal cancer, as screening rates are lower compared to other cancers.

Acquiring evidence from past studies was done through multiple searches, such as Ovid MEDLINE, Elsevier EMBASE, EBSCO CINAHL Plus, and Ovid PsycINFO. Reviewers gathered data from each article in regards to its study purpose/design, geographic location, sampled population, and measured outcomes. Interventions and comparison characteristics were

also extracted from the articles, which were then categorized into either usual care, general colorectal cancer screening information, or another decision aid. A variety of decision aids were observed, such as the use of videos addressing the different screening options for colorectal cancer. Lastly, reviewers analyzed whether adequate and accurate knowledge offered to patients impacted their screening intentions and/or uptake. The review performed by the researchers found that, “decision aids for colorectal cancer screening improve patients’ knowledge by about 20% compared with control conditions and general colorectal cancer screening information,” (Volk et al., 2016, pg. 8). More specifically, the review found that patients in the decision aid groups were 1.3 times more likely to follow through with screening completion compared to patients in control conditions, like that of usual care or no screening information at all.

One of the main limitations recognized by the researchers of this systematic review was that the term, “decision aid” had a broad definition, and there was no conduction of rating or evaluation of the aids in relation to its standards for content and development. An additional limitation was that the outcomes in the meta-analysis were determined on a variety of scales, rather than just one. A strength, however, of this meta-analysis was that it, “showed greater knowledge among patients receiving decision aids compared with standard colorectal cancer screening information,” (Volk et al., 2016, pg. 8). The researchers acknowledged that further efforts to implement patient decision aids is highly warranted given that it benefits both screening rates and patient cognitive outcomes.

Randomized Clinical Trials

Raber et al. (2018) aimed to, “describe the development and feasibility of a comprehensive cancer center’s culturally flexible, multi-component CRC prevention program.” A study design of a three-session CRC Education Program (CCEP) was conducted at community

centers, non-profit organizations, and places of worship in Houston, Texas. To acknowledge the racial and ethnic disparities in colorectal cancer incidence and survival rates, the researchers' populations of interest included the Hispanic and Asian communities in the area. These communities were targeted because they represent large minority groups in Houston that may encounter cultural and linguistic barriers when facing traditional health resources. Selected individuals of these groups were of ages 40 years or older, as the general recommended age for colorectal cancer screening starts around the age of 50.

The implemented CCEP study design was made available in English, Spanish, and Vietnamese, and was led by trained bilingual health education specialists (Raber et al., 2018, pg. 2). The program was divided into three parts: Colorectal Cancer 101, Healthy Cooking Demonstrations, and a Physical Activity Class. The first session, Colorectal Cancer 101, informed participants of risk factors and screening exams for colorectal cancer. The presentation also focused on the general biology and statistics of colorectal cancer, and advised participants of available resources. The second session started with a review of dietary factors that increases risk of colorectal cancer. Various recipes were prepared and made in front of participants, who all had the chance to taste the final products. Recipes and skills of healthy cooking were translated and given to participants. The third session entailed a 30–45-minute physical activity class followed by reemphasizing colorectal cancer risk reduction.

The researchers found that the CCEP utilized, “a combination approach by offering a structured, class-based curriculum, while also leveraging community partnerships in an effort to reach specific communities” (Raber et al., 2018, pg. 4). This was especially important to the researchers as one of their main matters of concern were the racial and ethnic disparities seen among colorectal cancer prevalence. In addition to their focus on multicultural outreach, the

CCEP made use of a participatory approach when planning and implementing the program, allowing for adjustments for diverse populations. According to the researchers, strengths of this study design include, “the unique partnership model between a comprehensive cancer center and community organizations and the diversity of the community sites,” (Raber et al., 2018, pg. 4). Tailoring cancer educational outreach programs to unique populations addresses the racial and ethnic disparities in colorectal cancer incidence and survival rates. The researchers acknowledged that future studies should, “consider evaluating the efficacy of the CCEP in different populations,” by implementing methods of behavior change, knowledge acquisition, and dissemination (Raber et al., 2018, pg. 4).

