WEIGHT-RELATED DISPARITIES IN COLORECTAL CANCER PREVENTION BEHAVIORS

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ABSTRACT

LUCIA A. LEONE: Weight-Related Disparities in Colorectal Cancer Prevention Behaviors
(Under the direction of Marci K. Campbell)

Although Colorectal Cancer (CRC) is the 2nd leading cause of cancer mortality, it is estimated that as many as 90% of CRC cases could be prevented through screening and healthy lifestyle, such as engaging in regular physical activity. Obese women, who are at higher risk for CRC, may be less likely to engage in cancer prevention behaviors than normal weight women. The purpose of this research project was to understand how obesity affects CRC screening and physical activity behavior in order to design appropriate intervention messages for decreasing CRC risk among obese women. The dissertation followed three aims. For Aim 1, national data on CRC screening were analyzed to better understand the combined influence of gender, weight and race on CRC screening practices. We found that obese white women were 34% less likely to have had a colonoscopy in the past 10 years (p=0.001), but that there was no significant relationship between screening and weight in African American women. For Aim 2, focus groups were conducted with unscreened obese women to better understand how weight affects compliance with screening and physical activity guidelines. We found that knowledge of CRC prevention was low among obese women. While many of the barriers cited were similar to those found with non-obese women, obese women had more co-morbidities which they may prioritize over cancer screenings tests. Women also cited many weight-related barriers to physical activity. Aim III consisted of an online evaluation of weight-targeted CRC prevention messages. White women were stratified by weight (obese vs. non-obese) and randomized to receive either 10 weight-targeted messages developed based on focus group findings or 10 generic messages about CRC screening and physical activity. Women rated messages using the Elaboration Likelihood (ELM) Scale; there were no differences between ELM scores of women who read weight-targeted vs. generic messages, but obese women in both conditions reported higher elaboration ($p=0.02$) and felt that the messages were more personally relevant ($p=0.005$) and believable ($p=0.047$) than non-obese women did. Together, data from these three aims can be used to inform the development of future CRC prevention interventions targeted at obese women.

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INTRODUCTION

I.A. Overview

Colorectal Cancer (CRC) is the second leading cause of cancer mortality in the United States. Screening tests allow for the detection and removal of precancerous tumors (polyps) and can prevent CRC from ever occurring. Since the risk of CRC increases with age, it is recommended that normal risk individuals begin CRC screening at age 50; however compliance with screening recommendations is poor. Other risk factors for CRC include obesity and physical inactivity. Weight and gender related disparities exist in both CRC screening and physical activity; obese women are less likely to be physically active and may be less likely to adhere to screening recommendations. Data from breast and cervical cancer screening indicate that weight-related screening disparities may also vary by race, but this relationship has not been examined for CRC screening tests.

Behavioral interventions have shown some effectiveness at increasing CRC screening and physical activity, but they may be differentially effective across weight groups. Weight-targeted interventions may be needed to effectively reach obese women. In order to better understand and address weight, gender and race-related disparities in CRC screening and decrease CRC risk among obese women through increased screening and physical activity, I conducted research in three phases:

I.B. Specific Aims

Phase I: Analyze data from the 2005 National Health Interview Survey (NHIS), a nationally representative sample which includes data on CRC screening behavior.

Aim 1: Determine if disparities in CRC screening rates exist by weight, gender and/or race.

Phase 2: Conduct focus groups with obese white and African American women age 50 and older to better understand determinants of CRC screening and physical activity in this population and to inform the development of a CRC prevention messages for obese women.

Aim 2: Determine why obese women may be less likely to adhere to CRC screening and physical activity recommendations.

2a: Determine why women decide to be screened for cancer and how their weight affects their medical decisions.

2b: Determine weight-specific barriers to physical activity.

2c: Determine what intervention methods would be most acceptable to obese women.

Phase 3: Develop and test CRC screening and physical activity promotion message for obese women.

Aim 3: Determine if the weight-targeted messages are more comprehensible, relevant, acceptable, and/or motivating for obese women compared to generic messages.

CHAPTER II

LITERATURE REVIEW

II.A. Colorectal Cancer Risk among Obese Women

Colorectal cancer (CRC) was responsible for an estimated 49,920 deaths in 2009 making it the second leading cause of cancer mortality.[1] Research has shown a positive relationship between CRC incidence/mortality and Body Mass Index (BMI).[2] A recent meta-analysis found that obese women (BMI≥ 30) have a 25% greater chance of getting CRC than women with a BMI <23. Additionally, obesity may increase colon cancer mortality risk in women by as much as two-fold.[2, 3] While the exact biological mechanisms through which obesity increases CRC risk are still debated, increased insulin is the best established biochemical mediator of this relationship.[4] Obesity is a prevalent condition in the United States, particularly among older women; it is estimated that more than 31% of women in the United States over age 60 are obese.[5] Given their high numbers and increased CRC risk, obese women are an important group to target for CRC prevention.

II.B. Colorectal Cancer Prevention

Regular screening for CRC and adenomatous polyps has the potential to significantly reduce CRC incidence and mortality[6-9] A joint taskforce on guidelines for screening and surveillance for the early detection of adenomatous polyps and colorectal cancer (CRC screening) recommend that all average risk individuals begin screening at age 50.[10-12] In addition to screening, the American Cancer Society concluded that there was convincing evidence that avoiding overweight and increasing physical activity would help to reduce colorectal cancer risk.[13, 14] Moreover, the Surgeon General's report on physical activity and health concluded that there is strong evidence suggesting a relationship between physical activity and colon cancer.[15] It is estimated that 13-14% of colon cancer cases can be attributed to physical inactivity, this is greater than the population attributable risk for family history or any other individual lifestyle factor.[16-18] For these reasons, CRC screening and physical activities are important behaviors to target in a CRC prevention intervention.

II.C. Colorectal Cancer Screening

Both observational and randomized controlled trials have demonstrated that routine CRC screening is both effective and cost-effective in decreasing CRC incidence and mortality[11]. For example, it is estimated that annual fecal occult blood testing (FOBT) starting at age 50 could lower mortality by up to 33%[6] and regular screening with colonoscopy could decrease mortality by up to 65-90%.[7, 8] Colonoscopy is recommended as both a stand-alone screening test and a follow-up to positive results obtained using other screening modalities. A colonoscopy can be used to find CRC in its early stages (when the survival rate is higher) or to find polyps which are precancerous growth. Polyps can be removed during a colonoscopy and thus prevented from ever becoming cancer.[19, 20] Regular colonoscopy usage has been estimated to decrease CRC incidence by 67%.[8]

CRC screening guidelines for average risk individuals begin at age 50. Average risk individuals are those with no family or medical history of CRC, polyps or inflammatory bowel disease. Obese individuals are generally considered average risk for screening purposes; however the American College of Gastroenterology recently recommended that given their higher CRC incidence and mortality rates that there should be special efforts to ensure that screening takes place in obese and overweight patients.[21] Additionally, they suggested that initiating screening as early as age 45 may be recommended, but that further study is warranted. Unfortunately, the current rate of adherence to CRC screening guidelines in the United States is low in general and particularly low in certain subgroups such as obese women.

Screening guidelines for average risk individuals include yearly stool tests [fecal occult blood test (FOBT), fecal immunochemical test (FIT) or stool DNA tests (sDNA)], flexible sigmoidoscopy every five years, annual FOBT or FIT plus flexible sigmoidoscopy every five years, double contrast barium enema every five years, Computed Tomographic Colonography (CTC) (i.e., virtual colonoscopy) every 5 years or colonoscopy every ten years.[11] Insurance coverage for CRC screening is available through most insurance plans including Medicare and is currently mandated by law in 18 states.[22] Despite insurance coverage and effectiveness evidence compliance with CRC screening guidelines remains low, especially when compared with screening for other cancers, like breast or cervical cancer.[23-25] Behavioral Risk Factor Surveillance Survey data showed that only 23.5% of respondents reported having FOBT in the past year, and 43.4% had a sigmoidoscopy or colonoscopy in the past ten years.[26] CRC screening much less common than that for breast or cervical cancer;[27] Among women under 65, over 85% are adherent to pap smear guidelines and over 58% with mammogram guidelines,[10] but only 47.4% are up-to-date for CRC screening[28] In addition, there is only one screening test recommended for each breast and cervical cancer whereas CRC has a number of recommended screening tests or combinations of tests, each with a different screening interval; this makes compliance more difficult and makes for potentially more complex interventions.

II.D. Physical Activity

Longitudinal studies provide evidence for a relationship between colon cancer risk and physical activity in women.[29] Specifically women who engage in more leisure time physical activity have reduced risk for colon cancer, but not rectal cancer.[30] For example, the Nurses' Health Study found that Women who engaged in physical activity at a level of 21 MET-hours/week for 40 years had a 49% reduction in risk compared with women who only had 2 MET-hours of physical activity per week. The relationship between physical activity and CRC remains, even after controlling for BMI.[31] While there is epidemiological evidence that physical activity may reduce colon cancer incidence, the biological basis for this relationship is still unclear, though many theories exist.[3233] Physical activity may decrease bowel transit time and reduce the colonic tissue's exposure to carcinogens. Physical activity is also purported to increase immune function; it may alter the function of macrophages and therefore affect tumor development. Alternatively it may decrease prostaglandin levels. Prostaglandins have been associated with colon cell proliferation and adenocarcinomas in the colon. Lifestyle factors associated with colon cancer are similar to those of insulin resistance suggesting a relationship between colon cancer and insulin and/or IGF (Insulin like growth factor). Insulin and IGF increase cell proliferation and tumor growth. Physical activity is known to improve insulin sensitivity and reduce levels of insulin in the blood.[32]

Although the exact amount and type of physical activity needed to reduce cancer risk is not known, ACS guidelines recommend that individuals engage in at least 30 minutes of moderate to vigorous activity each day. They also specifically state that evidence is mounting to suggest that 45 to 60 minutes of physical activity on 5 or more days per week is optimal for reducing breast and CRC risk. [14] According to BRFSS data, over 50% of Americans are not even meeting national physical activity guidelines, defined as 30 minutes of moderate intensity activity 5 days a week or 20 minutes of vigorous activity 3 days per week.[28] Thus, even fewer Americans are active at a level thought to help prevent cancer.

II.E. Colorectal Cancer Prevention Behaviors among Obese Women

Despite their increased risk for cancer, evidence suggests that obese individuals may be less likely to engage in health-promoting behaviors such as physical activity, healthy diet, and cancer screening tests.[26, 34-37] Our own research found similar disparities for screening and physical activity, but not diet in a sample of rural African Americans.[38] Several studies have specifically examined the relationship between screening and weight (Appendix A). Data from the Behavioral Risk Factor Surveillance Survey (BRFSS) showed that as weight increased, the likelihood that a person was adherent to CRC screening recommendations decreased for women, but not for men.[26, 34] A medical record review of 22 practices found that both obese men and women had significantly lower rates of screening than non-obese.[39] The Cancer Prevention II Nutrition Cohort found that compared to normal weight women; overweight, obese and morbidly obese women were all significantly less likely to have had a flexible sigmoidoscopy or colonoscopy. However, three studies, one conducted in Maryland and two using NHIS data have found no association between screening and weight.[40-42] NHIS has one of the most comprehensive screening questionnaires of any nationally representative survey, however the two studies which have used this data set have not been designed to specifically examine the relationship between screening and weight. Additionally, no study to date has examined this relationship stratified by both race and gender. Research on mammography has indicated that screening disparities may exist for white women, but not other races.[43-45]

While overall, the number of Americans who get no leisure-time physical activity is high,[46] there is a negative association between physical activity and BMI, with obese individuals reporting substantially lower rates than normal or overweight individuals.[36] Accelerometer data also indicates that obese individuals are less likely to meet physical activity recommendations than normal weight individuals. Obese individuals spent 21 minutes less per day engaged in moderate or higher intensity activities compared to normal weight individuals.[47] In addition, women have lower reported rates of physical activity than men, with obese women being the most inactive group overall. According to BRFSS data 36.2% of obese women report no leisure time activity compared to 19.7% of normal weight women and 27.7% of obese men.[28]

II.F. Physical Activity Determinants among Obese Women

While there is a great deal of anecdotal evidence that obese individuals face more barriers to physical activity, the published literature is limited. One study in Australia found that there was an association between reporting being "too fat" as a barrier to exercise and saying that they were too shy or lazy to exercise. Women who thought they were too fat were also more likely to say that they were not the sporty type. Women were more likely to report that they were too fat to exercise than men, even though there were more obese men in the sample.[48] A study of African American women found that obese individuals were more likely to report that they lacked motivation to exercise. Normal weight individuals were also more likely to report no barriers to exercise (31%) than overweight (0%) or obese individuals (5%).[49] Another study examined predictors of physical activity among overweight and obese individuals in a 6 month weight loss study. While there were no relationships between baseline psychosocial variables and 6 month physical activity levels, they did find that those who had greater self-efficacy and decisional balance at 6 months engaged in more activity.[50, 48] Our own research found that obese individuals were more likely than normal weight individuals to report that they did not have the will power to exercise or that they felt uncomfortable with how they looked while exercising.[38]

While research on determinants of physical activity in obese women is limited, we do have some understanding of the factors that affect physical activity initiation and continuation in older adults. Self efficacy has been shown to be a consistent predictor of both exercise initiation and adherence in older populations.[51-53, 53-55] Other important physical activity correlates include perceived behavioral control, perceived benefits, and perceived social support.[51] While social support from friends, family and physicians had been shown to increase physical activity, many older adults don't get the support that they need. Older adults also face additional barriers to physical activity including fear of injury, physical conditioning and poor health.[51-53, 53] Previous experiences with physical activity and attitudes towards physical activity also have an effect on initiation and adherence either alone or as mediators of the relationship with self-efficacy.[51, 54, 54, 55]

Based on the literature social support, self-efficacy and perceived barriers appear to have the largest affect of physical activity in older adults. Qualitative research is needed to better understand how these factors affect physical activity participation in obese women.

II.G. Colorectal Cancer Screening Determinants among Obese Women

It is not clearly understood why obese women are less likely to be adherent to CRC screening recommendations; no literature exists which specifically examines the causes of this disparity. In order to better understand the factors which may affect CRC screening behaviors in obese women, we looked to a wide body of literature. First we examined the psychosocial factors which have been show to correlate with screening in the general population. Second we looked at the more general body of literature on screening and weight and thirdly we included research which detailed the experience of obese women in the health care system in general.

Screening Correlates

Many quantitative studies have focused on correlates of CRC screening. One of the strongest predictors of screening is that it was recommended by a doctor,[56] so it is hypothesized that differential rates of doctor referral may explain some of the weight-related screening disparities. Previous research also indicates that patient-provider communication may have a significant influence on screening compliance.[57-59] However, mammography data from the National Health Interview Survey (NHIS) indicate that differential doctor recommendation was not responsible for lower screening rates. Demographic factors which are frequently reported as increasing screening compliance include older age,[60-62] higher SES,[61, 63] 3 or more doctor visits in the last year,[60, 62, 64] use of other preventive care services,[58, 60, 64, 65] and insurance or access to a regular source of care.[61, 63, 65] Women and minorities were less likely to have had an up-to-date CRC screening.[58, 61-64, 66] Psychosocial variables which have been cited as screening correlates include knowledge of testing intervals, greater perceived susceptibility, greater perceived support,[58] and lower barriers to screening.[64]

Gender Differences

One study specifically looked at differences in screening predictors/barriers between men and women. Cost of screening was reported as a barrier among women, but not men. Women were also more likely to get a screening if they believed that it led to early detection or if they had a comparatively higher risk of getting CRC than their peers.[60] One qualitative study examined non-adherence to screening colonoscopy found that women had more apprehensions about screening colonoscopies then men. These included fear of pain, disagreeable preparation, concerns about modesty, and fear of perforation.[62] Another focus group study conducted with men and women found notable gender differences in attitudes towards colonoscopy. Women expressed more anxiety about being unclothed and exposed during endoscopic procedures than about the physical discomfort involved. Women also felt that there was more emphasis placed on breast and cervical cancer than colon cancer. Additionally, concerns about menopause were more salient among women who were just reaching screening age.[67]

Other Screenings

Similar to CRC, weight-related screening disparities exist for breast and cervical cancer screening; it is estimated that obese women are between 8 and 69% less likely to adhere to screening guidelines for mammography, pap smears or clinical breast exam.[43-45] These weight-related differences in screening rates were seen for white women, but not

African American or Hispanic women.[43-45] In one study investigating barriers to gynecological screening, over 50% of morbidly obese women reported that they delayed seeking health care because of their weight. Over 70% reported that their weight was a barrier to receiving appropriate health care.[35, 43] In a recent qualitative study examining mammography usage, obese women reported additional barriers to screening, including previous bad experiences, low perceived susceptibility, discomfort, fear, poor treatment, provider gender.[68] In addition to having more screening-specific barriers, obese participants may also have more co-morbidities or acute needs which doctors (or patients) prioritize over cancer screening tests,[69, 70] however number of reported medical conditions has been found to correlate positively with screening compliance.[59]

Healthcare-related Factors

While obese individuals on average, have a higher number of outpatient visits.[71] they may delay preventive care.[72] Reasons cited for delayed care include disrespectful treatment, embarrassment about being overweight, perceived negative attitudes of health care providers concerning their weight, dislike of unsolicited weight loss advice and small gowns and equipment which may not be appropriate for their size. However, not all studies have found that obese women delay care. One study conducted among Europeans found that overweight and obese individuals were more likely to receive flu vaccination, but found no relationship between weight and CRC screening. They did however find lower rates of breast cancer screening and more frequent physical activity consultation by physicians for obese individuals.[73] Another study found that obese patients had a significantly higher mean number of visits to both primary care and specialty care clinics. Even after controlling for health status, depression, age, education, income, and sex, obesity was significantly related to the use of primary care.[74]

Healthcare satisfaction may be related to how often women visit the doctors and whether or not they choose to have screenings. It has been hypothesized that obese individuals have lower satisfaction with their healthcare, but the research does not fully support this theory. Wee et al. found a relationship between obesity and patient satisfaction (for a specific visit), but the relationship was not statistically significant after researcher controlled for health status, which is an important predictor of patient satisfaction.[75] Conversely, another study found that overweight women perceived their healthcare experiences to be significantly more positive than their normal weight counterparts even though there were no reported differences in the amount of time that their physician spent with them.[76] These findings are supported by a larger study, using data from the 2000 Medical Expenditure Panel Survey, which found that BMI was positively associated with patient satisfaction in both men and women age 55 and older; however this finding emerged after adjusting for health status.[77] While obesity may not directly cause decreased patient satisfaction, it is possible that obese women who tend to have more co-morbidities may have lower than average satisfaction with their healthcare.

Previous research indicates that patient-provider communication may also have a significant influence on screening compliance. Focus group and baseline data from the WATCH (Wellness for African American's through Churches) study was used to better understand the relationship between perceived patient-provider communication and completion of CRC screening. WATCH was a CRC prevention intervention study conducted in rural churches in North Carolina. Six focus groups (n = 45) were conducted prior to the baseline survey. Discussions focused on CRC knowledge, and perceived barriers/motivators to CRC screening. A theme that emerged during each groups' discussion about CRC screening was the quality of the participants' communication with their health care provider; this issue was subsequently explored using cross-sectional data from the baseline survey. Among the 397 participants over age 50 who completed the baseline survey, 31% reported CRC screening within the recommended guidelines. Participants who self-rated their communication as good were more likely to have been screened (36%) within the recommended guidelines than were participants with poor communication (17%) (OR = 2.8, 95% CI 1.2, 6.4; p = 0.013).[57] These results support the need to better understand how women and their doctors prioritize health decisions, such as screening. More research is needed to better understand how obese women make decisions about preventive services and how they relate to the health care system in general.

Preliminary Research

Our analysis of data from the WATCH study provided some further characterization of the relationship between weight and screening. We analyzed baseline data of 813 church members who provided information on their height and weight and found that 78% of respondents were classified as overweight or obese. For women age 50 and older, there was no significant association between weight group and screening compliance (p=.09), however, weight was significantly associated with having had any CRC screening test in the past-year (n=278, p=.05). Among normal weight women, 44.8% reported a past year screening compared to only 22.8% of obese I (BMI 30-34.9) and 28.9% of obese II (BMI >35) women. Among men age 50 and older, there was no significant association between weight and having any "on-time" screening ($p=.87$) or having any past-year screening ($n=100$, $p=.99$). Due to limited sample size, we were unable to control for potential confounders.

Total scale scores for perceived barriers ($F(3, 504) = .44$, $p=.72$) and benefits ($F(3, 650) = .25$ $p=.86$) of screening did not significantly differ by weight group. There was however, a significant association ($p= .02$) between weight group and the barrier "colorectal cancer screening tests are too expensive" with 42.9% of Obese II subjects and only 13.6% of normal weight subjects responding "agree a Lot." There was also a significant association ($p= .04$) between weight group and the barrier "My doctor or health care provider has never recommended a colorectal cancer screening test" with 52.9% of Obese II participants vs. 36.4% of normal weight participants responding "agree a Lot."[38] These findings indicate that obese participants may be less likely to get a screening because it costs too much or the doctor did not recommend it. We hypothesized that cost may be especially important to obese individuals who have more co-morbidities and thus competing health care costs. As doctor recommendation is an important predictor of CRC screening, further research is needed to understand how this is contributing to weight-related screening barriers. One study which examined breast cancer screening found that even after controlling for doctor recommendation, obese women still had lower rates of screening.[78, 78] Aim 1 analyses will confirm if this is also the case for CRC screening.

CHAPTER III

INTERVENTION DESIGN

III.A. Screening Behavior Theory

The overall goal of this research is to inform development of a theory-based intervention for increasing CRC prevention behaviors among obese women. While multiple theories have been applied to screening behavior, Health Belief Model (HBM) has been used most frequently. Other popular theories include the transtheoretical model, the theory of planned behavior, social support/social networks and Social Cognitive Theory (SCT). Based on the above review of the literature, several constructs from these theories have surfaced as being most salient to a CRC screening with obese women. They include perceived barriers, perceived benefits, perceived risk/susceptibility, cues to action, patient-provider communication, social support, and self-efficacy. This section highlights the research supporting usage of the chosen theory and conceptual model.

Perceived Susceptibility

Focus group data among obese women cited lower perceived susceptibility as a reason for low uptake of cervical cancer screening.[68] Thus, obese individuals may not be fully aware of how much their weight increases their risk for cancer. Perceived risk is also more strongly associated with CRC screening in women than in men.[60] This may be related to the fact that CRC is often perceived as a man's disease so women may have lower perceived susceptibility to start with.[67]

Perceived Barriers

The literature shows that there are significant barriers to all of the CRC screening tests, possibly even more so than screening tests for breast or cervical cancer. As a whole, women report more barriers related to the unpleasantness of screening tests. Having higher barriers is strongly correlated with low screening rates.[64] Obese individuals report additional barriers to screening over and above typical barriers.[38] These barriers are related to prejudice in the health care system, weight related personal discomfort, lack of appropriate facilities and equipment and higher numbers of co-morbidities.[35, 72] Higher perceived barriers be largely responsible for the lower screening rates seen among obese women. Specifically, we showed that obese individuals were more likely to report cost and lack of physician recommendation as barriers to CRC screening.[38]

Perceived Benefits

Believing that screening leads to early detection of cancer or polyps is correlated with screening usage. However, many individuals still express a great deal of fear over the possibility of finding cancer. Misconceptions about the purpose of CRC screening tests are common among women.[62]

Self-efficacy

Increasing patient self-efficacy to ask for screening is integral to any effective intervention that focuses on individuals or the patient-provider relationship. One intervention study showed that over 50% of women needed activation cards to initiate screening conversations with the doctor. This indicated that women may have difficulty starting the conversation.[79]

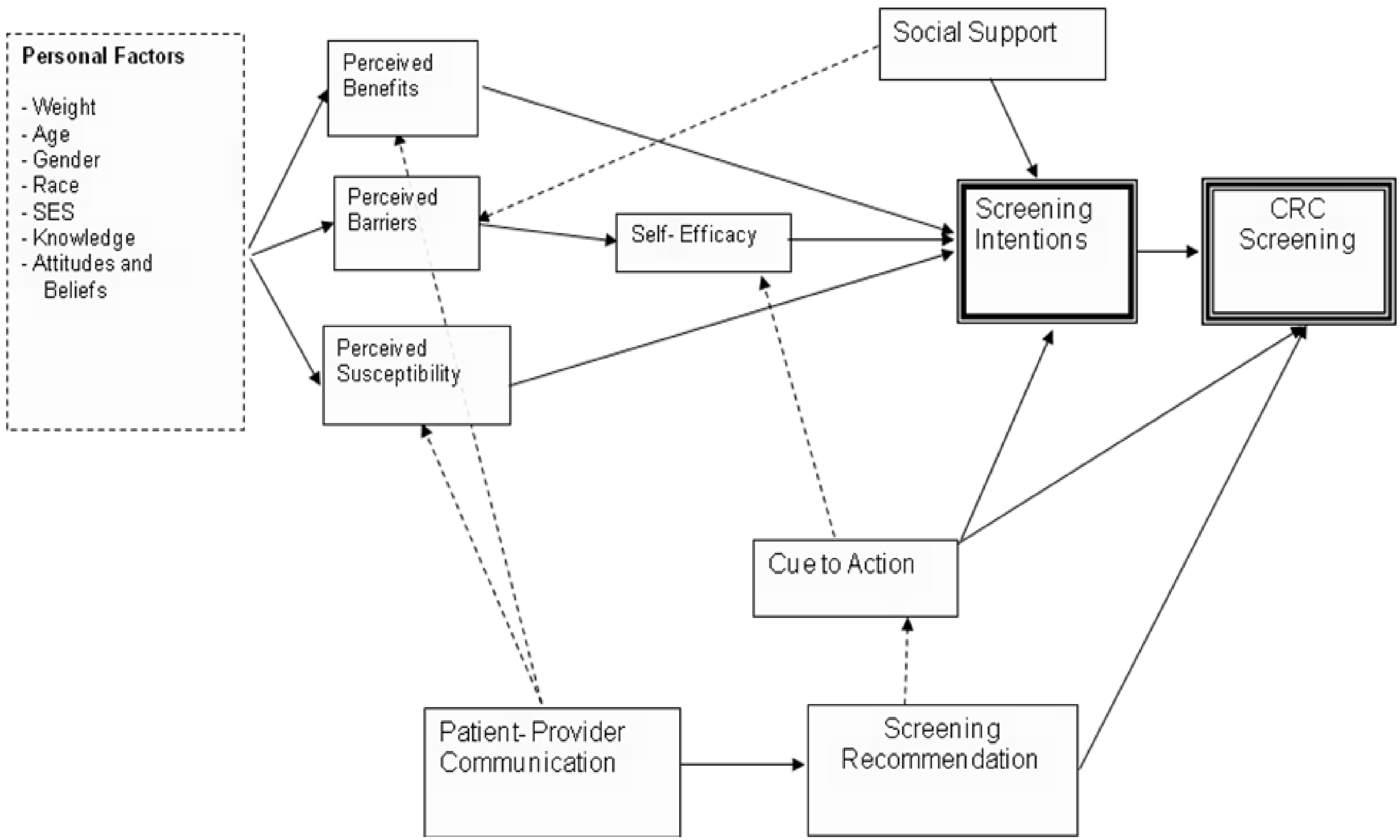
Social Support

Qualitative research among obese women noted the importance of social support from families and friends in encouraging compliance with screening tests.[68] Instrumental support from healthcare providers and staff may also improve compliance with screening recommendations. Obese women often face discrimination within the healthcare system and thus may not receive the same levels of social support for screening.[71]

Cues to Action/Patient-Provider Communication

Doctor recommendation for screening has been shown to one of the most important predictors of screening behavior, but obese individuals may not be receiving recommendations at the same rate as others. Screening recommendation may serve as an important cue to action for –screening which may be enhanced by patient-provider communication. While research has shown that better patient-provider communication is associated with CRC screening, the literature is mixed as to how an individual's weight affects their relationship with health care providers

Figure 3.1. Conceptual Model Guiding Aims 2 and 3



III.B Screening Interventions Methods

While CRC prevention interventions have been effective at increasing screening, to our knowledge there has never been an intervention that specifically targeted obese women. Given their increased risk for CRC and lower rates of CRC prevention behaviors, they are an important group to target. In addition, preliminary research indicates that obese individuals may not be adequately reached by current intervention strategies.

