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Colorectal cancer FIT screening in the hope vi population of Jefferson County, Kentucky.

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COLORECTAL CANCER FIT SCREENING IN THE HOPE VI POPULATION OF JEFFERSON COUNTY, KENTUCKY

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A Thesis Approved on

April 14, 2017

by the following Thesis Committee:

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DEDICATION

This thesis is dedicated to my son Zachary who has given me the motivation and strength to continue my education, and to my wife Ramona who made it all possible and who never stopped believing in me.

ACKNOWLEDGMENTS

I would like to thank my professor, Dr. Carol Hanchette, for her invaluable feedback and patience, and to my committee members, Dr. Margath Walker and Dr. Gerard ‘Rod’ Barber, for their guidance and assistance over the years.

ABSTRACT

COLORECTAL CANCER FIT SCREENING IN THE HOPE VI POPULATION OF JEFFERSON COUNTY, KENTUCKY

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Using pre-post survey data collected from 209 randomly selected African American people from the population of former residents of Clarksdale and Sheppard Square public housing areas, this study explores the relationship between individual characteristics and colorectal cancer screening behavior, measured by the uptake of the Fecal Immunochemical Test (FIT) and by prior colorectal screening, while controlling for neighborhood factors and geographic proximity to healthcare facilities. This particular public housing population is of interest because of their relocation from the downtown area, where healthcare facilities are within walking distances, to other public housing units either in large apartment complexes or scattered throughout the county, or to units on the rental market. The framework used for this study is the Andersen's Healthcare Services Utilization Model, where variables are measured at individual and at census tract level. Analyses include descriptive and multivariate statistical techniques. Data are presented in tables, graphs, and choropleth maps.

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CHAPTER I

INTRODUCTION

According to the Centers for Disease Control and Prevention (CDC 2016), colorectal cancer (CRC) is the second most common cancer in the United States, and second leading cause of cancer mortality (Shokar et al. 2015). For 2008-2012, Kentucky had the highest age-adjusted invasive CRC incidence rate (51.4, with a confidence interval (CI) of 50.5-52.3) per 100,000 persons, compared to the national rate of 41.9 (CI: 41.8-42.0). In addition, Kentucky had the 5th highest CRC mortality rate 18.1 (CI: 17.6-18.7), after Mississippi, Arkansas, Louisiana, and West Virginia; the U.S. CRC death rate for 2008-2012 was 15.5 (CI: 15.4-15.6).

The Kentucky Cancer Registry (KCR) data for 2016 shows that for African-Americans, the 2008-2012 CRC incidence rate in Kentucky was 58.1 (CI: 54.2-62.5) as compared to the U.S. rate of 49.7 (CI: 49.4-50.1) over the same period. The age-adjusted mortality rate was 23.4 (20.8-26.2) as compared to the national rate of 21.4 (CI: 21.2-21.6). Further, in Jefferson County, Kentucky, the 2008-2012 CRC age-adjusted incidence rate was 51.7 (CI: 49.5-54.0) for all races, and 60.8 (CI: 54.7-67.3) in blacks. The age-adjusted CRC mortality rate for African-Americans in Jefferson County was 22.6 (18.9-26.8) compared to the age-adjusted rate for all races of 17.2 (CI: 16.0-18.6). Data obtained from the National Cancer Institute (NCI), presented in Table 1 and in

Figure 1, show the age-adjusted incidence rates per 100,000 people for colorectal cancer at the national (gray), state (blue), and county (red) levels.

Table 1

Colorectal Cancer Incidence and Mortality Rates per 100,000 Persons

2008-2012	Incidence Rates		Mortality Rates	
	All Races	Black	All Races	Black
U.S.A.	41.9	49.7	15.5	21.4
Kentucky	51.4	58.1	18.1	23.4
Jefferson Co.	51.7	60.8	17.2	22.6

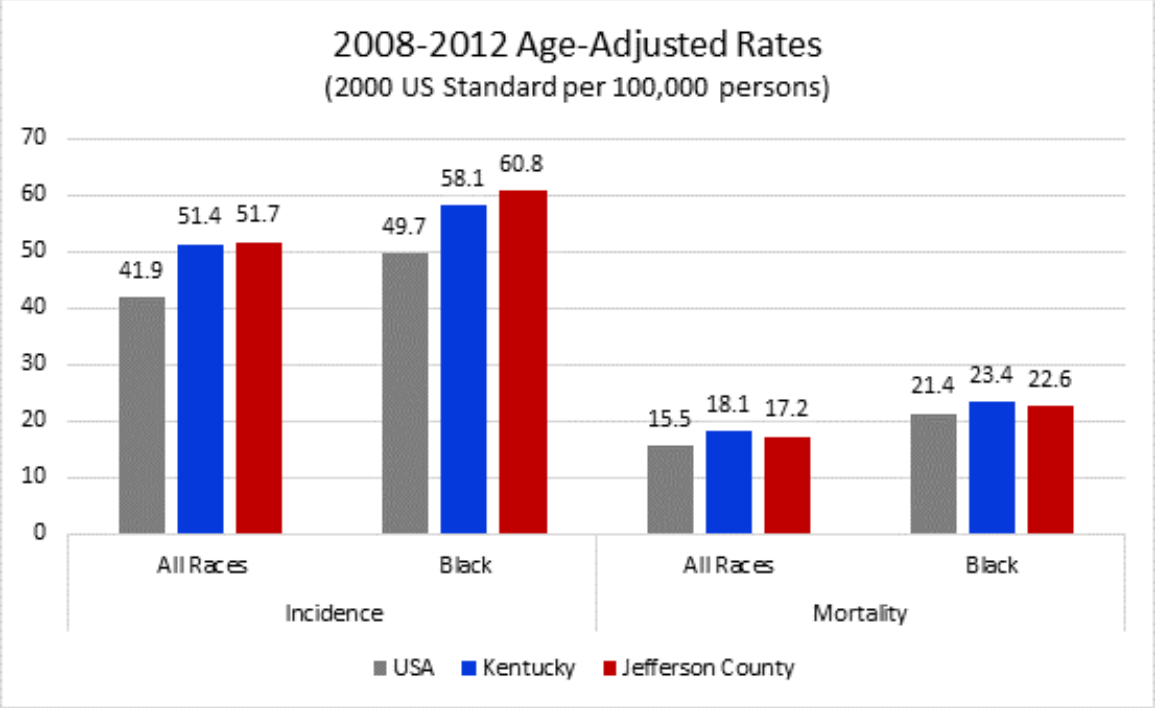

Figure 1. Colorectal Cancer Age-Adjusted Incidence and Mortality Rates

Study Purpose

This study aimed to explore the uptake of the Fecal Immunochemical Test (FIT) in a population of African Americans, of ages 45 to 75, who had very low income, which means at least below the 100% federal income level as defined by the federal poverty guidelines, and who were residents of Clarksdale or Sheppard Square public housing developments at the time they were demolished. The interest in this population and in this topic is twofold.

First, numerous studies on racial health disparities show that African American populations have higher mortality and lower survival rates (Cooper et al. 1995; Hassan et al. 2009; Laiyemo et al. 2010; Enewold et al. 2012; Beyer et al. 2016), that might be explained by differences in stage of disease at the time of diagnosis (Enewold et al. 2012), to healthcare utilization, including cancer screening (Laiyemo et al. 2010), to have access to healthcare (Laiyemo et al. 2010; Hall, Ruth, and Giri 2012; Sabounchi, Keihanian, and Anand 2012) or to have access to the latest treatments available (Hao et al. 2009; Sineshaw, Robbins, and Jemal 2014).

Second, the residents in these two communities were relocated across Jefferson county Kentucky, when their neighborhoods were slated for redevelopment, fully demolished and rebuilt. The cancer research shows that neighborhood socioeconomic inequalities are associated with disparities in the risk for premature death among healthy adults (Doubeni, Schootman, et al. 2012), but not among the adults with poor health. Moreover, the relationship between both individual and area-level socioeconomic status and the incidence of CRC was found to be significant (Doubeni, Laiyemo, et al. 2012).

CHAPTER II

LITERATURE REVIEW

To reduce the burden of colorectal cancer on public health, the U.S. Preventive Task Force recommends population-based screenings, including an annual high-sensitivity fecal occult blood testing, such as the FIT, which is available as an inexpensive and easy to use home kit. It is estimated that CRC screening could prevent about a third of the annual deaths; yet screening rates remain low, especially among the uninsured and underinsured populations (Shokar et al. 2015). Furthermore, the CRC mortality rate declined in the past two decades as a result of screening, but it was in primarily white populations, and racial disparities persist (Green and Coronado 2014).

The more recent national CRC screening rates in whites are about 62% as compared to 55% in African Americans and 47% in Hispanics (Sineshaw, Robbins, and Jemal 2014). Lower rates of screening are generally associated with lower income, lower education, and minority social status (Steele et al. 2008; Doubeni et al. 2009; Hassan et al. 2009; Paskett et al. 2011; Cole, Jackson, and Doescher 2012; Hines and Markossian 2012; Jemal et al. 2015). Studies of disparities across geographic regions showed that rural areas have significantly lower screening rates than urban areas (McLafferty and Wang 2009; Cole, Jackson, and Doescher 2012; Monson et al. 2014; Wheeler et al. 2014; Daly et al. 2015). These differences are explained by factors specific to rural populations, including lower socioeconomic status, lack of insurance and spatial access or distance to the nearest

healthcare facility. However, the rural-urban differences in late-stage diagnosis show that not all urban populations fare better than rural populations.

Urban low-income populations form "clusters of urban disadvantage" with significantly poorer health than other urban or rural populations (McLafferty and Wang 2009). One study found that the odds of urban African Americans for late stage diagnosis were 40% greater than the odds of whites in rural Georgia (Hines and Markossian 2012). Other studies found that areas with higher poverty and geographically remote areas have lower CRC screening rates (Cress et al. 2006; Espey et al. 2007; McLafferty and Wang 2009; Paskett et al. 2011; Cole, Jackson, and Doescher 2012; Perdue et al. 2014; Towne et al. 2014; Towne, Smith, and Ory 2014; Faruque et al. 2015). Within the rural areas the lowest screening rates were in the most remote areas, while in urban areas the lowest screening rates were in the census tracts with high proportions of minority and low socioeconomic status populations, hence the higher incidence of late-stage diagnosis and mortality rates found in these disadvantaged groups.

As stated earlier, many studies on racial health disparities show that African American populations have higher mortality and lower survival rates (Cooper et al. 1995; Hassan et al. 2009; Laiyemo et al. 2010; Enewold et al. 2012; Beyer et al. 2016). Some suggest that the disproportionately higher CRC incidence and mortality rates in African Americans compared to whites might be a result of differences in healthcare utilization (Laiyemo et al. 2010) rather than to colorectal cancer susceptibility; others pose that ethnicity itself "is a factor for disparate outcomes in colorectal cancer" (Hassan et al. 2009). Differential access to healthcare was explained by disparities in screening rates

(Theuer et al. 2006; Hall, Ruth, and Giri 2012; Brenner et al. 2015) which remain significantly lower in African Americans than in whites.

The access to healthcare was defined by other in terms of quality of care, and specifically access to latest treatments available for CRC. One study shows that the disparities in mortality rates between older blacks diagnosed with metastatic CRC and their white counterparts were specifically related to the differences in access to the latest available treatments (Sineshaw, Robbins, and Jemal 2014). They claim that African Americans "have not equally benefitted from the introduction and dissemination of new treatments." (Sineshaw, Robbins, and Jemal 2014). However, another study (Sabounchi, Keihanian, and Anand 2012) found "no racial difference in the treatment outcome of CRC"; the "patients with similar treatment had similar outcomes". They concluded that the "severity of disease at presentation and the outcome of treatment [were] not dependent on race." (Sabounchi, Keihanian, and Anand 2012).

Furthermore, the literature on health disparities shows that the neighborhood of residence matters. The "individuals residing in poorer communities with lower access to medical care did not experience the reduction in CRC incidence rates seen in more affluent communities" (Hao et al. 2009). Hao and colleagues claim that disparities across neighborhoods with different median incomes could be explained by the barriers to healthcare access, such as lack of health insurance and lack of a regular healthcare provider.

A different set of studies focused on the development of practical models for colorectal cancer screening and patient navigation for populations known to be at higher

risk for CRC mortality or CRC late stage diagnosis (Bolen, Adams, and Shenson 2007; Escoffery et al. 2015; Shokar et al. 2015; Beyer et al. 2016; Brenner et al. 2016).

The overall conclusion of these studies (Table A1) is that there are significant disparities across geographic regions of the United States, and across race and socioeconomic groups. One common recommendation across the studies is to increase screening in highly urbanized areas where there is a high proportion of minority in poverty, and to tailor communications (Myers et al. 2007) for better outreach. Future studies should use individual level socioeconomic data, number of physicians, and geographic access to healthcare, to explain regional variations (Espey et al. 2007; Schenck et al. 2009; Perdue et al. 2014).

One of the most vulnerable urban populations is that of families eligible for housing subsidies; the majority of these are racial and/or income minorities. Housing, along with income and race, are common indicators used in health disparity research (Tawk et al. 2015). Public housing residents and other inadequately housed individuals, are at higher risk to be under-screened for this disease. The health behaviors research focused on low-income residents housed in larger public housing developments and in scattered or market rental housing is scarce.

The different housing subsidies are due to a Housing and Urban Development (HUD) federal program of urban development that provides federal support to local housing authorities to redevelop dilapidated public housing projects into mixed income communities. Since 1996, HUD has awarded four Housing Opportunities for People Everywhere (HOPE VI) grants to the local Louisville Metro Housing Authority (LMHA); in 1996, Cotter & Lang Homes; in 2002, Clarksdale I; in 2003, Clarksdale II; and in 2010,

Sheppard Square. One of the main criticisms of the HOPE VI program is that residents lose their easy access to critical services, such as transportation and healthcare.

The HOPE VI program has somewhat controversial reviews and diverse outcomes across the nation; it was recently replaced with the Choice Neighborhoods program. According to the HUD's website, the new program, like HOPE VI, aims to rebuild communities by addressing long-term disinvestment through community-driven strategies. The HOPE VI grants directly influenced the lives of about 13,000 residents and their families; over 90% of these people were African Americans, about 80% were females, about half were ages 18 or below, and about 13% were ages 45 or older. The researchers at the University of Kentucky, stated in the protocol submitted to the Institutional Review Board, that during March 2016, there were 1,656 African American former HOPE VI residents, ages 45-75 in the LMHA's Tracking System; 1,343 (81.1%) of the 1,656 residents were women. The tracking system is an administrative database, internal to LMHA, with highly sensitive information about each HOPE VI resident; it is not available to the public.