Researchers Coronado et al. (2018) aimed to answer the question regarding how a mailed fecal immunochemical test outreach program can be effective in busy community clinic practices. Their objective was, “to determine the effectiveness of an electronic health record (EHR)-embedded mailed fecal immunochemical test outreach program implemented in health centers as part of standard care,” (Coronado et al., 2018, pg. 2). The study was performed using a cluster randomized pragmatic clinical trial format, and was conducted in 26 federally qualified health center clinics in both Oregon and California that served similar low-income communities. The 26 clinics were randomized and split into two groups—either receiving the mailed fecal immunochemical test (FIT) intervention or receiving usual care. Implementation of the fecal immunochemical test involved mailing an introductory letter to participants, mailing a FIT, and lastly mailing a reminder letter that entailed collaborative learning and facilitation. By using the EHR, the researchers were able to identify which patients were eligible for the particular study. All participants, totaling to 41,193 adults, were due for a colorectal cancer screening and were between the ages of 50 and 74 years old.

The researchers found that, compared to usual care for this adult population, the mailed FIT outreach resulted in a higher rate of test completion and any colorectal cancer screening. This particular intervention of a pilot fecal immunochemical test outreach program, “resulted in a 38% boost in FIT completion rates,” (Coronado et al., 2018, pg. 7). There was shown to be a statistically significant difference of 3.4 percentage points of FIT completion rates between clinics that received the intervention and clinics that performed usual care. Of the adults that completed a FIT, 13.6% of them had positive results, and about 59% of those individuals completed a colonoscopy screening. In other words, there were higher rates of colorectal cancer screening in clinics that successfully fulfilled the mailed outreach program.

Several limitations of the study were identified, one of which that included the fact that some clinics were unable to implement the intervention because there were other interventions that held a higher priority. This was reasoned by health center leaders, as they stated that, “primary challenges were time burden on clinic staff, limited organizational capacity,” and problems with the EHR (Coronado et al., 2018, pg. 7). Additionally, there was a potential for underreporting of completed FIT samples as some clinics were unable to process specimens that were missing collection dates. Lastly, because the researchers provided health centers with resources to carry out the outreach program, such resources may be unattainable to clinics who seek to conduct the program in the future. Nonetheless, the substantial and diverse target population displayed strength to the study, as well as the use of the same EHR system across health centers which minimized variation in data collection. While the FIT outreach program was found to increase colorectal cancer screening completion rates, the researchers emphasize that there is, “the need to identify additional strategies to support program implementation in low-resource health centers,” (Coronado et al., 2018, pg. 8).

With the intention of addressing the low participation screening rates for colorectal cancer, researchers Gupta et al. (2013) aimed to sought out whether organized mailed outreach can boost screening rates compared to usual care, and if fecal immunochemical tests (FITs) are better than colonoscopies for screening in underserved populations. FITs are significantly less invasive and more affordable compared to colonoscopy procedures, and therefore may be associated with higher participation rates (Gupta et al., 2013, pg. 3). A randomized clinical trial was conducted with specific patients who fit the following criteria: (1) were uninsured, (2) were not up to date with colorectal cancer screening, (3) were between the ages of 54 and 64, and (4) were enrolled in a medical assistance program under the John Peter Smith Health Network in Texas. The resulted study population came out to be a total of 5,970 patients who were randomly assigned into either a FIT outreach group, a colonoscopy outreach group, or usual care group. The measured primary outcome of *screening participation* was defined as, “completion of any colorectal cancer screening test within 1 year of follow-up after randomization,” (Gupta et al., 2013, pg. 5).

The researchers found that the use of an organized mail outreach program made a considerable increase in colorectal screening participation within the population of underserved patients. Compared to usual care, which had a screening participation rate of 12.1%, FIT outreach tripled screening rates to 40.7% and colonoscopy outreach nearly doubled the rates to 24.1%. The stated results build onto findings from other studies of outreach interventions, suggesting that these strategies show potential in enhancing screening rates for colorectal cancer. Additionally, it was recognized that there were substantially higher screening rates for FIT outreach compared to colonoscopy outreach. This specific finding raises the likelihood that,

“large-scale public health efforts to boost screening may be more successful if noninvasive tests, such as FIT, are offered over colonoscopy,” (Gupta et al., 2013, pg. 8).