Our research shows that, at least for physical activity, obese individuals may respond differently to CRC prevention interventions than normal or overweight individuals. Analyses of WATCH follow-up data revealed a significant interaction effect ($p=0.02$) of weight group and intervention condition on recreational physical activity (RPA) METS at follow-up, but not for weight or condition alone. Normal and overweight individuals receiving the Lay Health Advisor (LHA) intervention increased RPA more, whereas Obese I and II responded more to the Tailored Print and Video (TPV) intervention. For CRC screening, the intervention-weight group interaction was not significant; only weight remained related to past year screening at follow-up ($n= 266$, $p=0.08$) with obese individuals reporting less CRC screening. Additionally, obese women in the LHA intervention group were less likely than normal or overweight women to report contact with a LHA at their church or to report participation in WATCH activities. This suggests that, at least for physical activity, a tailored intervention may be more effective than a social support intervention for promoting behavior change in obese women.[80] We also found that even after the intervention, weight was still a significant predictor of whether or not a person completed a screening,[80] indicating that current interventions may not be adequate for overcoming weight-related screening disparities. These findings indicate that obese individuals may also have different preferences for how they receive their health information. A different study with African American women found variations in the efficacy of recruitment strategies based on BMI[81] however, this study found that women with higher BMIs were more likely to be recruited through social networks than women with lower BMIs.

Several of the studies have successfully employed tailored messages to increase screening behavior.[82, 83] Tailored communications are formal individual communications in which the content and/or style of the materials have been created based on data specific to the individual and informed by health behavior theory. Theory suggest that tailored communications are more likely to be effective than generic materials because they provide personally relevant information that meets the exact information needs of readers and excludes irrelevant or superfluous facts.[84, 85] It follows that when these needs are more closely met, an individual will be more likely to make desired changes in knowledge, belief, attitude, and to move towards behavior change. However, some studies have shown that well designed targeted materials can be just as effective at changing health behaviors.[86] The proposed research will test the acceptability and utility of targeting health messages to obese women. If weight targeting proves useful, it could justify the use of weight-targeted messages in future intervention studies. While messages for the current study will not be tailored, they will address relevant psychosocial and behavioral factors thought to mediate the relationship between weight and screening and weight and physical activity that are identified through literature reviews, formative research and health behavior theory.

III.C. Message Testing

Best practice for intervention design is to pre-test messages prior to conducting a randomized controlled trial.[86, 87] Since much of the justification for the efficacy of targeted and tailored messages is explained by the elaboration likelihood model (ELM),[88] the message testing process will include ELM measures. The ELM states that an individual with high motivation and ability to process a message will have higher elaboration likelihood, and thus persuasion will occur through a central route. Persuasion which occurs through the central route is thought to be enduring, resistant to change, and predictive of future behavior.[89] Conversely, when an individual has low motivation or ability to process a message they will have low elaboration likelihood and persuasion will occur through a peripheral processing route. In this case the individual is influenced more by message characteristics such as source credibility and likeability. These types of messages are thought to lead to more transitory behavior change. Aim 3 will use the ELM to evaluate behaviorally-based messages which could be used in a future RCT designed to decrease CRC risk among obese women.

III.D. Summary

Interventions are needed to decrease CRC risk among obese individuals. CRC screening has been shown to significantly reduce CRC mortality. Physical activity is also highly correlated with reduced CRC risk. Obese women are the target population because they have some of the lowest rates of both screening and physical activity. In addition, their weight also puts them at increased risk for CRC. Research has shown that weight and physical activity are independent risk factors for CRC. While promoting physical activity among obese women may produce some weight loss, the main focus of the health promotion messages will not be to decrease weight unless formative research indicates that this would be appropriate. Focusing on weight loss may detract from the main goal of this study which is to develop message which can be used in an intervention to reduce disparities in cancer screening and physical activity. If effective, it may be possible to adapt these weight-targeted messages to be used to increase prevention behaviors for other cancers. Weight-related disparities are also seen for breast and cervical cancer screening. If common factors explain why obese women are not up-to-date with screening tests, it may be possible to address correlates of multiple screening behaviors with one intervention.

CHAPTER IV

RACE MODERATES THE RELATIONSHIP BETWEEN OBESITY AND COLORECTAL CANCER SCREENING

IV.A. Abstract

The goal of this study was to determine if the relationship between obesity and usage of colorectal cancer (CRC) screening in women varies when stratifying by race. Using nationally representative data from the 2005 National Health Interview Survey, we examined the relationship between obesity and CRC screening for white and African-American women ages 50 and older. Screening usage variables indicated if a woman was up-to-date for any CRC screening test, colonoscopy, or fecal occult blood test (FOBT). We used multivariable logistic regression models that included interaction terms to determine if race moderates the obesity-screening relationship. We also calculated adjusted up-to-date colonoscopy rates using direct standardization to model covariates. The relationship between obesity and screening differed by race for any CRC screening test ($p= 0.04$ for interaction) and for colonoscopy ($p=0.01$ for interaction), but not for FOBT. Obese white women had a lower adjusted colonoscopy rate (30.2%, 95%CI 25.9-34.8) than non-obese white women (39.1%, 95%CI 36.1-42.2). Obese African-American women, on the other hand, had a higher adjusted colonoscopy rate (41.2%, 95%CI 31.6-51.4) than their non-obese counterparts (35.6%, 95%CI 28.3-43.6). Overall, adjusted colonoscopy rates were lowest among obese white women. In conclusion,

obesity is associated with lower CRC screening rates in white, but not African-American women.

IV.B. Introduction

Among women in the Unites States, colorectal cancer (CRC) accounts for approximately 10% of all cancers diagnosed annually and was responsible for an estimated 25,700 deaths in 2008, making it the third leading cause of cancer mortality.[1] Regular screening for CRC and adenomatous polyps starting at age 50 has the potential to significantly reduce CRC incidence and mortality.[6, 7] Despite their proven effectiveness, utilization of CRC screening tests remains sub-optimal, especially when compared with screening for other cancers, like breast or cervical cancer.[23-25] Among women under age 65, over 85% are up-to-date with cervical cancer screening recommendations and over 58% with breast cancer screening,[10] but only 47.4% are meeting the CRC screening recommendations.[28] Many barriers to CRC screening have been identified, including lack of physician recommendation for screening,[56] lack of knowledge about testing options and intervals,[58] and embarrassment about the testing procedure.[67]

In addition, some research indicates that obesity may be a barrier to CRC screening in women.[26, 34, 38, 39] Obesity is a prevalent condition in the United States, particularly among older women; it is estimated that more than 31% of women in the United States over age 60 are obese.[5] There is a wide body of research showing a positive relationship between body mass index (BMI) and both colon cancer incidence and mortality. One study found that morbidly obese women (BMI$\geq$ 40) were 49% more likely to get colon cancer than normal weight women.[90] It is also estimated that obese women (BMI $\geq$ 30) have a 40-85% greater chance of dying from colon cancer than normal weight individuals (BMI < 25).[2] Because obese women are at high risk for colon cancer, failure to screen for CRC in this population could result in substantial morbidity and mortality.

In order to decrease CRC risk among obese women it is important to understand if their weight is a barrier to receiving a screening that could potentially prevent them from ever getting colorectal cancer. Several studies have investigated the relationship between CRC screening and bodyweight, but the results have been mixed.[91] Two studies which used data from the Behavioral Risk Factor Surveillance Survey (BRFSS) showed that as weight increased the likelihood that an individual was adherent to CRC screening recommendations decreased for women, but not for men.[26, 34] A medical record review of 22 medical practices found that both obese men and women had significantly lower rates of screening than their non-obese counterparts.[39] Research on the Cancer Prevention II Nutrition Cohort, a predominately white (97%) study population, found that, compared to normal weight women, overweight, obese, and morbidly obese women were all significantly less likely to have had a flexible sigmoidoscopy or colonoscopy.[92,93] However, three other studies have concluded that there was no statistically significant relationship between screening and weight.[40-42] With the exception of Nutrition Cohort Study, the above-mentioned studies included a similar proportion of African Americans as is found in the U.S. population (range 9-21%). Despite this none of them stratified by race and gender, which could explain the mixed results. Studies on screening usage for other cancer types suggest that stratifying by race and gender may be important. For example, there is reasonable evidence to suggest that obesity is associated with lower breast and cervical cancer screening rates in white women, but not for other races/ethnic groups.[43-45] A similar pattern may also exist for women with regards to colorectal cancer screening.

The goal of this study is to determine whether or not race moderates the relationship between CRC screening and obesity in women. We hypothesize that, as was shown for breast and cervical cancer screening, there may be a previously unrecognized interaction between obesity and race that affects CRC screening rates. If this interaction exists, it could explain why previous research examining the relationship between CRC screening and obesity in women has been inconsistent.

IV.C. Methods

Study Sample

This analysis uses nationally representative data from the 2005 National Health Interview Survey (NHIS), which has one of the most comprehensive screening questionnaires of any national survey.[94] NHIS is a multi-purpose health survey conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics and is the principal source of information on the health of the civilian, non-institutionalized, household population of the United States. The survey collects a variety of health related information including socio-demographic characteristics, basic indicators of health status, health insurance coverage, access to and utilization of health care services, medical conditions and history, and health behaviors.

Detailed information on survey and sampling methods for NHIS can be found elsewhere.[94] Briefly, NHIS uses a multistage sample design and one adult per family is randomly selected for an in-person interview by Census interviewers. In 2005, the interviewed sample included 31,428 persons 18 years of age and older. The final response rate for adults was 69.0%,[95] which is comparable to other national surveys. For this analysis, individuals were excluded if they were under age 50, reported a race other than white/Caucasian or black/African-American, or if they had missing information on weight, colorectal cancer screening, or any relevant covariates.

Measures

Colorectal Cancer Screening. The primary dependent variable for this analysis was a dichotomous variable *any CRC Screening* indicating whether or not a respondent reported being up-to-date with CRC screening. We classified an individual as being up-to-date with CRC screening if he or she reported having a Fecal Occult Blood Test (FOBT) within the year prior to the interview, flexible sigmoidoscopy (flex sig) within the past 5 years, or colonoscopy within the past 10 years. In addition to the primary screening variable, we looked separately at whether a respondent reported being up-to-date for each of the following individual screening modalities: colonoscopy, any endoscopy (flex sig or colonoscopy) and FOBT. For example, for the colonoscopy outcome, we only looked at whether or not an individual reported having a colonoscopy in the past 10 years and did not include any other screening modalities.

The screening variables were created based upon responses to the following survey questions about CRC screening test completion 1.) *"The following questions are about the blood stool or occult blood test, a test to determine whether you have blood in your stool or bowel movement. The blood stool test can be done at home using a kit. You smear a small amount of stool on cards at home and send the cards back to the doctor or lab. Have you EVER HAD a blood stool test, using a HOME test kit?"* 2.) "*Have you EVER HAD a sigmoidoscopy, colonoscopy, or proctoscopy? These are exams in which a* *health care professional inserts a tube into the rectum to look for signs of cancer or other problems*." For participants who answered yes to one or both of these questions, follow-up questions ascertained exactly which test the respondent had and the approximate date of their last test. Data on a particular test was coded as missing if the individual answered "*don't know*" or refused the question. If data on either endoscopy or FOBT was missing for a respondent, then the data was coded as missing for primary CRC screening variable. Screening data were available for 86% of female respondents age 50 and older.

Data were only collected for the respondent's most recent endoscopic test (colonoscopy or flexible sigmoidoscopy) and her most recent FOBT. For these tests, respondents were asked if the test was "*part of a routine exam*," "*because of a problem*," or for an "*other reason*." We completed analyses both including and excluding tests that were not reported to be part of a routine examine (i.e., diagnostic vs. screening). Although screening rates across the board were slightly higher when diagnostic tests were included, the trends remained the same. For the results presented in this paper, diagnostic tests are included in the screening rate estimates since a test administered for diagnostic purposes still "counts" towards whether or not an individual is considered up-to-date with CRC screening guidelines.

Obesity. The primary independent variable for this analysis was the dichotomous variable obesity status (i.e., obese vs. non-obese). We calculated each respondent's BMI as weight in kilograms divided by height in meters squared based on responses to self-reported questions on height and weight. For the dichotomous obesity status variable we classified individuals as either obese (BMI $\geq$30) or non-obese (BMI 18.5-29.9). Because it was not clear whether the relationship between BMI and CRC screening would exhibit a threshold or graded pattern, we also examined results for trends using a BMI group variable. For the BMI group variable, individuals were classified as underweight (BMI < 18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9), obese I (BMI 30.0–34.9), obese II (BMI 35.0- 59.9) or obese III (BMI ≥ 40).

Race/Ethnicity: The original NHIS race variable included 6 possible categories: White only, Black/African-American, American Indian/Alaskan Native, Asian only, race group not releasable, and multiple races. We converted race to a dichotomous variable, using only the first two racial groups (White and African-American); all other categories were excluded from the analysis. These two racial sub-groups were examined because they have the highest CRC incidence rates of any racial sub-group.[96] We coded ethnicity as a dichotomous variable (Hispanic vs. Non-Hispanic) based on participants' responses to the question *"[Do you] consider [yourself] Hispanic/Latino?"* Since there were no differences in the proportions of Hispanics in each of the race and obesity categories, we did not stratify analyses by ethnicity. Additionally, separate analyses completed excluding Hispanics showed similar trends, thus we retained them in the final analyses.

Other Covariates. Several potential demographic, behavioral, and healthcare-related confounders were included in the analyses because previous literature indicated that they might be associated with CRC screening. Sociodemographic variables examined included age, education, and marital status. Due to the high percentage of missing data for personal income (64%), NHIS created an imputed income variable using a variety of sociodemographic indicators.[97] The original imputed income variable had 11 categories, however for this analysis we collapsed it into 4 categories ($0-$24,999,

$25,000-$54,999, $55,000-74,999, and $75,000 and up). Behavioral variables included smoking status (daily smoker, occasional smoker, former smoker or never a smoker), alcohol usage (never, former drinker, light drinker, or moderate/ heavy drinker) and recreational physical activity. Physical activity was expressed as MET (metabolic equivalents) minutes per week. This figure was calculated as (3 METs x moderate/light minutes/week) + (7 METS x vigorous minutes/week). Recreational activity was then categorized as no activity/unable to exercise (0 METS), some activity (1-<675 MET minutes/week) or meets/exceeds the surgeon general's recommendation (≥ 675 MET minutes/week).[98] We coded both reported physician recommendation for screening (either FOBT or any endoscopic test) and insurance coverage as dichotomous (yes/no) variables. Number of visits to a health care provider was ascertained using the question "*During the past 12 months, how many times have you seen a doctor or other health care professional about your own health at a doctor's office, clinic or some other place? Do not include times that you were hospitalized overnight, visits to hospital emergency rooms, home visits, dental visits or telephone calls.*" A past-year visits variable was then created using the following categories: 0, 1, 2-3, 4-5, 6 or more. Participants were also asked about co-morbidities: "*Have you EVER been told by a doctor or other health professional that you had [condition]?*" We used a sum of all yes answers for the following conditions to determine the number of co-morbidities: hypertension, myocardial infarction, coronary heart disease, other heart disease, emphysema, stroke, asthma, any kind of cancer, ulcer, diabetes or arthritis. Number of co-morbidities was then categorized as 0, 1, 2-3, 4-5 and 6 or more.

Statistical Analyses

All analyses were conducted using SAS v9.1.3 to account for the multistage sampling structure used by NHIS (Procedures: SURVEYFREQ, SURVEYMEAN, SURVEYLOGISTIC). We limited all analyses to women age 50 and older, since this is the age at which screening is first recommended for normal risk individuals. Additionally, we used NHIS sampling weights for all analyses to create U.S. population estimates. We used Rao-Scott chi-square[99] to test for relationships between any CRC screening (up-to-date or not) and each of the covariates for both races and then separately for white and African-American women. Rao-Scott chi-square tests were also used to examine the relationship between obesity status (obese vs. non-obese) and all covariates.

All covariates found to be associated ($p<0.1$) with either screening or obesity status were entered into a multivariable logistic regression model with screening as the dependent variable. We created four separate regression models for each of the screening variables (Any CRC screening, colonoscopy, endoscopy and FOBT) to test the significance of the interaction term (obesity status X race) while controlling for possible confounders. A step-wise elimination procedure was used to create a logistic regression model of the relationship between each screening outcome variable and the interaction term while holding the race and obesity status variables constant in the model. We eliminated potential confounders if they had a p-value > 0.1 and did not change the estimate of the interaction term by more than 10%. The regression model was also run using the BMI group variable, and results were found to be similar; thus for simplicity further analyses were performed using the obesity variable.

We calculated adjusted odds ratios of the relationship between obesity and colonoscopy, stratified by race, using multivariable logistic regression to control for confounders. Both unadjusted and adjusted screening rates, including 95% confidence intervals, are reported for selected sub-groups. Adjusted colonoscopy rates for each weight and race group were calculated by direct standardization to the demographic characteristics of the study population using the coefficients from the multivariable model.[100]

IV.D. Results

Descriptive Statistics

Since NHIS is designed to be nationally representative, demographic characteristics of this population should reflect those of White and African-American women age 50 and older in the United States (Table 4.1). The average age of this population is 64.5 (95%CI 64.2-64.8) and the mean BMI is 32.0 (95%CI 31.5-32.5). Overall, 28.3% (95%CI 27.1- 29.6) of women were obese and 51.7% (95%CI 50.1-52.9) were up-to-date with any CRC screening. Obesity was more prevalent in African-American women than in white women (33.0% vs. 24.9%, $p<0.0001$). All measures capturing screening rates were significantly higher for white women (Table 1). Using combined data from all women, a statistically significant non-linear relationship was seen between the primary CRC screening variable and the following variables: age, marital status, alcohol usage, and smoking status (Table 4.2). Women ages 70-79, married women, light drinkers and former smokers had the highest screening rates in their respective categories. There was also significant positive association between screening and the following variables: reported physician recommendation for screening, past-year healthcare visits, number of co-morbidities and recreational physical activity. We did not find any differences in reported rate of physician recommendation for screening between obese and non-obese women overall or when stratifying by race (data not shown). Additionally, there were no statistically significant differences in CRC screening rates between insured and uninsured women (50.8% vs. 51.8%, p=0.6).

Unadjusted Screening Rates

Unadjusted screening rates, stratified by obesity status and race, are shown in Table 4.3. When white and African-American women were combined, there was little overall difference in the proportion of women up-to-date with any CRC screening by obesity status. We did identify a difference in the percent of obese women who were up-to-date for colonoscopy (p=0.02), compared with the percent of non-obese individuals who were up-to-date. Colonoscopy rates for obese women were 3.9 percentage points lower than those for non-obese women (95%CI 0.7, 7.2). In the unadjusted analysis, the relationship between obesity status and CRC screening differed according to race, but again only for the colonoscopy variable. Among whites, obese women were less likely to be up-to-date for colonoscopy compared with non-obese women (40.3% vs. 44.7%, p=0.01). Conversely, among African-American women, there was no statistically significant relationship between obesity and colonoscopy usage (35.3% for non-obese women vs. 38.1% for obese women, p=0.51).

Obesity-Race Interaction

Multivariable logistic regression models indicated that race moderates the relationship between up-to-date CRC screening and obesity for all screening tests except FOBT alone. There was a statistically significant association (p = 0.04) between the interaction term (obesity status X race) and the primary CRC screening variable (any up-to-date screening) when controlling for reported physician recommendation, past-year medical visits, number of co-morbidities, education, smoking status, physical activity, and age. The interaction term was also significant in the models which had up-to-date colonoscopy (p=0.01) and up-to-date endoscopy (p=0.02) as their dependent variables. When past-year FOBT was used as an outcome variable, neither race, obesity, nor the interaction term were found to be significantly related to screening, after controlling for potential confounders.

Race-Stratified Regression Analyses

Multivariable logistic regression models were created to look at the relationship between colonoscopy usage and the selected covariates in white and African-American women separately (Table 4.4). The models were similar for the three screening outcomes which were associated with the interaction term (any CRC screening, colonoscopy, and endoscopy); however only race-stratified adjusted odds ratios for up-to-date colonoscopy are reported since this is the screening test with usage most strongly associated with obesity status. Even after controlling for potential confounders, obesity was still significantly related to colonoscopy usage in white women (p=0.001). Among white women, the odds of being up-to-date for colonoscopy was 33% lower for obese women compared to non-obese women (OR=0.67, 95%CI 0.53-0.86). There was a non-significant trend among African-American women indicating that obesity actually increased the odds that a woman was up-to-date with a colonoscopy.

Physician recommendation for screening was the most significant predictor of colonoscopy for both races. White women who reported receiving a recommendation for screening from their physician had a much higher odds of having an up-to-date colonoscopy than those who did not receive a recommendation (OR=59.72, 95%CI 47.10-75.72). The association was even greater for African-American women (OR=145.58, 95%CI 75.69-283.86). Among whites, having an up-to-date colonoscopy was also significantly ($p<0.05$) associated with older age, a greater number of co-morbidities, and a greater number of medical visits. Among African-American women, colonoscopy was significantly associated with a higher number of past-year medical visits ($p=0.01$).

Adjusted colonoscopy rates were created to examine differences between obese and non-obese white and African-American women after accounting for possible confounders included in the regression model for up-to-date colonoscopy (Figure 4.1). Obese white women had an adjusted colonoscopy rate of 30.2% (95%CI 25.9-34.8) which was significantly lower than the 39.1% (95%CI 36.1-42.2) colonoscopy rate seen in non-obese white women ($p=0.001$). Obese African-American women, on the other hand, had a higher adjusted colonoscopy rate (41.2%, 95%CI 31.6-51.4) than their non-obese counterparts (35.6%, 95%CI 28.3-43.6), but these differences were not statistically significant ($p=0.16$). Overall, adjusted colonoscopy rates were lowest among obese white women.

IV.E. Discussion

Our analysis found that race moderates the relationship between obesity and colon cancer screening usage. Among white women, being obese reduced the chances that a woman was up-to-date with CRC screening. The opposite, however, was true for African-American women, for whom obesity was associated with higher screening rates.

This screening disparity appears to be driven by the lower rates of colonoscopy seen among obese white women since the interaction between obesity and race affected whether or not a woman was up-to-date for any type of screening test and colonoscopy or flexible sigmoidoscopy, but was not related to past-year FOBT usage. Similar to past research on screening correlates, reported physician recommendation had the largest affect on reported screening rates, however obesity was still related to screening even after controlling for reported recommendation and other factors. The relationship between CRC screening and health insurance has been inconsistent across studies.[101] In this analysis, whether or not a woman reported having health insurance was not related to being up-to-date with CRC screening.

Previous studies which have examined the relationship between screening and weight have shown mixed results. Three of these studies were limited to a specific geographic area and/or did not include high numbers of African Americans.[39, 40, 92] Even studies which used more nationally representative data from BRFSS, were not able to differentiate between colonoscopy and flexible sigmoidoscopy, which have different screening timeframes and thus were not accurately able to classify women as up-to-date for colonoscopy or not.[26, 34, 102] One advantage of using data from NHIS is that it is sampled and weighted to be representative of the U.S. population. It also has one of the most comprehensive screening questionnaires of any nationally representative survey. Unlike BRFSS and other surveys, NHIS is able to differentiate between flexible sigmoidoscopy and colonoscopy. Additionally, NHIS is interviewer administered and allows respondents to answer in multiple formats to indicate when they had their last screening, which improves data accuracy. NHIS also included questions about many covariates including doctor recommendation for screening.

Only two previous studies have looked at the relationship between weight and screening using NHIS data, both of these used data from 2000. While both studies controlled for relevant confounders, they did not stratify their results by gender or race. Seeff et al. found no differences between normal, overweight or obese individuals for rates of past year-FOBT or endoscopy in the previous 10 years. A study by Wee et al. found a statistically significant relationship between screening and BMI, similar to our results, but this relationship was attenuated in the adjusted model. The present study improved upon previous research on CRC screening and weight by using a comprehensive nationally representative data set, examining each recommended screening modality within its recommended time frame, and stratifying results by race and gender. The literature on how weight affects breast and cervical cancer screening rates in women indicate that stratifying by race is appropriate and necessary. Similar to our findings with colonoscopy, previous research has shown that obese white women have lower rates of mammography and pap smears than non-obese white women, but there was no relationship between these screening tests and obesity in African American women.[43-45]

Despites its many advantages, using NHIS data did present a few limitations. First, because it is meant to be representative of the U.S. population, it has much smaller number of African-Americans and other minority groups compared to whites. Small numbers in the African-American group limit the power of the analysis as compared to that done with white women. Another limitation of NHIS is that it does not include questions on Barium Enema, a recommended screening test, so some women who have had this test may be improperly classified. We do not believe this will appreciably affect the data since barium enema has steeply declined over the last decade and is now rarely used to screen for colon cancer; approximately 0.05 % of the Medicare population received a barium enema in 2005.[103]

Future research is needed to better understand why obese white women are less likely to get screened than their non-obese counterparts. Findings from the breast and cervical cancer screening literature provide some insights. In one study investigating barriers to gynecological screening, more than half of morbidly obese women reported that they delayed seeking health care because of their weight and over 70% reported that their weight was a barrier to receiving appropriate health care.[35, 43] In a recent qualitative study examining mammography usage, obese women reported additional barriers to screening, including previous bad experiences, discomfort, fear, poor treatment by providers, and low perceived susceptibility to cancer. They also stated that having a female doctor would increase their likelihood of having a screening.[1] It has been suggested that obese individuals may have lower screening rates because they have more co-morbidities or acute needs which may be prioritized over cancer screening tests.[69, 70] Conversely, our data supports previous studies which have actually shown a positive relationship between screening and number of reported medical conditions.[59] Nevertheless, these theories do not fully explain why weight-related screening disparities may differ by race.