The former Clarksdale (now Liberty Green) and Sheppard Square residents were relocated during 2004 and 2011, respectively, from the downtown area to various locations across Jefferson County, Kentucky. Both Clarksdale and Sheppard Square areas are located near the medical campus of the University of Louisville (UofL); thus, at relocation, the majority of the residents lost their easy access to healthcare facilities located downtown. Therefore, this population is especially attractive to sociologists and public health researchers who want to learn of the types of effects relocation had on people's lives. Could relocation to mixed-income neighborhoods have made an impact on

individual employment, social, or health behaviors such as CRC screening? While some research discusses the potential effects of the HOPE VI relocation on individual employment and social behavior (Curley 2010), little research discusses its potential impact on health behaviors (Pollack et al. 2014; Hayward et al. 2015), even though it is well documented that poor health is "an even bigger problem for HOPE VI families than lack of employment (Manjarrez et al. 2007).

Using a focus group methodology, Hayward and colleagues found that, before demolition, public housing developments were unhealthy physical environments that limited residents' health and wellbeing, that contributed to social isolation of its residents. They suggest that "increased neighborhood social capital could improve health" and recommend use of housing policies to improve environmental health conditions (Pollack et al. 2014; Hayward et al. 2015). Pollack and colleagues conducted a natural experiment to compare residents in scattered housing with residents in larger housing developments on their social network's perceived health and health behaviors. They found no differences in the perception of major health problems in one's social network by place of residents. However, participants who resided in scattered public housing were more likely to state that their neighbors exercise more than the participants who resided in larger public housing developments (Pollack et al. 2014; Hayward et al. 2015).

Research Hypothesis

The main hypothesis of this thesis research is that the socioeconomic level of the area of residence does not affect individual health seeking behavior, such as accessing and

utilization of healthcare services, after controlling for individual characteristics. Specifically, the research questions are:

1. What are the individual characteristics that make a difference in individual FIT uptake?
2. What are the individual characteristics associated with prior CRC screening behavior?
3. What are the neighborhood factors that make a difference in a person's CRC screening behavior?
    a. Are HOPE VI residents who relocated to mixed-income communities more likely to accept the FIT screening than the residents who reside in primarily African-American low-income communities?
    b. Are HOPE VI residents who relocated to mixed-income communities more likely to have had prior CRC screening than the residents who reside in primarily African-American low-income communities?
4. Is there a relationship between proximity to healthcare facilities and the prior utilization of CRC screening services among urban African Americans, current or former HOPE VI public housing residents?

Theoretical Framework

The Andersen's Behavioral Model of Health Utilization (Andersen 1995) is the theoretical framework used for this study. Andersen developed this theory about two decades ago, attempting to describe and understand the factors that influence individual utilization of healthcare services (Figure 2).

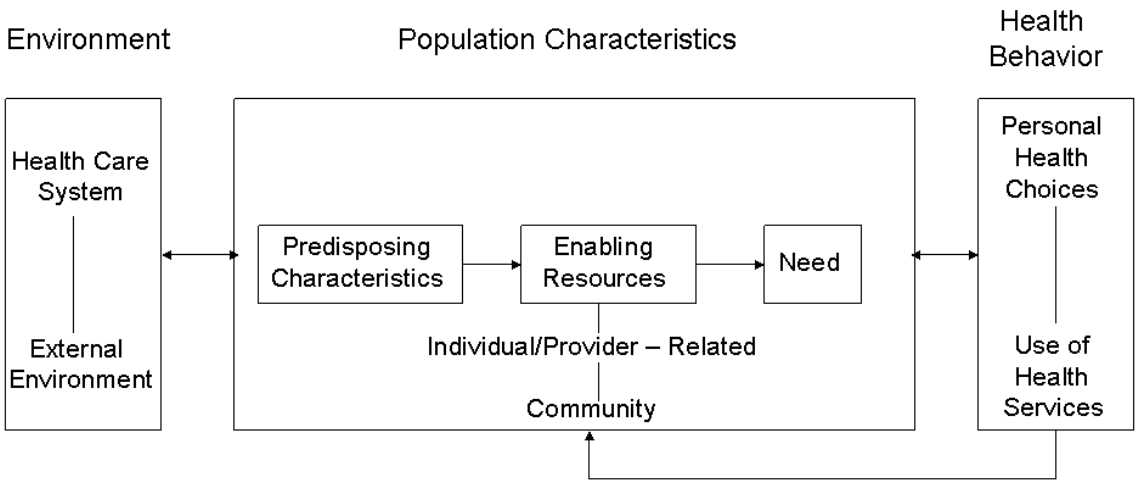

Figure 2. Original Andersen's Healthcare Utilization Model

Andersen's model combines both individual and community level indicators of health behavior, placed in a broader social context, attempting to explain the determinants of individual healthcare utilization behavior. Over the years, public health researchers have used Andersen's conceptual framework to develop healthcare utilization models that were focused on a specific disease (i.e., cancer, HIV/AIDS) or vulnerable population (i.e., homeless). The original Andersen Model of healthcare utilization was later revised to include health outcomes and healthcare satisfaction.

Andersen's models include feedback loops to show that healthcare utilization depends on both individual and contextual factors, and that ultimately, healthcare-seeking behavior has an impact on the individual health outcomes. Specifically, Andersen's models suggest that individual healthcare-seeking behavior is determined by a person's predisposing characteristics (i.e., gender, race, characteristics that are not modifiable), by the person's resources (i.e., health insurance, physical access to care), and by his/her perceived or evaluated (i.e., diagnosis) need for healthcare. Nevertheless, individuals belong to a larger context, which has an impact on the resources available to them (i.e.,

healthcare system). Health behavior includes both personal health practices and the use of health services, strongly associated with individual health outcomes. Health outcomes include the persons' perceived and evaluated health status, and consumer satisfaction.

FIT Sensitivity and Specificity

A comparison study of the FIT with an older test, Guaiac-based fecal occult blood test (g-FOBT), showed that the FIT had a greater sensitivity for detection of the colorectal cancer than the g-FOBT (Oort et al. 2010). Specifically, FIT detected 87.1% of the invasive cancers as compared to 74.2% detected by the g-FOBT ($p=.002$); detected 35.6% of the advanced adenomas as compared to 18% detected using the g-FOBT ($p<.001$). FIT screening sensitivity, the ability to correctly identify those with the disease, was 40.5% as compared to 23% for g-FOBT ($p<.001$). However, the FIT screening specificity, or the ability to correctly identify those without the disease, was lower (91%) than that of g-FOBT (95.7%).

CHAPTER III

DATA AND METHODS

Project Description

This thesis is a segment of a pilot survey research project conducted by a group of health behavior researchers from the Rural Cancer Prevention Center (RCPC) at the University of Kentucky, funded by the grant number 5U48DP005014-03 received from the Center for Disease Control and Prevention. The RCPC team designed a community-based pilot research study (Figure 3) to compare the uptake of CRC screening FIT kits among rural Appalachian white residents to urban low-income African Americans. However, the thesis study is using only the data collected from the urban low-income African American group. The study area is Jefferson County, Kentucky.

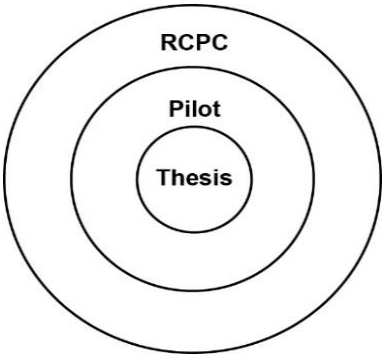

Figure 3. Context of Thesis Research

Research Design

This is a quasi-experimental study with a pre-post design, including both PRE (kit distribution) and POST (follow-up) surveys. Because a team of public health researchers

at the University of Kentucky collected the pre-post surveys as part of a larger research study, the data are considered "secondary" or "existing" data for the purposes of this thesis research study.

The **population of interest** for this thesis study is the former residents of Clarksdale and Sheppard Square public housing areas of Jefferson County, Kentucky. From a population of 356 African-Americans of ages 45-75, the UK team selected a simple random sample of 200 individuals and invited them to participate in the colorectal cancer screening and navigation community-based research study. LMHA approved the study and informed the residents about the opportunity for colorectal cancer screenings; they were asked to call a local number to schedule an appointment for the PRE survey and to receive the FIT kit.

The **sample of participants** in this study was randomly selected from the population of former Clarksdale and Sheppard Square HOPE VI public housing residents of Jefferson County, Kentucky, who were ages 45 through 75 as of July 1, 2016. The LMHA provided access to the tracking system specifically developed for the HOPE VI program. The population file was downloaded and opened in IBM SPSS 23. Next, all individuals younger than 45 and older than 75 years of age were filtered out and deleted from the population file, yielding a total of 356 people between the ages of 45 and 75. Using SPSS, a random sample of 200 individuals was selected from these 356 individuals (Figure 5). If a selected person refused to participate, could not be found or was deceased, another resident was selected randomly from the population. Of the randomly extracted sample of 200 residents, 18 (4%) declined to participate, and 29 (14.5%) could not be

located in spite of multiple attempts. These 47 people (23.5%) were replaced with the "next in line" persons from the remaining pool.

The final sample included 200 African American public housing residents of Jefferson County, Kentucky, plus 9 family members who were either ages 45-75 or had an immediate family member diagnosed with colorectal cancer. All of the recruited people were African-Americans residents of public housing units, most of them located in the most economically distressed census tracts of Jefferson County, Kentucky (as of July-December 2016). Note that, to be eligible for public housing subsidies individuals have to meet the very low income criteria as defined by the federal income and poverty guidelines. The study eligibility criteria were, a) race (being African American), AND b) age (being between 45 and 75 years old), OR c) having a first-degree relative with a CRC diagnosis, regardless of age.

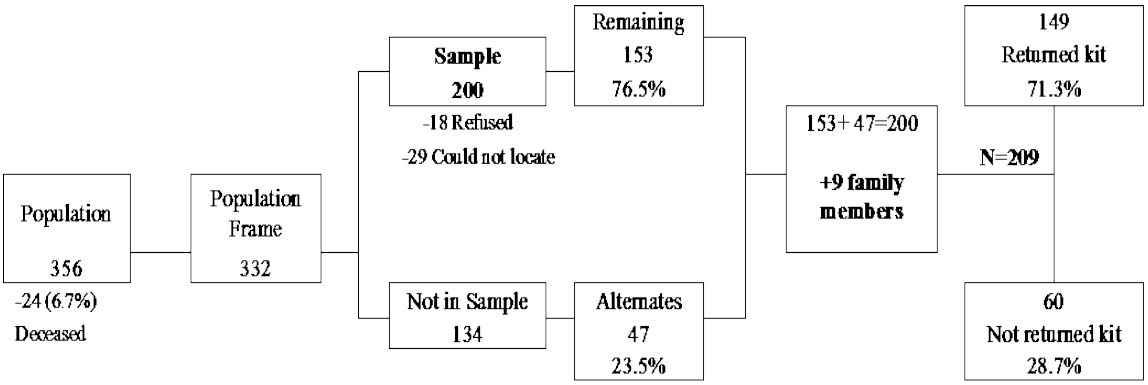

Figure 4. Sample vs. Eligible Population

Recruiting efforts included phone calls and home visits using the information available in the tracking system at LMHA. In addition, LMHA conducted three mailings, at six-week intervals. The letters explained that the University of Kentucky was enrolling participants in the study, that a person would go to their homes to conduct a brief survey

and to provide the FIT kit to screen for CRC, and that they would receive a gift card as an incentive to participate in the study. The UK interviewer was trained to describe how to use the FIT kit and prepare the mailing, and to explain the steps of the entire process.

Data Items

The PRE survey, completed in person at the time of kit distribution, included questions about health and health-related behaviors (i.e., health screening experience, eating habits, physical activity, etc.), along with sociodemographic questions. Participants used a pre-stamped envelope to mail their FIT kit to UK for analysis. Once results were available, a second home visit was conducted to inform them of the result and to complete a brief follow-up survey about their FIT screening experience. All participants received research incentives. They received a $20 Kroger gift card at the time of the PRE survey, and a second $20 Kroger gift card at the time of the POST survey. The IRB at UK and at UofL approved this thesis research study.

The **dependent variable** is individual screening behavior (yes/no), a proxy variable for healthcare utilization. In this study, there are two variables that measure screening behavior:

i. return of the FIT kit (yes/no)
ii. prior colorectal cancer screening (yes/no)

It is noteworthy that the prior screening was conducted independent of this study, and the return of the kit is not expected to be associated with transportation or income, considering that participants were asked to return the kit by mail using a pre-stamped envelope. The independent variables were measured at two different levels: individual and

community (census tract) level data. The **individual level data** items available from the pre-post surveys:

a) PRE survey: individual socio-demographics, general health questions, family history of cancer, health beliefs (perceived fatalism scale), health behaviors (smoking, alcohol use, physical activity, prior CRC screening);

b) POST-survey: experience with the use of FIT, timeline, best and worst thing about using FIT, intent to use FIT annually, intent to schedule a colonoscopy, intent to recommend to others;

c) residential address at the time of relocation and at the time of the CRC screening (reported as choropleth maps, to protect respondents' privacy).

The **community data items** are available at census tract level from the 2010 U.S. Census and the 5-year American Community Survey; the census tract level data was downloaded from the U.S. Census website (Census 2010) and includes measures such as the percentage of minority population, median household income, educational attainment, percentage of people living in poverty, percentage of people using public transportation. The locations of the healthcare facilities in Jefferson County, Kentucky were available in the Louisville/ Jefferson County Information Consortium (aka LOJIC), the geographic information system for the Louisville Metro area. For each resident, the distances to all healthcare sites were computed in ArcGIS. Then, a "proximity" variable was computed using the shortest distance on street networks to a healthcare site for each resident.

Using the Andersen's conceptual model, all of the data items (collected with the surveys, from the U.S. Census, and from LOJIC) were organized in a conceptual framework. Figure 5 shows the variables included in the Andersen's model under:

(1) Environment (census tract level variables), (2) Population characteristics: a) predisposing (age, gender), b) enabling (insurance, regular provider, education, income, housing, etc.), and c) need (perceived health status); and (3) Individual health practices (smoking, alcohol use, exercise, diet) are hypothesized to predict the (4) individual health behavior measured by prior CRC screening, and the uptake of FIT.