Several limitations were discerned by the researchers while interpreting their results, one being that the study’s results only reflect screening participation after one round of outreach. This is significant because it is possible that more rounds of invitations and outreach can result in higher rates of screening in the different groups, thus potentially altering whether or not FIT outreach is a superior tactic. Another limitation to acknowledge is that of the patients who received an abnormal FIT result, 18% of them did not seek to complete a colonoscopy. “This could also affect long-term impact of FIT vs colonoscopy outreach,” (Gupta et al., 2013, pg. 8). Additionally, implementing a fourth group that gave participants the power to choose between receiving a FIT or colonoscopy could have led to higher rates of screening. This potential for enhancing patient autonomy further warrants future study. However, a noticed strength of the trial is that the results displayed consistency over the varying demographics of the study population. The researchers conclude that while organized outreach was effective towards increasing colorectal cancer screening in an underserved community, further studies should include analyses of cost and long-term effectiveness.

Researchers Potter et al., (2013) had the objective of testing the, “effectiveness of offering home fecal immunochemical tests (FITs) during influenza vaccination clinics to increase colorectal cancer screening,” (Potter et al., 2013, pg. 1). Through combining traditional care strategies and a mailed FIT outreach intervention, colorectal cancer screening rates increased to over 75% in targeted populations receiving care through Kaiser Permanente Northern California (KPNC). However, there are still many age-eligible patients, between 50 to 75 years, who remain unserved and unscreened. To address this matter, Potter et al. (2013)

conducted a FLU-FIT Program at influenza vaccination clinics, where they offered FIT kits to suitable patients when they received their influenza vaccines. The randomized clinical trial took place at KPNC facilities in Redwood City, Richmond, South San Francisco, Union City, and Fresno California. Influenza clinic sites were randomly assigned clinic dates to intervention, where the FIT was offered, or control, where FITs were not offered. Eligible patients were identified by their age and whether or not they were due for a colorectal cancer screening, according to KPNC electronic health record. Patients who were provided with FIT kits additionally received statements from clinic staff, such as, “This test is free and could save your life,” “You can do the FIT today and mail it in tomorrow,” “Just like a flu shot, you need to complete a colon test every year,” (Potter et al., 2013, pg. 2).

As a result of the FLU-FIT Program, reaching patients who were due for colorectal cancer screening was deemed successful and effective. The program also showed benefit to increasing screening activity within this patient population, making it a potentially effective method to reach patients who are not gaining access to screening through other primary care strategies. By offering FIT kits alongside influenza vaccinations, the researchers found that there was, “a clinically and statistically significant increase in colorectal cancer screening rates,” (Potter et al., 2013, pg. 5). The results showed a nearly 15% difference between proportions of participants completing screening within 90 days of receiving their flu vaccine, 29.7% within the intervention group and 15.2% in the control group. This trial not only emphasizes the importance of increasing colorectal cancer screening rates in targeted populations, but also exposes the value of multilevel interventions for patient outreach and follow up.

Challenges to the FLU-FIT Program are to be recognized, as these may have altered the researchers’ end results. A number of the challenges were in relation to the clinic staff and

instruction provided to them. For example, there was only an average of 47% to 60% of eligible patients offered a FIT kit across the 5 sites. There were also a few patients who were mistakenly given a FIT kit, implying that better training and quality control in FIT kit distribution is needed. The researchers took notice of potential limitations as well, one being that the study pertains only to the patient population of KPNC. In addition to the trial's potential limitations, there was found to be minimal baseline differences between the intervention and control groups, which were not likely to be clinically significant, but is still a factor to regard. The FLU-FIT program shows value to increasing colorectal cancer screening rates among patients who do not receive other forms of screening outreach. Nonetheless, there is still more research to be done in this area of study, which should be considering how to implement and disseminate programs like these on a national level.

Discussion of Literature Review

According to the data collected for this literature review, variations and combinations of colorectal cancer screening outreach has proven to have a positive effect on increasing screening rates in adult populations who are either underserved and/or are due for colorectal cancer screening. All articles showed a rather substantial increase in patient's actions to be screened when presented with interventions, showing promise for the research question presented with this literature review, and for further studies to replicate the work that was brought about by the mentioned research.