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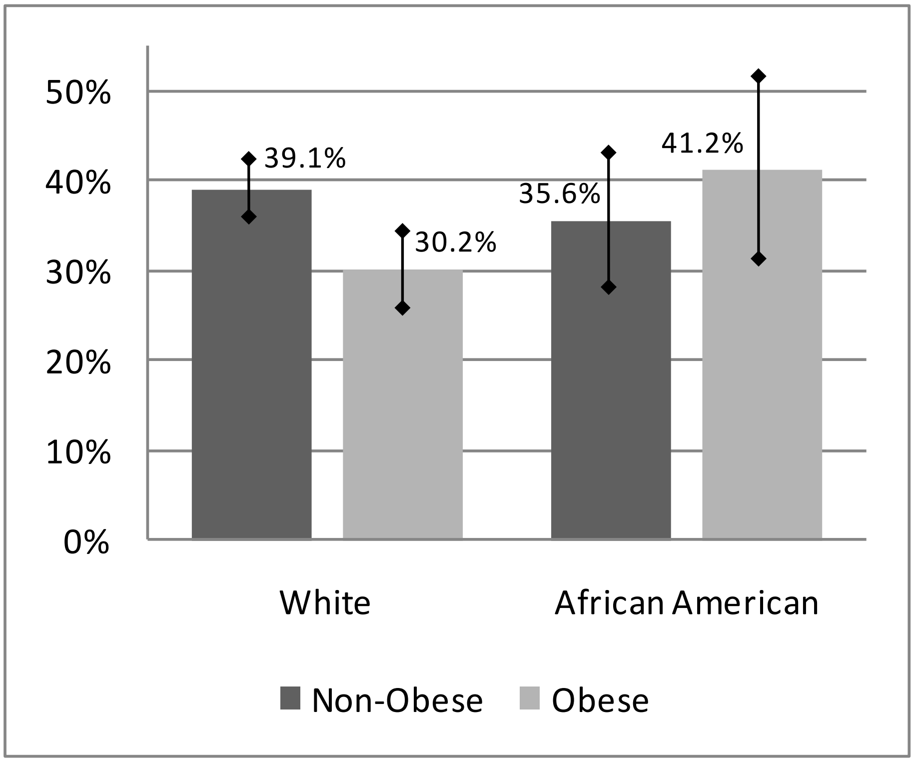
[1] Personal communication with Jeanne Ferrante (New Jersey-Robert Wood Johnson Medical School) regarding unpublished focus group data.

It is possible that racial differences in screening are related to differences in body image and body esteem. Previous research has indicated that obese women may delay preventive care because they are embarrassed or fear disrespectful treatment because of their weight.[72] Many obese women also are deterred from going to the doctor because they do not want to receive unsolicited weight loss advice and they are made uncomfortable by small gowns and equipment which may not be appropriate for their size. These issues may be particularly salient for women who have poor body image or body esteem. This could explain why obese African-American women, who tend to be more accepting of a larger body size than their white counterparts,[104] do not have lower screening rates than non-obese African-American women.

Body image-related issues may also explain why obesity appeared to affect rates of endoscopic tests, particularly colonoscopy, but not of FOBTs. The invasive nature of the colonoscopy and the fact that it must be performed in a clinical setting (as opposed to at home which is the case with FOBT), may explain why screening rates are lower for obese women, but not men. One focus group study found that men and women had similar views about FOBT testing, but noted gender differences in attitudes towards colonoscopy.[67] Women expressed more anxiety about being unclothed and exposed during endoscopic procedures. These feelings could be enhanced in higher weight women, especially if they have poor body image.

While the present study provides further evidence that obesity affects screening behavior in women, especially for more invasive tests like colonoscopy, it is still unclear why these disparities exist. Qualitative research is needed to better understand how weight affects a woman's decision to get a cancer screening. Once the source of weight-related screening disparities are better understood, we can improve screening promotion and education to better meet the needs of women with the lowest screening rates.

Figure 4.1 Race Stratified Adjusted* Colonoscopy Rates for Women Age 50 and Older by Obesity Status.



*Adjusted colonoscopy rates for each weight and race group were calculated by direct standardization to the demographic characteristics of the study population using the coefficients from the multivariable model.[100]

Table 4.1 Characteristics of White and African-American Women Age 50 and Older in the U.S.

	White and African-American (n=7,469)	**White Only** (n=6,459)	**African-American Only** (n=1,010)	**P-value***
Screening				
Up-to-date for Any CRC Screening	51.7%	52.5%	44.8%	0.0004
Up-to-date Colonoscopy	42.3%	43.0%	36.1%	0.002
Up-to-date Endoscopy	45.3%	46.0%	39.2%	0.002
Up-to-date FOBT	15.4%	15.7%	12.7%	0.046
Hispanic/Latino Origin	23.9%	23.8%	25.4%	0.34
Age				
50-59	40.9%	40.3%	46.4%	
60-69	26.9%	26.9%	26.9%	
70-79	19.2%	19.4%	17.5%	
80+	13.0%	13.5%	9.2%	0.001
BMI Group				
Underweight	2.1%	2.3%	1.1%	
Normal Weight	37.3%	39.1%	21.7%	
Overweight	32.8%	32.3%	37.4%	
Obese I	16.6%	16.1%	21.0%	
Obese II	6.7%	6.3%	10.1%	
Obese III	4.4%	3.9%	8.6%	<0.0001
Marital Status				
Married/Living w/Partner	56.4%	59.0%	34.0%	
Divorced/Separated	15.3%	13.9%	26.8%	
Never Married	4.7%	3.9%	10.9%	
Widowed	23.7%	23.1%	28.2%	<0.0001
Education				
Less than High School	37.4%	36.9%	38.5%	
High School/ GED	22.2%	22.5%	20.1%	
Some College/ Associates	22.2%	22.1%	22.8%	
College Degree	12.8%	12.7%	13.9%	
Graduate/ Professional	5.7%	5.8%	4.7%	0.46
Personal Income				
$0-$24,999	46.5%	46.7%	44.4%	
$25,000-$54,999	33.9%	33.5%	37.3%	
$55,000-$74,999	9.2%	9.0%	10.1%	
$75,000 and up	10.4%	10.7%	8.1%	0.26
Health Insurance Coverage	83.7%	83.6%	84.5%	0.52
Past Year Medical Visits				
0	7.9%	7.8%	8.0%	
1	11.6%	11.8%	10.1%	
2-3	24.8%	24.7%	25.2%	
4-5	18.4%	18.2%	19.9%	
6 or more	37.4%	37.5%	36.7%	0.62
Physician CRC Screening Recommendation	56.4%	58.6%	50.4%	0.0002
Self- Reported Health Status				
Excellent	33.9%	33.9%	33.7%	
Very Good	29.3%	29.4%	28.7%	
Good	26.3%	26.3%	26.6%	

Fair	7.6%	7.6%	7.5%	
Poor	2.9%	2.8%	3.4%	0.93
Co-Morbidities				
0	21.9%	22.4%	17.4%	
1	27.3%	27.6%	24.7%	
2-3	36.1%	35.5%	40.6%	
4-5	11.6%	11.4%	13.8%	
6 or more	3.1%	3.0%	3.6%	0.002
Alcohol usage				
Never	32.2%	30.8%	44.1%	
Former	20.0%	19.2%	26.5%	
Light	36.6%	37.9%	25.7%	
Moderate/ Heavy	11.3%	12.1%	4.0%	<0.0001
Smoking Status				
Daily	11.4%	11.3%	12.5%	
Occasional	2.2%	2.1%	3.8%	
Former	26.5%	27.1%	21.8%	
Never	59.8%	59.5%	61.9%	<0.0001
Recreational Physical Activity (MET minutes/week)				
None/Unable to exercise	47.5%	45.6%	63.6%	
<675	30.0%	30.7%	24.8%	
>675	22.5%	23.7%	11.7%	<0.0001

* P-value calculated using Rao-Scott Chi-Square test of the relationship between race and the selected variable

Table 4.2 CRC Screening Rates for White and African-American Women Age 50 and Older: Percent Up-to-date for Screening by Selected Demographic and Health Characteristics.

	White and African-American (n=6,412)	**White** (n=5,566)	**African-American** (n=846)
Ethnicity			
Hispanic	52.4%	52.9%	44.7%
Non-Hispanic	51.5%	52.1%	44.5%
	p=0.58	*p=0.66*	*p=0.96*
Age			
50-59	42.5%	43.0%	37.7%
60-69	58.2%	58.2%	56.1%
70-79	60.4%	61.3%	49.8%
80+	55.7%	56.6%	39.7%
	P<0.0001	*p<0.0001*	*p=0.0009*
BMI Group			
Underweight	50.5%	52.4%	18.8%
Normal Weight	51.9%	52.8%	37.5%
Overweight	54.0%	54.8%	48.0%
Obese I	50.4%	50.7%	48.3%
Obese II	52.5%	53.6%	45.9%
Obese III	48.7%	49.2%	46.8%
	p=0.52	*p=0.54*	*p=0.27*
Marital Status			
Married/Living with Partner	52.9%	53.3%	46.9%
Divorced/Separated	48.6%	48.6%	48.8%
Never Married	44.4%	47.4%	35.8%
Widowed	52.4%	53.9%	42.1%
	p=0.01	*p=0.04*	*p=0.23*
Education			
Less than High School	51.7%	52.6%	44.3%
High School/ GED	49.1%	50.0%	40.1%
Some College/ Associates	52.5%	52.7%	50.6%
College Degree	55.8%	58.0%	39.6%
Graduate/ Professional	46.6%	45.9%	53.3%
	p=0.06	*p=0.02*	*p=0.37*
Personal Income			
$0-$24,999	49.3%	49.8%	45.1%
$25,000-$54,999	51.2%	52.3%	42.3%
$55,000-$74,999	54.4%	54.1%	56.4%
$75,000 and up	56.1%	56.9%	45.5%
	p=0.20	*p=0.22*	*p=0.61*
Health Insurance			
Covered	50.8%	51.7%	43.0%
Not Covered	51.8%	52.7%	44.5%
	p=0.60	*p=0.62*	*P=0.78*
Past Year Medical Visits			
0	18.0%	18.1%	17.5%
1	39.3%	40.5%	27.2%
2-3	49.7%	51.1%	37.2%
4-5	58.0%	59.6%	46.7%
6 or more	61.4%	61.4%	61.2%
	p<0.0001	*p<0.0001*	*p<0.0001*

Physician CRC Screening Recommendation *No* *Yes*	 12.5% 87.5% *p<0.0001*	 12.9% 86.2% *p<0.0001*	 9.2 % 85.8 % *p<0.0001*
Self- Reported Health Status *Excellent* *Very Good* *Good* *Fair* *Poor*	 51.9% 52.0% 51.0% 49.8% 59.2% *p=0.42*	 52.7% 52.6% 51.9% 51.2% 59.3% *p=0.63*	 44.7% 47.2% 42.9% 38.1% 58.7% *P=0.55*
Co-Morbidities *0* *1* *2-3* *4-5* *6 or more*	 36.9% 50.6% 57.3% 62.3% 58.1% *p<0.0001*	 37.4% 52.0% 58.3% 63.1% 59.1% *p<0.0001*	 31.3% 36.5% 49.5% 56.4% 50.4% p=*0.002*
Alcohol usage *Never* *Former* *Light* *Moderate/ Heavy*	 44.9% 52.4% 56.1% 55.2% *p<0.0001*	 46.5% 52.3% 56.4% 55.4% *p<0.0001*	 35.4% 52.8% 52.2% 49.8% *p=0.0004*
Smoking Status *Daily* *Occasional* *Former* *Never*	 36.3% 43.7% 59.0% 51.8% *p<0.0001*	 36.0% 49.1% 59.1% 52.8 *p<0.0001*	 38.1% 18.7% 57.4% 43.2% *P=0.004*
Recreational Physical Activity (MET minutes/week) *None/Unable to exercise* *<675* *>675*	 44.3% 57.9% 58.8% *p<0.0001*	 45.3% 58.3% 58.5% *p<0.0001*	 38.4% 53.8% 64.1% *p<0.0001*

Table 4.3 Race Stratified Unadjusted CRC Screening Rates for Women Age 50 and Older by Obesity Status.

	White and African-American Women		**White Women**		**African-American Women**	
	Non-Obese	*Obese*	*Non-Obese*	*Obese*	*Non-Obese*	*Obese*
Up-to-date for Any CRC Screening, % (95% CI)	**52.9** (51.1-54.6)	**50.6** (47.9-53.3)	**53.7** (51.8-55.5)	**51.2** (48.1-54.2)	**44.1** (38.6-49.5)	**47.4** (41.1-53.7)
	p=0.17		*p=0.16*		*p=0.44*	
Up-to-date Colonoscopy, % (95% CI)	**43.9** (42.1-45.7)	**40.0** (37.3-42.7)	**44.7** (42.8-46.5)	**40.3** (37.3-43.2)	**35.3** (29.8-40.9)	**38.1** (31.9-44.3)
	p=0.02		*p=0.01*		*p=0.51*	
Up-to-date Endoscopy, % (95% CI)	**46.7** (45.0-48.5)	**43.6** (40.9-46.3)	**47.5** (45.6-49.3)	**44.0** (41.0-47.0)	**38.8** (33.4-44.3)	**41.0** (34.8-47.2)
	p=0.06		*p=0.06*		*p=0.61*	
Up-to-date Fecal Occult Blood Test, % (95% CI)	**15.2** (14.0-16.4)	**15.9** (14.0-17.8)	**15.4** (14.2-16.7)	**16.5** (14.4-18.7)	**12.5** (9.2-15.8)	**12.4** (8.4-16.4)
	p=0.53		*p=0.39*		*p=0.96*	

Note: Non-obese = BMI 18.5-29.9, Obese = BMI 30+

Table 4.4 Adjusted Odds Ratios for Up-to-date Colonoscopy.

	White (*n=4,430*)		*African-American* (*n=690*)	
Predictor Variable	**Odds Ratio (95%CI)**	**P-Value***	**Odds Ratio (95%CI)**	**P-Value ***
Obesity				
Non-Obese	1.00		1.00	
Obese	0.66 (0.50-0.85)	0.001	1.30 (0.83-2.96)	0.16
Age				
50-60	1.00		1.00	
60-70	2.00 (1.51-2.65)		1.97 (0.90-4.30)	
70-80	2.84 (1.80-3.53)		2.52 (0.95-6.72)	
80+	2.52 (1.80-3.53)	<0.0001	2.39 (0.91-6.29)	0.08
Physician CRC Screening Recommendation				
No	1.00		1.00	
Yes	59.72 (47.10-75.72)	<0.0001	145.58 (75.69-283.86)	<0.001
Past Year Medical Visits				
0	1.00		1.00	
1	1.01 (0.57-1.78)		1.60 (0.45-5.69)	
2-3	1.20 (0.71-2.04)		1.28 (0.11-3.97)	
4-5	1.82 (1.05-3.17)		4.73 (1.40-15.96)	
6 or more	1.92 (1.12-3.30)	0.001	4.37 (1.29-14.80)	0.01
Co-Morbidities				
0	1.00		1.00	
1	1.00 (0.71-1.40)		0.51 (0.20-1.28)	
2-3	1.31 (0.91-1.88)		0.56 (0.22-1.41)	
4-5	1.29 (0.82-2.04)		0.52 (0.19-1.44)	
6 or more	2.26 (1.23-4.16)	0.03	0.89 (0.27-2.95)	0.50
Education				
Less than High School	1.00		1.00	
High School/ GED	0.92 (0.70-1.21)		0.40 (0.16-0.95)	
Some College/Associates	1.21 (0.90-1.63)		0.97 (0.40-2.30)	
College Degree	1.49 (1.06-2.08)		1.03 (0.42-2.56)	
Graduate/ Professional	0.82 (0.48-1.40)	0.05	1.34 (0.59-5.32)	0.23
Recreational Physical Activity				
None/Unable to exercise				
<675	1.00		1.00	
>675	1.26 (0.97-1.63)		2.41 (1.12-5.17)	
	1.35 (1.02-1.78)	0.06	1.77 (0.59-5.32)	0.06

* P-value based on Wald Chi-Square test

CHAPTER V

INCREASING COLORECTAL CANCER SCREENING AMONG OBESE WOMEN

V.A. Abstract

Obese women are at higher risk for colorectal (CRC) cancer, but are less likely to engage in preventive screening. We conducted 7 focus groups with obese (BMI≥30) white and African American women age 50 and older who were not currently adherent to CRC screening guidelines (N=31). Topics discussed included perceived benefits and barriers to screening, patient-provider communication, healthcare decision making, and preferred sources of health information. Overall, knowledge about CRC and understanding of the purpose of screening tests was low. Most women did not recognize that their weight might put them at higher risk for CRC. They cited many barriers to screening including cost and unpleasantness, but few benefits. Women discussed several healthcare and provider-related factors which might help or hinder screening behavior; the importance of shared decision making and provider thoroughness was frequently mentioned. Several organizational level changes, including patient screening reminders, were also suggested. Public education about CRC prevention is poor, particularly among high risk groups such as obese and African American women. Improving patient-provider communication and including information about risk factors for

CRC and the benefits of screening in health promotion messages may help improve screening rates.

V.B. Introduction

Obese women have both higher incidence and mortality rates for many cancers, including colorectal cancer (CRC). Research has shown that morbidly obese women (BMI $\geq$ 40) are 49% more likely to get colon cancer than normal weight women[90] and that obese women (BMI $\geq$ 30) have a 40-85% greater chance of dying from colon cancer than normal weight individuals (BMI < 25).[2] Despite their increased risk for cancer, evidence suggests that obese individuals may be less likely to engage in health-promoting behaviors such as cancer screening tests.[26, 34, 36-38, 91] This appears to be true for all three recommended cancer screenings for women in the United States (breast, cervical and colorectal). Particularly concerning is that compliance with screening recommendations for CRC is much lower than it is for breast or cervical cancer.[10, 23, 24] A recent study found that obese white women have significantly lower CRC screening rates than non-obese women.[105] However, this association did not appear to exist for African-American women. While a positive relationship between BMI and screening may only be confined to white women,[34, 44, 45, 105, 106] improving screening rates in both white and African American women is important since these two groups suffer from the highest rates of CRC. Unfortunately, women in both racial groups have lower CRC screening rates than their male counterparts,[56, 61] even though CRC is the 3rd most common cause of cancer death for both sexes.[1]

Regular screening for CRC and adenomatous polyps has the potential to significantly reduce CRC incidence and mortality.[6, 7] The American Cancer Society guidelines for screening and surveillance for the early detection of adenomatous polyps and CRC recommend that all average risk individuals begin screening at age 50.[10] In order to increase CRC screening among obese women, it is important to first understand what is causing the weight-related disparities. For example, obese women may have more or different barriers to CRC screening than non-obese women. Unfortunately we could find no previous studies that specifically address factors that either help or hinder obese women to get screened for CRC.

Many quantitative studies have focused on correlates of CRC screening and can provide some insight into the factors that may determine screening behavior. One of the strongest predictors of screening is physician recommendation,[56] so it is hypothesized that differential rates of physician referral may explain some of the weight-related screening disparities. However, data from the National Health Interview Survey showed that the likelihood of having a colonoscopy in the past 10 years was 33% lower for obese white women compared to non-obese white women, even after controlling for reported rate of physician recommendation for screening.[105] Previous research also indicates that general patient-provider communication, independent of screening recommendation, may also have a significant influence on screening usage.[57-59] In addition, several psychosocial variables are positively correlated with screening including knowledge of testing intervals, greater perceived susceptibility, greater perceived support,[58] and lower barriers to screening.[64]

While decreased weight could reduce obese women's cancer risk, it is still unclear exactly how a women's weight affects her decisions about cancer screening. Qualitative research approaches may provide such insight. Thus, the goal of the present study was to use focus group methodology to better understand why obese women choose to engage or not engage in CRC screening. By uncovering the root causes of the disparity we see in behavior, we will be better equipped to develop interventions to increase screening rates.

V. C. Methods

Recruitment

Women age 50 and older were recruited using mass e-mail, study flyers, and word-of-mouth. Periodic recruitment e-mails announcements were sent to all affiliates of the University of North Carolina at Chapel Hill. Flyers were distributed in various locations in Orange and Durham counties in NC (USA), including hospitals, senior centers, community centers, and exercise facilities. To participate, interested women had to contact the study staff; women in current research databases were contacted directly. Each potential participant was screened for eligibility by our staff. A woman was eligible if she had a BMI≥29, was 50 or older, reported her race as white or African American/Black and was not currently up-to-date with CRC screening recommendations (Stool card test within 1 year, colonoscopy within 10 years or other CRC screening test in the past 5 years). Because BMI was based on self-reported height and weight, we used a slightly lower cutoff (29 kg/m^2) than the traditional obesity cut-off (BMI≥30) since obese women on average tend to underreport their weight and over-report their height leading to an underestimated BMI.[107]

Focus Groups

The focus groups were structured to be homogeneous with respect to race. We conducted a total of 4 groups with white women and 3 groups with African American women. Groups ranged from 2-7 participants each and were conducted at the UNC

Gillings School of Global Public Health. Upon arrival, each woman completed a consent form and a brief demographic questionnaire. Prior to the discussion, we informed participants about purpose of the study, explained how focus groups worked, and answered any questions. The discussion was led by a trained moderator and was audio recorded. In addition, notes were taken by at least one note taker. Each focus group lasted between 1.5 and 2 hours total. As an incentive, women were served dinner during the focus group as well as given a check for $30.

The moderator led the discussion using a semi-structured focus group guide, which was developed using current literature on weight, preventive healthcare, cancer screening, and physical activity. Questions were guided by the Health Belief Model[108] and social support theories;[109] they focused on perceived barriers and benefits to CRC screening and preventive care, CRC susceptibility, screening self-efficacy, and social support for CRC screening. In addition, the focus groups explored patient-provider communication and medical decision making to better understand how physician recommendations for screening affect screening behaviors. Additional questions focused on perceived barriers and benefits to physical activity as well as social support for being active. Finally, we asked women about their preferences for receiving health information and specifically what would help them get a CRC screening or increase their activity. Analysis for the present study will be limited to data specific to CRC and screening (physical activity related results will be presented elsewhere). All study procedures were approved by the university's Institutional Review Board.

Analysis

Audio recordings of the focus groups were transcribed then checked for accuracy by a note taker who was present at the focus group. Analysis was completed using Atlas.ti 5.2 qualitative analysis software. All coders were trained by the principal investigator (LAL). First, we completed a round of deductive coding focused on the specific theoretical constructs used to develop the focus group guide. The first round of coding consisted of identifying and grouping together all discussion related to a particular construct (e.g., perceived barriers to screening, patient-provider communication etc.) For this round, each transcript was coded by one of three initial coders. A second coder reviewed each transcript and ensured inter-coder reliability. Next, we used an inductive process to uncover themes within each theoretical construct. After themes were identified, we combined similar themes and counted the frequency at which themes occurred. Theme coding and data reduction were completed by two separate coders and any differences were reconciled through discussion. To determine code frequency, each time that a unique comment, which could be categorized under a certain theme, was made we counted it as one occurrence. Multiple comments made by one person on a single theme were counted as one occurrence. In many cases there were multiple people in the group who agreed with the comment (as was indicated by nodding or sounds of affirmation); however since we could not accurately count how many people agreed, we did not include their affirmations in the count. They were only included in the count if they made an additional comment which clearly indicated their agreement with the person who initiated conversation on the theme. For each construct, we created a matrix to examine differences in theme frequency between the African American and white focus groups. Summaries were made of each construct, noting the most common themes and comparing and contrasting by race. These summaries are presented in the results along with selected quotes from the transcripts which best illustrate the most common themes.

V.D. Results

Sample Characteristics: Demographics and CRC Knowledge

Demographic characteristics of the focus group participants, separated by race, are shown in Table 5.1. The average age of participants was slightly higher for white participants (55 years) compared with African American participants (53 years). Overall, the average BMI of the sample was approximately 36 (range 28.2-46.6). Education and income levels were slightly higher for the white women than they were for African American women. Knowledge about colon cancer was mixed; while the majority of women were familiar with the concept of colon cancer screening, some were unable to name specific tests or its purpose. Colonoscopy was the most frequently mentioned screening test, but a few women were also familiar with Fecal Occult Blood tests (FOBT). In relation to primary prevention, women had limited knowledge of what they could do to help prevent colon cancer. For both races, the most frequently mentioned risk factors were genetics and poor diet. Women in every focus group mentioned diet (specifically fiber intake) as affecting colon cancer risk.

Attitudes about Colorectal Cancer Screening

A summary of the Health Belief Model constructs (perceived barriers, perceived benefits and perceived susceptibility) and their related themes and frequencies is shown in Table 5.2. The most frequently cited barrier to screening for white women was cost, followed by worry that the test would be unpleasant or uncomfortable. African American women, on the other hand, were most likely to state that they did not have time or had competing priorities, including other health issues, to deal with. Contrary to the discussion about barriers, few women brought up potential benefits of screening. However, a small number of women did mention that screening would give them "peace of mind" meaning that they would no longer need to wonder if something was wrong.

We asked each woman how her risk of CRC compared to that of other women her age, and the majority thought that they were at lower risk. Main reasons given by the white women to support this belief were lack of family history of cancer and a healthy lifestyle. African American women, on the other hand, were more likely to say that they had faith (i.e. religious based beliefs) they would not get cancer. Two women specifically stated that they believed they were at higher risk: one white had a mother with colon cancer and one African American woman previously had polyps removed. The discussion on the potential relationship between colon cancer and weight revealed that only three women felt weight was associated with risk for CRC.

Delayed Care

We started the conversation on healthcare by asking women if they had ever delayed preventive care such as screening and almost all women agreed that they had. For white women, anxiety about the procedure and concern about cost were the most commonly mentioned reasons. African American women also reported that cost and health insurance were concerns. Another frequently cited reason for the African American women was that because of other personal and medical priorities, many women did not have time to wait at the doctor's office.