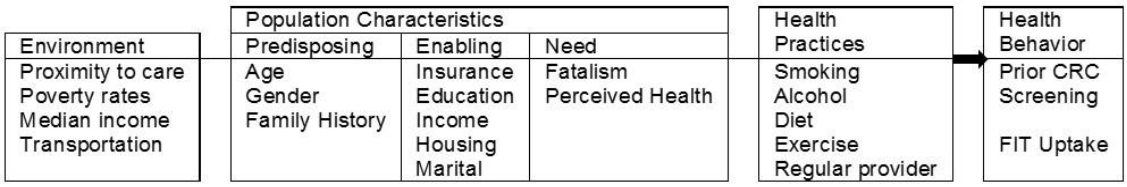

Figure 5. Application of Andersen's Model to the HOPE VI CRC FIT Screening Study

The scale measuring respondent's *perceived CRC fatalism* has four items. The four items are: (1) "I am likely to develop colorectal cancer in my lifetime," (2) "I am worried that I will develop colorectal cancer in my lifetime," (3) "If it was meant for me to develop colorectal cancer there is nothing that I can do about it," and (4) "There is nothing I can do to reduce my risk of developing colorectal cancer." The scale has a good reliability coefficient (Cronbach's $\alpha = .726$); this is similar to the inter-item correlation Cronbach coefficient reported by other cancer studies (Davis et al. 2002) in low-income African American populations (Powe Fatalism Scale, $\alpha = .79$). Cronbach coefficient measures the reliability of a measurement scale, meaning the scales ability to yield the same results if applied multiple times. A Cronbach coefficient of 0.60 to less than 0.80 indicates that the scale has a good reliability; a coefficient of 0.80 to less than 0.90 indicates very good reliability, and a coefficient that is greater than 0.90 indicates excellent reliability.

Survey data was collected (by the author of this paper) on paper during face-to-face interviews at the home of each participant. Before completing the pre survey, the interviewer obtained informed consent for participation in the study and permission to contact and inform them of the results. Next, the pre survey was completed and the participant was instructed how to conduct the specimen collection. Finally, the kit distribution information was logged on the distribution form, and the participant was provided with a $20 gift card after he or she signed the receipt. All study procedures were approved by the Office of Research Integrity at the University of Kentucky, and by the management staff at the LMHA. The data collection, data entry, data management, and data analyses were conducted by the author of this paper, as a part-time employee of the University of Kentucky. However, because the data was used for thesis research, the protocol received approval from by the University of Louisville's Institutional Review Board.

Each participant received a pre-stamped envelope, and a kit which included the FIT itself, two paint brushes, and two trash bags. The FIT kit has two sealed flaps (A and B, see a picture in the Appendix). Participants were instructed as follows:

1) Collect the two samples at two different points in time, within one week.
2) Use the trash bag to dispose of the toilet paper;
3) Raise flap A on the kit;
4) Dip the paint brush into the specimen;
5) Rub the paint brush onto the absorbent paper under the flap.
6) Close and seal the flap, to avoid sample contamination.
7) Write the date on the flap A;

8) Repeat the process for the second sample, using flap B.
9) After the two samples are collected, place the kit in the pre-stamped envelope and mail the kit no later than one week from the time they collected the first sample.

Data Analyses

The data was entered in the Research Electronic Data Capture System (REDCap), downloaded into SPSS, exported as a dbase file, and imported into ArcMap. The individual addresses were geocoded, counted at census tract level, and joined spatially with the socioeconomic and race data from the 2010 U.S. Census. Data analyses include basic descriptive and inferential statistics. The basic descriptive analyses include univariate and bivariate statistics.

The univariate statistics section includes counts, proportions, means, medians and standard deviations for the independent and dependent variables. For individual level data, univariate analysis was conducted by gender, race, age, current tobacco use, family history of cancer, and residential proximity to the nearest healthcare site. To test the association between returning the FIT kit and key sociodemographic and health variables, chi-square tests and t-tests were used. All variables with identified significant differences between the group of people who returned the kit and the group that did not, were entered into stepwise logistic regression models to calculate the adjusted odds ratios (OR) and their 95% CI. For census-tract level data, univariate analysis includes number and proportion of cases within each tract, number of healthcare sites within the census tract, along with choropleth maps of all census variables.

The bivariate statistics section includes the results of chi-square tests of independence and independent t-tests for the comparisons of means. Then, logistic regression analysis was conducted to test the relationship between individual screening behavior and proximity to healthcare sites, while accounting for individual characteristics that were found significant during the bivariate analyses. The data is presented in tables, graphs, and choropleth maps.

CHAPTER IV

RESULTS

Univariate Analyses

Of the 209 African American participants, 149 (71.3%) returned the FIT kit using the pre-stamped envelope; 42 (28.2%) of the 149 returned kits were positive. The average age of the sample was 55.9 years (SD = 7.51 years), the youngest being 37 years old and the oldest 74 years of age. As shown in Table 2, 85.6% of participants were females, 67.2% were single, and 13.4% were married, while the remaining were divorced, separated, or widowed. The majority had at least high school level education (66.2%), had less than $10,000 annual household income (82.8%), and resided in a large public housing development (69.9%). Very few respondents were uninsured (3.3%) or had no regular healthcare provider (4.8%). Respondents were insured by Medicaid (58.4%), Medicare (17.7%), through an employer (13.4%), or self-purchased ACA-plan (19.1%); note that this was a multiple choice question, and the percentages can add up to more than 100% due to some of the participants having more than one insurance policy. About 80% of the participants had a BMI of 25 or greater, being overweight or obese given their height and weight, yet only 44% perceived themselves as overweight or obese. Overall, 41.6% perceived their health as fair or poor. Health behavior data shows that 48.8% were smokers and 73.7% did not drink alcohol at all during the past 30 days.

Table 2

Sociodemographic Characteristics (N=209)

Variable	Category	N	%Valid
Gender	Male	30	14.4
	Female	179	85.6
Age Category	Lowest - 49	49	23.4
	50 - 54	47	22.5
	55 - 59	47	22.5
	60 - 64	41	19.6
	65 - 69	14	6.7
	70 - 75	11	5.3
Current Marital Status	Married	29	13.4
	Divorced/Separated	25	12.0
	Widowed	14	6.8
	Single	139	67.2
Highest Grade / Year of School Completed	Elementary	5	2.4
	Some high school	65	31.4
	High school graduate/GED	97	46.9
	Some college, technical school	35	16.9
	College graduate	5	2.4
Public Housing Dev.		146	69.9
Employment (Multiple Choice)	Employed	72	34.0
	Unable to work	90	43.1
	Unemployed	19	9.1
	Retired	27	12.9
Annual Household Income From All Sources	< $10,000	173	82.8
	$10,000 to < $20,000	20	9.5
	$20,000 to < $35,000	11	5.3
	$35,000 to < $75,000	5	2.4
BMI calculated	Overweight or obese	168	80.4
BMI perceived	Overweight or obese	92	45.1
Has Health Insurance		202	96.7
Has Regular Healthcare Provider		199	95.2
Exercised (Past Week)		130	62.2
Smoker (past 30 days)		102	48.8
Alcohol use (past 30 days)		55	26.3
Perceived Fair/Poor Health		87	41.6
Family History of Cancer		115	55.0
Returned the FIT kit		**149**	**74.5**
Prior CRC Screening		**109**	**52.2**

NOTE: the two **dependent variables** are in bold font

More than half (55%) had family history of any cancer, and 52.2% had a colonoscopy or sigmoidoscopy at least 12-months before the FIT screening.

Figure 6 shows the distribution of the 209 participants across Jefferson County, Kentucky. In addition, Figure 7 shows the distribution of the 209 study participants along with the location of health clinics and hospitals and the 1- and 2-mile dissolved buffers, to illustrate that the nearest healthcare facility is within one to two miles from the participants' home residences.

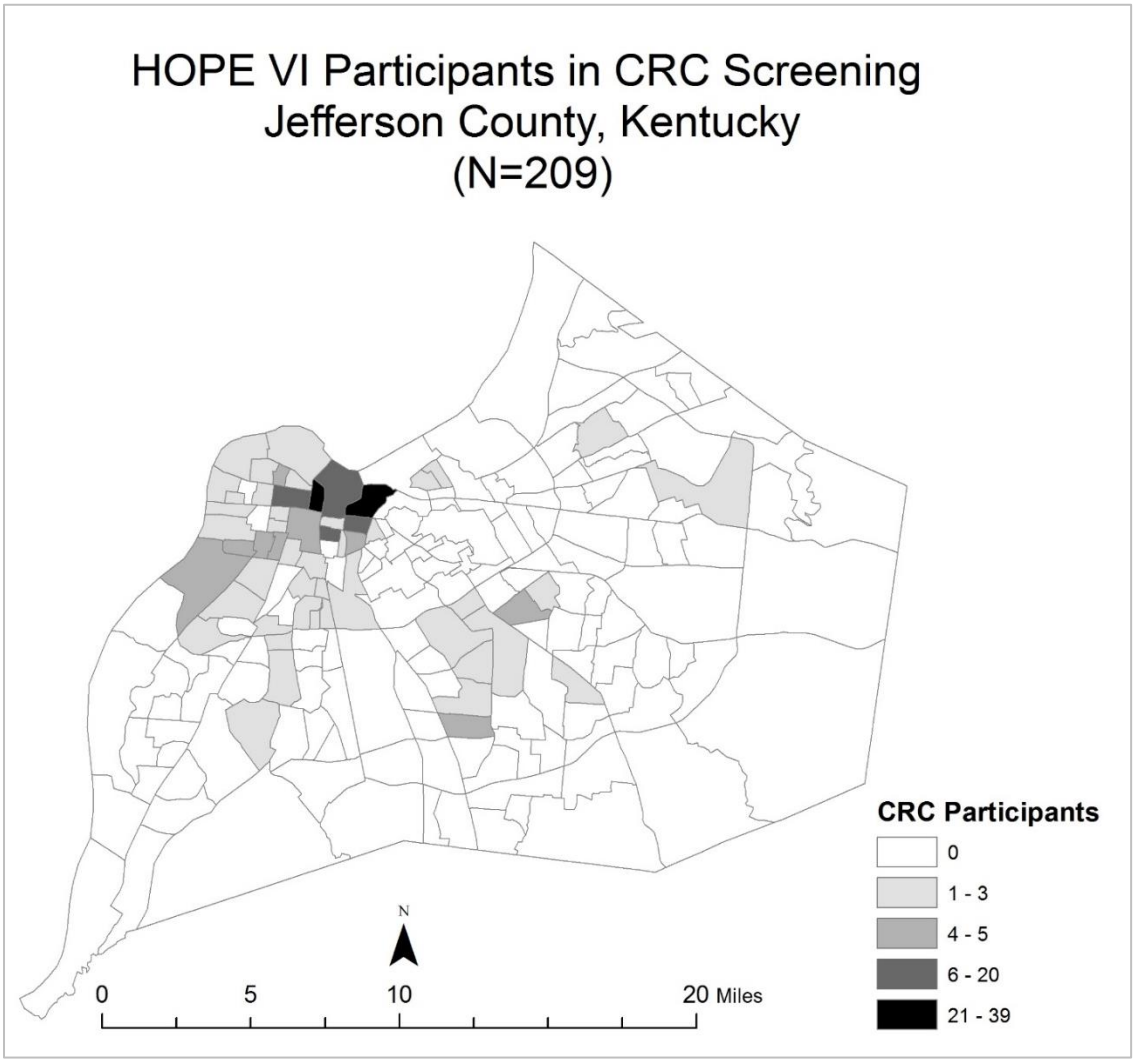

Figure 6. Distribution of the HOPE VI Participants in the CRC FIT Screening (N=209)

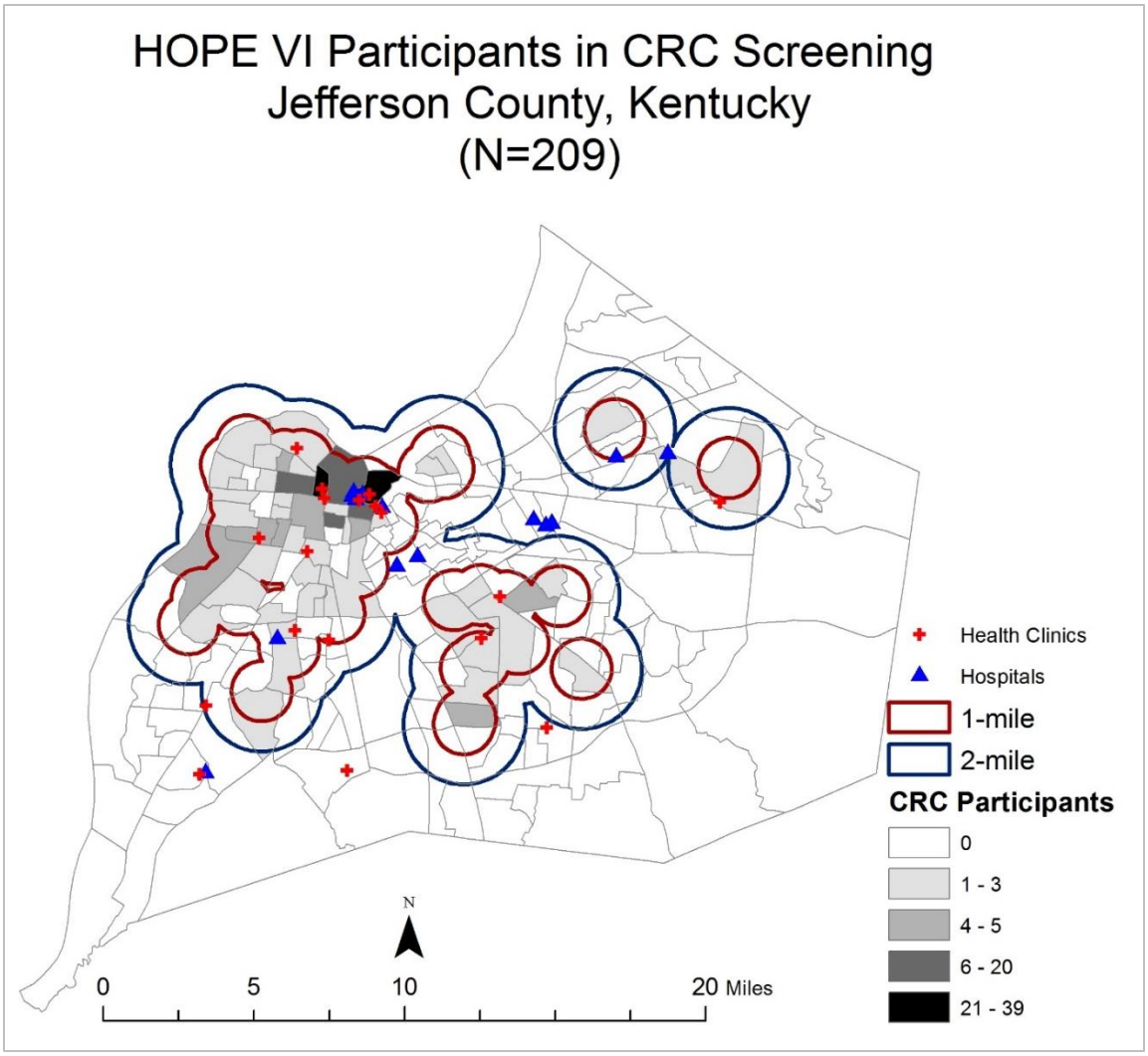

Figure 7. HOPE VI Participants' Proximity to Healthcare Facilities (N=209)

The 209 participants resided in 55 different census tracts (CT); 22 CTs had a single participant, 15 CTs had two participants, 3 CTs had three participants, 6 CTs had four participants, 3 CTs had five participants, 2 CTs had seven participants, and the last 4 CTs had 11, 19, 25 and respectively 39 participants. Thus, on one hand, 52 participants (25%) were spread out across 37 CTs, and on another hand, 94 (45%) participants resided within only four census tracts (out of 191).