Further research is called to determine the feasibility and structure that is needed to carry out interventions that can improve screening rates, particularly in diverse communities and in the young adult population. Patient decision aids in particular are identified to be of most significant consideration, as they improve both patient knowledge and colorectal cancer screening rates. In

addition to decisional aids, offering more accessible and convenient ways to screen patients is also emphasized to improve overall outcomes.

Rates of screening for colorectal cancer remains to be lower compared to other cancers, due to factors such as lack of effective patient education, convenience of testing, and even cultural and linguistic barriers. Obstacles such as these are more manageable to face with interventions that improve patient knowledge and availability to appropriate care. Effective colorectal cancer screening will not only improve screening rates, but ultimately the patient's wellbeing.

Theoretical Framework

Nola Pender is a co-founder of the Midwest Nursing Research Society and currently a professor emerita within the Division of Health Promotion and Risk Reduction at the University of Michigan School of Nursing. She is most known for the development of her Health Promotion Model, which was brought about by her acknowledgment of improving patient's quality of life prior to developing acute or chronic health problems. Pender's model aims to assist nurses in comprehending "the major determinants of health behaviors as a basis for behavioral counseling to promote healthy lifestyles," (Petiprin, 2020). Five key concepts; person, environment, nursing, health, and illness, comprise the Health Promotion Model, where the purpose of nursing is to collaborate with patients, their families, and communities to produce the best manifestation of improved quality of life and optimal health.

Pender's Health Promotion Model was designed to be applicable in healthcare practices, where nurses focus on understanding and acknowledging variables most predictive of certain health behaviors. Screening for colorectal cancer not only calls for knowledge of risks and

patient understanding, but also a patient's perceived barriers and self-efficacy. A theoretical proposition that contributes to Pender's model is that, "barriers can constrain commitment to action," (Petiprin, 2020). By recognizing such barriers, such as convenience to screening, nurses work towards promoting the most optimal well-being for their patients.

Proposal for Further Study

Improving screening rates for colorectal cancer is essential to decreasing the prevalence of cases and preventing patients from developing the disease at later stages. This paper determined that deliberate interventions, in addition to traditional care methods, can have a positive effect on not only colorectal cancer screening rates, but patient knowledge as well. However, the literature review was generally only applicable to middle and older adults, and did not have sufficient information in regards to younger adults. Consequently, questions remain. The population of young adults are considered to be too young for colorectal cancer screening, as the recommended age is 50. These individuals, those under the age of 45, are of consideration due to the fact that incidence rates among this group have been increasing throughout the years. Therefore, the need for increasing screening rates earlier than the recommended age of 50 is essential to decrease the prevalence of colorectal cancer in younger adults.

The research question being studied is: For young adults, does increased patient education, decision aids, and earlier reminders on colorectal cancer increase the rate of screening? This author hypothesizes that screening rates will be positively correlated with young adults being presented with information, patient decision aids, and reminders for colorectal cancer screening. The purpose of this study is to identify whether or not expanding such interventions to a younger

population will be of significance to addressing colorectal cancer in young adults, and thus improving screen rates. Primary research aims for this study are as stated in the following:

1. For young adults ages 25 to 45 years in California, what is the prevalence of colorectal cancer?
2. For this age group, what is the rate of screening for colorectal cancer?
3. For this age group, will increased patient education, decision aids, and earlier reminders increase the rate of screening?

This study will be quantitative, utilizing patients' charts and questionnaires through statistical methods. Questionnaires will assess patients' knowledge of colorectal cancer and their likelihood to screen within the next 5 years. This study is designed to be implemented in the Kaiser Healthcare System across California, due to the vast number of individuals the organization serves. For Aim #1, medical records within the Kaiser Electronic Medical Record (EHR) will be reviewed for patients ages 25 to 45 diagnosed with colorectal cancer. Secondly, Aim #2 involves reviewing medical records within the Kaiser EHR system for patients ages 25 to 45 to assess the frequency of screening for colorectal cancer. The studies for Aim #1 and #2 will be retrospective descriptive assessments of patients' charts. For Aim #3, participants will be given a questionnaire to assess their understanding of colorectal cancer and their likelihood to screen within the next 5 years. An educational module will then be presented in a small group, and the group will be retested afterwards, making this a test-retest interventional quantitative study.