> "And at that time I was supposed to go, I didn't feel like it either, 'cause I was dealing with allergies and different things like that. I just didn't feel like sitting and waiting, waiting, and waiting, you know? After working all day, and sitting, waiting for the doctors, I just didn't feel like it." (African American Woman)

Women were also asked if their weight ever caused them to delay seeking healthcare. At least two-thirds of the white women agreed that they had delayed going to the doctor in the past because of their weight. Some women worried that the doctor would chastise them about their weight. They recalled delaying appointments until they had lost a few more pounds. Others attributed their hesitancy to self-esteem issues; they felt uncomfortable with their bodies and did not want to undress at the doctor's office. The consensus, however, was that these were mostly old concerns as they had either established an understanding with their physician or become more accepting of their weight and weight-related comments as they aged.

> "I think it could because there's a lot of self-esteem issues when you're heavy, and there's just not that desire to get into a gown with nothing underneath it and you have people looking at you. Well, on the flip side of it, the older I get, the less I care what people think!" (White Woman)

> "It isn't now because I had a wonderful physician… I can talk openly about my weight, and that whole issue. But it certainly has been, in the past. And it's not helpful for someone to say, 'You've got to lose weight.' But it's been easy to be embarrassed or humiliated. But it's not a problem, now." (White Woman)

With one exception, African American women did not generally believe that their weight was a reason to delay care. A few of the African American women stated that they delayed doctor's appointments or screenings because they did not like to undress, however, they did not attribute this dislike to their weight; some stated that this would not be an issue if they could be guaranteed a female physician. Women also did not see a connection between weight and the decision to get screened for colon cancer; only two women felt that being overweight might be an impetus for more frequent screenings because they were at higher risk. One African American woman mentioned that her doctor recommended she be screened more often because of several indicators including her diet and weight; however, she was the only one who reported such a recommendation.

> "I think those guys that do… a bunch of them [tests] every day... to them, it's just another day at work. I don't think they care whether you're fat or not." (White Woman)

Patient-Provider Communication

Although most women expressed satisfaction with their current health care providers, there was also extensive discussion regarding previous bad experiences with the healthcare system in general (i.e., problems with insurance, hospitals or past providers). Most women expressed a strong desire for a relationship with their provider characterized by shared decision making. They described several techniques used by physicians to facilitate that relationship. The most frequently mentioned technique was encouraging collaborative discussions by ensuring the patient ask questions. Women also emphasized the importance of agreeing upon an approach or healthcare plan with their physician.

> "So I've been really, really fortunate in having caregivers who are professional but very personable in whom I place a great deal of trust and who are willing and have joined me in looking at alternatives, and in one case, making a referral to an alternative practitioner." (African American Woman)

Another important physician attribute was thoroughness. Specifically, African American women were particularly concerned that a physician not jump to conclusions about their condition or recommend drastic treatment options prior to completing appropriate diagnostic tests. They also expressed appreciation for physicians who they could rely on to bring up potential health concerns or recommended screenings. Many of the white women were also concerned that their physicians did not bring up important issues like their weight. Those who reported receiving weight loss recommendations from their physicians were often discouraged or frustrated because the physician did not also suggest concrete action steps which could be taken to achieve weight loss.

> "Most of the things that I've found or called to his attention was my doing. You know? In fact, I think if he would say, "Get off your duff. And, this is what you need to do." Next time he'd tell me all about it, it might make me a little more serious about it. But, sometimes I need somebody to put a little grief on me, to make me do something. But, other than that, I'm plugging along like I am, I'll just keep plugging." (White Woman)

> "I mean, what are they gonna tell you to do? "Go home, don't eat so much, and exercise more." That's all they ever say. That's what they'll tell you." (White Woman)

Factors Influencing the Decision to Undergo Screenings

Next we asked women about their decisions to undergo screening tests and which factors they felt were most important in screening behavior adherence. Since none of these women were up-to-date with CRC screening at the time of recruitment, the discussions focused on screening tests in general rather than CRC screening specifically. It is important to note that while we emphasized the difference between a screening and diagnostic test, women sometimes confused the two during the discussion. For white women, doctor recommendation was the single most important factor influencing screening behavior. After data reduction we found many factors to cluster around a single theme of necessity. Women deemed a test medically necessary if they had a family history of the disease in question, perceived themselves as being higher risk (because of age or personal medical history), or were currently exhibiting symptoms.

Another common factor influencing medical decisions was personal judgment based on their educational background, research or reading about the test.

> "I do listen to what they say. But then, I do do my own reading and investigation. Also, with the Internet now, I mean, you can read the American Medical Journal (chuckles)... I mean, you can research anything you want to research, and at least get some statistics, and baseline. So... I always ask a ton of questions and... I'm very blunt: 'What are you looking for?'" (White Woman)

Like white women, African American women also made their decisions based on whether or not they felt a procedure was medically necessary. The most frequently cited influence in the decision to undergo screening testing for the African American women was whether or not they had symptoms. Unlike white women, they did not mention their confidence in a test's preventive value as being an important part of the decision. As was mentioned earlier, time and competing priorities also played an important part in their decision making process.

> "So I put my focus into seeing my eye doctor, I go there religiously that's my priority… I'm not saying I don't need to have other things checked out, too… but right now, I'm healthy. I don't have diabetes or high blood pressure.... If I had a stroke tomorrow, but I don't, today. But, my priority is to be able to see." (African American Woman)

Although overall, doctor recommendation was the single most reported influence on screening decision making, it did not appear to have a strong influence on the current CRC screening behavior of the women in the focus groups. Out of 31 women, fifteen directly stated that their doctor had recommended a CRC screening compared to only three who reported not receiving a recommendation. Despite this high number, none of these women were up-to-date with any of the CRC screening recommendations at the time of recruitment.

Strategies for Increasing Screening

We asked participants what could be done to increase CRC screening among women. White women suggested various institutional changes that could increase their likelihood of getting screened. For example, they suggested that providers could better facilitate screening by scheduling recommended tests before the end of the visit. Some women felt overwhelmed by the many different tests that were recommended to them, particularly once they turned 50. They thought that if a specific test was really necessary for them that the doctor would follow-up and assist with scheduling. Additionally, reminder calls and having someone to go through the process with them (i.e., a patient navigator) were potentially helpful strategies for increasing screening. It was also noted that better insurance coverage of preventive care would make many women less hesitant to get screening. Lastly, a few women discussed the burden of the colonoscopy and felt that a quicker test would make them more likely to get a screening. As was mentioned above, the screening conversation centered mostly on colonoscopy and some women were unaware of FOBT as a screening option.

> "See, if they really were thinking, instead of saying, 'Okay, you need to go, make this appointment with this one, and this...' they need to go ahead before you leave that office, and make those appointments for you so that they're done! Cause it's too easy to go, 'Oh... maybe I don't really need to go then.'" (White Woman)

Both white and African-American women expressed surprise and concern over the prevalence of colon cancer and felt that education and discussion about colon cancer were lacking. African American women highlighted several venues where colon cancer education was needed including public service announcements, community and church groups and schools.

> “I think what’s so amazing is that I think of myself as pretty on top of things, and I get emails from medical emails, and I read them, and I research and do things, I know almost nothing about colon cancer. I don’t know anything about it. I didn’t...all this stuff is... I know nothing! And so, I think that’s a real sign that there is not enough information being disseminated to average people.” (White Woman)

> “In my church we talk about lung cancer, we talk about cancer, cancer in general. We talk about diabetes… But, no one talks about colon cancer, or any other kind of [cancer]... other than breast cancer in church… That’s what I call the biggies.” (African American Woman)

We ended the conversation by asking women how they preferred to receive their health information. The Internet was the most frequently mentioned source of health information and was preferred by most of the women. They were generally aware that not all information on the Internet is reliable and some women cited specific sources that they trusted. After the Internet, talking with a trained professional, such as a doctor or a pharmacist, was the preferred source of health information. Print materials from the doctor were also seen as a reliable source of information. We specifically asked women if they would prefer to receive information through either: an in-person discussion, the Internet/e-mail or the mail. While it was clear that mail was not preferred, women cited pros and cons to both the in-person and Internet-based sources of health information. Several women reiterated that all possible methods should be used since a single method may not be capable of reaching enough people.

V. E. Discussion

Obese women are at higher risk for colon cancer, but current CRC screening recommendations do not address obesity or other lifestyle factors that have been shown to affect risk. In its most recent *Guidelines for Colorectal Cancer Screening*, the American College of Gastroenterology (ACG) proposed that obesity be considered a possible risk factor which would indicate earlier or more frequent screenings[21]. While recommending that obese individuals be screened more may raise awareness about the importance of screening in this high risk group, we must first consider that less than half of this population is at present even meeting the current guidelines. Our research provides several insights into how primary care and public health practitioners can shape messages to increase CRC screening among obese women.

It is evident from this and other studies,[57-59] that patient-provider communication has a strong influence on screening behavior. Physician recommendation remains the strongest predictor of screening, even among obese women.[105] Primary care physicians can play a powerful role in increasing obese women's screening rates, but simply making a recommendation is not enough. Data from our focus groups suggest that obese women have other co-morbid conditions (e.g., diabetes, hyperlipdemia, hypertension) that are being prioritized. Most of them did not realize that their weight may also put them at higher risk for cancer. It is important that conversations about CRC screening address lifestyle factors, such as weight and physical activity, as well as the specific purpose and benefits of cancer screening. The women in our study were familiar with screening logistics and were able to list many negatives or barriers to screening procedures (cost, preparation, time involved etc.), but had little knowledge of the benefits or actual reasons for screening. Many women still do not understand that it is important to be screened even if they do not have symptoms or a family history of cancer. Also, conversations need to address how colonoscopy is used as a cancer prevention tool (rather than just early detection). For example, ACG proposed using different language to describe cancer prevention tests versus cancer detection tests. While colonoscopy may be the only screening test that can also remove polyps, stool-based tests should not be discounted. Many women in the sample did not realize there were alternatives to colonoscopy that might better meet their lifestyle and budget. The need to fast prior to a colonoscopy was a particular concern for the many diabetic women in the group. Education about stool tests may be appropriate for women with significant barriers to colonoscopy.

Participants made several practice-level and organizational-level suggestions for how to increase cancer screening and generally improve healthcare for obese women. Discussion of weight at the doctor's office or clinic has proven to be a very tricky subject. While some women expect their physician to mention it, others are upset by routine weighing and unsolicited weight loss advice. Women who felt respected by their physician and involved in a shared decision making process were more likely to take his/her advice. Discussing weight as a risk factor for diseases, such as colon cancer, may be better received than a general weight loss recommendation. The participants in our sample of women over 50 had struggled with their weight their whole lives and had finally come to accept it. They did, however, care very much about their health and most engaged in many health-promoting activities. Organizational changes that make it easier for patients to get screened could be very effective. Strategies that were suggested included making appointments for patients before they leave, sending reminders about recommended procedures, and having a patient navigator to explain the screening process in more detail. Additionally, women felt they were more likely to complete a test or procedure if it could be combined with other services or if they were all offered in the same place.

While it was not an explicit goal of this study, we did uncover some differences in screening and healthcare-related attitudes and beliefs between white and African American women. For example, African American women were more likely to attribute their risk for CRC to uncontrollable factors such as fate. Unlike white participants, the African American women in the study did not see a connection between their weight and healthcare seeking behaviors. While physician recommendation was the greatest screening motivator for white women, African American women were predominantly motivated to seek screening if they had symptoms. In general, African American women appeared to feel little control over their disease risk. Like white women, they felt there was a paucity of information available to them. While greater communication about CRC is needed, messages which address how women's behaviors can reduce risk may be most beneficial. Even if weight-related screening disparities do not exist among African American women, this group still has lower rates of adherence to screening guidelines than white women. Therefore it is important to uncover causes of this racial disparity. Further research using quantitative comparison or mixed methods is needed to confirm the racial differences seen in our sample.

This is first qualitative study we are aware of which attempts to explain why some obese women do not get the cancer screenings tests. While this study offers important suggestions for organizational changes and messages which could be used in primary care or public health interventions with obese women, more research is needed to fully understand how obesity affects screening behavior. The current study was limited to a small number of women in North Carolina and may not be generalizable to women in other areas of the country. This self-selected sample was highly educated and representative of the university community from which the women were recruited. The study is, however, strengthened by the fact that we limited enrollment to a purposeful sample of women who were not currently up-to-date with screening. Recruitment of this population proved difficult and resulted in several focus groups with lower than ideal numbers of women (i.e. less than 6 participants per group).

Despite its limitations, this research provides insight into the types of information and messages that may help increase screening among obese women. These results can inform future interventions to promote screening among obese women and potentially decrease both their cancer incidence and mortality rates.

Table 5.1 Demographics of Focus Group Participants by Race

Demographic Variables	White (n=19)	African American (n=12)
Average Age (Range)	55 (50-72) years	53 (50-61) years
Average Body Mass Index (Range)	36.0 (28.2-46.6)	36.5 (29.3-43.6)
Education: *% with a college degree or higher (n)*	52.6% (10)	41.6% (5)
Median Household Income	$50,000-$74,999	$30,000-$49,999
Marital Status: *% married or living with a partner (n)*	36.8% (7)	33% (4)

Table 5.2 Summary of Health Belief Model Constructs and Themes

Construct	Common Themes and Frequencies[2]	Illustrative Quotes
Perceived Barriers to Screening[1]	<u>White:</u> Cost (11); Don't like the thought of it/ uncomfortable (6); Preparation or dietary changes are too difficult (5); Denial/not at risk (4); Has a medical issue which she believes precludes screening (3); Too invasive (2); Taboo area/private (2); No symptoms (2); Doesn't think she needs a screening (2);	"… The reason I didn't go when I was scheduled for it [colonoscopy]. I got these marching orders from UNC Hospital, "Be here at this time, $500 in your hand, or we won't even look at you." "Well, I just wonder if there's something that, like for diabetics, that there's a liquid that you could take so that you would keep your sugar levels when you're not... 'cause you can't fast when you're a diabetic."
	<u>African American:</u> Don't want to wait/ don't have the time (5); Don't want to know/Scared about what they might find (3); Denial/faith they won't get cancer (3); Preparation or dietary changes are too difficult (2); Other health issues take precedence (2); Cost/Insurance concerns (2); Don't want to undress (2);	"I just didn't want to have to deal with anything - not that I had to deal with anything there, 'cause I don't... I just didn't feel like it, to be honest about it. I have so many doctors' appointments. I mean, not that many. It's just that, you know, I'm trying to be faithful in going to them, because I found out about breast cancer in my very first mammogram. So I know these things are important." "Also, I'm trying to keep insurance for my eyes, too, 'cause I'd rather have my vision. When I leave this world, I'd rather be able to see where I was, as opposed to being blind."
Perceived Benefits of Screening	<u>White:</u> Can see inside colon/ find problems (2); Early detection (1); Look for polyps (1); Peace of mind (1)	"I wanted to have it because of the fear, you know, just to remove the fear, and not have to wonder. That's a really good reason I wanted to go because I wanted to know that, well, they've done this, and now I can feel pretty sure that I don't have to worry about this. Then they say, after you have the colonoscopy, and you know that you don't have a cancer, then you can just do a blood test. That, you know, can give you some signs, but it's not as good as the colonoscopy. So I just really wanted to make sure that I did it, just to remove the fear."
	<u>African American:</u> Remove fear/ not have to wonder (1); Test for blood in stool (1)	

Perceived Susceptibility (Compared to your other women your age, how likely are you to get CRC in the future?)	White: Less (3); Equal (2) Don't know (2); More (1)	"Well, I mean, granted, I don't take my drugs like I should and take care of that kind of stuff. I still try to eat right and eat healthy. And I'm a very active person. I have two hours of horses and dogs that I take care of every morning, before I come to work; and then, three hours of doing it every evening, and training and showing and things like that. I'm a very active person, and I do try to eat a healthy diet."
	African American: "I'm not getting it" (3) Less (1) More (1)	"I don't believe that I'm gonna get it [cancer] as opposed to the next person. And, like she said, I'm a born-again Christian, so, I truly believe that I won't get it. I just believe that. And then, it has a lot to do with why I'm not really worried about the fact that I haven't had the screening? Because I know that they're not gonna find anything?"

[1]Due to high numbers of perceived barriers, only those which were cited 2 or more times are included in the chart.
[2]Frequencies of each theme are listed in parentheses

CHAPTER VI

TARGETED COLORECTAL CANCER PREVENTION MESSAGES FOR OBESE WOMEN: RESULTS OF AN INTERNET-BASED MESSAGE TESTING PILOT STUDY

VI.A. Abstract

Obese women are at higher risk for multiple cancers, but less likely than normal weight women to engage in cancer prevention behaviors such as screening and physical activity (PA). Research indicates that higher perceived barriers and lower perceived benefits to screening/PA may affect behavior. In order to address these disparities, we proposed using weight-targeted messages to improve colorectal cancer (CRC) prevention among obese women. Messages were tested online with women age 50 and older (N=181). Participants were stratified by weight (obese vs. non-obese) and randomized to receive either 10 weight-targeted or 10 generic messages. Targeted messages were written for obese women based on pre-study focus groups and addressed Health Belief Model constructs such as benefits and barriers to CRC screening/PA which were relevant to that population. After reading the messages, women were asked to evaluate them using an Elaboration Likelihood Model (ELM) scale. We hypothesized that obese women who received targeted messages would have higher ELM scores than those who received generic messages; we did not expect higher scores among non-obese women who received targeted messages. We rejected our hypothesis and found that obese women had higher ELM scores than non-obese women regardless of which messages they read

(p=0.02). Specifically, obese women had higher scores on two ELM subscales: motivation to thoughtfully read and evaluate the messages (p=0.01) and favorable thoughts about the quality of the information presented (p=0.02) Obese women also found the online messages to be more believable (p=0.047) and more personally relevant (p=0.005) than non-obese women did. Women were also asked to list thoughts or questions that came to mind while reading the messages. Qualitative findings supported ELM sub-group outcomes. Message testing results indicate that Internet messages may be an effective way to reach obese women, however, weight-targeted messages do not appear to increase central processing or potential for behavior change.

VI.B Introduction

Colorectal cancer (CRC) is the 3rd leading cause of cancer mortality among women in the United States.[1] As with many diseases, colorectal cancer disproportionately affects certain high risk subgroups, including obese women. Compared to normal weight women, obese women have higher CRC incidence and mortality rates.[2, 90] While there is a physiological link between excess bodyweight and cancer, [110] lower rates of cancer prevention behaviors may also contribute to this relationship. Obese women, particularly white women, have lower usage rates of several cancer screening tests, [91] including colonoscopy,[105] the most widely used CRC screening test. They are also less likely to engage in regular physical activity.[36, 47] A recent meta-analysis estimated that higher physical activity levels, independent of weight, could reduce colorectal cancer risk by 14%.[30]

There is limited research examining the relationship between CRC screening and obesity in women. Focus group discussion with obese women revealed that obese women may face barriers to screening which are not faced by non-obese women. (Chapter 5) For example, obese women have a higher number of co-morbid conditions, such as diabetes or heart disease, which may take precedence over cancer screening. Treatment of these conditions may monopolize women's clinic time and exhaust healthcare dollars leaving little resources for cancer prevention. Certain conditions may also make screening more difficult for obese women. Focus groups indicated that obese women had poor knowledge of screening benefits and did not believe that their weight put them at higher risk for cancer (Chapter 5).

Obese women also report more difficulties starting and maintaining regular physical activity. Many factors may contribute, but injuries which are related to or exacerbated by excess body weight are among the most commonly cited (Chapter 5). Obese women also differ from non-obese women in their reasons for exercise. Obese women are more likely to only engage in exercise when they are trying to lose weight and may not recognize that exercise can provide benefits (such as disease prevention) even if it does not produce weight loss. They are also more likely to report feeling uncomfortable while exercising and less likely to say that they enjoy it (Chapter 5).

Interventions are needed to increase cancer prevention behaviors among obese women. While many CRC prevention programs and messages have been developed, they may not be effectively reaching obese women; different methods or messages may be necessary. One study indicated that tailored information was more effective at increasing physical activity among obese women than a lay health advisor intervention. [80] Several other studies have also successfully employed tailored messages to increase screening behavior.[82, 83] Tailored communications are formal individual communications in which the content and/or style of the materials have been created based on data specific to the individual and informed by health behavior theory. Research and theory suggest that tailored communications are more likely to be effective than generic materials because they provide personally relevant information that meets the exact information needs of readers and excludes irrelevant or superfluous facts.[84, 85] It follows that when these needs are more closely met, an individual will be more likely to make desired changes in knowledge, beliefs, and attitudes and to move towards behavior change. However, some studies have shown that well designed targeted materials can be just as effective at changing health behaviors.[86]

This paper describes a pilot study designed to test the acceptability and utility of targeting health messages to obese women. If weight targeting proves useful, it could justify the use of weight-targeted messages in future intervention studies. Best practice for intervention design is to pre-test messages prior to conducting a randomized controlled trial.[86, 87] The Elaboration Likelihood Model (ELM)[88] explains the rationale for using targeted and tailored messages making it an appropriate model to guide the evaluation of the messages. The ELM states that an individual with high motivation and ability to process a message will have higher elaboration, and thus persuasion will occur through a central route. Persuasion which occurs through the central route is thought to be enduring, resistant to change, and predictive of future behavior.[89]

For this study we compared weight-targeted messages designed for obese women to generic messages about colon cancer prevention. We hypothesized that obese women who read the weight-targeted messages would show greater elaboration compared to obese women who read the generic messages. Additionally, the differences in elaboration scores between women who read the weight-targeted messages and those who read the generic messages would be higher among obese women than non-obese women.

VI.C Methods

Message Testing Website

Participants were recruited to the study using two main Internet-based methods: mass e-mails and postings/advertisements on social networking sites. Advertisements directed interested individuals to a website which gave them further information about the study. If they still wanted to participate, they were asked to complete an eligibility questionnaire. To be eligible, participants had to be female, age 50 or older, have a BMI > 18.5 (as assessed by self-reported height and weight), and identify as white/Caucasian. Potential participants were not made aware of the eligibility criteria so that there would be no incentive to falsify data. Ineligible individuals were told that they could not participate in the study, but were offered information about colon cancer prevention.

Next, eligible individuals were asked to view a consent form with information about the study. In order to proceed they had to check a box saying that they had read and agreed to the information in the form. They also had the option to print the form. At this point they were asked to provide an e-mail and password so that their information could be saved in the event that they were unable to complete the entire study at once. Once they provided an e-mail and password, women were considered to be officially enrolled in the study. To ensure adequate enrollment of obese (BMI 30+) women, we stratified the sample based on weight group (obese vs. non-obese). A total of 207 women enrolled in the study (109 obese and 98 non-obese).

After enrolling in the study, women were asked to complete a baseline survey which included questions on screening, physical activity behavior and related psychosocial variables. The survey also included questions on health status and health care experiences. After the baseline survey, women within each stratum were randomized to view either the intervention or control messages. Each condition reviewed 10 messages about colon cancer prevention. Each message was followed by four open-ended questions assessing women's thoughts and opinions about the messages. After reading the messages, women completed a follow-up survey where they were asked to assess the messages as a whole using the Elaboration Likelihood Model Scale and were asked to answer some of the same psychosocial questions that they did at baseline. Women were encouraged to complete the entire study at one time, but had the option to save their answers and return at a later date. Prior to beginning enrollment, we conducted a usability test of the study website with women from the target population. We found that the majority of women were able to complete the entire study in less than 1 hour.

The study website was available online for approximately 6 months. Within that time a total of 181 women completed the study (93 non-obese and 88 obese). Women who enrolled but did not complete the study received 2-4 e-mails asking them to return to the website and complete the study. Three weeks before the study ended, everyone who had not yet completed the study received an e-mail notifying them of the last possible day for completion. Of those enrolled, non-obese women were more likely to complete the study than obese women (94.9% vs. 80.7%, $p=0.002$). Completers were also more likely to be up-to-date with screening than non-completers (70.7 vs. 46.1, $p=0.01$). All individuals who completed the entire study received either a check or an Amazon gift card for $25. This study was approved by the University of North Carolina at Chapel Hill's Public Health- Nursing Institutional Review Board.

Messages

Participants who were randomized to the targeted message group received weight-targeted messages which were created to meet the informational needs of obese women. The messages were created based on results from focus groups with the target population and were based on constructs from the health belief model and other relevant theories. Topics addressed by each of the 10 intervention and control messages are shown in Table 1; actual messages are included in Appendix F. Intervention messages addressed the screening and physical activity related constructs which were most salient among obese women. Control messages were selected to address the same general topics included in the intervention messages, but were taken from the Centers for Disease Control and Prevention's (CDC) *Screen for Life* Fact Sheet and CDC's physical activity website.

Quantitative Measures

Our <u>primary outcome</u> for this study was Elaboration as measured by the Elaboration Likelihood Model (ELM) Scale. <u>Secondary outcomes</u> included trustworthiness and relevance of the messages, changes in intentions, knowledge, perceived susceptibility and self-efficacy for CRC cancer screening and exercise. The ELM and relevance/trustworthiness questions were only administered at follow-up (after reading the messages) since they assessed thoughts about the messages which participants received. Intentions, perceived susceptibility, knowledge and self-efficacy were measured at both baseline and follow-up. Some additional personal characteristics were measured only at baseline and included: demographics, CRC screening and physical activity behaviors, health status, healthcare experiences and perceived barriers and benefits to screening and physical activity.

Elaboration Likelihood Model (ELM) Scale. We used an adapted version of the scale created by Heppner et al. to measure Elaboration Likelihood.[111] The questionnaire consists of 12 items assessing three main areas: motivation to thoughtfully evaluate the message (Subscale A: six questions), ability to think about and understand the message (Subscale B: three questions), and favorable thoughts about the quality of information tested (Subscale C: three questions). All questions are on a 7-point likert scale with ranging from 1 (strongly disagree) to 7 (strongly agree). Three negatively worded questions (ex., *"It was difficult to understand the information in the messages"*) were reverse coded so that a higher score would indicate more elaboration. The ELM scale is designed to be summed so that the highest possible score a person could get is 84. Higher scores indicate greater central route processing. The ELM Questionnaire has been shown to be an effective measurement for changes in elaboration and other constructs in the ELM.[111] For this study, the scale was modified to reflect the format of the messages and answer scales were modified based on survey pre-tests with the target population. Internal consistency reliability for the modified scale remained high (Cronbach's alpha= 0.81).

Trustworthiness and Relevance. After reading all of the messages, participants were asked to rate the trustworthiness and relevance of the messages using an adapted version of questions asked in the NC Strides Study Trustworthiness and relevance of the message were shown to be related to behavior change in the NC STRIDES study.[112] Both constructs were each measured using a likert scale ranging from 1 (strongly disagree) to 7 (strongly agree): Relevance was measured as the sum of the following two items: "*The messages were written especially for someone like me*" and "*the information in the messages applied to my life*." Trustworthiness was measured with one question item: "*I believed the information in the messages.*"

Intention: CRC screening and exercise intentions were measured by 1 item each: "*how likely are you to get a CRC screening test within the next 6 months*" and "*how likely is it that you will exercise regularly over the next 2 weeks*," respectively. Each item was measured on a 10 point likert scale ranging from 1 (not at all likely) to 10 (very likely).