Bivariate Analyses

Individual-Level Factors by CRC Screening Behavior

To answer the first and second research questions, focused on the individual characteristics that make a difference in individual FIT uptake and in prior CRC screening, all individual-level variables mentioned in the study's conceptual model were tested for association with each of the two dependent variables (1) return FIT status and (2) prior CRC screening, both measured as Yes/No.

(1) Dependent Variable: FIT Return Status

Table 3 shows that the group of people who returned the kit and the group of people who did not return the kit were not significantly different by gender, age, education, or marital status, but they were slightly different in terms of annual income, employment and insurance type. Specifically, the proportion of respondents with less than $10,000 annual income was greater in the group that returned the kit (84.8%) than in the group that did not return it (78.1%).

The proportion of people employed in the group that returned the kit was smaller (30.3%) than in the group that did not return the kit (43.8%). Finally, among the group who returned the kit the proportion of participants with public health insurance (Passport/Medicaid, Medicare) is larger than in the group that did not return the kit. The group that returned the kit had 61.4% Medicaid and 18.6% Medicare recipients as compared to 51.6% and respectively 14.1% in the other group.

Table 3

Sociodemographic Characteristics by FIT Return Status (N=209)

Variable	Category	Not Returned		Returned		Total	
		N	%	N	%	N	%
Gender	Male	9	15.0	21	14.1	30	14.4
	Female	51	85.0	128	85.9	179	85.6
Age Category	Lowest - 49	15	25.0	34	22.8	49	23.4
	50 - 54	15	25.0	32	21.5	47	22.5
	55 - 59	13	21.7	34	22.8	47	22.5
	60 - 64	11	18.3	30	20.1	41	19.6
	65 - 69	3	5.0	11	7.4	14	6.7
	70 - Highest	3	5.0	8	5.4	11	5.3
Highest Year of School Completed	Elementary/Some HS	22	36.7	48	32.7	70	33.8
	High school /GED	26	43.3	71	48.3	97	46.9
	Some college/ technical school	10	16.7	25	17.0	35	16.9
	College graduate	2	3.3	3	2.0	5	2.4
Current Marital Status	Married	9	15.3	19	12.8	28	13.5
	Divorced/Separated	5	8.5	20	13.4	25	12.0
	Widowed	2	3.4	12	8.1	14	6.7
	Single	43	72.9	98	65.8	141	67.8
Annual Household Income	< $10,000	47	78.3	126	84.6	173	82.8
	$10,000 to < $20,000	9	15.0	11	7.4	20	9.6
	$20,000 to < $75,000	4	6.7	12	8.1	16	7.7
Employment (Multiple Choice)	Employed	27	42.2	45	30.2	72	34.0
	Unable to work	23	38.3	67	45.0	90	43.1
	Unemployed	3	5.0	16	10.7	19	9.1
	Retired	10	16.7	17	11.4	27	12.9
Insurance (Multiple Choice)	Passport/Medicaid	33	55.0	89	59.7	122	58.4
	Medicare	9	15.0	27	18.1	36	17.2
	ACA/self-purchase	14	23.3	26	17.4	40	19.1
	Employer/spouse	11	18.3	17	11.4	28	13.4
	Other	8	13.3	29	19.5	37	17.7
	None	2	3.1	5	3.4	7	3.3
Has Health Insurance		58	96.7	144	96.6	202	96.7

The majority in the group with "other" insurance (n=37) had WellCare (23, 62.2%), while the remaining 14 people had Anthem, CIGNA, CareSource, Etna, InterState, MD2U, United Health, or Veteran Affairs; the proportion of participants with "other insurance" was 20% in the group that returned the kit, and 12.5% in the group that did not.

Table 4 shows that there were no significant differences in the average age or in the average fatalism scores between the group of participants who returned the kit and those who did not. In conclusion, gender, age, marital status, education, income, BMI (perceived or calculated), health behaviors (smokers, alcohol users) and fatalism measure were not associated with the participants' choice to return the kit or not.

Table 4

FIT Kit Return by Sociodemographic Numeric Characteristics (N = 209)

Variable	Outcome	N	Mean	SD	t	p-value
Age	No FIT	60	55.53	7.2	0.406	0.685
	FIT returned	149	56	7.65		
Fatalism	No FIT	60	9.37	3.87	0.899	0.37
	FIT returned	149	9.85	3.39		

Table 5 displays the number and the proportion of participants who returned the kits across the individual key sociodemographic variables. It also shows the results of the chi-square tests of independence between returning the FIT kit and having or not a specific characteristic.

Table 5

FIT Kit Return by Sociodemographic Discrete Characteristics (N = 209)

Variable	Category	Kit Return (N)	Kit Return (%)	Chi-Square	p-value
Sex	Male	21	70.0	0.029	.866
	Female	128	71.5		
Married	No	130	71.8	0.186	.666
	Yes	19	67.9		
Single	No	51	75.0	0.677	.411
	Yes	98	69.5		
LTH Less than HS	No	101	72.7	0.381	.537
	Yes	48	68.6		
Employed	No	104	75.4	3.289	**.070**
	Yes	45	63.4		
Less than $10,000	No	23	63.9	1.165	.281
	Yes	126	72.8		
Public Housing Development	No	39	61.9	3.883	**.049**
	Yes	110	75.3		
BMI high (perceived)	Normal or underweight	74	66.1	2.440	.118
	Overweight or obese	70	76.1		
BMI high (calculated)	Normal or underweight	27	65.9	0.737	.391
	Overweight or obese	122	72.6		
Exercise	No	54	68.4	0.535	.464
	Yes	95	73.1		
Smoker	No	80	74.8	1.293	.255
	Yes	69	67.6		
Alcohol use (past 30 days)	No	109	70.8	0.075	.784
	Yes	40	72.7		
Perception of Fair/Poor Health	No	80	65.6	4.682	**.030**
	Yes	69	79.3		
Family History of Cancer	No	72	76.6	2.348	.125
	Yes	77	67.0		
Insured (low variation)	No	5	71.4	0.000	.994
	Yes	144	71.3		
Provider (low variation)	No	4	40.0	5.025	.025
	Yes	145	72.9		

NOTE: **significant p-values** are in bold font

Several variables were associated with returning the kit or not: participants who were residing in a large public housing development (75.3%) appear to be more likely to return the kit than those who resided in mixed-income communities (61.9%), such as scattered housing or market rentals. Participants who perceived their health as fair or poor (79.3%) were significantly more likely to return the kit than those who perceived their health as good, very good or excellent (65.6%); and, individuals who were not employed (75.4%) were significantly more likely to return their kit than those who were employed (63.4%), and a .10 critical level (marginally significant).

Finally, 72.9% of the participants who had a regular healthcare provider returned the kit as compared to 40% of their counterparts, but the lack of variation in this data item prevents its inclusion in further bivariate or multivariate analyses. A possible explanation for the lack of variation are the change in the current health insurance landscape, prompted by the Affordable Care Act.

Figure 8 and 9 show the distribution of participants who returned the FIT kit and respectively the distribution of participants with reactive result. It appears that the proportion of reactive results is greater in the census tracts with greater FIT return, as expected. There is no unusual pattern in these maps that would indicate a relationship between the FIT kits return and the participants' place of residence. Areas with higher number of participants have higher number of kits returned, and respectively higher number of participants with reactive results.

The 149 participants who returned the FIT kits resided in 48 of the 191 CTs of Jefferson County (Figure 8). There were 24 CTs with a single participant, 9 CTs with two participants, 5 CTs with three participants, 4 CTs had four participants, 3 CTs had five

participants, and the last the three CTs with returned FITs included 12, 21 and respectively 27 participants. In other words, 60 of the 149 participants (40.2%) with returned FIT kit resided within just 3 CTs, while 57 participants resided with 36 CTs.

The 42 participants with reactive FIT resided across 22 CTs (Figure 9); 16 CTs had a single participant with reactive FIT, 3 CTs had two participants, and the last 3 CTs had 3, 7 and respectively 10 residents. This means that about half of all of the residents with a reactive FIT were spread out across 19 CTs, while the other half were all located within 3 CTs.

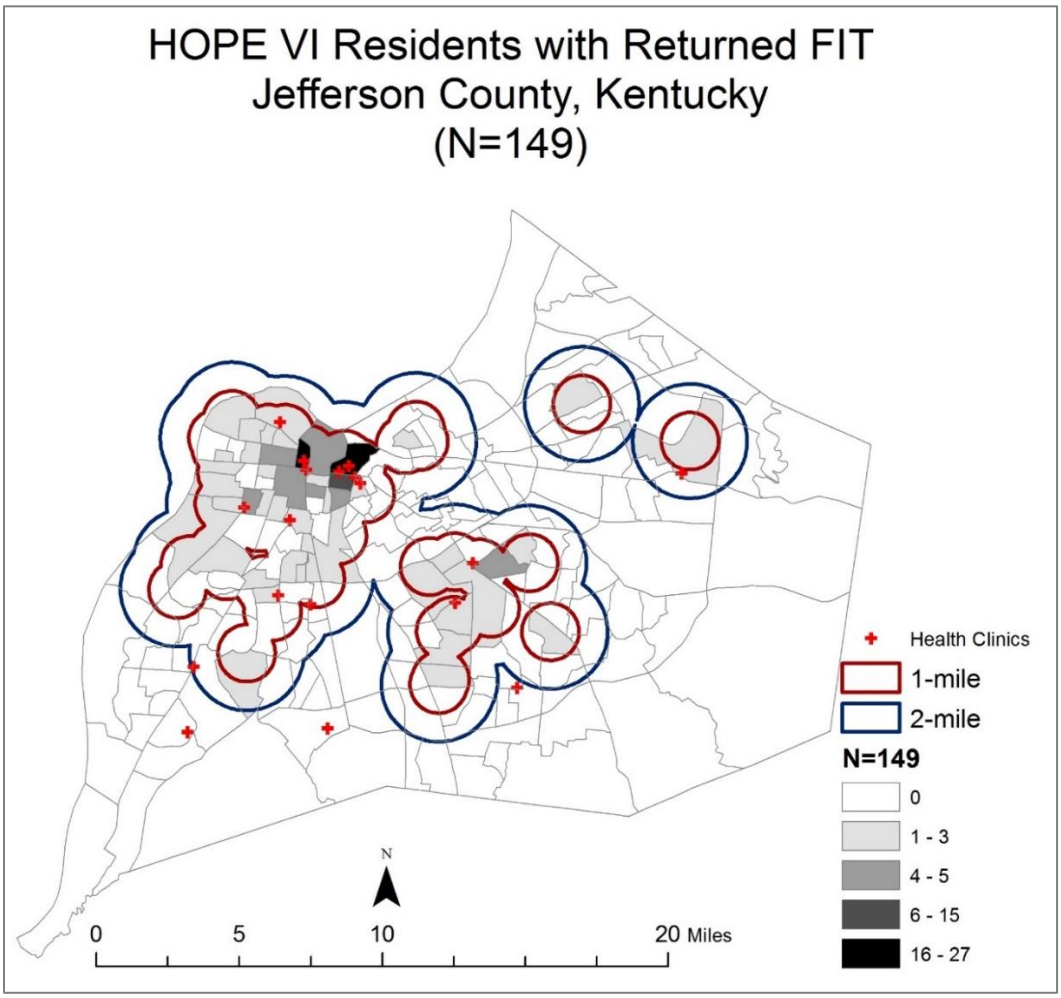

Figure 8. FIT Kit Returns (N=149)

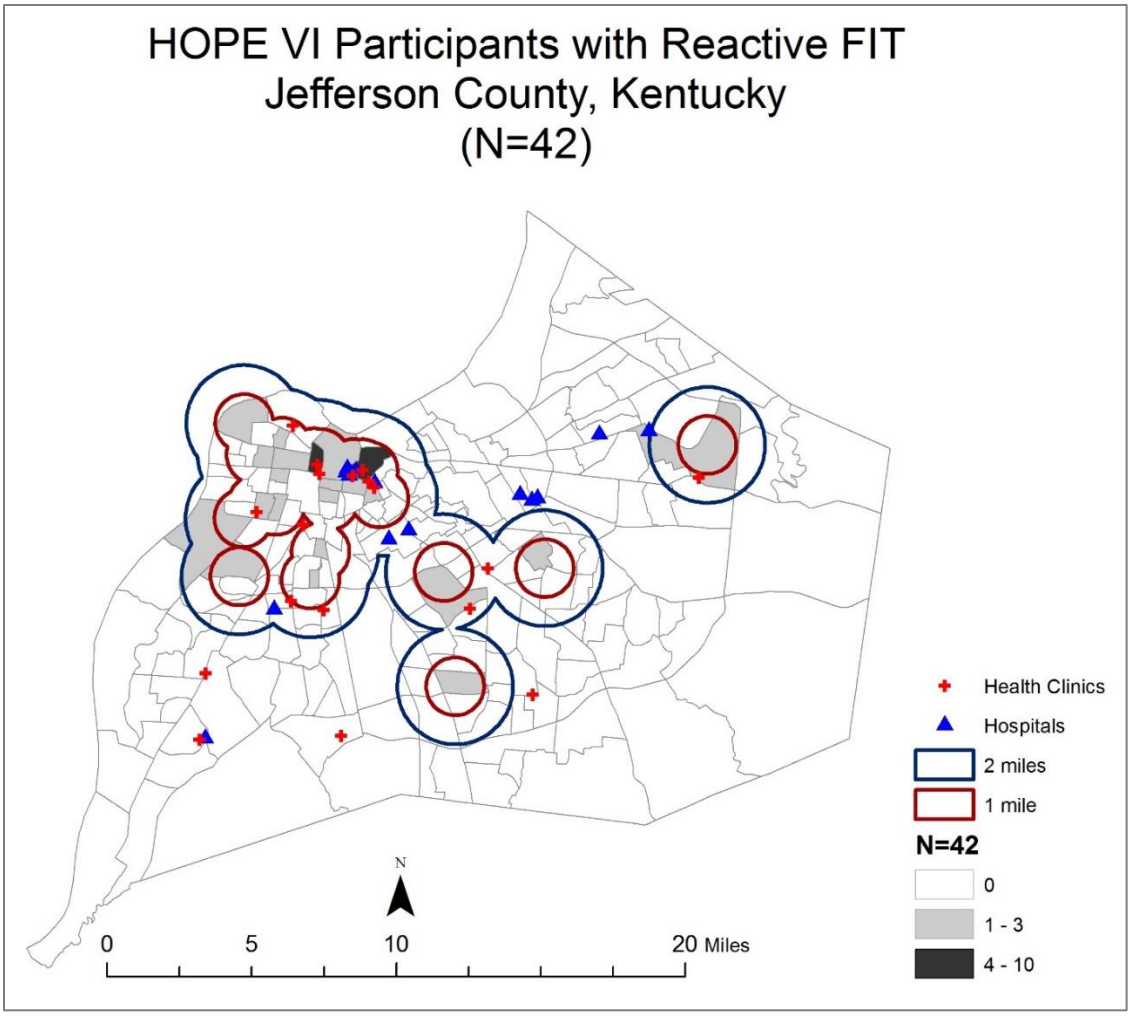

Figure 9. Participants with Reactive FIT (N=42)

Thus, the answer to the first research question: "What are the individual characteristics that make a difference in individual FIT uptake?" is: The HOPE VI African-American residents who returned the FIT kit were more likely to perceive their health to be fair/poor, to not be employed, and to reside in larger public housing developments.