This convenience sample of adults between the ages of 25 to 45 who are not diagnosed with colorectal cancer will represent the young adult population in California. Prior to conducting the study, written consent will be obtained by all 50 young adults, making up the proposed sample

size. All participants will first be given a questionnaire that evaluates their knowledge of colorectal cancer, with questions such as, “how much do you know about the risk factors for colorectal cancer?” or, “to what extent of knowledge do you have of colorectal cancer mortality?” All answers will be rated on a 1 – 5 numerical scale, with a score of 1 being ‘none at all’ to 5 being ‘substantial’. To conclude the questionnaire, participants will be asked to rate their likelihood to screen within the next 5 years. After completion of the questionnaire, participants will be presented with an educational module that discusses basic risk factors, recent statistics, and prevention strategies of colorectal cancer. Following the module, participants will be “re-tested” with the same questionnaire.

Data Analysis and Discussion of Potential Outcomes

In order to analyze the gathered data, a t-test will be performed to determine whether or not the educational module improved knowledge of colorectal cancer and likelihood to undergo screening. The t-test is aimed to assess whether the means of two groups, in this case: the likelihood to be screened for colorectal cancer before and after an educational module, is significantly different from one another. This will be conducted with the “re-test”, in which the participants initial answers will be compared to their responses after the educational presentation. It will then be determined whether or not the additional knowledge offered to the participants had a positive correlation with their responses to likeliness of undergoing screening. Outcomes of this proposed study should be taken with consideration of its limitations, while also examining how the results could be of use to future research for improving colorectal cancer screening rates.

Conclusion

In order to address why colorectal cancer, though very much preventable, has such low screening rates, researchers aimed to implement strategies that could continue and hopefully answer this issue. What was learned from this thesis is that when patients are shown with interventions that emphasize education and convenience within colorectal cancer prevention, they are more likely to undergo screening. Various studies showed that patient participants opted to go through screening procedures, like FITs and colonoscopies, after receiving valuable information and access to health resources. Each intervention came at no cost and was highly convenient for the participants, making the decision to receive screening that much more feasible. Further research is needed to comprehend the cost-effectiveness of such interventions, as well as understanding how implementing such strategies can be useful in more diverse and younger populations. Nonetheless, it is well understood that optimizing such strategies can positively affect rates of screening in middle and older aged adults.

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Literature Review Table

Authors/Citation	Purpose/Objective of Study	Sample - Population of interest, sample size	Study Design	Study Methods (how it's done?)	Major Finding(s)	Strengths	Limitations
<p>Coronado, G. D., Petrik, A. F., Vollmer, W. M., Taplin, S. H., Keast, E. M., Fields, S., & Green, B. B. (2018). Effectiveness of a mailed colorectal cancer screening outreach program in community health clinics. <i>JAMA Internal Medicine</i>, 178(9), 1174-1181. doi:10.1001/jamainternmed.2018.3629</p>	<p>To determine how effective an electronic health record (EHR)-embedded mailed fecal immunochemical test (FIT) outreach program is when implemented in health centers as part of standard care.</p>	<ul style="list-style-type: none"> • 26 federally qualified health center clinics in Oregon and California • All participants were both overdue for CRC screening and were between the ages of 50-74. 	<p>Cluster randomized pragmatic clinical trial</p>	<ul style="list-style-type: none"> • Half of the health center clinics received the intervention (receiving an introductory letter, and FIT kit packet, and a reminder letter). • The other half of health center clinics continued their usual standard process for CRC screening. 	<p>Clinics that received the intervention had a higher proportion of participants who completed a FIT and any CRC screening.</p>	<ul style="list-style-type: none"> • The 26 clinics were randomly assigned to either group. • Large and diverse population • All clinics used the same EHR system, allowing for minimal variation in data quality. 	<ul style="list-style-type: none"> • A potential for underreporting as some health center clinics were unable to process several completed FIT tests as they were missing collection dates. • Resources offered by research group may or may not be available to health centers after completion of research.
<p>Dougherty, M. K., Brenner, A. T., Crockett, S. D., Gupta, S., Wheeler, S. B., Coker-Schwimmer, M., . . . Reuland, D. S. (2018). Evaluation of interventions intended to increase colorectal cancer screening rates in the United States: A systematic review</p>	<p>To identify interventions that are associated with increasing CRC screening rates as well as their overall effect sizes.</p>	<p>73 randomized clinical trials made up of over 366,000 average-risk adult patients who are considered to be at low or medium risk of bias.</p>	<p>Systematic review and meta-analysis</p>	<ul style="list-style-type: none"> • Selection of studies were pooled from databases such as PubMed and CINAHL, and all had the main outcome of completion of colorectal cancer screening. 	<p>Combinations of interventions that are associated with increased CRC screening (i.e. clinician interventions, patient navigation, fecal-blood test outreach) corresponded with greater increases compared to that of single intervention use.</p>	<p>Review only included randomized control trial studies.</p>	<ul style="list-style-type: none"> • Study only included RCTs of the US • Due to the nature of systematic reviews and meta-analyses, publication and reporting biases may have had an impact on the results of the systematic review. • Economic outcome of increasing CRC screening