Colorectal cancer screening. To measure screening behavior we used a selection of validated questions developed by Vernon and others[113, 114] to assess CRC screening. Survey items assessed whether participants have ever had any of the following tests to check for colorectal cancer within the recommended timeframe: stool cards in the past year, flexible sigmoidoscopy within the past five years, colonoscopy within the past 10 years, and/or double contrast barium enema within the past five years. Marcus and others have shown reasonably good validity of self-reported CRC testing.[115] A woman was considered up-to-date with screening if she reported having one or more CRC screening tests within the recommended timeframe.

Physical Activity. Physical activity was assessed using this self-administered version of the IPAQ short form. This questionnaire is designed to separate individuals into three levels of physical activity: low, moderate and high. The IPAQ has been shown to have reasonable reliability and validity in diverse populations.[116]

Demographic Measures. Age was measured as a continuous variable while education (high school/GED, some College/trade school, college graduate, more than college), income (<30,000, 30,000-49,999, 50,000-74,999, 75,000-99,999, 100,000+), and health insurance status (yes/no) were all categorical. Only 10 women stated that they did not have any form of health insurance coverage.

Health Status: Self-reported health was measured as excellent, very good, pretty good, or fair. No one in the sample indicated that their health was poor. Participants were asked if they were actively trying to lose weight, gain weight, or maintain their current weight. From this question we created a dichotomous variable: weight loss practices (trying to lose weight vs. not trying to lose weight). Only one person indicated that she was trying to gain weight; thus she was categorized as not trying to lose weight. . We asked participants if they had any of the following co-morbidities: high blood pressure, heart disease, diabetes (type I or II), arthritis, Crohn's disease, ulcerative colitis, cancer or other. For the other category, participants could list their illness, and each additional illness not mentioned previously was counted as a separate co-morbidity (range was 0-4). This number was added to the total number of reported illnesses to create a co-morbidity variable (range 0-6). Since over three-quarters of participants reported fewer than 3 co-morbidities, answers of 3 or more were collapsed into one category for the final analysis.

Psychosocial Constructs. Knowledge about colorectal cancer was measured using six questions which were drawn from previous literature and pre-intervention focus groups. Items addressed important facts regarding CRC risk (gender, age, weight) and prevention (screening, physical activity, symptoms). Possible answers included: agree, disagree and don't know. A knowledge score was created by summing all the correct answers so that the highest possible score was six. Perceived barriers and benefits to

CRC screening and exercise were measured using a 4-point likert scale (agree a lot, agree a little, disagree a little, disagree a lot). Items were created based on previous research and pre-intervention focus groups. Result for perceived benefits and barriers are presented elsewhere (Appendix G).

Healthcare Variables: Patient Provider Communication was measured using a modified version of a scale which was previously shown to correlate with CRC screening behavior.[57] Questions were added based on pre-study focus groups resulting in a total of eight questions (Cronbach's alpha= 0.95). A question assessing health care visits in the past year was categorized to reflect those used in Aim 1 (0, 1, 2-3, 4-5, 6 or more). Healthcare satisfaction was measured using a single item taken from the Medical Expenditure Panel Survey (MEPS), cosponsored by the Agency for Health Care Research and Quality and the National Center for Health Statistics. This survey has been used in previous studies looking at the association between weight and patient satisfaction.[77] Results for the healthcare variables are reported elsewhere (Appendix G).

Statistical Analysis

All analyses were conducted using SAS version 9.2 (Cary, NC). Baseline characteristics were calculated for all study completers. To examine the differences at baseline between obese and non-obese participates we used chi-square tests (categorical variables) and two-sided t-tests (continuous variables). Two-sided t-tests were also used to look at unadjusted differences between control and intervention change scores within each weight group for the outcome variables and behavioral constructs. Change scores were created by subtracting the baseline value for each variable from the follow-up variable.

We also created linear regression models with an interaction term (obesity status * condition) to determine if weight moderated the change in outcome variables between control and intervention groups. If no interaction was present, we eliminated the interaction term from the model and reported results based on obesity status and condition alone. We used PROC GLM to calculate adjusted means for each subgroup based on covariates in the model. Potential confounders were selected by completing t-tests of the association between each outcome variable and all sample characteristics found to be associated with obesity. Any variable found to be associated ($p<0.1$) with a given outcome variable was included in that variables adjusted model. Additionally, all models included intervention condition as a covariate.

Lastly we completed sub-group analyses to examine the relationship between the main outcome variable (ELM) and certain sub-groups. Sub-groups were created based on their answers to certain psychosocial and behavioral questions. These analyses were used to determine if there were certain groups for which the messages might be more appropriate. Results are reported elsewhere (Appendix G).

Qualitative Measures and Analysis

After reading each message, women were asked to answer 4 open-ended questions about the message they just read. The first questions asked women: "*what thoughts or questions came to mind while reading this message*?" This question allowed us to measure elaboration in a qualitative manner. Subsequent questions focused on ways in which the message could be improved. All comments made were coded using an inductive coding process with each statement receiving a unique code. Codes were grouped into the following themes: 1.) related to/agreed with/acknowledged the importance of the information in the message or did not relate/agree; 2.) found information to be novel or already knew information in message; 3.) information increased intentions to engage in CRC screening or physical activity/perceived susceptibility to CRC or decreased intentions/perceived susceptibility; 4.) positive thoughts/benefits related to the message or negative thoughts/barriers; 5.) message quality (what was liked or needed to be changed).

For each set of codes, we compared the proportion of occurrences within selected subgroups based on obesity status and intervention condition. For example, we calculated the percentage of comments coded as "related to/agreed with message" which were made by obese women versus non-obese women. We then noted if less than 40% (or more than 60%) of the comments coded came from one group or the other; these cut-offs were used to identify potential differences between groups.

VI.D. Results

Sample Characteristics

Table 6.2 shows the baseline characteristics of the sample stratified by obesity status. There were statistically significant differences in age, education, physical activity level, self-reported health, co-morbidities and weight-loss status. Compared to obese women, non-obese women were older and more likely to have a post-graduate degree, have a high level of physical activity, report their health as excellent and have no co-morbidities. A majority of the women in the sample stated that they were actively trying to lose weight, but the percentage was higher ($p<0.0001$) among obese women (88.9%) compared to non-obese women (54.4%). Obese women also reported lower rates of CRC screening than non-obese women (65.9%, vs. 75.3%, p=0.17), but these differences were not statistically significant.

Baseline Psychosocial Measures

Few differences were seen in baseline psychosocial measures between obese and non-obese women (Table 6.3). Obese women reported lower exercise self-efficacy than non-obese women (5.2 vs. 6.3, p=0.005). Obese women also had lower scores for exercise intentions (5.5 vs. 6.7 for non-obese women, p=0.06). Perceived susceptibility to CRC was higher among obese women (6.0 vs. 5.3 for non-obese women, p=0.06), however as a group they did not perceive their risk to be much higher than that of other women their age; a score of 5-6 out of 10 indicated that they thought they were about as likely as other women their age to get colon cancer. There were no notable differences in CRC screening intentions, CRC knowledge or CRC screening self-efficacy between weight groups.

Within Weight Group Comparisons

We compared cognitive processing scores between the women in the control and intervention conditions to determine if weight-targeted messages could increase cognitive processing (Table 6.4). We found no statistically significant differences between conditions for either weight group. Contrary to what we had hypothesized, ELM scores of obese women who received the weight-targeted messages did not significantly differ from those of obese women who received the control **generic** messages (73.8 vs. 74.3, p=0.80). The intervention messages did produce increases in intention to engage in CRC screening or exercise in specific subgroups, but the statistical power of the comparisons were limited by the small number of women in these groups. Among non-obese participants, those who read the intervention messages had a greater increase in intention to get screened than those who read the control messages (1.8 vs. 1.1, p=0.30). CRC screening intentions also increased more among obese individuals who were not up-to-date with screening when they read the intervention messages (2.7 vs. 1.7 for the control, p=0.27). A similar pattern was also seen for exercise; non-obese individuals in the intervention condition increased their exercise intentions by 1.2 points compared to only 0.5 points for the control (p=0.16). Among obese individuals who did not currently engage in regular exercise, exercise intentions increased more when they read the intervention messages (2.9 vs. 1.2 for the control, p=0.06). For the other psychosocial measures there were few notable differences between the conditions for either weight group. Colonoscopy self-efficacy was increased slightly more in the intervention condition for the obese group (p=0.12). Non-obese women, on the other hand, had lower colonoscopy self-efficacy after reading the intervention messages (p=0.09).

Between Weight Group and Condition Comparisons

Intervention outcomes stratified by weight group are shown in Table 6.5. Obese women had significantly higher elaboration scores (p=0.02) than non-obese women. Obese women had an average ELM score of 74.0 compared to 70.6 for non-obese women. Relevance and trustworthiness scores were also higher for obese women (p=0.005 and 0.047, respectively). Average relevance score was 11.7 for obese women compared to 10.4 out of a possible 14 for non-obese women. Trustworthiness scores were high for both groups; 6.2 and 6.6 out of 7 for non-obese and obese women, respectively. There were no significantly different outcomes scores between weight groups for any of the other outcome measures. In addition, there were no outcome measure score differences between intervention and control groups as a whole.

Adjusted Analysis

We had hypothesized that the weight-targeted intervention messages would increase changes in outcome variables more in the obese women than in the non-obese women. We did not find any evidence for moderation on the primary outcome, however, we found that ELM scores were still higher in obese women as a group (p=0.03), even after controlling for intervention condition, education and age (Table 6.6). Similar results were seen for the relevance and trustworthiness variables; weight-group did not moderate the intervention effects, however obesity remained significantly related to both relevance (p=0.02) and trustworthiness (0.047) when controlling for confounders (data not shown).

Weight-group moderated the relationship between intervention group and change in colonoscopy and FOBT self-efficacy (p=0.02 and p=0.05 respectively). Obese women who received the intervention messages increased their adjusted colonoscopy self-efficacy by 1.0 points compared to an increase of 0.27 in the control group. The opposite was true in the non-obese individuals who increased their adjusted colonoscopy self-efficacy by 0.71 in the control group, but only by 0.05 in the intervention group. An identical pattern was also seen for FOBT self-efficacy (p=0.02). Obese individuals in the intervention group increased adjusted FOBT self-efficacy by 0.19 points compared to a 0.10 decrease in the control group. Non-obese women decreased their FOBT self-efficacy by 0.13 points in the control group and 0.89 points in the intervention group. We found no moderation effects for the intention, perceived susceptibility or knowledge variables, nor were there any primary effects of obesity or intervention condition on any of those outcomes.

ELM Subscales

To better understand what was driving the higher ELM scores in obese women, we examined the relationship between weight group and each of the three ELM subscales. Obese women had significantly higher scores for subscale A (p=0.01) and subscale C (p=0.02), but not for subscale B (p=0.55). For ELM subscale A (motivation to thoughtfully hear and evaluate the message) obese women had an average score of 30.4 compared to 29.1 for non-obese women. Obese women also had more favorable thoughts about the quality of the information presented; their subscale C score was 19.1 vs. 17.7 for non-obese women. There were no significant differences in women's ability to think about and understand the message (subscale B).

Comments on Messages

We coded a total of 452 separate comments written in response to the question "what thoughts or questions came to mind while you were reading this message?" We compared women's responses to the open-ended questions to elucidate the main outcomes. After coding the responses, we found differential rates of certain types of comments based on weight status. Obese women were more likely to comment on whether or not they were familiar with the information in the messages; 62.1% of the comments indicating that they learned something new or wished the information provided was more widely available came from obese women. Additionally, 60.7% of the comments coded as "nothing new" also came from obese women. Notably, most

(64.8%) of obese women's comments about the newness of the information were from women in the intervention group.

Non-obese women were more likely to comment on the quality of the message. Of all comments listing something that was not liked or should be changed about the messages, 62.8% of them came from obese women. A majority (60.5%) of the comments stating that they did not relate to/agree with message came from non-obese women. Among those comments from non-obese women reflecting disagreement with the message, 71.2% of them were made about the intervention messages. Similarly, 81.8% of comments stating that the messages reduced their intentions (for screening or exercise) or susceptibility to CRC came from non-obese women.

Next we compared comments made by women in the intervention to those made by women in the control group. Overall, women in the intervention group were more likely to comment that they didn't relate to or disagreed with the message (67.4%), or that the information in the message was new (68.0%). The message describing colonoscopy as a screening method elicited the most disagreement; many women felt that the description did not reflect their own experience. Women who read the intervention messages were less likely (36.4% of comments) to state that they decreased their susceptibility. Additionally, only 39.6% of comments coded as questions (related to or about the information in the message) were from women in the intervention group. Lastly, intervention messages were more likely to elicit positive thoughts or recognition of benefits (of screening and physical activity) than the control messages (64.2% of comments).

VI.E. Discussion

Targeting or tailoring of intervention messages is thought to increase elaboration of the reader. We hypothesized that obese women who received messages that were targeted to the informational needs of obese readers would have higher elaboration scores. We rejected this hypothesis and found instead that obese women had higher elaboration than non-obese women regardless of whether they received the generic or targeted messages. There are several possible explanations for why obese women may have had higher elaboration. First, obese women may be more engaged by the message medium Internet-based information); previous research has shown tailored messages to be more effective for increasing physical activity among obese women compared to an in-person lay health advisor intervention.[80] In the same study, normal weight women in the tailored message intervention actually decreased their physical activity compared to control when they received the tailored messages. Focus groups conducted with obese women showed that they overwhelmingly preferred to receive health information through the Internet. This may not be the case for non-obese women. Non-obese women rated the messages lower on trustworthiness and relevance than obese women did. Although non-obese women were aware that the messages were coming from a university cancer center, they may be less likely to trust Internet-based information as opposed to that which comes from a doctor or healthcare provider. While the underlying reason for this is unknown it may be related to differences in patient-provider communication or trust of the healthcare system. Differences in relevance and trustworthiness scores persisted even after we controlled for relevant confounders such as education.

Analysis of the ELM sub-scales indicated that two aspects of elaboration were significantly different between the obese and non-obese women. Based on their scores, obese women were more motivated to read the messages (subscale A) and had more favorable thoughts about the quality of the information in the messages (subscale C). There were not, however, any differences by weight in women's reported ability to understand the messages. Women's answers to the open-ended responses support these findings as well. Obese women made more comments indicating that the information in the messages was novel and should be more widely known. They also were more likely to indicate that they already knew the information in the messages. In both cases these responses might translate into higher motivation to read the messages. New information may hold their interest; on the other hand, if they already know the information it may be because the topic is important to them. Items in subscale A measure both ability of the messages to hold the readers interest and interest in the topic.

Non-obese women were more likely to point out problems with the messages or make suggestions for improvements. This reflects their lower scores on subscale C. It is unclear why non-obese women were more likely to comment on improvements which could be made to the messages. All women who participated in the study were told that we needed their help to improve the messages for other women and to be candid in their comments about them. It is possible that non-obese women had more experience with the topics addressed (i.e., they had higher rates of physical activity and cancer screening) and felt more qualified to evaluate the information in the messages.

This study is unique in that it proposes a systematic way for testing health messages. The field of health communication emphasizes the importance of pre-testing messages,[87] but there are few established protocols for doing so. This was a relatively inexpensive way to test messages prior to using them in a larger trial. Qualitative data from the open-ended questions provides extremely useful information on how messages can be improved. There were, however, a few weaknesses in this protocol. First, we chose to compare intervention messages to established CDC messages. Intervention messages were reviewed by several women in the target population and minimally edited by our staff prior to testing, but may not have been as polished as the CDC messages. Additionally, intervention messages used a more familiar tone, similar to that of a popular magazine, as opposed to the more factual tone used by the CDC messages. Differences in message tone and quality may have been more noticeable to women than the content differences that we were attempting to study. However, there were no differences in the number of message improvement comments made based on intervention condition.

Another shortcoming of our study is that unscreened and obese women were less likely to complete the study. This is unfortunate since these are the groups which are most in need of information about colon cancer prevention. Overall, our sample was highly educated, reflecting the demographics of the university community from which almost half of the women were recruited. The women who chose to participate in the study are probably more inclined to seek out cancer prevention information. This was reflected in their high elaboration scores; scores may have been lower on average had we been able to retain more unscreened women. Women in the study also had high rates of screening compared to the general population.[105] This, combined with limited sample size, may explain why we did not see significantly different rates of screening between obese and non-obese women in the study.

While we did not see significant differences in ELM scores between intervention and control, we did see some positive results of the intervention messages for obese women. The intervention messages improved screening self-efficacy more in obese women than non-obese women. Intervention messages also elicited more positive thoughts and recognition of benefits although we did not quantitatively measure changes in perceived benefits. Focus groups revealed that there was limited knowledge of the benefits of colon cancer screening. Women also did not recognize a connection between physical activity and colon cancer. Intervention messages highlighted both of these benefits.

It is possible that tailored messages may be preferable to weight-targeted messages. Topics for the messages were chosen based on results to focus groups with a small number of unscreened obese white women. However, obese women were more likely to more likely to express disagreement with or say that they did not related to the intervention messages than they did for the control messages. The weight-targeted intervention messages made assumptions about the issues that would be most salient for obese women; however, those topics may not have resonated with all obese women. Conversely, they may have resonated with some non-obese women. We would recommend that cancer prevention messages address some of the topics which are salient for many obese women, but not assume that they are important to all of them. Future research should examine whether or not adding these topics to a tailoring algorithm might improve message evaluation for obese women. Improving the delivery of cancer prevention information to obese women has the potential to increase CRC screening and physical activity for this high risk population.

Table 6.1 Topics and Psychosocial Constructs Addressed by Intervention and Control Messages.

Message Topic	**Intervention Message (Weight-Targeted)**	**Control Message (Generic)**
Colorectal Cancer Importance	CRC knowledge Perceived Susceptibility to CRC (gender, age)	CRC Knowledge Perceived Susceptibility to CRC (gender, age)
Colon Cancer Risk	Perceived Susceptibility (family history, age, weight, activity level), Perceived Barriers (no family history)	Perceived Susceptibility (gender, age, high risk)
CRC Screening	Screening Knowledge (colonoscopy), Screening Benefits (polyp removal/cancer prevention)	Screening Benefits (polyp removal/cancer prevention)
Colonoscopy	Screening Knowledge, Perceived Barriers (pain). Colonoscopy Benefits (peace of mind)	Screening Knowledge, Perceived Barriers (pain), Colonoscopy Benefits (direct view of colon)
FOBT	Screening Knowledge, Screening Benefits (lower cost, less time), Perceived Barriers (no symptoms)	Screening Knowledge
Patient-Provider Communication	Perceived Barriers to PPC (delaying care, impersonal healthcare), Self-efficacy (to improve PPC and ask for screening)	Perceived Benefits of PPC (healthcare satisfaction), Self-efficacy (to improve PPC)
Exercise Benefits	Knowledge (colon cleanse), PA Benefits (colon health, decreased CRC risk)	PA Benefits (decreased risk for cancer)
Exercise Benefits	Perceived Barrier (exercise is only important for weight loss), PA Benefits (disease prevention)	PA Benefit (weight management), PA Knowledge
Exercise Benefits	PA Benefits (disease prevention, disease treatment, less healthcare visits and costs)	PA Benefits (disease prevention, disease treatment); Perceived Barrier (not everyone can benefit from PA)
Exercise Tips	PA Self-Efficacy, Perceived Barriers (nowhere to exercise, uncomfortable exercising, safety)	Risks of PA, PA Barriers (injury, disease)

Table 6.2 Baseline Characteristics of Study Completers

Variable	**Non-Obese (n=93)**	**Obese (n=88)**	**P-value**
Age, mean (SD)	57.4 (5.4)	55.6 (5.2)	0.03
Income, %			
<30,000	7.1 (7)	20.5 (18)	
30,000-49,999	17.2 (16)	18.2 (16)	
50,000-74,999	26.9 (25)	29.6 (26)	
75,000-99,999	21.5 (20)	11.4 (10)	
100,000+	26.9 (25)	20.5 (18)	0.06
Education, % (n)			
High School/GED	4.3 (4)	18.2 (16)	
Some College/Trade School	25.8 (24)	25.0 (22)	
College	24.7 (23)	22.7 (20)	
More than College	45.1 (42)	34.1 (30)	0.02
Uninsured, % (n)	3.2 (3)	8.0 (7)	
Up-to-date with CRC Screening, %	75.3	65.9	0.17
Physical Activity, %			
Low	26.2	42.3	
Medium	38.1	38.5	
High	35.7	19.2	0.03
Self-reported Health, %			
Excellent	28.0	9.1	
Very Good	44.1	39.8	
Pretty Good	22.3	36.4	
Fair	5.4	14.7	0.001
Co-morbidities, %			
0	38.9	18.5	
1	30.0	27.2	
2	22.2	28.3	
3+	8.9	26.1	0.002
Currently Trying to Lose Weight, %	54.4	88.9	<0.0001

Table 6.3 Baseline Values for Psychosocial Constructs Related to CRC, CRC Screening and Physical Activity

Psychosocial Constructs, Mean (SD)	**Non-Obese**	**Obese**	**P-Value**
CRC Screening Intentions			
All Participants	3.6 (3.1)	3.4 (3.2)	0.76
Unscreened†	4.2 (3.1)	4.5 (3.5)	0.75
Physical Activity Intentions			
All Participants	6.7 (3.2)	5.5 (3.1)	0.06
Not regularly active‡	5.6 (2.9)	4.7 (2.7)	0.12
CRC Knowledge	4.2 (1.2)	4.1 (1.2)	0.63
Colonoscopy Self-Efficacy	8.4 (2.8)	8.1 (3.0)	0.57
FOBT Self-Efficacy	8.5 (2.7)	8.4 (2.7)	0.90
Exercise Self-Efficacy	6.3 (3.2)	5.2 (2.9)	0.005
Perceived Susceptibility to CRC	5.3 (2.6)	6.0 (2.6)	0.06

† Limited to participants who did not report being up-to-date with screening at baseline (Non-obese: n=25, Obese: n=33).

‡ Limited to participants who reported that they did participate in any regularly scheduled activity and did not report that they were unable to do physical activity (Non-Obese: n=44, Obese: n=41).

Table 6.4 Unadjusted Intervention Outcomes: Within Weight Group Comparisons by Intervention Condition

***Outcome Variable*, Mean (SD)**	**Non-Obese**			**Obese**		
	Control (n=48)	*Intervention (n=45)*	*P-value*	*Control (n=44)*	*Intervention (n=44)*	*P-value*
*Message Evaluation**						
Elaboration Likelihood Score	70.2 (11.8)	71.0 (9.7)	0.71	74.2 (7.3)	73.8 (9.3)	0.80
Relevance	10.7 (3.0)	10.2 (3.1)	0.43	11.8 (2.2)	11.9 (2.6)	0.79
Trustworthiness	6.3 (1.2)	6.2 (1.4)	0.65	6.7 (0.94)	6.5 (1.1)	0.34
Change in CRC Screening Intentions						
All Participants	1.1 (3.4)	1.8 (2.7)	0.30	1.5 (2.5)	1.9 (2.7)	0.51
Unscreened†	1.9 (2.5)	1.7 (1.6)	0.83	1.7 (2.1)	2.7 (2.8)	0.30
Change in Exercise Intentions						
All Participants	0.6 (2.2)	1.2 (2.3)	0.19	1.1 (3.0)	1.1 (2.3)	0.91
Not regularly active‡	1.4 (1.8)	1.4 (2.0)	0.98	1.2 (2.6)	2.9 (2.4)	0.06
Change in CRC Knowledge	1.4 (1.2)	1.6 (1.3)	0.40	1.3 (1.4)	1.5 (1.5)	0.68
Change in Colonoscopy Self-Efficacy	0.51 (1.9)	-0.62 (1.7)	0.09	0.25 (2.1)	0.96 (2.2)	0.12
Change in FOBT Self-Efficacy	0.15 (2.1)	-0.39 (1.9)	0.21	0.23 (1.8)	0.47 (1.5)	0.50
Change in Exercise Self-Efficacy	0.28 (2.0)	0.27 (1.5)	0.98	0.36 (2.6)	0.84 (2.1)	0.34
Changes in Perceived Susceptibility	-0.30 (2.9)	-0.13 (2.7)	0.78	0.23 (3.4)	0.2 (2.8)	0.97

* Message Evaluation Measures were only collected at follow-up so mean score at follow-up is reported
† Limited to participants who did not report being up-to-date with screening at baseline (Non-obese: n=23, Obese: n=31).
‡ Limited to participants who reported that they did participate in any regularly scheduled exercise and did not report that they were unable to do physical activity (Non-Obese: n=40, Obese: n=33).

Table 6.5 Unadjusted Intervention Outcomes: Between Weight Group and Condition Comparisons

***Outcome Variable*, Mean (SD)**	**Weight Group**			**Condition**		
	Non-Obese	*Obese*	*p-value*	*Control*	*Intervention*	*p-value*
*Message Evaluation**						
Elaboration Likelihood Score	70.6 (10.8)	74.0 (8.3)	0.02	72.1 (10.0)	72.4 (9.5)	0.87
Relevance	10.4 (3.0)	11.7 (2.4)	0.005	11.2 (2.7)	11.0 (3.0)	0.68
Trustworthiness	6.2 (1.3)	6.6 (1.0)	0.047	6.5 (1.1)	6.3 (1.5)	0.36
Change in CRC Screening Intentions						
All Participants	1.4 (3.1)	1.7 (3.1)	0.54	1.3 (3.0)	1.9 (3.2)	0.19
Unscreened†	1.8 (2.1)	2.2 (2.5)	0.94	1.8	2.3	0.45
Change in Exercise Intentions						
All Participants	0.80 (2.6)	1.2 (2.3)	0.33	0.86 (2.3)	1.1 (2.6)	0.51
Not regularly active‡	1.3 (2.2)	2.0 (2.3)	0.17	1.4 (1.9)	2.0 (2.6)	0.25
Change in CRC Knowledge	1.4 (1.3)	1.5 (1.4)	0.39	1.5 (1.2)	1.4 (1.4)	0.67
Change in Colonoscopy Self-Efficacy	0.38 (2.0)	0.43 (2.0)	0.89	0.21 (1.8)	0.61 (2.2)	0.18
Change in FOBT Self-Efficacy	-0.11 (2.0)	0.35 (1.7)	0.10	0.19 (2.3)	0.05 (1.8)	0.61
Change in Exercise Self-Efficacy	0.27 (1.7)	0.60 (2.3)	0.28	0.19 (2.0)	0.05 (1.8)	0.61
Changes in Perceived Susceptibility	-0.22 (2.6)	0.21 (3.1)	0.33	-0.04 (3.2)	0.03 (2.7)	0.86

* Message Evaluation Measures were only collected at follow-up so mean score at follow-up is reported
† Limited to participants who did not report being up-to-date with screening at baseline (Non-obese: n=23, Obese: n=31).
‡ Limited to participants who reported that they did participate in any regularly scheduled exercise and did not report that they were unable to do physical activity (Non-Obese: n=40, Obese: n=33).