(2) Dependent Variable: Prior Colorectal Cancer Screening

To answer the second research question regarding the individual characteristics that make a difference in a person's CRC screening behavior, all analyses presented above for the FIT uptake were replicated for the prior CRC screening (Yes/No) as a dependent variable.

Figure 10 shows the distribution of the N=109 participants who had a prior CRC screening. Table 6 shows that the group of people who had prior colorectal cancer screening and the group of people who did not have prior CRC screening were slightly different across gender, age, marital status, employment, income and insurance types; they were not different in terms of education. Specifically, the group with prior CRC screening had a slightly larger proportion of males (16.5% vs. 12%), they were more likely to be older, not single, and unable to work or retired.

The proportion of respondents with less than $10,000 annual income was greater in the group with prior CRC screening (85.3%) than in the group without prior screening (80%). In the group with prior CRC screening 27% were employed; in the group without prior screening 44% were employed. Further, in the group with prior CRC screening 83.5% had public health insurance (Passport/ Medicaid, Medicare) compared to 67% in the group without prior CRC screening. The group with prior CRC had 61.5% Medicaid and 22% Medicare recipients as compared to 55% and respectively 12% in the other group.

Table 6

Prior CRC Screening by Sociodemographic Characteristics (N=209)

Variable	Category	No Prior CRC Screening		With Prior CRC Screening		Total	
		N	%	N	%	N	%
Gender	Male	12	12.0	18	16.5	30	14.4
	Female	88	88.0	91	83.5	179	85.6
Age Category	Lowest - 49	38	38.0	11	10.1	49	23.4
	50 - 54	20	20.0	27	24.8	47	22.5
	55 - 59	18	18.0	29	26.6	47	22.5
	60 - 64	16	16.0	25	22.9	41	19.6
	65 - 69	5	5.0	9	8.3	14	6.7
	70 - Highest	3	3.0	8	7.3	11	5.3
Highest Year of School Completed	Elementary/ Some HS	33	33.0	37	34.6	70	33.8
	High school /GED	46	46.0	51	47.7	97	46.9
	Some college/ tech. school	18	18.0	17	15.9	35	16.9
	College graduate	3	3.0	2	1.9	5	2.4
Marital Status	Married	10	10.1	18	16.5	28	13.5
	Divorced/Separated	10	10.1	15	13.8	25	12.0
	Widowed	7	7.1	7	6.4	14	6.7
	Single	72	72.7	69	63.3	141	67.8
Annual Household Income	< $10,000	80	80.0	93	85.3	173	82.8
	$10,000 to < $20,000	14	14.0	6	5.5	20	9.6
	$20,000 to < $75,000	6	6.0	10	9.2	16	7.7
Employment (Multiple Choice)	Employed (Y/N)	44	44.0	28	25.7	72	34.4
	Unable to work (Y/N)	32	32.0	58	53.2	90	43.1
	Unemployed (Y/N)	16	16.0	12	11.0	28	13.4
	Retired (Y/N)	10	10.0	17	15.6	27	12.9
Insurance (Multiple Choice)	Passport/Medicaid	55	55.0	67	61.5	122	58.4
	Medicare	12	12.0	24	22.0	36	17.2
	ACA/self-purchase	21	21.0	19	17.4	40	19.1
	Employer/spouse	15	15.0	13	11.9	28	13.4
	Other	16	16.0	21	19.3	37	17.7
	None	6	6.0	1	0.9	7	3.3
Has Health Insurance		94	94.0	108	99.1	202	96.7

The 109 participants with a prior CRC screening (Figure 10) were distributed across 39 CTs: 19 CTs with one participant, 11 CTs with two participants, 5 CTs with three participants, while the last 4 CTs had 7, 8, 15, and respectively 20 participants.

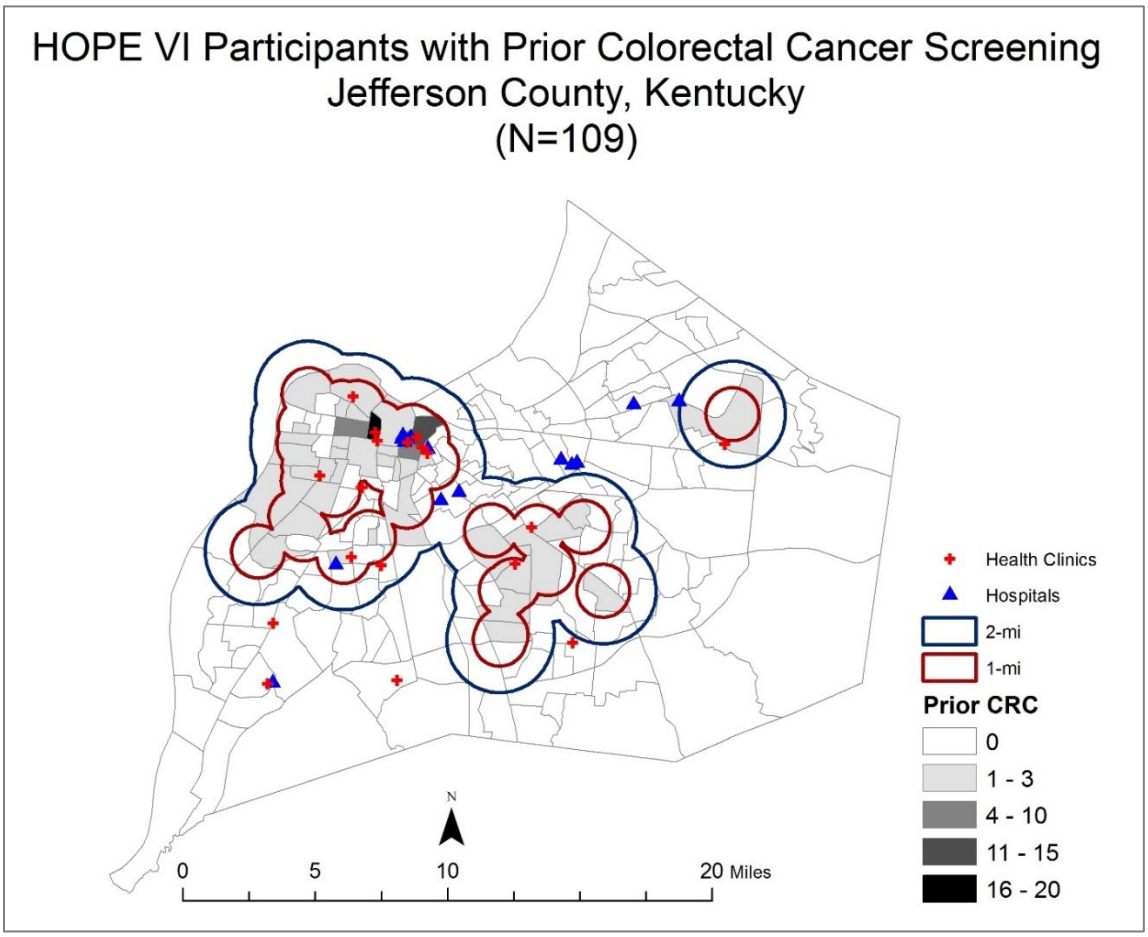

Figure 10. Prior Colorectal Cancer Screening

To test the potentially significant differences identified in Table 6, Chi-Square tests of independence (Table 7) and t-tests comparisons of means (Table 8) were conducted.

Table 7

Prior CRC Screening by Sociodemographic Discrete Characteristics (N = 209)

		Prior CRC (N)	Prior CRC (%)	Chi-Square	p
Age 50 to 75	No	11	22.4	22.632	**.000**
	Yes	98	61.3		
Sex	Male	18	60.0	.864	.353
	Female	91	50.8		
Married	No	91	50.3	1.907	.167
	Yes	18	64.3		
Single	No	40	58.8	1.797	.180
	Yes	69	48.9		
LTH Less than HS	No	72	51.8	.021	.885
	Yes	37	52.9		
Employed	No	82	59.4	8.597	**.003**
	Yes	27	38.0		
Less than $10,000	No	16	44.4	1.036	.309
	Yes	93	53.8		
Public Housing Development	No	31	49.2	.314	.575
	Yes	78	53.4		
BMI high (perceived)	Normal or underweight	55	49.1	1.113	.291
	Overweight or obese	52	56.5		
BMI high (calculated)	Normal or underweight	21	51.2	.018	.894
	Overweight or obese	88	52.4		
Exercise	No	46	58.2	1.878	.171
	Yes	63	48.5		
Smoker	No	59	55.1	.784	.376
	Yes	50	49.0		
Alcohol use (past 30 days)	No	86	55.8	3.195	**.074**
	Yes	23	41.8		
Fair/Poor Health	No	55	45.1	5.873	**.015**
	Yes	54	62.1		
Family History of Cancer	No	43	45.7	2.812	**.094**
	Yes	66	57.4		
Health Insurance (low variation)	No	1		4.162	.041
	Yes	108			
Regular Provider (low variation)	No	2		4.351	.037
	Yes	107			

NOTE: **significant p-values** are in bold font

There was a significant association between residents' age and the prior CRC screening; residents older than 50 were more likely to have had a sigmoidoscopy or a colonoscopy in the past (more than 12-months prior). Residents who were employed (p=.003) or perceived their health to be good/very good/excellent (p=.015) were less likely to have had a prior CRC screening. The alcohol use and family history of cancer were only statistically associated with prior CRC screening at p<.10. All other variables -- gender, marital status, education, income, BMI (perceived or calculated) and health behaviors (smokers, alcohol users) -- were not associated with prior CRC screening. The extremely small proportion of participants without health insurance and without a regular healthcare provider, indicates that participants in this study, in spite of their low-income status, did *not* experience lack of access to healthcare.

Table 8 shows that the two groups were significantly different in age (p<.01), and that they were not different in their health beliefs (fatalism) (p=.269). Employment status (p=.003), and perception of a fair/poor health (p=.015) are associated with prior CRC screening.

Table 8

Prior CRC Screening by Sociodemographic Numeric Characteristics (N = 209)

		N	Mean	SD	t	p-value
Age	No Prior Screening	100	53.84	7.475	-3.861	**.000**
	Prior Screening	109	57.72	7.068		
Fatalism	No Prior Screening	100	9.43	3.50	-1.109	.269
	Prior Screening	109	9.97	3.56		

NOTE: **significant p-values** are in bold font

Thus, the answer to the second research question: "What are the individual characteristics that make a difference in a person's CRC screening behavior?" is: The HOPE VI African-American residents with prior CRC screening were more likely to be age 50 or older, to perceive their health as fair/poor, to have family history of cancer, to be unemployed, and to not use alcohol on a regular basis.

Neighborhood Factors by CRC Screening Behavior

To answer the third research question regarding the association between the neighborhood characteristics and the screening behavior, a series of independent t-tests were conducted to compare the means of census tract variables between the two groups defined by each of the two dependent variables: FIT returned vs. FIT not returned, and Prior CRC screening vs. No Prior CRC screening. The comparisons of means of census tract socioeconomic variables between those who returned the kit (N=149) and those who did not (N=60), and respectively between those who had a prior CRC screening (N=109) and those who did not (N=100) are shown in Table 9. The inspection of the means and standard deviations along with the non-significant p-values, showed that overall the neighborhood characteristics were very similar.

The participants in this study resided in neighborhoods that were primarily African American (63%), with an average unemployment rate of over 20%. About 30% of the residents in these neighborhoods have an annual household income below $10,000, and about 18% have less than high school education.

Table 9

Descriptive Statistics for Socioeconomic Indicators at Census Tract Level

		Return FIT				Prior CRC		
		Mean	SD	P		Mean	SD	P
Household Income	No	$21,379	$9,333	.666	No	$21,812	$10,546	.922
	Yes	$22,093	$11,321		Yes	$21,958	$11,020	
Family Income	No	$27,648	$14,496	.721	No	$28,133	$16,390	.880
	Yes	$28,595	$17,907		Yes	$28,496	$17,551	
Unemployment Rate (%)	No	21.6%	10.3%	.658	No	20.9%	10.1%	.867
	Yes	20.9%	10.3%		Yes	21.2%	10.4%	
Using public transportation (%)	No	15.7%	10.4%	.693	No	15.4%	10.3%	.855
	Yes	15.0%	10.6%		Yes	15.1%	10.8%	
Income below $10,000 (%)	No	29.0%	15.2%	.765	No	28.8%	15.5%	.845
	Yes	28.3%	15.6%		Yes	28.3%	15.4%	
With Earnings (%)	No	64.2%	9.5%	.630	No	64.0%	9.1%	.643
	Yes	63.5%	9.6%		Yes	63.4%	9.9%	
TANF (%)	No	5.8%	3.2%	.763	No	5.9%	3.1%	.886
	Yes	6.0%	3.0%		Yes	5.9%	3.0%	
Food Stamps (%)	No	45.7%	21.1%	.712	No	45.1%	21.3%	.872
	Yes	44.5%	21.7%		Yes	44.6%	21.8%	
Public Health Insurance (%)	No	55.6%	12.6%	.639	No	55.0%	12.5%	.993
	Yes	54.7%	12.6%		Yes	54.9%	12.8%	
Uninsured (%)	No	16.4%	3.5%	.297	No	16.1%	3.6%	.462
	Yes	15.8%	3.7%		Yes	15.8%	3.7%	
AA/ Black (%)	No	66.5%	27.8%	.283	No	62.8%	27.3%	.755
	Yes	62.1%	26.4%		Yes	63.9%	26.4%	
Less Than High School (%)	No	18.2%	8.6%	.781	No	17.9%	7.7%	.923
	Yes	17.8%	7.6%		Yes	18.0%	8.0%	
Proximity (miles)	No	0.70	0.57	.164	No	0.82	0.78	.703
	Yes	0.84	0.80		Yes	0.78	0.71	

NOTE: **significant p-values** (if any) are in bold font

Furthermore, the majority of the 209 residents were located within one mile from a healthcare facility (average= 0.8 standard deviation= 0.75, N=209); there was one resident who recently moved to Lexington, KY (74.5 miles away) who was excluded from the proximity analysis.