UNDERSTANDING COLORECTAL CANCER: INCREASING SCREENING RATES AMONGST YOUNG- AND MIDDLE- 24
 AGED ADULTS BY ENHANCING PREVENTION POTENTIAL

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and meta-analysis article information							interventions was not determined.
Gupta, S., Halm, E. A., Rockey, D. C., Hammons, M., Koch, M., Carter, E., . . . Sugg Skinner, C. (2013). Comparative effectiveness of fecal immunochemical test outreach, colonoscopy outreach, and usual care for boosting colorectal cancer screening among the underserved: A randomized clinical trial. <i>JAMA Internal Medicine</i> , 173(18), 1725-1732. Doi:10.1001/jamainternmed.2013.9294	To determine whether or not: (1) if organized mailed outreach improves CRC screening compared to usual care and (2) if FIT is superior to colonoscopy outreach for CRC screening participation in undeserved populations.	Patients who are... <ul style="list-style-type: none"> • Uninsured • Not up to date with CRC screening • Ages 54-64 • Served by John Peter Smith Health Network, Fort Worth and Tarrant County, Texas 	Randomized clinical trial	<ul style="list-style-type: none"> • Patients randomly assigned to 1 of 3 groups. • One group received fecal immunochemical test (FIT) outreach • Another group was assigned to colonoscopy outreach • Third group was assigned to usual care (i.e. primary care visits) • Outcome measures were determined by screening participation in any CRC test within 1 year. 	<ul style="list-style-type: none"> • Screening participation was found to be significantly higher for the FIT and colonoscopy outreach groups compared to the usual care group. • "Rates of CRC identification were 0.4% for FIT outreach, 0.4% for colonoscopy outreach, and 0.2% for usual care." • Patients with advanced stages of the cancer were detected among 0.8% of FIT outreach group, 1.3% of colonoscopy outreach group, and 0.4% of usual care patients. 	Study was randomized.	<ul style="list-style-type: none"> • Results only reflect screening participation after 1 round of invitations, implying that repeated outreach could lead to a higher result in screening participation. • Offering choice between FIT or colonoscopy could have led to higher rates of screening. • These efforts require further study to determine whether they can be resourced and implemented sustainably.
Potter, M. B., Ackerson, L. M., Gomez, V., Walsh, J. M. E., Green, L. W., Levin, T. R., & Somkin, C. P. Effectiveness and reach of the FLU-FIT program in an integrated health	To test the effectiveness of offering home fecal immunochemical tests (FITs) during influenza vaccination clinics to increase CRC screening.	Patients who... <ul style="list-style-type: none"> • Are aged 50-75 • Are served by a Kaiser Permanente Northern California (KPNC) clinic 	Randomized clinical trial	<ul style="list-style-type: none"> • Each clinic provided a list of vaccination clinic dates to which the researchers randomly assigned the intervention or control. 	There was an increase in completed CRC screening tests in the intervention group within 90 days of vaccination compared to the control group. The FLU-FIT program intervention has potential to increase CRC screening among those who are not		<ul style="list-style-type: none"> • Generalizability beyond Kaiser Permanente Northern California. • Some statistical baseline differences between the intervention and control groups.