Table 6.6 Adjusted ELM Scores Stratified by Variables from the Multivariate Model

Model Variable	Average Adjusted ELM Score	p-value
Weight group		0.02
Non-obese	71.9	
Obese	75.5	
Condition		0.77
Intervention	73.5	
Control	73.9	
Education		0.03
High School/GED	77.2	
Some College/Trade School	72.8	
College	74.2	
More than College	70.6	
Age		0.02
50-55	70.9	
55-60	74.6	
60+	75.7	

CHAPTER VII

SUMMARY AND RECOMMENDATIONS

VII.A. Summary of findings

The information presented in this dissertation contributes to design and delivery of cancer prevention interventions with obese women in four main ways: (1) by confirming that obese white women, among other groups, have lower than average screening rates making them an important group to target with cancer prevention interventions; (2) by increasing understanding of the factors affecting screening and physical activity behavior among obese women; (3) by recommending potential intervention methods and messages which might help improve cancer prevention behaviors in this population; (4) by assessing the usefulness of weight-targeted messages among women.

Taken together, the results of this dissertation suggest that a variety of personal and healthcare related factors are contributing to lower rates of screening and physical activity among obese women. Current efforts to promote CRC screening and physical activity do not adequately address the psychosocial and informational needs of this population. It is clear that interventions are needed to help increase rates of these and other cancer prevention behaviors in high risk populations such as obese women. Internet-based messages appear to be an effective way to reach obese women, but like many methods this strategy still may not help the most hard to reach populations. It is also unknown whether or not this method is superior to other methods such as a clinic-based intervention.

In the first aim, studied in chapter 4, we analyzed the relationship between CRC screening and obesity in women using nationally representative data. We found that obese white women had lower rates of CRC screening, particularly colonoscopy, than non-obese white women ($p<0.05$); the opposite was true for African American women, but results were not statistically significant. This analysis helped to explain why previous studies which examined the relationship between obesity and CRC screening, but did not stratify by race or gender, found mixed results. Our results confirm that obese women, particularly white obese women, are an important group to target with cancer prevention interventions. The analysis also concluded that differential rate of doctor recommendation was not responsible for weight-related screening disparities.

In the second aim, explored in chapter five, we attempted to better understand the factors that affect screening and physical activity behavior in obese women. We found that many of the barriers to CRC screening were similar to those found in non-obese women (i.e., cost, time, anxiety about preparations or procedures); however, we also found that these barriers had different meaning for obese women. Many of the women in the focus groups had one or more co-morbidities which were caused or exacerbated by their current weight. These health concerns were seen as their priority; because these concerns took up a great deal of women's time and healthcare dollars, there were few resources left for screening. While women expressed many barriers to screening, they had poor knowledge about CRC prevention and were generally unfamiliar with the benefits of screening. Most women also did not see a connection between weight and CRC.

As with weight, women also did not see a connection between physical activity and CRC. While they knew that physical activity was important and could have many health benefits, they did not connect it with cancer prevention. There was also general agreement that physical activity was most necessary for women who were overweight; however this belief was countered by the belief that physical activity was important for general health and did not produce much weight loss. Women described a vicious cycle in which higher weight made it harder for them to exercise, but that exercise was important for preventing more weight gain. They cited many weight-related barriers to physical activity including embarrassment about exercising in front of others, getting out of breathe easily, not having enough energy to exercise and having physical difficulty exercising. Many women, particularly African American women, noted frustration with the fact that often when they started a new exercise program, difficulties or schedule changes arose and made it difficult to continue their planned activities. Women made many suggestions for what could be done to increase screening and activity in this population and shared their preferences for receiving information about health. The Internet was listed as the most frequently consulted source for health information; some women still preferred to receive information from their physicians though they recognized the limitations of their physicians' expertise when it came to diet and exercise. Many women were frustrated by doctors who made general recommendations for weight loss, but did not provide them with any specific instructions on how to achieve it.

In the third aim, examined in chapter 6, we designed a protocol for pilot testing CRC prevention messages among white women. Participants were stratified by weight (obese vs. non-obese) and then randomly assigned to review either weight-targeted messages designed for obese women or generic messages written by the CDC. Both sets of messages addressed CRC screening, physical activity and patient-provider communication. We assessed several variables including elaboration, behavioral intentions, CRC knowledge, self-efficacy and perceived susceptibility. We had hypothesized that the weight-targeted messages would produce greater elaboration and more positive changes for obese women than the generic messages would. We did find that the intervention messages improved screening self-efficacy among obese women and not in non-obese women. Weight group did not, however, moderate the relationship between intervention condition and any of the other outcomes. Instead we found that obese women had higher ELM scores than non-obese women regardless of which message group they were in. They also rated the messages significantly higher on relevance and trustworthiness than the non-obese women did. Baseline survey data from Aim 3 also confirmed that obese women had higher rates of certain barriers to screening and physical activity.

VII.B. Theoretical Implications

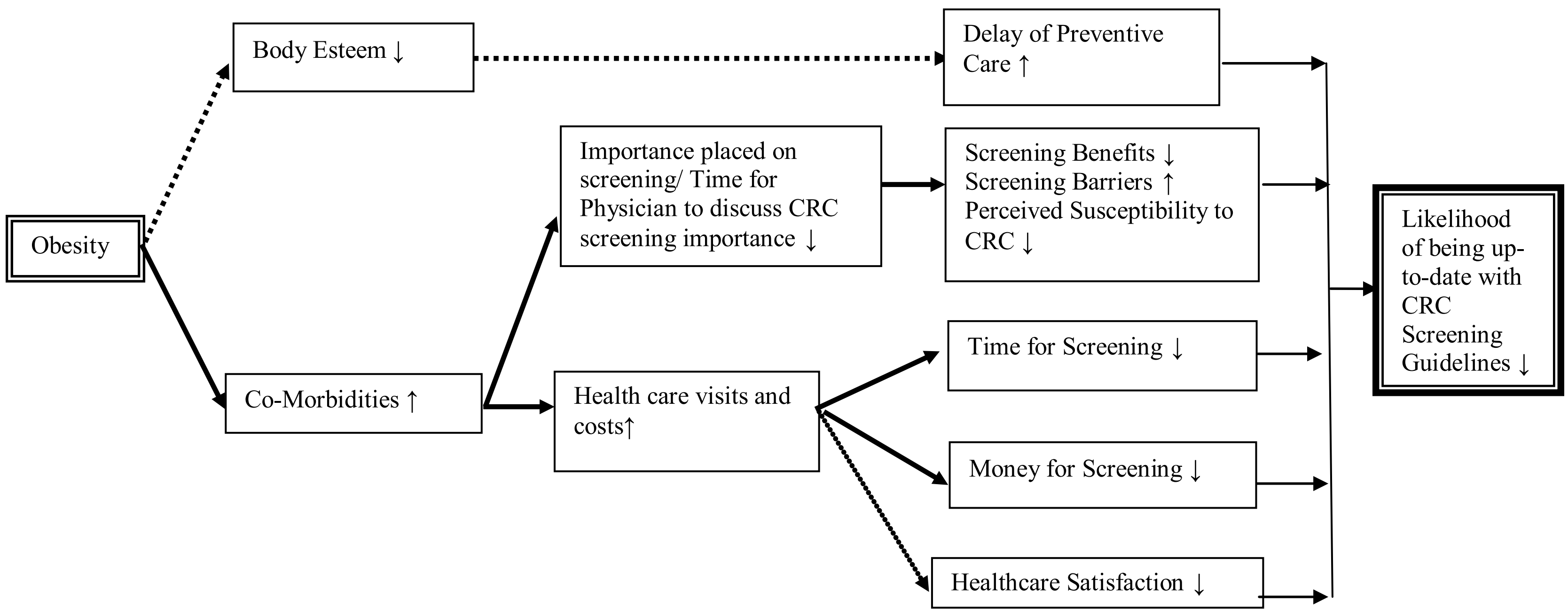
The results of all three Aims taken together informed a revised model of the link between obesity and CRC screening (Figure 7.1). We have chosen "Likelihood of being up-to-date with CRC screening" as the final outcome in this model for several reasons. First, data from Aims 1 and 2 both indicate that obesity is more likely to affect the timing of screening. That is to say that while there was no relationship between ever having a screening and obesity, there was a relationship between being up-to-date with screening recommendations and obesity. Timely screening is important as the risk of CRC increases after age 50 and current screening guidelines are set to reflect the time it takes for the disease to develop and the accuracy of the screening method. Secondly, women in the focus groups talked generally about the effect their weight had on screening and preventive care. They stated that while their weight might not keep them from going to the doctor, it might cause them to delay getting care. We use the word screening generally because it is possible that many of the factors linking obesity and screening apply not only to colorectal cancer screening, but also may explain some of the weight-related disparities seen in breast and cervical cancer screening.

One factor which stood out in aims 2 and 3 was the effect of competing healthcare needs on screening. Women in the focus groups often stated that they had other health concerns (i.e., diabetes, cholesterol) which they believed were more important. Since they did not realize that their weight put them at higher risk for CRC, screening was not a top priority. Baseline survey data from aim 3 confirmed that while time and cost involved in CRC screening did not alone seem overwhelming, they became barriers when placed in the context of other healthcare concerns faced by obese women. It is also important to note that higher co-morbidities and higher number of healthcare visits were associated with greater screening in the adjusted colonoscopy model developed based on aim 1 data. In this model, obesity remained significantly related to screening after controlling for both number of co-morbidities and past-year healthcare visits. This suggests that there may be some other unmeasured factor at play, such as body esteem, which is causing lower screening rates in obese women.

In the model, the arrows linking body esteem and delayed preventive care are broken because our data were not able to fully explore this relationship. Differences in body esteem may explain why obesity does not decrease screening rates among African American women. We hypothesize that, compared to their non-obese counterparts; body esteem is lower in obese white, but not obese African American women[104]. Women with low body esteem may be more likely to delay care because they don't want to face weight-related bias or discussion at the doctor's office. This phenomenon was discussed in Aim 2, but not specifically in relation to CRC screening. Additionally, women with lower body esteem may find screening to be more embarrassing. In Aim 3, we found that obese women were more likely to agree that screening tests were embarrassing. Unfortunately our data did not include a measure of body esteem so we were not able to confirm these hypotheses. Further exploration of the relationship between body esteem and screening in white and African American women may help explain how race moderates the screening-obesity relationship.

Even though weight-related screening disparities were not seen among African American women, they still have lower average screening rates than white women. Focus group discussions emphasized the importance of patient-provider communication, general healthcare trust, and healthcare satisfaction in the healthcare decision-making process. Focus group discussions uncovered significant distrust of the healthcare system among African American women. Past research has also shown higher physician distrust among certain groups of African Americans[117] which may partially explain their lower screening rates.. In Aim 3, we observed that healthcare satisfaction was correlated with baseline screening as well as several other outcome variables. Previous research has shown a relationship between healthcare satisfaction and health status (i.e., illness burden).[77] We hypothesized that greater co-morbidities and/or more healthcare visits may lead to less healthcare satisfaction. We have left this arrow broken since our study did not confirm these results in white women; there was no relationship between obesity and healthcare satisfaction or patient-provider communication, even after controlling for number of co-morbidities or self-reported health status. Moreover, we saw a positive relationship between number past-year visits and healthcare satisfaction. Further research is needed to better understand how number of co-morbidities, frequency of healthcare visits, patient-provider communication and healthcare satisfaction may interact to affect screening behavior in different sub-groups. The pathways drawn are hypothesis created based on qualitative data; mediation analyses of quantitative data would assist in confirming these relationships.

Figure 7.1 Model Linking Obesity with Screening Behavior in Women



VII.C. Intervention Recommendations

Aim 1

The results from Aim 1 confirm that obese white women have lower rates of CRC screening, particularly with colonoscopy, than non-obese white women. Analyses such as this are important because they allow us to identify disparities in behavior which could be addressed with behavioral interventions. The study also concluded that obesity was not significantly associated with lower screening in African American women. Adjusted analyses indicated that when all other covariates are held equal, obese white women have the lowest rate of up-to-date colonoscopy (30.2%) and obese African American women have the highest rate (41.2%). While calculating adjusted screening rates, as was done for Aim 1, is useful highlighting the effects of a single factor (such as race or obesity) independent of other possible confounder (such as age or illness burden) on a particular outcome, we must caution against their use in identifying at-risk groups.

Adjusted screening rates assume that all participants have average values for all covariates except the variables of interest (i.e., obesity and race). For this reason, it is important that when attempting to identify disparities that we rely instead on unadjusted analyses. The unadjusted analyses clearly indicate that African American women have significantly lower rates of up-to-date colonoscopy than white women (36.1% vs. 43.0%, $p=0.002$). Furthermore, the average unadjusted colonoscopy rate for obese African American women (38.1%) was lower than the average unadjusted rate for obese white women (40.3%). While the purpose of our analyses was to identify weight-related disparities, which appear to exist only for white women, we cannot ignore the fact that across weight-groups African American women have lower screening rates than white women. Additional efforts are needed to increase screening among African American women who not only have lower screening rates than white women, but who also have the highest CRC mortality of any racial/ethnic group.[96]

Aim 2

The qualitative study conducted for Aim 2 was the first we are aware of to examine screening and physical activity knowledge, attitudes, beliefs and behaviors among obese women. One strength of this study was that, at the time of recruitment, none of the women in the focus groups was up-to-date with CRC screening. While this allowed us to look more closely at the population of interest, it made it extremely difficult to recruit women. Women who have not had screening may be less inclined to participate in a study about colon cancer either because they are not interested in the topic or they are afraid to admit that they are not engaging in socially desirable health behaviors. This also may have biased the sample toward younger women who had not yet had their first screening. Nearly two-thirds or the women in the focus groups were under the age of 55. Many of the women felt that they would have a screening eventually, but they had not done it yet. While we did not specifically plan to recruit women in this age group it may have been an advantage for the study. Previous research indicates that obese women delay care and this is an ideal population within which to study that phenomena. Older unscreened women are more likely to have developed a pattern of non-adherence and may be difficult to reach with behavioral intervention; younger women may be more open to new information and initiating new behaviors.

When we began recruitment, we asked women to volunteer, but had difficultly recruiting women and scheduling them for focus groups. While many of the women worked in close proximity to the groups, they were not otherwise connected; this made it difficult to schedule discussions and get women to attend. In the past, it has proved easier to recruit and retain participants who are part of some common group (housing, church etc.), however we did not choose to do this because we felt it would be difficult to limit participation on the basis of sensitive topics such as screening or weight.

We tried an alternative method for recruitment which involved directly calling women associated with a large medical practice. We used a database of information on screening behavior to identify women who were not currently meeting CRC screening guidelines. Unfortunately, this database was not updated and many of the women we contacted did not meet our recruitment criteria. We were able to recruit a handful of women using this method, however only one or two of them actually attended our focus groups. We abandoned this method for several reasons; first, calling women in the database was extremely time intensive and did not yield much result. Second, the Institutional Review Board changed its policies to no longer allow us to identify women through medical records. Third, we felt strongly that we did not want to label women as obese based on their BMI. It is preferable that future studies allow women to self-identify as overweight (we did not use the word obese when communicating with participants). Women who we contacted directly often had strong feelings about the use or misuse of BMI measures or weight class labels.

For this study, we also debated whether a focus group was an appropriate data collection method to use when discussing sensitive topics such as weight. We found, however, that women very much enjoyed the supportive nature of the discussion. They felt comfortable discussing weight-related issues in front of women who were facing the same challenges. One woman specifically stated that she was relieved to find out that no one else had been screened for CRC and that she was not going to be admonished for avoiding screening. The focus groups did not, however, endorse or discourage CRC screening. Still, in many cases women said that they came to the discussion to learn more about CRC prevention and left with intentions of getting screened. Although this was not the goal of the focus group, it is important to note. As noted earlier, our previous research had shown that a social support interventions was not be as effective at reaching obese women for CRC prevention as a tailored message intervention[80]. We hypothesized that obese women may have felt uncomfortable discussing health issues with non-obese women or vice versa. Reactions to these focus groups suggest future promise for social support interventions that are homogenous with respect to weight. Conversely, the majority of women felt that the internet was the best way for them to get health information. While a few women mentioned group discussions as a possible method, some felt that group activities were too time consuming.

Aim 3

For Aim 3, we did not see higher ELM scores for obese women reading the targeted messages compared to the generic messages, but we did see higher ELM scores overall in obese women. The ELM posits that higher elaboration leads to greater central processing and thus greater potential for behavior change. If this is true, then these results are promising; the group with lower screening/physical activity rates had higher ELM scores and more potential for change. This result may support our focus group finding that messages received through the Internet are a potentially effective way to reach obese women. Unfortunately, we did not see significantly higher screening or PA intentions in obese women. This leads us to questions whether the ELM scale is the best way to evaluate messages. It is possible that there was not enough time between reading and evaluating the messages for women to reevaluate their intentions and that we would see different results had these messages been used, as intended, in the context of a larger intervention trial.

To better gauge the utility of the ELM scale for message testing, we looked at the association between ELM scores and changes in behavioral intentions. Overall, ELM scores were more highly correlated with changes in intentions to engage in physical activity ($r=0.23$, $p=0.002$) than changes in intentions to have a CRC screening ($r=0.11$, $p=0.13$). Interestingly, these correlations were also much stronger in non-obese women than obese women; the relationship between ELM score and changes in physical activity intentions was significant among non-obese women ($r=0.33$, $p=0.001$), but not obese women ($r=0.11$, $p=0.29$). There was also positive a correlation between changes in physical activity intentions and relevance/trustworthiness scores. Contrary to previous research stating that relevance and trustworthiness predict behavior,[112] believing the information in the messages was not correlated with screening intentions ($r=0.00$, $p=0.97$); there was a non-significant positive correlation between relevance and screening intentions ($r=0.12$, $p=0.09$). Again, these correlations were confined to non-obese women. It is unclear why these associations would differ by obesity status. It is possible that higher ELM scores among obese women do not indicate greater potential for behavior change, but may reflect some other latent difference between obese and non-obese women. Qualitative measures may prove more indicative of actual elaboration and potential for the messages to prompt future behavior change.

While this study did not find evidence for weight-targeting messages, it did confirm some of the weight-related barriers that we found in the focus groups. For screening, we saw that a larger proportion of obese women agreed that other health concerns were a priority when it came to their time and healthcare dollars. We also confirmed that obese women were more likely to agree that they only exercise when they are trying to lose weight and that their weight makes it difficult for them to exercise. The weight-targeted messages addressed all of these weight specific barriers. Consequently, women who expressed agreement with the weight-related barriers had higher ELM scores when they read the intervention messages than when they read the control ones. These findings indicate that these messages may be motivating for the sub-group of women who express weight-related barriers. However, not all obese women face these barriers and some non-obese women do. Including these messages in a tailoring algorithm could be more beneficial than a weight-targeted message intervention.

VII.D. Future Research

Based on the findings described above, we would recommend additional inquiry in the following areas:

1) Focus group discussions were conducted with both white and African American women, but since aim 3 data was only collected with white women, we were not able to compare psychosocial variables for screening or physical activity by race and weight group. We are in the process of collecting these data with African American men and women. Making comparisons between weight, gender and race groups we allow us to better understand which factors might be responsible for the screening disparities we see between sub-groups. To more accurately confirm the hypotheses

set forth in the conceptual model linking screening and weight, we would need to conduct a longer term intervention study to address potential psychosocial mediators and perform formal mediation analyses and/or structural equation modeling.

2) We were unable to fully explore the effect of body esteem on screening behavior. Research indicates that this may play a role in weight-related disparities in breast and cervical cancer screening, but women in the focus groups did not believe that their weight kept them from getting CRC screenings specifically (thought they did admit to delaying preventive care because of their weight). It is possible that the focus group setting was not the proper method for exploring the relationship between screening and latent variables such as body esteem. Future studies could include quantitative measures of body esteem and look at their relationships with cancer screening. Currently our research does not provide a good explanation for why obesity does not affect cancer screening rates in obese men or African American women. Our explanation of the obesity-screening relationship focused on co-morbidities and healthcare satisfaction, but we have no reason to believe that these issues would differentially affect obese white women. More research is need to explore whether or not racial differences in weight acceptance, body esteem or other related factors are better explanatory variables for the differential effects we see by race and gender.

3) An important finding from the focus groups was that obese women had poor CRC knowledge and were unfamiliar with the benefits of screening. They also believed that they had average or below average risk for CRC because they did not have a family history of cancer. Emerging research indicates that doctors spend the majority of their time discussing screening logistics and little or no time is spent discussing the

risk factors for CRC or the purpose/benefits of screening.[2] Data from actual patient-physician conversations can be used to confirm our hypothesis that conversation about obesity-related co-morbidities are taking precedence over cancer prevention.

4) Focus group data and preliminary results from the message testing study indicate that messages which focus on CRC risk and prevention may be better able to increase intentions in women. Women expressed interest in more information about general cancer prevention and colon health (including the benefits of weight loss and physical activity). Unfortunately, they did not have confidence that their doctors could/would give them information about how to increase physical activity or manage their weight. From a health communications perspective, we may be doing women a disservice by framing the cancer prevention discussion in terms of a choice between screening tests rather than a choice to screen or not to screen. Additionally, we may be missing opportunities to discuss risk factors for and prevention of CRC. In regards to physical activity, messages which promote exercise outside the context of weight-loss may be needed to change obese women's attitudes and beliefs about exercise. Further analysis of the qualitative message testing data will allow us to better understand which types of cancer prevention messages would best resonate with women. Pilot studies are needed to test the effectiveness of benefit-focused messages compared to conventional messages about screening tests. It is unclear if these types of messages can increase the importance of CRC prevention among groups who face multiple health issues.

5) We hypothesized that obese women had higher ELM scores because they were more accepting of the intervention method. However, we do not know if giving screening

[2] Data presented by Dr. Elston Lafata at UNC (12/8/2009)

messages online is more effective than a clinic-based or other type of intervention. Previous research suggests that the method of delivery may be just as important as the message when it comes to reaching different population sub-groups. Pilot studies could test preference for online messaging versus other methods to see if it differs by weight group, race or gender. Targeted intervention delivery methods may be integral to reaching groups with the lowest rates of cancer prevention behaviors.

In summary, this research has provided insight into potential ways to improve CRC screening and physical activity rates among older obese women. This research prompts us to rethink the way we provide information about cancer prevention behaviors, especially in clinical settings. It suggests that targeting interventions methods and tailoring messages may better reach some of the most at-risk populations. Further research is still needed to understand all the factors that are affecting cancer screening in obese women, however we can still begin to address the factors which are better understood such as the influence of competing medical demands. While the main focus of this research was colorectal cancer prevention, its findings may be applicable to the prevention of other cancers such as breast and cervical cancer.

APPENDIX A

SUMMARY TABLE OF WEIGHT AND CRC SCREENING STUDIES

Author, Date	Data Source	Screening Outcome Measurement	Weight Categories	Results/OR	Adjustment for Confounding	Limitations
1.) Rosen et al. (2004)	BRFSS 1999 (Only results for women are reported)	Self Report: FOBT in last year or Endoscopy in last 5 years	Normal (18.5-24.9); Overweight (25.0-29.9); Obese (30-34.9); Morbidly Obese (≥35)	Morbidly obese women had a significantly lower rate of screening than normal weight women **Any On-time:** 37.1 vs. 42.7 **FOBT**: 18.7 vs. 22.4 **Endoscopy**: 25.9 vs. 30.8	Age, ethnicity, income, education, marital status, insurance status, region, self-reported health status, smoking status, and time of last medical visit.	Cannot differentiate between colonoscopy and sigmoidoscopy, some people may be misclassified. Did not stratify by race.
2. Ferrante et al. (2006)	Chart Abstraction in 22 Family Medical Practices in N.J. and P.A.	Documentation in Chart of: FOBT in past year, sigmoidoscopy in last 5 years; colonoscopy in last 10 years; DCBE in last 5 years	Obese (BMI ≥ 30) vs. Non-Obese	**Men and Women:** OR 0.75 (0.62-0.91) No interaction with obesity and gender.	Age, gender, number of visits in the last 2 years, number of co-morbidities, number of years at practice	Did not separately examine different tests. Did not control for or stratify by race.
3.) Heo et al. 2004	BRFSS 2001 (only results for	Self Report: FOBT in last year or Flex Sig in last	Normal (18.5-<25); Overweight (25-	**Flex Sig:** *Obese I* OR 0.86 (0.78-0.94)	Age, health insurance, race and smoking.	Did not stratify by race. Ignored colonoscopy

	women are reported)	5 years	<30); Obesity class I (30-<35); Obesity class II (35-<40): Obesity class III (≥ 40) (normal weight as referent)	*Obese II* OR 0.88 (0.79-0.99 **FOBT**: No association		which is included in the flex sig question on the BRFSS questionnaire.
4.) Chao et al. 2004	Cancer Prevention Study II Nutrition Cohort 97,786 Women (only results for women are reported)	Self Report: Screening Sigmoidoscopy or Colonoscopy Ever	BMI: <18.5; 18.5-24.9; 25.0-29.9; 30.0-39.9; ≥40 (normal weight as referent)	*Overweight* OR 0.89 (0.85-0.93) *Obese* OR 0.86 (0.81-0.91) *Morbidly Obese* OR 0.71 (0.59-0.85)	Age, race, education, work status, occupation, recent doctors visit, health insurance coverage, ever diagnosed with cancer, ever diagnosed with other health conditions, personal history of polyps, number of relatives with CRC, vitamin usage, fiber laxative usage, other laxative usage, physical activity level, cigarette smoking, alcohol usage	Did not look at FOBT, did not look at tests in recommended time frame. Did not stratify by race.
5.) Seeff et al. 2004	NHIS 2000	Self- report: FOBT within the past year, Endoscopy in last 10 years.	Normal (<25); Overweight (25-29); Obese (≥30)	**Any On-time:** *Overweight* OR 1.07 (0.96-1.20) *Obese* OR 1.11 (0.98-1.27)	Gender, race, ethnicity, age, education, marital status, health care coverage, usual	Endoscopy includes proctoscopy which is not a recommended

				FOBT: *Overweight* OR 0.99 (0.87-1.14) *Obese* OR 1.07 (0.92-1.25) **Endoscopy:** *Overweight* OR 1.10 (0.98-1.23) *Obese* OR1.09 (0.95-1.25)	source of care, number of physicians visits in the last year, general health status, personal history of cancer, family history of CRC, family history of other cancers, physical activity, cigarette smoking, alcohol use	screening modality. Normal weight includes underweight individuals who tend to have lower screening rates. Did not stratify by gender or race.
6.) Wee et al. 2005	NHIS 2000	Self Report: FOBT in past year, sigmoidoscopy in last 5 years; colonoscopy in last 10 years	BMI <18.5; 18.5-<25.0; 25.0-<30.0; 30.0-<35.0; 35.0-<40.0; 40.0+	No significant results: All odds ratios between 1 and 1.2	Age, sex, race/ethnicity, education, insurance coverage, region, usual source of care, health status, smoking, family history of colon cancer, and marital status	Study not designed to look at weight and screening. Did not stratify by race or gender
7.) Menis et al. 2006	2002 Maryland Cancer Survey, a population-based statewide survey on cancer screening	Self-report telephone survey: FOBT within the last year, sigmoidoscopy within the last 5 years, or colonoscopy within the last 10	Normal weight or underweight (BMI <25); Overweight (BMI 25–29.9); Obese (BMI >30)	*Overweight* OR 1.05 (0.83-1.33) *Obese* OR 0.84 (0.65-1.09)	Sex, race, age, marital status, education, employment, geographic area, health insurance, having had a physical examination in the last 2 years, and	Normal weight category includes underweight individuals. The interaction terms between sex and BMI were excluded from the final models because the

	and behavioral risk factors among people aged 40 and older (3,436 50+ respondents)	years			CRC screening recommendation.	overall modifying effect by sex was not significant after controlling for all other covariates in the logistic regression model. Compared with the U.S. population in 2000, adults aged 50 and older who lived in Maryland had a much higher up-to-date CRC screening rate (34.0% for the U.S. population vs. 64.9% for Marylanders). Did not stratify by race.
8.) Slattery et al. 2004	Case Control Study conducted with Kaiser Permanente Medical Care Group of	Self- report: Sigmoidoscopy within past 10 years	BMI < 25; 25-29; >30	*Overweight* OR 2.3 (1.5-3.5) *Obese* OR 1.8 (1.2-2.8)	Education level, marital status, family history of colorectal cancer, physical activity, NSAID use, dietary supplement use, Western/Prudent Diet, cigarette	Study not designed to look at weight and screening. Referent category includes underweight individuals. Sigmoidoscopy

	California (1,231 women age 30+)				smoking history, HRT, alcohol intake	time frame is not recommended frame. Does not include other recommended tests. Individuals 40+ were included if they had a family history of colon cancer.
9.) James et al. 2008	Baseline data from Rural African American Church Members in NC	Self-report: Screening in the past year	Normal (18.5-<25); Overweight (25-<30); Obesity class I (30-<35); Obesity class II (≥35-)	In women, weight was significantly associated with having had any CRC screening test in the past-year (n=278, p=.05). <u>Screening rates:</u> *Normal* 44.8% *Overweight* 28.1% *Obese I* 22.8% *Obese II* 28.9%	None	Only looked at screening in the past year, not adherence to recommendations; however, FOBT was the predominant test. Small numbers made it difficult to control for any confounders.