There were no significant differences in the socioeconomic characteristics between the neighborhoods of residents of the individuals who returned the kit and of those who did not. Similarly, there were no significant differences in the socioeconomic characteristics of the neighborhoods where the residents with prior CRC screening reside and the neighborhoods of those who did not have a CRC screening before this study. Given the lack of variation in socioeconomic characteristics at census tract level, it is difficult to tell whether residing in a mixed-income community would make a difference in health behaviors.

To summarize the bivariate analyses, none of the neighborhood level variables were associated with any of the two dependent variables. However, the following individual binary variables were significantly associated (at $p<.05$, or marginally at $p<.10$) with the two dependent variables, *FIT kit return* or with the *Prior Screening:* perception of fair/poor health, employment status, residence in a large public housing development, family history of cancer, alcohol use during the past 30 days, and being age 50 or older.

Thus, the answer for the third research question "What are the neighborhood factors that make a difference in a person's CRC screening behavior?" is that results are inconclusive due to insufficient variation in neighborhood level variables; participants reside in neighborhoods that are extremely similar in their socioeconomic status.

Finally, the answer for the fourth research question "Is there a relationship between proximity to healthcare facilities and the prior utilization of CRC screening services among urban African Americans, current or former HOPE VI public housing residents?", is that proximity to healthcare facilities does not seem to matter in prior CRC screening behavior; respondents' age (50 or older) and their perception of having a fair/poor health status are the best predictors for having had a colonoscopy in the past or not.

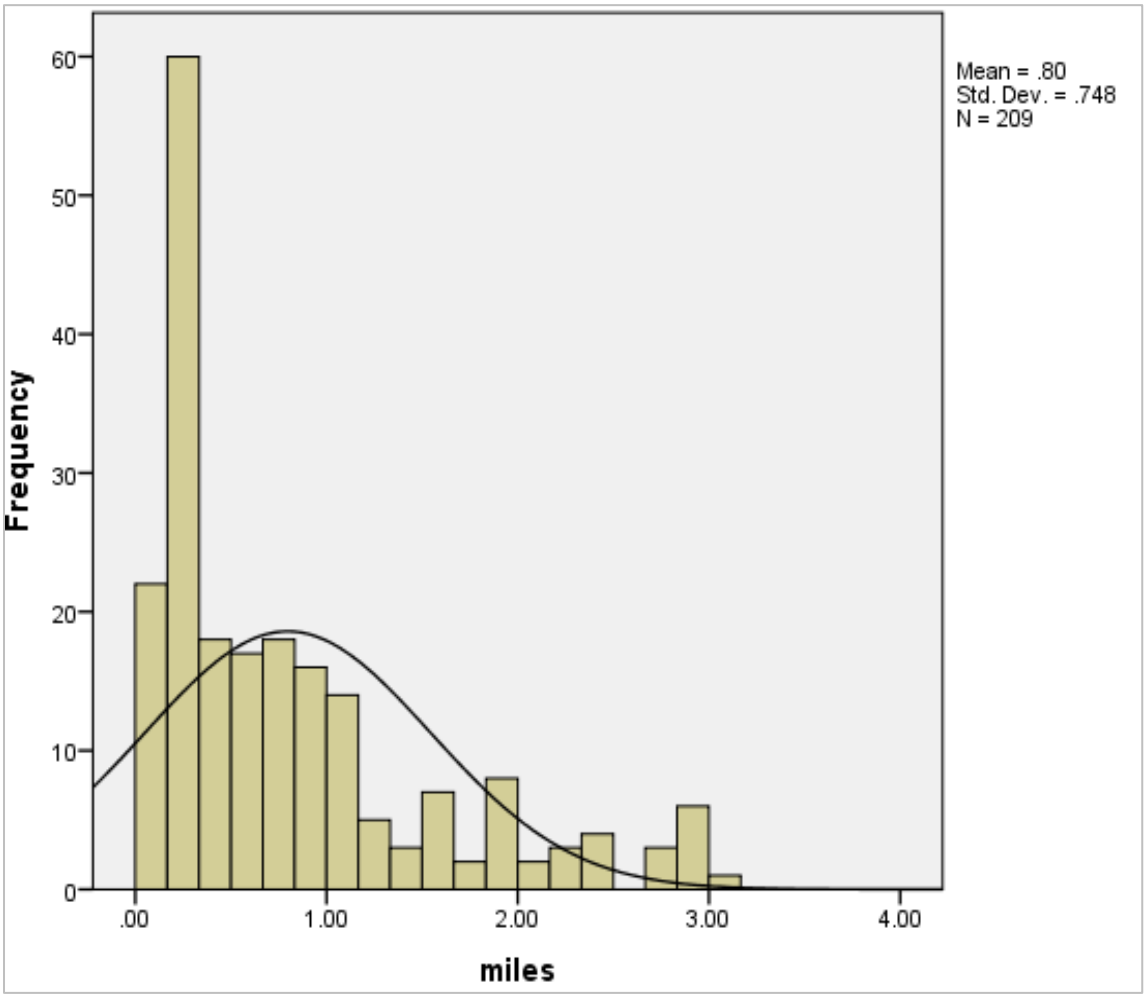

Figure 11. Histogram for Proximity to Healthcare Facilities (in miles)

Multivariate Analyses

The multivariate analyses followed closely the conceptual model developed using the Andersen framework, presented earlier in this document (Figure 2). From the original list of variables measured at *individual level*, only the participant's perceived health and the employment status were associated with the two dependent variables. Housing type (large development or scattered housing) was significantly associated with FIT kit uptake/return, and family history of cancer and alcohol use were associated with prior CRC screening. Using a backward conditional elimination, logistic regression models were conducted using all of these significant or marginally significant variables to predict the likelihood of FIT uptake and of CRC prior screening. None of the *neighborhood level* variables were significant, therefore none of these were included in the multivariate analyses.

Table 10 shows the first (full model) and last (best model) iteration of the logistic regression, using a backward elimination method, which predicted the likelihood that participants would return the FIT kit. Similarly Table 11, shows the first (full model) and last (best model) iteration of the logistic regression, using a backward elimination method, which predicted the likelihood that participants had a prior CRC screening. The full model for both of these analyses included all of the independent variables that were found significant during the bivariate analyses, meaning they were significantly associated with the FIT return or with the prior screening.

Table 10 shows the results of logistic regression for two models: (1) the full model, where all of the variables that were significantly associated with the FIT return or with the prior screening were included; (2) the best fitting logistic regression model that

was found by using a backward conditional method. The full model shows that only health status was significantly associated with returning the FIT; people who perceived their health as fair or poor were almost twice as likely to return the kit. The best and simplest logistic regression model shows that indeed, people who perceived their health to be fair or poor were twice as likely (OR=2.055, p<.05) to return the kit than those who perceived their health to be good, very good or excellent.

In addition, the residents of larger public housing developments (OR=1.873, p<.10) were 87.3% more likely to return the FIT kit than those who reside in scattered housing or in rentals on the regular housing market. Employment made no difference in the likelihood of kit return after adjusting for respondent's perceived health status, and neither did alcohol use or family history of cancer. Table 11 shows that adjusting for age made no difference in predicting the likelihood of FIT return; the final / best model was the same.

Table 10

Logistic Regression Predicting FIT Uptake/Return (N=209)

FIT Return	Predictors (IV)	B	S.E.	Sig.	Odds Ratio	OR 95% C.I. Lower	OR 95% C.I. Upper
Full Model	Employed	-.398	.338	.238	.671	.346	1.302
	Public Housing Development	.531	.335	.113	1.700	.881	3.280
	Alcohol use (past 30 days)	.270	.373	.469	1.310	.631	2.722
	Family History of Cancer	-.523	.324	.106	.593	.314	1.118
	Fair/Poor Health	.677	.345	**.050**	1.968	1.001	3.869
	Constant	.673	.401	.093	1.961		
Best Model	Public Housing Development	.627	.327	**.055**	1.873	.987	3.552
	Fair/Poor Health	.696	.329	**.034**	2.005	1.053	3.821
	Constant	.224	.287	.435	1.252		

NOTE: **significant p-values** are in bold font

Table 11

Logistic Regression Predicting FIT Uptake/Return (N=209): Age-Adjusted Results

	Predictors (IV)	B	S.E.	Sig.	Odds Ratio	OR 95% C.I.	
						Lower	Upper
Full Model	Employment	-.469	.359	.191	.626	.310	1.264
	Public Housing Development	.552	.337	.102	1.737	.896	3.365
	Alcohol	.283	.375	.451	1.327	.636	2.766
	Family History of Cancer	-.523	.324	**.107**	.593	.314	1.119
	Fair/Poor Health	.691	.346	**.046**	1.996	1.013	3.932
	Age 50 or older	-.233	.400	.560	.792	.362	1.734
	Constant	.854	.508	.093	2.350		
Best Model	Public Housing Dev.	.627	.327	**.055**	1.873	.987	3.552
	Fair/Poor Health	.696	.329	**.034**	2.005	1.053	3.821
	Constant	.224	.287	.435	1.252		

NOTE: **significant p-values** are in bold font

Similarly, Table 12 presents the results of the logistic regression predicting the likelihood that study participants had a prior CRC screening at least 12 months prior to the study. The results show that individuals who are employed were significantly less likely to have had a CRC screening in the past (OR=.502, CI: .270-.934). This means that people without employment earnings have 1/0.502=1.992 odds ratio or are two times more likely to have had a prior CRC screening than those who were employed. The significant association between employment status and the respondent's age of 50-75 (Chi-square=24.49, p<.001), provides further insight in this result: older individuals were more likely to have had a CRC screening, and they are more likely to be unemployed. The family history of cancer was only marginally significant (p=.095) when predicting prior CRC screening.

Table 12

Logistic Regression Predicting Prior CRC Screening (N=209)

Prior CRC	Predictors (IV)	B	S.E.	Sig.	Odds Ratio	OR 95% C.I. Lower	Upper
Full Model	Employed	-.689	.317	**.030**	.502	.270	.934
	Public Housing Development	.127	.319	.690	1.136	.608	2.122
	Alcohol use (past 30 days)	-.432	.335	.198	.649	.337	1.253
	Family History of Cancer	.485	.290	**.095**	1.624	.919	2.870
	Fair/Poor Health	.458	.303	.130	1.581	.873	2.861
	Constant	-.109	.374	.771	.897		
Best Model	Employed	-.741	.309	**.016**	.476	.260	.873
	Fair/Poor Health	.522	.297	**.079**	1.685	.941	3.017
	Constant	.123	.226	.586	1.131		

NOTE: **significant p-values** are in bold font

The simplest and best model that predicts the prior CRC screening (Table 12), shows that participants with employment were significantly less likely (OR= 0.476, $p<.05$), that is 1/0.476= 2.1 times less likely, to get a CRC screening than those without employment. The place of residence made no difference in the likelihood to have had CRC screening prior to this study; thus, respondents who reside in large public housing developments were just as likely to have had prior CRC screening as those residing in scattered housing or market rental apartments.

Table 13 shows that the age adjustment made a significant difference in predicting the likelihood of having a prior CRC screening or not; the final / best model continues to include health status, but the age of the respondent (being age 50 or older) is now in the model instead of employment status. Age and employment are highly associated with each other, and between the two, age was a stronger predictor of the prior CRC screening than employment status.

Table 13

Logistic Regression Predicting Prior CRC Screening (N=209): Age-Adjusted Results

	Predictors (IV)	B	S.E.	Sig.	Odds Ratio	OR 95% C.I.	
						Lower	Upper
Full Model	Employment	-.304	.343	.375	.738	.377	1.444
	Public Housing Development	.022	.336	.948	1.022	.529	1.975
	Alcohol	-.503	.351	.152	.605	.304	1.203
	Family History of Cancer	.517	.304	**.089**	1.678	.925	3.044
	Fair/Poor Health	.443	.314	.158	1.558	.842	2.884
	Age 50 or older	1.573	.403	**.000**	4.819	2.185	10.626
	Constant	-1.390	.520	.008	.249		
Best Model	Fair/Poor Health	.585	.301	**.052**	1.796	.995	3.241
	Age 50 or older	1.643	.382	**.000**	5.171	2.446	10.933
	Constant	-1.439	.363	.000	.237		

NOTE: **significant p-values** are in bold font

This finding is not surprising, given that physicians recommend colonoscopies to all individuals ages 50 or older. However, the significant difference in prior CRC screening between the employed and unemployed is more interesting to this study, because one would expect that people who are employed would be more responsive to using a take home FIT kit.

Adjusting for age did not make a difference in the prediction of FIT kit return (Table 11), but it did for the prior screening of CRC (Table 13); people older than 50 were five times more likely to have a colonoscopy or sigmoidoscopy as compared to people younger than 50 years. This is not a surprise considering that physicians recommend colonoscopies to all of their patients ages 50 or older. Also, older public housing residents are more likely to be retired or disabled, hence they are without employment earnings (87% of participants without employment earnings were ages 50 to 75 years old) and to reside in larger public housing buildings, such as the "senior high-

rises". Because age and employment are highly associated with each other, they are generally not included in the same regression model; rather, they are tested separately depending on whether the interest is in differences across age groups or across employment groups.

The common variable between the two best logistic regression models predicting screening behaviors, FIT uptake and respectively CRC prior screening, is the perception of fair/poor health. The distribution of the 87 residents who perceived their health as fair/poor is presented using a choropleth map (Figure 12).