UNDERSTANDING COLORECTAL CANCER: INCREASING SCREENING RATES AMONGST YOUNG- AND MIDDLE- AGED ADULTS BY ENHANCING PREVENTION POTENTIAL 25

Authors/Citation	Purpose/Objective of Study	Sample - Population of interest, sample size	Study Design	Study Methods (how it's done?)	Major Finding(s)	Strengths	Limitations
care system: A multisite randomized trial doi:10.2105/AJPH.2012		<ul style="list-style-type: none"> Have received an influenza vaccination at one of the 5 participating clinics 		<ul style="list-style-type: none"> Clinic staff provided FIT kits to eligible members (patients ages 50-75) and told them phrases such as, "This test is free and could save your life", or "Just like a flu shot, you need to complete a colon test every year" 	reached by other forms of CRC screening outreach.		
Raber, M., Huynh, T., Crawford, K., Kim, S., & Chandra, J. (2018). Development and feasibility of a community-based, culturally flexible colorectal cancer prevention program. Journal of Community Health, 43(5), 882-885. doi:10.1007/s10900-018-0497-x	To explain the development and feasibility of a cancer center's culturally cognizant, multi-component CRC prevention program.	Hispanic and Asian communities of Houston, Texas. <ul style="list-style-type: none"> Represent major minority groups in the area that may face cultural and linguistic barriers to health resources. Over 40 years old 	Delivery of a three-session CRC Education Program (CCEP) at community centers, non-profit organizations, and places of worship.	<ul style="list-style-type: none"> The CCEP was made available in English, Spanish, and Vietnamese. Session 1 was the Colorectal Cancer 101 class; risk factors and screening exams. Session 2 included Healthy Cooking Demonstrations. Session 3 entailed a Physical Activity Class lasting 30-45 minutes. 	<ul style="list-style-type: none"> There was a participatory approach in both program planning and implementation, which allows the program to adjust for diverse groups. Taking advantage of community partnerships can help in efforts to reach specific communities that are otherwise not usually reached out to. 	Unique partnership model between comprehensive cancer centers and community organizations.	<ul style="list-style-type: none"> Addressed and acknowledged how interventions to improve screening rates must be culturally and racially aware of the target population. Tailoring care and interventions to the demographics of a population enhanced the effectiveness of the program.
Volk, R. J., PhD, Linder, S. K., PhD, Lopez-Olivo, Maria A., MD, MS, PhD, Kamath, Geetanjali R., BDS, MPH, Reuland, Daniel S.,	To describe studies evaluating patient decision aids for CRC screening within the average-risk adults population.	21 trials including a total of 11,900 participants. <ul style="list-style-type: none"> Majority of trials had participant populations 	Systematic Review and Meta-analysis	<ul style="list-style-type: none"> Based off of the 21 qualitative trials, 13 different decision aids for CRC screening were identified. 	<ul style="list-style-type: none"> Decision aids for CRC screening can improve patients' knowledge by roughly 20% compared to that of control conditions. 		<ul style="list-style-type: none"> "Decision aid" had a broad definition and no rating for content, development, and evaluation in the meta-analysis.

UNDERSTANDING COLORECTAL CANCER: INCREASING SCREENING RATES AMONGST YOUNG- AND MIDDLE- AGED ADULTS BY ENHANCING PREVENTION POTENTIAL 26

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<p>MD, MPH, Saraykar, Smita S., MBBS, MPH, . . . Pignone, Michael P., MD, MPH. (2016). Patient decision aids for colorectal cancer screening. American Journal of Preventive Medicine, 51(5), 779-791. doi:10.1016/j.amepr.2016.06.022</p>	<p>To explain the impact of knowledge, screening intentions, and uptake within this population.</p>	<p>of average-risk adults aged 50-74 years.</p> <ul style="list-style-type: none"> • Three trials had specific populations of focus; i.e. low education, low SES, limited English proficiency. 		<ul style="list-style-type: none"> • Reviewers independently chose studies that quantitatively evaluated a decision aid compared to one or more aids. • Reviewers then withdrew characteristics, interventions, and outcomes of the studies. 	<ul style="list-style-type: none"> • Greater intentions to be screened and screening uptake were evident in studies with decision aids compared to control conditions.” 		<ul style="list-style-type: none"> • The meta-analysis was restrained to the data published or provided by the authors.