APPENDIX B

FOCUS GROUP PARTICIPANT INFORMATION SHEET

Please answer the following questions before we begin the focus group discussion:

1. What is the highest grade of school or amount of college you have completed? (check one)

- ☐ Eighth grade or less
- ☐ Some high school
- ☐ High school graduate or GED
- ☐ Trade or beauty school graduate
- ☐ Some college
- ☐ College graduate
- ☐ More than college (some post graduate, post graduate, or professional degree)

2. Which of the following best describes your yearly household income? (check one)

- ☐ less than $10,000
- ☐ $10,000 - $19,999
- ☐ $20,000 - $29,999
- ☐ $30,000 - $49,999
- ☐ $50,000 - $74,999
- ☐ $75,000 – $99,999
- ☐ $100,000 - $124,999
- ☐ $125,000 – $149,999
- ☐ more than $150,00

3. How do you pay for your health insurance? (check all that apply)

- ☐ I have Medicaid
- ☐ I have Medicare
- ☐ I have Veterans benefits
- ☐ My employer [or previous employer] and I share health insurance costs
- ☐ I pay for my own health insurance
- ☐ Other
- ☐ I don't have any health insurance

5. What is your marital status? (check one)

- ☐ Married or living with a partner
- ☐ Never been married
- ☐ Divorced
- ☐ Separated
- ☐ Widowed

☐ Other

4. What is your age? ____

5. What is your height? ____ ft. _____ in.

6. What is your weight in pounds? ______

APPENDIX C

FOCUS GROUP MODERATOR'S GUIDE

Introduction

Hello and welcome, my name is _______. (Introduce other team members and roles) I thank you for taking time to join us in this research focus group session today. We are researchers from the University of North Carolina. We want to learn more about the best ways to help prevent colon cancer in women. We are having focus group discussions with several groups of women in the triangle area to help us better understand why women choose to have colon cancer screening test and be physically active. The overall goal of this research is to understand how a woman's weight affects whether or not she does physical activity or gets a screening test for colon cancer. We know that in the U.S. we tend to gain weight as we age, so we want to make sure that programs designed to help prevent colon cancer and increase physical activity are acceptable to all women .

The session should last between an hour and a half and two hours. At the end of that time you will receive a check for $30 for your time. Feel free to help yourself to refreshments at any time. If you need to use the ladies room it is [give directions]

Forms

You have in front of you a few different documents. First, you have two identical copies of a consent form. I ask that you review the information in the consent form and then sign the last page stating that you understand what is involved in this research study and that you agree to participate. Please return the signed copy to me and keep the other copy for yourself.

The second document is a Participant Information Sheet. I also ask that you fill this out and return it to me before we start.

Before we begin, does anyone have any questions about the study or anything listed in the consent form?

Collect Consent Forms and Participant Information Sheets

Focus Group Conduct Issues

1. *We would like to tape record the discussion today to make sure we don't miss any of your comments. We take notes but often they are not as complete as when we tape the discussion. Is that OK with everyone? Any objections? If you want to make a comment that you don't want recorded, just tell us that and we'll turn off*

the tape and re-start it when you finish making your comment. Is that OK? (Check for nods, agreement) Try to speak up so the tape recorder picks up your answers.

TEST TAPE AND START RECORDING

2. *Everything we say here today is confidential. We will only be using first names on the recording. Individual names or answers will not be shared with anyone. Only a summary of all the focus groups we are doing will be used. We also ask that you do talk about what people in this group say today to anyone outside the group. What is said in the room should stay in the room. Can everyone agree to this? As researchers, we commit to keeping confidential the information you share with us. However, we can't control what happens outside of the group. If there is anything that you don't want known outside the group, don't talk about it in the discussion. If you have something you want us to know but don't want to talk about in the group, , I will stay around after the group and will be happy to talk with you privately.*

3. *Please feel free to share your ideas and opinions even if they are different from others. All views and ideas are important. There are no right or wrong answers. We would like to get as many different points of view as we can. Since this is a group discussion you do not have to wait for me to call on you to speak, but please try to speak one at a time. If everyone starts talking at once I may ask you to stop so that we can hear everyone on the tape recorder.*

4. *To help our note taker, I am going to ask you all for your first and last initial.*

Begin Discussion

To start the focus group session, we'll first discuss some issues around health and cancer screening, take a break, and then discuss physical activity and intervention preferences. When we are done, you will sign a receipt and receive your check.

To begin, I would like to go around the (table, room) and have each of you tell us your first name, and if you like, share why you were interested in participating in this focus group.

Take about a minute or so to do this.

I. Health Issues

As we have this discussion I would like you to keep in mind that we are trying to learn if weight has an effect – or not – on women's concerns about their as well as on the health choices they make.

Let's start with a general discussion about your health.

1. What concerns you most about your health?

Probe: What about weight?

2. What kind of things do you normally do to take care of your health?
   Probe: Are there any regular check-ups or screening tests you get?

3. Have you ever delayed getting a screening test or any other preventive health care that you knew you should get? [By preventive healthcare I mean anything you see a health care provider about when you are not sick such as regular check-ups, cholesterol tests, blood sugar tests, vaccines or cancer screenings]
   Probe: Can you tell me about what happened?

4. Some women have said that they delay going to get screenings because they don't want to be weighed or be told to lose weight. Has this ever been a concern for you?

5. Has your weight ever prevented you from visiting a health care provider for any other reason?

6. How do you decide whether or not you should get medical tests or screenings?
   a. Which tests do you think are most important to get?
   b. What role does your health care provider have in your decision to get a test or screening? Who else influences your decision?

7. How satisfied are you with your current healthcare provider?
   Probe for reasons
   a. Have you ever been dissatisfied with a health care provider? Why?

II. Knowledge of colon cancer

The next questions are about colon cancer.

1. What's the first thing you think of when you hear the words "colon cancer"?

2. What do you know about colon cancer?
   Probe: What do you think are reasons people get colon cancer?

3. Compared to other women your age, do you think you are more or less likely to get colon cancer?
   Probe: What puts you at higher/lower risk?
   If not mentioned: What about weight?

4. What can be done to help prevent women from getting colon cancer?

III. Colon Cancer Screening

1. What colon cancer screening tests have you heard of?

2. What do the tests look for?

Describe Screening Tests and Purpose

3. Have you ever had a colon cancer screening test?

4. If you were to get a(nother) colon cancer screening test, what would be the reason?

5. What are some reasons why women don't get colon cancer screenings?
   Probe: Earlier we discussed how weight might affect the healthcare that women receive. Is there any connection between weight and a woman's decision to get a colon cancer screening?

6. Has your doctor told you that you should have a colon cancer screening?

   a. If so, what kind of screening?

   b. If not, if your doctor recommended it, how likely would you be to get a colon cancer screening?

7. Have any of your friends or family been screened for colon cancer?

   a. What have they told you about screening?

8. What could be done that would help you to get a(nother) screening test for colon cancer?
   Probe: Is there information that you would like? Who would help you?

BREAK

Welcome back. In the first part of the session we discussed you your thoughts about health issues, colon cancer and cancer screening. Now we are going to talk about physical activity and how you best like to receive health information.

V. Physical Activity

1. How would you define physical activity?
   Probe: What kinds of things do you consider to be physical activity?

2. What kind of physical activity do you currently do?
   Probe for those who are active: How often do you do it?
   How long have you been doing this activity?

a. How has your physical activity changed over time?

b. Does your weight have any effect on your activity level?

3. What motivates you (or would motivate you) to be physically active?

4. What gets in the way of being active?

   Probe: Do you consider any of these barriers to be weight-related?

5. What do your friends and family members say to you about physical activity?
   Probe: What role does weight play in these conversations, if any?

   a. How do friends and family affect how much physical activity you do?
      Probe: Do they make it harder for you to be active? Do they encourage you to be active?

   b. Do you have friends or family members who are active on a regular basis?

6. How comfortable do you feel talking to your doctor about physical activity?

   a. What does your doctor say to you about physical activity?
      Probe: What role does weight play in these conversations, if any?

   b. How do your health care providers affect your decision about how much physical activity you do?

7. If you were going to be more physically active, what would help you most to do that?
   Probe: Is there information that you would like? Who would help you?

VI. Best ways to get health information

1. There are lots of ways that people get information about colon cancer and physical activity. Here are three:
   i. talking to someone like you who had been trained to talk to others about health
   ii. receiving information over the internet or through e-mail,
   iii. receiving print information sent to you home

   a. Where do you usually get your health information?

   b. Which way do you prefer? Why?

c. Is there another way of getting this information that I haven't mentioned that you would prefer?

2. Is there anything that annoys you in health messages?

3. What types of health messages have been able to encourage you in the past?

That's the end of the questions. Is there anything else you would like to add?

Thank you very much for your time.

(Name of note taker) will give you each a check for $30 for your participation today. Thanks for your help today.

APPENDIX D

FOCUS GROUP RESULTS FOR PHYSICAL ACTIVITY

Women in the focus groups were asked what type of exercise they currently do. For white women, the most common type of current physical activity was walking and doing yard work/outdoor activities. Others stated that they were just trying to always be active (e.g. "always moving"). Also, some women indicated that they were either too pressed for time or that medical problems prohibited them from exercising. For black women, walking was also the most frequently cited physical activity. However, they also indicated that their current PA fluctuates between periods of high to moderate activity to relatively none at all. These changes were generally related to changes in personal routines, schedules or weather.

Next we asked about other factors, such as weight, which might affect participants' exercise behaviors. Perceived benefits and barriers to participating in physical activity are shown in Table D.1. For white women, the most common barrier to exercise was physical injuries, many of which were aggravated by excess body weight. Lack of time and "weight-related" barriers and were also frequently cited; women stated that their weight made it more difficult for them to exercise and made activity physically uncomfortable. "Weight-related" barriers were also common among African American, several of whom expressed discomfort with how they looked while they were exercising. Many African American women were discouraged from exercising because it did not produce significant changes in their weight.

White and African American women sighted similar motivations for engaging in physical activity. For both groups, the health benefits were cited as being the most motivating factor for engaging in any form of physical activity. Women also reported using exercise as a way to develop and maintain a social network. While few women cited weight lose as a motivation for exercise, most women believed that exercise was most important for women who were trying to lose weight.

> "I never had to exercise in my young life to stay in shape. It never was even a thought in my head. And so, like I said, it's not something I'm used to." (White Woman)

We also discussed potential strategies which might help women to increase their current exercise level. Strategies included exercising in a motivating setting (i.e. beach or other pleasant scenery), seeking encouragement via a social group or having an exercise partner.

While women recognized the health benefits of exercise, some of them associated these benefits with weight loss. If obese women who do not see significant weight loss resulting from exercise participation they may not believe exercise is benefiting their health. This coupled with the increased difficulty of exercise for larger women may discourage them from continuing regular exercise. Future exercise promotion programs targeted to obese women should emphasize that the benefits of exercise can be achieved even at moderate levels, which may not produce weight loss.

Table D.1. Perceived Benefits and Barriers to Physical Activity among Obese Women

Construct	Common Codes and Frequencies	Illustrative Quotes
*Perceived Barriers to Physical Activity (General)**	White: Injury or surgery (9); Time (5); Life gets in the way/ you get distracted (3); Chronic condition (3); Environment/safety issues (2); Don't want to exercise in front of others (2) African American: "Life situations" i.e. events which cause schedule changes (6); Exercising doesn't cause enough weight loss (4); Don't have place/don't know how to exercise (4); Lack of Time (3); Too tired/old (3); Injury (2); Weather (2); Don't enjoy exercise (2); Lost group or partner (2); Fatalism (2); Lack energy/ motivation (2)	"The knees. And the hips, too, right now. Yeah I used to go to the gym but the knees are now going, "Don't do that!" So I have to accommodate them, now." (White Woman) "When my blood sugar's low, I can't go out and walk because it's gonna drop, and then I'll be lying around somewhere, half dead! (Laughs) So... you know, it's a constant balancing act." (African American Woman) "I went back in the group, got me a walking partner, we would go to South Point every morning and [then] we had an emergency with one of my daughters... what put me into that situation, and I haven't gotten back yet, find my group back there." (African American Woman) "But when you pass a certain age, it's just not as, um... advantageous to you, 'cause you can exercise, and you can eat less, and you don't change. And it takes six/ eight months before anything happens, and then, like I said, there's other little problems coming in between that make you either slow down or you just can't keep that routine." (African American Woman)
Perceived Barriers to Physical Activity (Weight-related)	White: Weight, general (3); Physically Uncomfortable while exercising (3) Short of breath (1); Uncomfortable with appearance while exercising (1) African American: Other's perception that larger women can't	"…the weight goes down and then I feel better about exercising, because who wants to be, you know, big, fat, tight clothes, that kind of thing, getting out of breather earlier or something like that, although my breath really is pretty good." (White Woman) "I think the reason I don't exercise is... I want to exercise by myself, but the only reason I don't want to join a club, or anything like that is because everybody in there is like a size 2!" (African

	do certain things (2); Uncomfortable with appearance while exercising (2); Weight makes you tire easily; Short of breath; Exercise harder when you are overweight	American Woman)
Perceived Benefits of Physical Activity	<u>White:</u> Improve Health/Quality of life (7); Weight management (6); Disease prevention (6); Improve physical health (5); Treat conditions/ Avoid medication (5); Improve mental health (4); Social/ Fun (2) <u>African American:</u> Weight management (5); Improve mental health (5); Social/Fun (4); Improve physical health (3); Manage diabetes (1); Take time for self (1); Improve skin (1)	"My physical activity drops off as I gain weight. And then it increases as I lose weight. And so, losing weight, seeing the numbers go down on the scale, feeling as though my clothes are fitting better or I get into, you know, my smaller size clothes and that sort of thing, that motivates me to work out, to be more purposeful in doing physical activity. I also don't want to hurt I don't want to have heart disease and so, when I'm doing what I need to be doing, those also help reinforce being active." (White Woman) "Walking to me is therapeutic, as well as the exercise. I've solved a lot of problems walking. I can really tell the difference in everything - my skin, my weight, my temperament and that works for me." (African American Women)

*Due to high numbers of perceived barriers, only those which were cited 2 or more times are included in the chart.

APPENDIX E

ONLINE MESSAGE TESTING SURVEYS

Eligibility Questionnaire

Please only complete the eligibility questionnaire once.

1. What is your gender?

   - ☐ Male
   - ☐ Female

2. What is your age? ___
3. What is your height ? _______ ft. ______ in.
4. What is your weight in pounds? _______
5. What is your race? (select one)

   - ☐ White (not Hispanic)/ European American
   - ☐ African American/ Black
   - ☐ Native American
   - ☐ Asian/ Pacific Islander
   - ☐ Hispanic
   - ☐ Multi-racial
   - ☐ Other

6. What is the highest grade of school or amount of college you have completed?

   - ☐ Eighth grade or less
   - ☐ Some high school
   - ☐ High school graduate or GED
   - ☐ Trade or beauty school graduate
   - ☐ Some college
   - ☐ College graduate
   - ☐ More than college (some post graduate, post graduate, or professional degree)

7. Which of the following best describes your yearly household income?

   a. Less than $10,000 (5)
   b. $10,000 - $19,999 (7)
   c. $20,000 - $29,999 (16)
   d. $30,000 - $49,999 (37)
   e. $50,000 - $74,999 (58)
   f. $75,000 – $99,999 (37)

g. $100,000 - $124,999 (26)
h. $125,000 – $149,999 (10)
i. More than $150,00 (11)

Baseline Survey

<u>Colon Cancer Questions</u>

These questions are about tests which you may have had to screen for colon cancer.

1. A stool blood test, also known as a Fecal Occult Blood Test or FOBT is a test to check for colon cancer. It is done at home using a set of three cards to determine whether the stool contains blood. You smear a sample of your fecal matter or stool on a card from three separate bowel movements and return the cards to be tested. **Before reading this description, had you ever heard of FOBT?**

   a. Yes → Continue to Question 1b.
   b. No → Continue to Question 2
   c. Not sure/ Don't know→ Continue to Question 2

1b. Have you ever had and FOBT?

   a. Yes → Continue to Question 1c.
   b. No → Continue to Question 2
   c. Not sure/ Don't know→ Continue to Question 2

1c. When was your last FOBT?

   a. A year ago or less
   b. More than 1 but not more than 5 years ago
   c. More than 5 years ago but not more than 10 years ago
   d. More than 10 years ago
   e. Not sure/ Don't know

2. On a scale of 1 to 10, how confident are you that you can complete a(nother) stool card test? *A 1 means that you are not at all confident, a 10 means that you are very confident.*

1 2 3 4 5 6 7 8 9 10

Not at all confident (goes under the 1) very confident (goes under the 10)

The following questions are about sigmoidoscopy and colonoscopy, two other tests to check for colon cancer. Both tests examine the colon using a narrow, lighted tube that is inserted in the rectum. Sigmoidoscopy only examines the lower part of the colon, while colonoscopy examines the entire colon.

<u>With the sigmoidoscopy:</u>

- You are awake.
- You are able to drive yourself home.
- You are able to resume your normal activities.

<u>With the colonoscopy:</u>

- You are given medicine through a needle in your arm to make you sleepy.
- You need someone to drive you home.
- You may need to take the rest of the day off from your usual activities.

3. Before reading this description, had you ever heard of a sigmoidoscopy?

    a. Yes → Continue to Question 3 b.
    b. No → Continue to Question 4
    c. Not sure/ Don't know→ Continue to Question 3

3b. Have you ever had a sigmoidoscopy?

    a. Yes → Continue to Question 3 c.
    b. No → Continue to Question 4
    c. Not sure/ Don't know→ Continue to Question 4

3c. When was your last sigmoidoscopy?

    a. A year ago or less
    b. More than 1 but not more than 5 years ago
    c. More than 5 years ago but not more than 10 years ago
    d. More than 10 years ago
    e. Not sure/ Don't know

4. Before reading the description above, had you ever heard of a colonoscopy?

    a. Yes → Continue to Question 4 b.
    b. No → Continue to Question 5
    c. Not sure/ Don't know→ Continue to Question 5

4b. Have you ever had a colonoscopy?

a. Yes → Continue to Question 4 b.
b. No → Continue to Question 5
c. Not sure/ Don't know→ Continue to Question 5

4c. . When was your last colonoscopy?

a. A year ago or less
b. More than 1 but not more than 5 years ago
c. More than 5 years ago but not more than 10 years ago
d. More than 10 years ago
e. Not sure/ Don't know

5. On a scale of 1 to 10, how confident are you that you can schedule and complete a(another) colonoscopy? *A 1 means that you are not at all confident, a 10 means that you are very confident.*

1 2 3 4 5 6 7 8 9 10

Not at all confident (goes under the 1) very confident (goes under the 10)

6.. Barium enema, or a lower gastrointestinal series, is another test to check for colon cancer. X-rays are taken of the colon after barium or barium and air are given by enema. The day before the test, you are asked to drink a lot of liquids and to take laxatives. No solid food is permitted. **Before reading this description, had you ever hear of a barium enema?**

a. Yes → Continue to Question 6 b.
b. No → Continue to Question 7
c. Not sure/ Don't know→ Continue to Question 7

6b. Have you ever had a barium enema?

a. Yes → Continue to Question 6 b.
b. No → Continue to Question 7
c. Not sure/ Don't know→ Continue to Question 7

6c. When was your last barium enema?

a. A year ago or less
b. More than 1 but not more than 5 years ago
c. More than 5 years ago but not more than 10 years ago
d. More than 10 years ago
e. Not sure/ Don't know

7. Please tell us whether you agree or disagree with the following statements about colorectal cancer.

	Agree	Disagree	DK
	1	2	3
a. The risk of colorectal cancer is *higher* in men than women.			
b. Physical activity *decreases* the risk for colorectal cancer.			
c. Individuals at *average risk* for colon cancer should start regular screenings at age 50.			
d. You *only* need to have a colorectal cancer screening test if you are having symptoms.			
e. Being overweight may increase your chances of getting colon cancer.			
f. If a polyp is removed during a colonoscopy it can prevent colon cancer from developing.			

8. Thinking about getting a screening test to check for colon cancer, please tell me how much you agree or disagree with the following statements.

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
	1	2	3	4
a. The benefits of colon cancer screening outweigh the discomforts.				
b. No one in my family has had colorectal cancer, so I have nothing to worry about				
c. I have faith that I will not get colon cancer, so I don't need to get screened				
d. My doctor or health care provider has never recommended a colon cancer screening test.				
e. I don't have symptoms of feel sick, so there is no reason for me to get a colorectal cancer screening test				
f. Colon Cancer Screening Tests are too embarrassing				

9. Thinking only about getting a **colonoscopy** to check for colon cancer, please tell me how much you agree or disagree with the following statements.

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
	1	2	3	4

a. It would be painful

b. The preparations I would have to do are too difficult (such as changing my diet or taking laxatives).

c. It would be too expensive.

d. I have too many other health costs right now and can't afford to have a colonoscopy.

e. I don't have time to get a colonoscopy.

f. I have other health concerns which are more important right now than getting a colon cancer screening.

10. On a scale of 1 to 10, how likely are you to get a **colon cancer screening test** within the next 6 months? *A 1 means that it is very unlikely, a 10 means that it is very likely.*

1 2 3 4 5 6 7 8 9 10

Very unlikely (goes under the 1) very likely (goes under the 10)

11. Compared to others your age, how likely is it that you will get **colon cancer** at some time in the future? Please answer on a scale of 1 to 10. *A 1 means that you a much less likely to get colon cancer than other people your age, a 10 means that you are much more likely to get colon cancer than other people your age .*

1 2 3 4 5 6 7 8 9 10

Much less likely (goes under the 1) about as likely (middle) much more likely (goes under the 10)

Physical Activity

12. Do you have any injuries or medical conditions that have kept you from being physically active over the last 7 days?

    a. yes → 12. b What is your condition? ______________________

    b. no

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

13. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

☐ 13b. No vigorous physical activities → ***Skip to question 3***

14. How much time did you usually spend doing **vigorous** physical activities on one of those days?

_____ **minutes per day**

☐ 14b. Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

15. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

☐

15.b No moderate physical activities → ***Skip to question 5***

16. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **minutes per day**

☐

16. b Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

17. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time?

_____ **days per week**

☐

17b. No walking → ***Skip to question 7***

18. How much time did you usually spend **walking** on one of those days?

_____ **minutes per day**

☐

18. b Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

19. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**

☐

19 b. Don't know/Not sure

20. Please tell me how much you agree or disagree with the following statements about exercise.

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
	1	2	3	4
a. I usually only exercise if I am trying to lose weight				
b. I don't have any one to exercise with.				
c. I don't have any place to exercise.				
d. I don't have the energy to exercise.				
e. I am uncomfortable with how I look while exercising or while wearing exercise clothing.				
f. My current weight makes it difficult for me to exercise				
g. I will have more energy if I exercise.				
h. I will control my weight if I exercise.				
i. I will improve my health if I exercise.				
j. Exercising will decrease my chances of getting some diseases.				
k. I enjoy exercising				

21. On a scale of 1 to 10, how confident are you that you can exercise at least five times per week for 30 minutes or more? *A 1 means that you are not at all confident, a 10 means that you are very confident.*

1 2 3 4 5 6 7 8 9 10

Not at all confident (goes under the 1) very confident (goes under the 10)

22. Do you currently participate in any regularly scheduled exercise?

a. yes

b. no → 23. In the past 6 months, have you participated in any regularly scheduled exercise?

a. no

b. yes → 24. Why did you stop your exercise routine?

a. Because of an injury

b. Something more important conflicted with my exercise routine

c. Other 24a. Please specify:

25. On a scale of 1 to 10, how likely is it that you will exercise regularly over the next 2 weeks. *A 1 means that it is very unlikely, a 10 means that it is very likely.*

1 2 3 4 5 6 7 8 9 10

Very unlikely (goes under the 1) very likely (goes under the 10)

26. Are you actively trying to: (select one)

a. Lose weight→ If selected: What are you doing to try and lose weight (select all that apply)

26a. I'm exercising more

26b. I'm eating less

26c. Other 26d.(please specify) _______

b. Gain weight

c. Maintain your current weight

d. Don't know/Unsure

These next questions are about your health and going to the doctor or other health care provider.