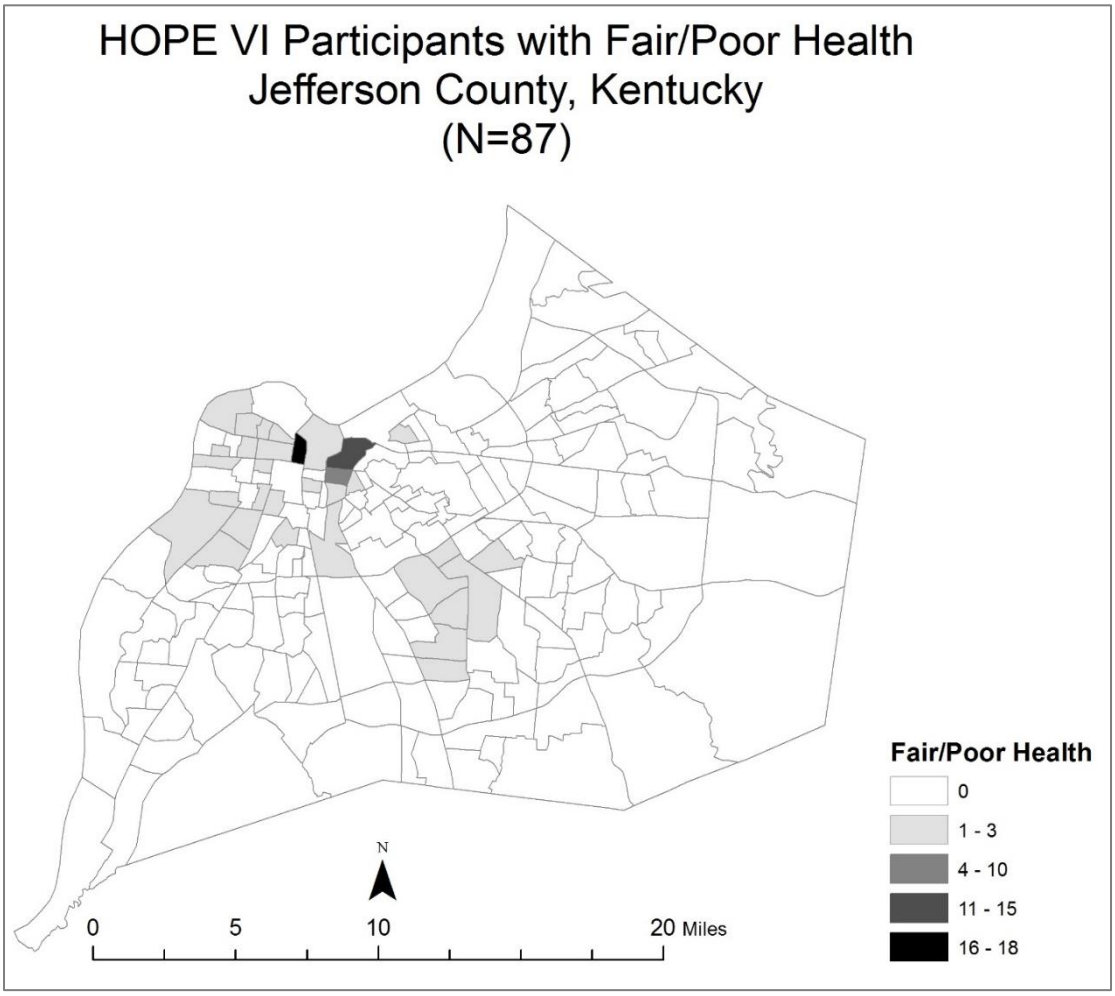

Figure 12. Participants with Perceived Fair or Poor Health

There were 32 CTs with 87 participants who perceived their health as fair/poor. There were 16 CTs with one person, 8 CTs with two persons, 5 CTs with three persons, while the last 3 CTs had 9, 13, and respectively 18 persons with fair/poor health. In addition, the distribution of the 87 residents is presented in Figure 13 together with the location of health clinics (red cross) and of hospitals (blue triangle), to illustrate their proximity to healthcare facilities. The majority of participants with fair/poor health resided in the public housing located in the downtown areas.

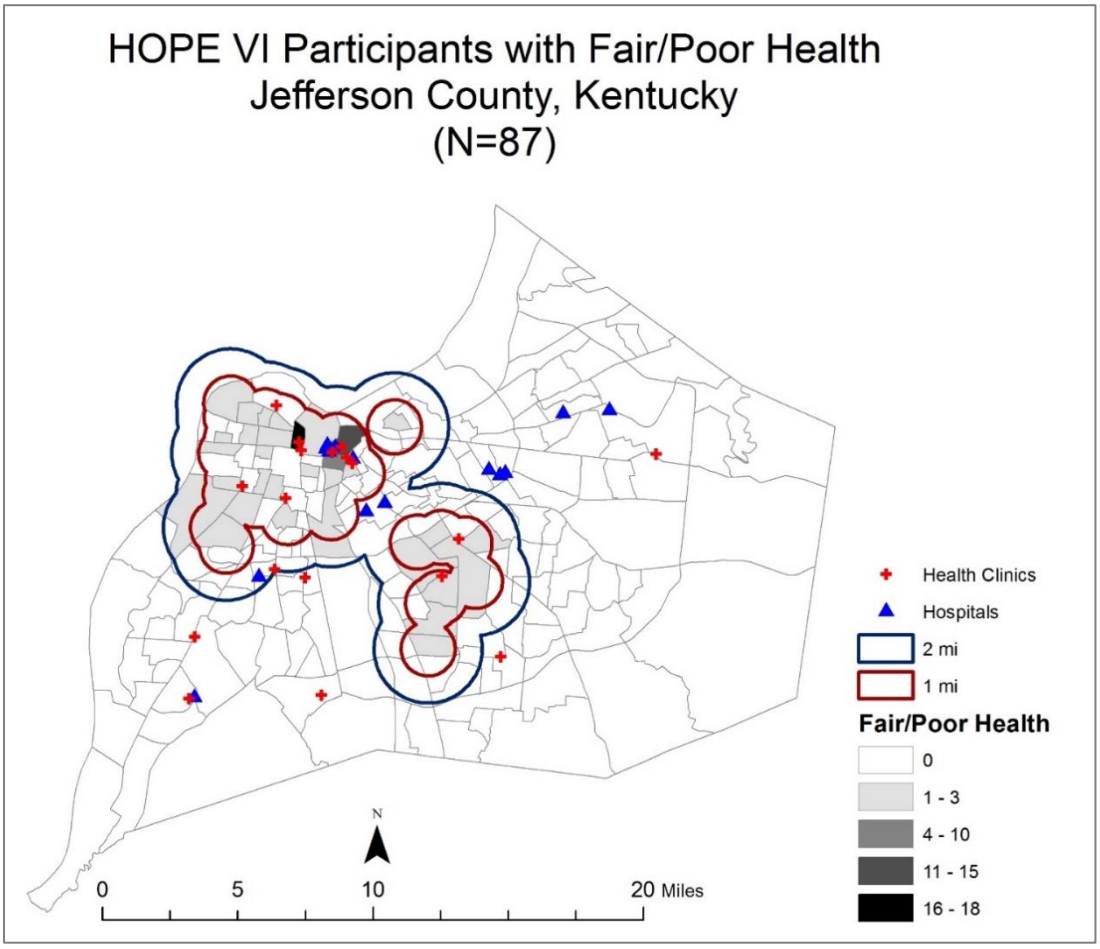

Figure 13. Perceived Fair or Poor Health: Proximity to Healthcare Facilities

CHAPTER V

DISCUSSION AND CONCLUSIONS

The FIT return rate in this study exceeded the return rates reported by previous studies. The higher return rate may be due to using a different strategy to recruit participants. In this study, randomly selected individuals from a population of age-eligible, low socioeconomic status, African American population, at high risk for CRC, were paid a home visit. In comparison, the other studies recruited participants through outreach in the community or at the local clinics. Home visitation was an opportunity to establish a more personable relationship, to earn participants' trust, and set the foundation for a sustainable relationship that led to higher rates of follow-up. However, because all of the participants were very low income, it was difficult to estimate the impact of the home visitation versus the impact of the financial incentives on the participation rates. It is reasonable to assume that financial compensation played an important role in increasing participation rates, along with the prepaid return envelope provided with the FIT kit during the home visit.

Another reason for the high rate of FIT kit return may have been the non-invasive nature of this study, along with the free, valuable health information they received. Moreover, the results were confidential and there was no pressure to follow-up with a colonoscopy. It is noteworthy that, while the follow-up study on the completed colonoscopies is forthcoming, all of the participants with a FIT reactive result stated that

they will schedule a colonoscopy. In fact, a few of these residents reached out for help to find a chaperone and transportation for the procedure, and they were linked to free community resources.

About half of the individuals who participated in the study, majority of age 50 or older, had a colonoscopy or sigmoidoscopy 12 months or more prior to this study. This rate is similar to the rate reported by other studies (Sineshaw, Robbins, and Jemal 2014) for the general African American population. This means that the CRC screening rates in very low-income African American population, with health insurance and a regular healthcare provider, are not significantly different than the CRC screening rates in the general African American population. Nevertheless, low and very low income populations residing in subsidized housing are less likely to visit a healthcare provider, in spite of their free access to healthcare and to a regular healthcare provider, and regardless of their proximity to healthcare facilities. It is noteworthy that the over 95% rate of insured individuals is a result of Kentucky's expansion of Medicaid, which offers full coverage to all individuals with incomes 133% above the federal poverty level.

Another finding was that younger, employed participants were less likely to have had a prior CRC screening, in spite of having health insurance and a regular healthcare provider. Within this group, the participants with family history of cancer were more likely to have had a prior CRC screening. In spite of the lower participation among employed residents and among those who were relocated in scattered housing or in subsidized rental units, these two groups may be the ones who would benefit the most from using a home visit outreach strategy and/or from screening with prepaid mailing of FIT kits.

Individuals who resided in scattered public housing or in subsidized rental units appear to be less likely to return the FIT kit. This is the opposite behavior of what was expected based on the literature on HOPE VI programs (Curley 2010). The theory of social capital suggests that people who reside in mixed-income communities increase their social capital, and they are likely to copy the "better" behaviors of their neighbors. The theory may be supported by the behaviors of individuals who reside in larger public housing, but it does not seem to be supported by the behaviors of individuals residing in slightly more mixed-income communities. It is noteworthy, that this finding was only marginally significant, at 90% confidence level.

The key finding of this study was that an individual's perception of his or her health status is the main predictor of FIT kit return and of CRC screening behavior. No matter the place of residence, age or employment status, participants who perceived their health as less than good were more likely to return the FIT kits, and were more likely to have had a prior CRC screening. This finding shows that screening behavior is very much like medical care seeking behavior. Therefore, Andersen's model, which prescribes that individual perception of a health need is the key factor for seeking medical care, and was an appropriate theoretical model for this study.

Finally, the standard outreach for CRC screening generally occurs in healthcare facilities (Myers et al. 2007). Community outreach and recruitment of patients in healthcare settings was found to be successful in many populations, but this study showed that home visitation can be a successful strategy to increase screening for colorectal cancer in high risk populations such as low and very low income communities of African Americans. To conclude, CRC screening within urban clusters of high poverty areas may

be more successful if conducted by community health advocates, via home visits, so that participants receive more individualized attention. Close proximity to health care facilities, free health insurance, and a regular healthcare provider do not guarantee that they get the healthcare they need. However, the hypothesis of this thesis research, that the socioeconomic level of the area of residence has no bearing on individual health seeking behavior after controlling for individual characteristics, seems to be confirmed.

Limitations

The findings of this study have several limitations. First, they are limited by the use of a small sample, given that this was a pilot study. Second, even though the sample was randomly selected, it would be difficult to generalize the results to other urban public housing populations using the pilot sample; there is a need for a control group, a sample of public housing residents who were not part of the HOPE VI program. Third, the researchers collected only a limited number of variables, which did not provide sufficient information about the participants to explain the differences in their screening behaviors. The public housing population is highly homogenous in terms of race and income; over 90% are African American and all of them have very low incomes. They are fairly homogenous in terms of health too, because many times their housing subsidy is due to poor physical or mental health or due to some type of disability.

Another study limitation is that senior housing developments and the other public housing developments for families with children and younger single people, such as Park Hill or Beecher Terrace, were included in the same category. Thus, it is reasonable to

assume that many factors that could have differentiated between different groups of public housing residents were not included in the survey. Future studies should include more extensive measurements and larger samples that would allow estimations of the effect of age, of the place of residence, and of the employment status on screening behavior. Finally, the differences between the neighborhoods of residence were not significant and thus a multilevel model could not be developed. Similarly, while this is a "good" limitation to have, the fact that almost all of the participants have health insurance and a regular medical provider made it impossible to test the differences in screening behaviors made by access to healthcare.

REFERENCES

Andersen, R. M. 1995. Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health Social Behavior* 36 (1): 1-10.

Beyer, K. M., Y. Zhou, K. Matthews, K. Hoormann, A. Bemanian, P. W. Laud, and A. B. Nattinger. 2016. Breast and colorectal cancer survival disparities in southeastern Wisconsin. *Wisconsin Medical Journal* 115 (1): 17-21.

Bolen, J., M. Adams, and D. Shenson. 2007. Routine preventive services for older women: A composite measure highlights gaps in delivery. *Journal of Womens Health (Larchmt)* 16 (5): 583-93.

Brenner, A. T., S. Gupta, L. K. Ko, N. Janz, and J. M. Inadomi. 2016. Development of a practical model for targeting patient decision support interventions to promote colorectal cancer screening in vulnerable populations. *Journal of the Health Care for the Poor and Underserved* 27 (2): 465-78.

Brenner, A. T., L. K. Ko, N. Janz, S. Gupta, and J. Inadomi. 2015. Race/ethnicity and primary language: Health beliefs about colorectal cancer screening in a diverse, low-income population. *Journal of the Health Care for the Poor and Underserved* 26 (3): 824-38.

Cole, A. M., J. E. Jackson, and M. Doescher. 2012. Urban-rural disparities in colorectal cancer screening: Cross-sectional analysis of 1998-2005 data from the Centers for Disease Control's Behavioral Risk Factor Surveillance Study. *Cancer Medicine* 1 (3): 350-6.

Cooper, G. S., Z. Yuan, C. S. Landefeld, J. F. Johanson, and A. A. Rimm. 1995. A national population-based study of incidence of colorectal cancer and age. Implications for screening in older Americans. *Cancer* 75 (3): 775-81.

Cress, R. D., C. Morris, G. L. Ellison, and M. T. Goodman. 2006. Secular changes in colorectal cancer incidence by subsite, stage at diagnosis, and race/ethnicity, 1992-2001. *Cancer* 107 (5 Suppl): 1142-52.

Curley, A. M. 2010. Relocating the poor: Social capital and neighborhood resources. *Journal of Urban Affairs* 32 (1): 79-103.

Centers for Disease Control and Prevention. 2016. Available at https://nccd.cdc.gov/uscs/toptencancers.aspx (Last accessed 7 December 2016)

Daly, J. M., B. T. Levy, M. L. Merchant, and J. Wilbur. 2010. Mailed fecal-immunochemical test for colon cancer screening. *Journal of Community Health* 35 (3): 235-9.

Daly, J. M., B. T. Levy, C. A. Moss, and C. P. Bay. 2015. System strategies for colorectal cancer screening at Federally Qualified Health Centers. *American Journal of Public Health* 105 (1): 212-219.

Davis, S. N., H. Thompson, Y. E. Gutierrez, S. G. Boateng, and L. Jandorf. 2002. #6-S breast cancer fatalism: Ethnic differences and association with cancer screening. *Annals of Epidemiology* 12 (7): 491-492.

Doubeni, C. A., A. O. Laiyemo, J. M. Major, M. Schootman, M. Lian, Y. Park, B. I. Graubard, A. R. Hollenbeck, and R. Sinha. 2012. Socioeconomic status and the risk of colorectal cancer: An analysis of more than a half million adults in the National Institutes of Health-AARP Diet and Health Study. *Cancer* 118 (14): 3636-44.