27. Overall, is your health: (select one)

a. excellent

b. very good

c. pretty good

d. fair

e. poor

28. Have you been diagnosed with any of the following illnesses?

a)	High Blood Pressure	yes	no	don't know
b)	Heart disease	yes	no	don't know
c)	Diabetes (Type I or Type II)	yes	no	don't know
d)	Arthritis	yes	no	don't know
e)	Crohn's Disease	yes	no	don't know
f)	Ulcerative colitis	yes	no	don't know
g)	Cancer	yes	no	don't know
	If yes, what kind of cancer? _______________________________________			

h) Other health problem: _______________________

29. In the last 12 months (not counting times you went to an emergency room), how any times did you go to a doctor's office or clinic to get care for yourself?

a) None
b) 1
c) 2-3

d) 4-5
e) 6 or more
f) Don't know

30. When your doctor or healthcare provider recommends that you get a test or screening, how do you decide whether or not you should get it? *For this question, test or screening means a procedure that is used to find out whether or not you have a certain health condition. It is not used to treat a health condition.*

Please check all that apply to you.

a) I usually get all of the tests that my doctor/healthcare provider recommends.
b) I usually only get the test if I am having pain or other symptoms
c) I usually only get the test if it is covered by insurance
d) I usually read up on the test before I decide if I will get it
e) I usually talk to my friends or family about the test before I decide if I should get it
f) Other ft. (please specify) _____________

31. Thinking about the doctor or health care provider that you currently see most often, please tell me how much you agree or disagree with the following statements.

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
	1	2	3	4
a. The nurses and office staff at my doctor's office treat me with respect.				
b. I receive enough understandable information from my doctor/ health care provider to make good decisions about my health.				
c. My doctor/ health care provider involves me in decisions about my health care.				
d. My doctor/health care provider understands my health needs.				
e. My doctor/ health care provider listens carefully to me				

f. My doctor/ health provider explains things in a way I can understand

g. My doctor/ health provider shows respect for what I have to say

h. My doctor/ health provider spends enough time with me

32. On a scale of 1 to 10, how would you rate all of the health care you received in the last 12 months?

A 1 means that you received the worst possible healthcare, a 10 means that you received the best possible healthcare.

1 2 3 4 5 6 7 8 9 10

Worst possible health care (goes under the 1) Best possible healthcare (goes under the 10)

33. How do you pay for your health insurance?

a. I have Medicaid
b. I have Medicare.
c. I have Veterans benefits
d. My employer [or previous employer] and I share health insurance costs
e. I pay for my own health insurance
f. I don't have any health insurance
g. I don't know
h. Other

Follow-up Survey

Please respond to each question by selecting the number on the scale which bet corresponds to your response. For example, an answer of **1** would mean strongly disagree and an answer of **7** would mean strongly agree. You can also choose any number between 1 and 7.

Strongly Disagree ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 **Strongly Agree**

1.. The topic of colon cancer prevention is important to me personally. (pos)

2.. I was motivated to read the messages. (pos)

3. The information in the messages held my attention. (pos)

4. It was difficult to understand the information in the messages. (neg)

5. While reading the messages, I was distracted from thinking about the topic. (neg)

6. The messages took a reasonable amount of time to read (pos)

7. The messages made good points about the topics. (pos)

8. I tried hard to think about the information in the messages. (pos)

9. The messages were organized and easy to follow. (pos)

10. It was difficult to concentrate on reading the messages. (neg)

11. The information in the messages was logical and accurate. (pos)

12. The messages were written especially for someone like me. (pos)

13. The information in the messages applied to my life.

14. I believed the information in the messages.

15. Overall, the quality of the messages was excellent.

<u>16. Knowledge Questions</u>

Please tell us whether you agree or disagree with the following statements about colorectal cancer.

	Agree	Disagree	DK
	1	2	3

a. The risk of colorectal cancer is *higher* in men than women.

b. Physical activity *decreases* the risk for colorectal cancer.

c. Individuals at *average risk* for colon cancer should start regular screenings at age 50.

d. You *only* need to have a colorectal cancer screening test if you are having symptoms.

e. Being overweight may increase your chances of getting colon cancer.

f. If a polyp is removed during a colonoscopy it can prevent colon cancer from developing.

Colon Cancer Questions

17. On a scale of 1 to 10, how confident are you that you can schedule and complete a (another) colonoscopy? A **1** means that you are not at all confident, a **10** means that you are very confident.

1 2 3 4 5 6 7 8 9 10

18. On a scale of 1 to 10, how confident are you that you can complete a (another) stool card test? A **1** means that you are not at all confident, a **10** means that you are very confident.

1 2 3 4 5 6 7 8 9 10

19. On a scale of 1 to 10, how likely are you to get a colon cancer screening test within the next 6 months? A **1** means that it is very unlikely, a **10** means that it is very likely.

1 2 3 4 5 6 7 8 9 10

20. Compared to others your age, how likely is it that you will get colon cancer at some time in the future? Please answer on a scale of 1 to 10. A **1** means that you a much less likely to get colon cancer than other people your age, a **10** means that you are much more likely to get colon cancer than other people your age.

1 2 3 4 5 6 7 8 9 10

Physical Activity Questions

21. On a scale of 1 to 10, how confident are you that you can exercise at least five times per week for 30 minutes or more? A **1** means that you are not at all confident, a **10** means that you are very confident.

1 2 3 4 5 6 7 8 9 10

22. On a scale of 1 to 10, how likely is it that you will exercise regularly over the next 2 weeks. A **1** means that it is very unlikely, a **10** means that it is very likely.

1 2 3 4 5 6 7 8 9 1

APPENDIX F

INTERVENTION AND CONTROL MESSAGE

Weight-targeted Messages

1. What should you know about colon cancer?

Many women are surprised to hear that colon cancer is the third leading cause of cancer deaths among women in the United States. Information about breast cancer is everywhere. And most women have known since they were young that they need to get a yearly pap smear to check for cervical cancer. But many of us don't hear anything about colon cancer until we turn 50 and the doctor surprises us with a long list of tests that we should do. It can be hard to figure out which things really need to be done. Colon cancer screening is one test you should not breeze over. Here are some reasons why:

- Women are as likely to get colon cancer as men.
- Colon cancer is responsible for over 26,000 deaths in women each year, compared to only about 4,000 deaths from cervical cancer.
- The American Cancer Society recommends that **everyone** age 50 or older should have regular colon cancer screening tests.

Generic Messages

1. What is Colorectal Cancer?

Colorectal cancer is cancer that occurs in the colon or rectum. Sometimes it is called colon cancer, for short. As the drawing shows, the colon is the large intestine or large bowel. The rectum is the passageway that connects the colon to the anus. Colorectal cancer is the second leading cancer killer in the United States, but it doesn't have to be. If everybody age 50 or older had regular screening tests, at least one-third of deaths from this cancer could be avoided. So if you are 50 or older, start screening now.

Colorectal Cancer Facts and Figures

• It's the 2nd leading cancer killer in the U.S. (after lung cancer).

• Both men and women are at risk.

• 93% of cases occur in people age 50 and older.

• The risk of developing it increases with age.

2. Why should you care about colon cancer?
Some people think that if no one in their family has had colon cancer that they don't have to worry about getting it. This is not necessarily true. Only between 5 and 10 percent of all colon cancers are genetic (i.e. they run in your family). The large majority of colon cancer cases are related to lifestyle and other factors such as:

- **Older Age:** Your risk goes up the most after age 50.
- **Exercise:** Women who exercise are less likely to get colon cancer.
- **Higher Weight:** Risk for colon cancer is higher in women who are overweight. The more you weigh, the higher your risk will be.

2. Who Gets Colorectal Cancer?

• Both men and women can get colorectal cancer.

• Colorectal cancer is most often found in people 50 and older.

• The risk for getting colorectal cancer increases with age.

Your risk for colorectal cancer may be higher than average if:

• You or a close relative have had colorectal polyps or colorectal cancer.

• You have inflammatory bowel disease.

People at high risk for colorectal cancer may need earlier or more frequent tests than other people. Talk to your doctor about when you should begin screening and how often you should be tested.

3. What can you do about colon cancer?

The good news is that most cases of colon cancer can be prevented. Colon cancer screening can help prevent colon cancer or find it early -- when it can be cured more easily. Unlike most illnesses, you don't have to wait until you have symptoms to go the doctor. In fact, most cases of colon cancer have no symptoms. Even women who are in touch with their bodies will probably not be able to tell that colon cancer is developing. A screening test can help let you know what is going on inside your body.

The most common screening test is called a colonoscopy. This test uses a lighted tube inserted through the anus to find small growths called polyps in the colon. If left alone, these polyps could develop in to cancer. During a colonoscopy, the doctor can remove the polyps and stop colon cancer from developing.

3. Screening Saves Lives

If you're 50 or older, getting a screening test for colorectal cancer could save your life. Here's how:

• Colorectal cancer usually starts from polyps in the colon or rectum. A polyp is a growth that shouldn't be there.

• Over time, some polyps can turn into cancer.

• Screening tests can find polyps, so they can be removed *before* they turn into cancer.

• Screening tests can also find colorectal cancer early. When it is found early, the chance of being cured is good.

Several tests are available to screen for colorectal cancer. Some are used alone, while others are used in combination with each other. Talk with your doctor about which is best for you.

4. Don't Delay!

Let's face it. Most of us do not like the idea of getting a colonoscopy. The test sounds invasive and the thought of spending the night before going to the bathroom to clean out your colon may make you feel uncomfortable. In the end, knowing that this test saves lives convinces most women to do it. And the truth is that they feel relieved after they get it. It is never as bad as you imagine. Here's why:

- You are given a medicine to make you sleepy and comfortable- most *women say that they didn't feel anything during the procedure.*
- The anxiety leading up to the test is all gone when you get the results- *it's better to know you are healthy than to worry and wonder.*
- If the doctor doesn't find any polyps, *you will probably only need to have a colonoscopy once every 10 years.*

4. What are the colon cancer screening tests?

One screening test is called a colonoscopy. For this test, the doctor examines the lining of your rectum and entire colon using a thin, flexible, lighted tube called a colonoscope. It is inserted into your rectum and colon. The doctor can find and remove most polyps and some cancers. This test should be completed once every 10 years starting at 50 for people with no family or personal history of polyps, and no symptoms.

Here are some things you should consider before you have this test:

- It provides direct view of rectum and entire colon.
- Before the test, your doctor will recommend that you restrict your diet and use laxatives and/or enemas to clean out your colon and rectum.
- You may feel discomfort during or after exam.
- You're given medication to help make the exam more comfortable for you and are advised not to drive or work on the day of the exam.
- There is a slight risk of perforation, infection, bleeding.

5. Another doctor visit?
Going to the doctor can be both costly and time consuming. Even if you have insurance, the co-pays and deductibles alone can make you think twice about going to the doctor. If you have any type of condition for which you need to go to the doctor more regularly, it can seem overwhelming to think about going back for anything else. If getting a colonoscopy to check for colon cancer, when you don't have any symptoms, seems like too much for you to do right now, there are other options. Stool card tests (sometimes called FOBT or FIT) are very inexpensive and can be done at home. Here's what you should know about stool card tests:

- FIT is a newer version of the FOBT which is more accurate and does not require you to change your diet.
- Stool card tests can be returned to your doctor through the mail, so don't have to go in unless you have a positive result.
- The doctor will test your stool for hidden blood which could indicate that you have colon cancer or an advanced polyp.
- Because this test is not as good at finding polyps as a colonoscopy, it should be repeated every year.

You can have peace of mind without all the waiting or financial worry.

5. The Fecal Occult Blood Tests (FOBT)
Sometimes called stool cards, this test checks for occult (hidden) blood in the stool. You receive a test kit from your doctor or health care provider. At home, you place a small amount of your stool from three bowel movements in a row on test cards. You return the cards to your doctor's office or a lab, where the stool samples are tested for hidden blood. This test should be completed once a year starting at 50.**Here are some things you should consider before you have this test:**

- You receive the test kit from your doctor or health care provider and do the test yourself at home.
- -Your doctor will probably recommend that you avoid some foods and medicines before and until stool samples are collected

6. Talking to the doctor

We all have different reasons for why we delay going to the doctor: “I just want to lose 5 more pounds before I go back” or “I don’t want to tell my doctor that I haven’t been doing the exercises she recommended.” While many women report that they have a good relationship with their doctor, they may have had a bad experience in the past. Doctors have a reputation for rushing, not listening to patients, and making impersonal recommendations. Still, most women trust their doctors to help them make important decisions about their health. Having a doctor you feel comfortable with can make a huge difference. Here are some tips for improving your communication with your doctor.

- Let your doctor know what your needs are. Most health care providers consider it their job to bring up anything they think is a health priority, but if you disagree or have other priorities be sure to let him/her know.
- Show up prepared with a list of questions or concerns so you don’t waste time or forget to ask certain things
- If you are over 50 and your doctor has not brought up colon cancer screening, be sure to ask about it. Ask as many questions as needed to help make a decision about getting screened.
- If you think of more questions later, you may not be able to reach the doctor, but you can ask to speak to a knowledgeable nurse or other staff member.

6. Talking to the doctor

Research has shown that patients who have good relationships with their doctors tend to be more satisfied with their care—and to have better results. Here are some tips to help you and your doctor become partners in improving your health care.

Give Information. Don't Wait to Be Asked!

You know important things about your symptoms and your health history. Tell your doctor what you think he or she needs to know.

Get Information

- Ask questions. If you don't, your doctor may think you understand everything that was said.
- Write down your questions before your visit. List the most important ones first to make sure they get asked and answered.
- You might want to bring someone along to help you ask questions. This person can also help you understand and/or remember the answers.

Once You Leave the Doctor's Office, Follow Up

- If you have questions, call.
- If your symptoms get worse, or if you have problems with your medicine, call.
- If you had tests and do not hear from your doctor, call for your test results.
- If your doctor said you need to have certain tests, make appointments at the lab or other offices to get them done.

If you and your doctor just don’t see eye-to-eye, it is okay to look for someone who fits your needs better.

Your relationship with your doctor should help (not hinder) you from getting the healthcare that you deserve.

- If your doctor said you should see a specialist, make an appointment.

Remember, quality matters, especially when it comes to your health.

7. A truly natural colon cleanse
Everybody has seen at least one advertisement for a colon cleanse. Based on those ads you would think that everyone needs a pill or procedure to clean their colon out. The reality is that the colon does a pretty good job of removing waste from the body. In fact, frequent colon cleanses, even the so-called "natural" ones, can reduce your body's ability to remove waste on its own. If you still feel like you need some help getting your colon to work there is one great thing you can do: Be Active! Exercise is the original, natural colon cleanse. It can help your body eliminate waste more quickly and efficiently. This may be one reason why people who are active have a lower risk of colon cancer.

7. The Benefits of Physical Activity
Regular physical activity is one of the most important things you can do for your health. For example, being physically active lowers your risk for two types of cancer: colon and breast. Research shows that:

- Physically active people have a lower risk of colon cancer than do people who are not active.
- Physically active women have a lower risk of breast cancer than do people who are not active.
- Although the research is not yet final, some findings suggest that your risk of endometrial cancer and lung cancer may be lower if you get regular physical activity compared to people who are not active.

8. Why do you exercise?
There are many reasons why women exercise, but let's face it, for most of us the biggest reason why we exercise is to manage our weight. Unfortunately, this leads to the misconception that thin people are healthy and don't need to exercise. However, your weight is not always an indicator of how healthy you are. There are plenty of thin women with high blood pressure and cholesterol and plenty of larger women without any health problems. Active people know that exercise can improve your health no matter what your weight is. Even if you are not losing weight, being active can help prevent many diseases, including some types of cancer.

8. Control Your Weight
Looking to get to or stay at a healthy weight? Both diet and physical activity play a critical role in controlling your weight. You gain weight when the calories you burn, including those burned during physical activity, are less than the calories you eat or drink. When it comes to weight management, people vary greatly in how much physical activity they need. You may need to be more active than others to achieve or maintain a healthy weight.

9. Need some more motivation?
You already know that being more active may decrease your risk of colon and other cancers, but it can also help with other health problems as well. Exercise can decrease your likelihood of getting heart disease and diabetes. It can also improve your cholesterol levels and help reduce chronic pain, not to mention help you reduce stress and improve your sleep. Additionally, women who already have a chronic disease (like heart disease, diabetes, arthritis or cancer) can use exercise to improve their condition and quality of life. Fewer health problems can mean fewer trips to the doctor, lower health care costs, and a better quality of life. No matter what you health is like, you can benefit from exercise. Talk to your doctor about which type of exercise would be best for you.

9. Need some more motivation?
In addition to the benefits mentioned earlier, exercise can also help you to:

- Reduce your risk of cardiovascular disease
- Reduce your risk for type 2 diabetes and metabolic syndrome
- Strengthen your bones and muscles
- Improve your mental health and mood
- Improve your ability to do daily activities and prevent falls, if you're an older adult
- Increase your chances of living longer

Everyone can gain the health benefits of physical activity - age, ethnicity, shape or size do not matter.

10. I want to be more active, now what?

Starting to exercise can be intimidating. You may feel uncomfortable exercising in front of others, especially if you are new to an activity. Here are some tips to help you exercise with confidence:

- **Chose something you enjoy.** Exercise doesn't have to be complicated or involve expensive equipment or a gym membership. It can be as easy as walking or biking around your neighborhood. If you are new to exercise start by making small changes like taking the stairs instead of the elevator or by doing activities around the home like cleaning and yard work.
- **Choose comfortable clothes** which fit your body type and that you can move easily in.
- **Ask for help.** If you are visiting a gym or community center for the first time, ask if someone can give you a tour and show you how to use the equipment. Even if they don't offer, there is usually someone whose job it is to do this.
- **Safety first.** Walking or biking on busy streets can be dangerous. Instead pick a quieter, more scenic, route where you won't be bothered. If you enjoy exercising with others, an exercise partner can make you feel more comfortable and safe as well as help keep you motivated. *And most importantly, always remember to check with your doctor before you start a new exercise program.*

10. Getting Started

If you're not sure about becoming active or boosting your level of physical activity because you're afraid of getting hurt, the good news is that **moderate-intensity aerobic activity**, like brisk walking, is generally **safe for most people**.

- **Start slowly.** Cardiac events, such as a heart attack, are rare during physical activity. But the risk does go up when you suddenly become much more active than usual.
- **If you have a chronic health condition** such as arthritis, diabetes, or heart disease, talk with your doctor to find out if your condition limits, in any way, your ability to be active. Then, work with your doctor to come up with a physical activity plan that matches your abilities.

The bottom line is - the health benefits of physical activity far outweigh the risks of getting hurt.

APPENDIX G

ADDITONAL BASELINE SURVEY RESULTS

Colorectal Cancer Screening Barriers

Colorectal Cancer (CRC) Screening barriers are listing in Table G.1. More women expressed agreement with the barrier "screening tests are too embarrassing" than any other barrier. Moreover, a significantly higher proportion (p=0.03) of obese women (41.1%) agreed with this statement than non-obese women (28.6%). Obese women were also more than twice as likely as non-obese women to agree that they would not need a screening if they did not have symptoms (p=0.04); however a only a small proportion of obese women agreed with this statement (13.8%). Overall, a higher percentage of women agreed with the colonoscopy specific barriers than agreed with the general CRC screening barriers. Obese women were more likely than non-obese women to agree that they had too many other health costs (p=0.049) or more important health concerns that took precedence over colonoscopy (p=0.045). There were no significant differences by weight group in agreement with the more general statements about cost or time as barriers to getting a colonoscopy.

Physical Activity Benefits and Barriers

Physical activity benefit and barrier results are listed in Table G.1. Agreement with listed benefits was above 95% for all but one benefit: "I enjoy exercising." A significantly lower percentage (p=0.01) of obese women reported that they enjoy exercising (56.9%) compared with non-obese women (73.5%). Obese women also reported greater agreement with every possible barrier, most notably the statement "my current weight makes it difficult for me to exercise." They were more than twice as likely as non-obese women to agree that they usually only exercise when trying to lose weight ($p<0.0001$).

Healthcare Quality

The association between healthcare quality measures [patient-provider communication (PPC) and healthcare satisfaction] and selected variables is shown in Table G.2. Obesity was not significantly associated with either variable, but screening status was. Individuals who were up-to-date with screening rated their both their PPC ($p=0.03$) and healthcare satisfaction higher ($p<0.001$). Both healthcare quality variables were significantly and positively associated with past-year healthcare visits and screening self-efficacy. Healthcare satisfaction was also positively associated with physical activity self-efficacy ($r=0.17$, $p=0.02$) and physical activity intentions among women who were not currently active ($r=0.26$, $p=0.04$). Finally, both healthcare quality variables were significantly associated with the main outcome. Baseline patient-provider communication ($r=0.25$, $p<0.001$) and healthcare satisfaction scores ($r=0.18$, $p=0.01$) were positively correlated with elaboration at follow-up (data not shown).

Sub-group Analyses

We conducted sub-group analyses to determine if the messages increased elaboration more in people with certain psychosocial characteristics. Specifically we looked at ELM scores of women who were more likely to agree with weight-related screening and physical activity barriers (discussed above). For all barriers examined, women who expressed these barriers had higher elaboration in the intervention group then in the control (Table G.3). We found that the intervention effect was moderated by three of the weight-related barriers ($p<0.05$ for the interaction): having other health concerns that were more important than CRC screening, having other health costs, and only exercising when trying to lose weight. Along with the symptoms barrier (i.e. I don't have symptoms so I don't need screening), these barriers were specifically addressed in the intervention messages, but not the control messages. These findings indicate that tailoring messages to these weight-related barriers may be an effective way to reach women who express these barriers.

Table G.1 Barriers and Benefits of CRC Screening and Physical Activity by Obesity Status

Barrier/Benefit (% who agree with each statement)	**Non-Obese**	**Obese**	**p-value**
CRC Screening Barriers			
a. No one in my family has ever had colon cancer so I have nothing to worry about	9.18	15.6	0.16
b. I have faith that I will not get colon cancer, so I don't need to get screened	7.14	12.84	0.17
c. My doctor or health care provider has never recommended a colon cancer screening	16.3	24.8	0.13
d. I don't have symptoms or feel sick, so there is no reason for me to get a colorectal cancer screening test	5.1	13.8	0.04
e. Colon Cancer Screening Tests are too embarrassing	28.6	43.1	0.03
Colonoscopy Barriers			
a. It would be painful	40.8	45.0	0.55
b. The preparations I would have to do are too difficult (such as changing my diet or taking laxatives).	54.1	51.4	0.69
c. It would be too expensive.	46.9	51.4	0.52
d. I have too many other health costs right now and can't afford to have a colonoscopy.	26.5	39.5	0.049
e. I don't have time to get a colonoscopy.	26.5	29.4	0.65
f. I have other health concerns which are more important right now than getting a colon cancer screening.	21.4	33.9	0.045
Physical Activity Benefits			
a. I will have more energy if I exercise.	95.9	95.4	0.86
b. I will control my weight if I exercise.	96.9	95.4	0.57
c. I will improve my health if I exercise.	98.9	100	*
d. Exercising will decrease my chances of getting some diseases.	97.9	97.2	*
e. I enjoy exercising	73.5	56.9	0.01
Physical Activity Barriers			
a. I usually only exercise if I am trying to lose weight	19.4	47.7	<0.0001
b. I don't have any one to exercise with.	41.8	53.2	0.10
c. I don't have any place to exercise.	14.3	19.3	0.34
d. I don't have the energy to exercise.	42.9	57.8	0.03
e. I am uncomfortable with how I look while exercising or while wearing exercise clothing.	26.5	49.5	0.0007
f. My current weight makes it difficult for me to exercise	8.16	51.4	<0.0001

*Number of people who disagree with the statement is too low to compute an accurate p-value

Table G.2 Correlates of Healthcare Quality

Correlate	Patient-Provider Communication	*p*-value	Healthcare Satisfaction	*p*-value
Obesity, *mean (SD)*		0.52		0.72
Non-obese	19.2 (4.9)		8.2 (1.6)	
Obese	19.7 (5.0)		8.2 (1.7)	
CRC Screening, *mean (SD)*		0.03		<0.001
Up-to-date	21.0 (4.4)		8.5 (1.5)	
Out-of-date	19.1 (5.7)		7.6 (1.8)	
Co-morbidities*, *r*	0.11	0.12	0.09	0.25
Past-year Medical Visits*, *r*	0.16	0.03	0.21	<0.01
FOBT Self-Efficacy, *r*	0.15	0.03	0.21	<0.01
Colonoscopy Self-Efficacy, *r*	0.37	<0.0001	0.40	<0.0001
Physical Activity Self-Efficacy, *r*	0.13	0.06	0.17	0.02
CRC Screening Intentions, *r*				
All Participants	0.05	0.51	0.09	0.21
Unscreened‡	0.12	0.26	0.26	0.04
Physical Activity Intentions, *r*	0.08	0.26	0.12	0.10
All Participants	0.11	0.30	0.13	0.25
Inactive Participants‡				

* Variables treated as continuous for this analysis

† Limited to participants who did not report being up-to-date with screening at baseline (Non-obese: n=25, Obese: n=33).

‡ Limited to participants who reported that they did participate in any regularly scheduled activity and did not report that they were unable to do physical activity (Non-Obese: n=44, Obese: n=41).

Table G.3 ELM Scores for Selected Sub-Groups of Women

Barrier (p for interaction*)	**Agree with Statement**		**Disagree with Statement**	
	Intervention	*Control*	*Intervention*	*Control*
**I have other health concerns which are more important right now than getting a colon cancer screening (0.04)	71.2	65.1	72.9	73.8
**I have too many other health costs right now and can't afford to have a colonoscopy (0.05)	71.8	67.1	72.6	74.1
**I don't have symptoms or feel sick, so there is no reason for me to get a colorectal cancer screening test (0.07)	71.4	58.3	72.4	72.6
Colon cancer screening tests are too embarrassing (0.55)	71.3	69.6	73.1	73.2
**I usually only exercise if I am trying to lose weight (0.02)	76.0	70.5	70.8	72.7
I don't have the energy to exercise (0.16)	73.5	71.1	71.2	72.9
I am uncomfortable with how I look while exercising or while wearing exercise clothing (0.90)	72.6	72.1	72.2	2.2
My current weight makes it difficult for me to exercise (0.63)	74.1	72.7	71.7	71.9

*Interaction between barrier and Intervention condition in the model predicting ELM score

**Barriers addressed in the intervention messages

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