Doubeni, C. A., A. O. Laiyemo, G. Reed, T. S. Field, and R. H. Fletcher. 2009. Socioeconomic and racial patterns of colorectal cancer screening among Medicare enrollees in 2000 to 2005. *Cancer Epidemiology Biomarkers Prevention* 18 (8): 2170-5.

Doubeni, C. A., M. Schootman, J. M. Major, R. A. Stone, A. O. Laiyemo, Y. Park, M. Lian, L. Messer, B. I. Graubard, R. Sinha, A. R. Hollenbeck, and A. Schatzkin. 2012. Health status, neighborhood socioeconomic context, and premature mortality in the United States: The National Institutes of Health-AARP Diet and Health Study. *American Journal of Public Health* 102 (4): 680-8.

Enewold, L., J. Zhou, K. A. McGlynn, S. S. Devesa, C. D. Shriver, J. F. Potter, S. H. Zahm, and K. Zhu. 2012. Racial variation in tumor stage at diagnosis among Department of Defense beneficiaries. *Cancer* 118 (5): 1397-403.

Escoffery, C., M. E. Fernandez, S. W. Vernon, S. Liang, A. E. Maxwell, J. D. Allen, A. Dwyer, P. A. Hannon, M. Kohn, and A. DeGroff. 2015. Patient navigation in a colorectal cancer screening program. *Journal of Public Health Management Practice* 21 (5): 433-40.

Espey, D. K., X. C. Wu, J. Swan, C. Wiggins, M. A. Jim, E. Ward, P. A. Wingo, H. L. Howe, L. A. Ries, B. A. Miller, A. Jemal, F. Ahmed, N. Cobb, J. S. Kaur, and B. K. Edwards. 2007. Annual report to the nation on the status of cancer, 1975-2004, featuring cancer in American Indians and Alaska Natives. *Cancer* 110 (10): 2119-52.

Faruque, F. S., X. Zhang, E. N. Nichols, D. L. Bradley, R. Reeves-Darby, V. Reeves-Darby, and R. J. Duhe. 2015. The impact of preventive screening resource distribution on geographic and population-based disparities in colorectal cancer in Mississippi. *BioMed Central Resident Notes* 8: 423.

Green, B. B., and G. D. Coronado. 2014. "BeneFITs" to increase colorectal cancer screening in priority populations. *Journal of the American Medical Association Internal Medicine* 174 (8): 1242-3.

Hall, M. J., K. Ruth, and V. N. Giri. 2012. Rates and predictors of colorectal cancer screening by race among motivated men participating in a prostate cancer risk assessment program. *Cancer* 118 (2): 478-84.

Hao, Y., A. Jemal, X. Zhang, and E. M. Ward. 2009. Trends in colorectal cancer incidence rates by age, race/ethnicity, and indices of access to medical care, 1995-2004 (United States). *Cancer Causes Control* 20 (10): 1855-63.

Hassan, M. O., Z. Arthurs, V. Y. Sohn, and S. R. Steele. 2009. Race does not impact colorectal cancer treatment or outcomes with equal access. *American Journal of Surgery* 197 (4): 485-90.

Hayward, E., C. Ibe, J. H. Young, K. Potti, P. Jones, 3rd, C. E. Pollack, and K. A. Gudzune. 2015. Linking social and built environmental factors to the health of public housing residents: A focus group study. *BioMed Central Public Health* 15: 351.

Hines, R. B., and T. W. Markossian. 2012. Differences in late-stage diagnosis, treatment, and colorectal cancer-related death between rural and urban African Americans and whites in Georgia. *Journal of Rural Health* 28 (3): 296-305.

Jemal, A., R. L. Siegel, J. Ma, F. Islami, C. DeSantis, A. Goding Sauer, E. P. Simard, and E. M. Ward. 2015. Inequalities in premature death from colorectal cancer by state. *Journal of Clinical Oncology* 33 (8): 829-35.

Laiyemo, A. O., C. Doubeni, P. F. Pinsky, V. P. Doria-Rose, R. Bresalier, L. E. Lamerato, E. D. Crawford, P. Kvale, M. Fouad, T. Hickey, T. Riley, J. Weissfeld, R. E. Schoen, P. M. Marcus, P. C. Prorok, and C. D. Berg. 2010. Race and colorectal cancer disparities: Health-care utilization vs different cancer susceptibilities. *Journal of National Cancer Institute* 102 (8): 538-46.

Manjarrez, C.A., Popkin, S.J. and Guernsey, E. 2007. Poor health: Adding insult to injury for HOPE VI families. The Urban Institute, Metropolitan Housing and Communities Center, Brief No. 5, June 2007. Available at: http://www.urban.org/UploadedPDF/311489_HOPEVI_Health.pdf

McLafferty, S., and F. Wang. 2009. Rural reversal? Rural-urban disparities in late-stage cancer risk in Illinois. *Cancer* 115 (12): 2755-64.

Monson, J. R., C. P. Probst, S. D. Wexner, F. H. Remzi, J. W. Fleshman, J. Garcia-Aguilar, G. J. Chang, and D. W. Dietz. 2014. Failure of evidence-based cancer care in the United States: The association between rectal cancer treatment, cancer center volume, and geography. *Annals of Surgery* 260 (4): 625-31; discussion 631-2.

Myers, R. E., R. Sifri, T. Hyslop, M. Rosenthal, S. W. Vernon, J. Cocroft, T. Wolf, J. Andrel, and R. Wender. 2007. A randomized controlled trial of the impact of targeted and tailored interventions on colorectal cancer screening. *Cancer* 110 (9): 2083-91.

Oort, F. A., J. S. Terhaar Sive Droste, R. W. Van Der Hulst, H. A. Van Heukelem, R. J. Loffeld, I. C. Wesdorp, R. L. Van Wanrooij, L. De Baaij, E. R. Mutsaers, S. van der Reijt, V. M. Coupe, J. Berkhof, A. A. Bouman, G. A. Meijer, and C. J. Mulder. 2010. Colonoscopy-controlled intra-individual comparisons to screen relevant neoplasia: Faecal immunochemical test vs. guaiac-based faecal occult blood test. *Alimentary Pharmacology and Therapeutics* 31 (3): 432-9.

Paskett, E. D., J. L. Fisher, E. J. Lengerich, N. E. Schoenberg, S. K. Kennedy, M. E. Conn, K. A. Roberto, S. K. Dwyer, D. Fickle, and M. Dignan. 2011. Disparities in underserved white populations: The case of cancer-related disparities in Appalachia. *Oncologist* 16 (8): 1072-81.

Perdue, D. G., D. Haverkamp, C. Perkins, C. M. Daley, and E. Provost. 2014. Geographic variation in colorectal cancer incidence and mortality, age of onset, and stage at diagnosis among American Indian and Alaska Native people, 1990-2009. *American Journal of Public Health* 104 Suppl 3: S404-14.

Pollack, C. E., H. D. Green, Jr., D. P. Kennedy, B. A. Griffin, A. Kennedy-Hendricks, S. Burkhauser, and H. Schwartz. 2014. The impact of public housing on social networks: A natural experiment. *American Journal of Public Health* 104 (9): 1642-9.

Sabounchi, S., S. Keihanian, and B. S. Anand. 2012. Impact of race on colorectal cancer. *Clinical Colorectal Cancer* 11 (1): 66-70.

Schenck, A. P., S. C. Peacock, C. N. Klabunde, P. Lapin, J. F. Coan, and M. L. Brown. 2009. Trends in colorectal cancer test use in the medicare population, 1998-2005. *American Journal for Preventive Medicine* 37 (1): 1-7.

Shokar, N. K., T. Byrd, D. R. Lairson, R. Salaiz, J. Kim, J. Calderon-Mora, N. Nguyen, and M. Ortiz. 2015. Against Colorectal Cancer in Our Neighborhoods, a Community-based colorectal cancer screening program targeting low-income

hispanics: Program development and costs. *Health Promotion Practice* 16 (5): 656-66.

Sineshaw, H. M., A. S. Robbins, and A. Jemal. 2014. Disparities in survival improvement for metastatic colorectal cancer by race/ethnicity and age in the United States. *Cancer Causes Control* 25 (4): 419-23.

Steele, C. B., C. J. Cardinez, L. C. Richardson, L. Tom-Orme, and K. M. Shaw. 2008. Surveillance for health behaviors of American Indians and Alaska Natives-findings from the behavioral risk factor surveillance system, 2000-2006. *Cancer* 113 (5 Suppl): 1131-41.

Suzuki, R., P. M. Wallace, and E. Small. 2015. Race, health-related quality of life and colorectal cancer screening rates in the National Health Interview Survey. *American Journal of Health Behavior* 39 (1): 132-9.

Tawk, R., A. Abner, A. Ashford, and C. P. Brown. 2015. Differences in colorectal cancer outcomes by race and insurance. *International Journal of Environmental Research and Public Health* 13 (1):ijerph13010048.

Theuer, C. P., T. H. Taylor, W. R. Brewster, and H. Anton-Culver. 2006. Gender and race/ethnicity affect the cost-effectiveness of colorectal cancer screening. *Journal of National Medical Association* 98 (1): 51-7.

Towne, S. D., Jr., M. L. Smith, S. Ahn, M. Altpeter, B. Belza, K. P. Kulinski, and M. G. Ory. 2014. National dissemination of multiple evidence-based disease prevention programs: Reach to vulnerable older adults. *Front Public Health* 2: 156.

Towne, S. D., Jr., M. L. Smith, and M. G. Ory. 2014. Geographic variations in access and utilization of cancer screening services: Examining disparities among American Indian and Alaska Native Elders. *International Journal of Health Geography* 13:18.

Wheeler, S. B., T. M. Kuo, R. K. Goyal, A. M. Meyer, K. Hassmiller Lich, E. M. Gillen, S. Tyree, C. L. Lewis, T. M. Crutchfield, C. E. Martens, F. Tangka, L. C. Richardson, and M. P. Pignone. 2014. Regional variation in colorectal cancer testing and geographic availability of care in a publicly insured population. *Health Place* 29: 114-23.

Winterich, J. A., S. A. Quandt, J. G. Grzywacz, P. Clark, M. Dignan, J. H. Stewart, and T. A. Arcury. 2011. Men's knowledge and beliefs about colorectal cancer and 3 screenings: Education, race, and screening status. *American Journal of Health Behavior* 35 (5): 525-34.

APPENDICES

Table A1

Selected CRC Studies

Article	Setting	Data Sources	Cases	Focus
(Beyer et al. 2016)	SE Wisconsin	Wisconsin Cancer Reporting System (WCRS)	2002-2011 breast (n = 11,411) or colorectal (n = 7286)	Focuses on disparities in breast and CRC survival in SE WI to provide actionable evidence to guide future cancer control efforts in the region.
(Bolen, Adams, and Shenson 2007)	DC and 49 states, except HI	Data from the 2004 (BRFSS)	N = 91,156	Used a composite measure to examine the delivery of routine clinical preventive services to women ages 50–64 & 65+ (2004).
(Brenner et al. 2015)	San Francisco	Colon Cancer Screening Adherence Study	N=933	Explore whether health belief model (HBM) constructs pertaining to CRC screening differ by race/ethnicity and primary language.
(Brenner et al. 2016)	San Francisco	2007-2008 CRC Adherence Study	N = 997	To develop a practical model for predicting probability of (CRC) screening completion in a diverse safety-net population and a framework for targeting screening promotion interventions.
(Cooper et al. 1995)	U.S.	1987 Medicare Provider Analysis & Review	N = 75,266	Examined the anatomic distribution of colorectal tumors by age, sex, and race in Medicare population (65 and older).
(Cress et al. 2006)		1992 and 2001 NCI (SEER)	M= 95,539 & F=93,329	Focus on patterns of CRC incidence by gender, race/ethnicity, and area of residence

(Daly et al. 2010)	Iowa	Conducted in a tertiary Midwestern medical Center's family medicine clinic.	350 potential subjects randomly selected from 1,564 patients.	Regular patients of a clinic, ages 50–64 years, not up-to-date with CRC screening will complete the at-home (FIT) test if it is mailed to them.
(Doubeni, Laiyemo, et al. 2012)	CA, FL, LA, NJ, NC, PA and 2 metro areas (Atlanta, GA and Detroit, MI)	NIH-AARP Diet and Health Study (NIH-AARP study). 1995-1996.	506,488 participants analyzed	This study examined the relationship between both individual and area-level SES and CRC incidence, overall and by tumor location.
(Doubeni, Schootman, et al. 2012)	CA, FL, LA, NJ, NC, PA and (Atlanta, GA and Detroit, MI)	NIH-AARP Diet and Health Study. 1995-1996 & 2004 to 2006	567,169 AARP members aged 50 to 71 years	Neighborhood socioeconomic inequalities lead to large disparities in risk of premature mortality among healthy U.S. adults but not among those in poor health.
(Enewold et al. 2012)	9 SEERs (CT, IA, NM, UT, HI, Detroit, San Francisco-Oakland, Atlanta, Seattle-Puget)	Department of Defense Automated Cancer Tumor Registry from 1990 to 2003		To determine whether tumor stage differed between whites and blacks with breast, cervical, colorectal, and prostate cancers, which have effective screening regimens.
(Escoffery et al. 2015)	25 states and 4 tribal organizations	November to December 2011		The purpose of this study was to characterize patient navigation (PN) programs for screening provision and promotion for the first 1 to 2 years of program funding.
(Hall, Ruth, and Giri 2012)	Philadelphia area	Fox Chase Cancer Center	N= 812	Assessment of disparities in uptake of CRC screening among men participating in a high-risk prostate cancer clinic.
(Hao et al. 2009)	18 states, Detroit metro, CA, CO, CT, FL, HI, ID, IL, IA, KY, LA, ME, NE, NJ, NY, RI, TX, UT, WA.	1995 to 2004 Behavioral Risk Factor Surveillance System (BRFSS)	N= 336,819	Individuals residing in poorer communities with lower access to medical care did not experience the reduction in CRC incidence rates seen in more affluent communities; disparities may be related to healthcare access barriers to CRC endoscopic screening.

(Hassan et al. 2009)	Cannot find	DOD tumor registry 01/1994 to 01/2004	N=398	Ethnicity is a factor for disparate outcomes in CRC.
(Laiyemo et al. 2010)	AL, CO, MI, HI, WI, MN, PA, UT, MO, DC.	November 1993 to July 2001 NCI	N=60,572	Disproportionately higher incidence and mortality from CRC among blacks compared with whites reflect differences in health-care utilization or CRC susceptibility.
(Sabounchi, Keihanian, and Anand 2012)	US	1996 to 2010 Michael E. DeBakey VA Medical Center in Houston, TX	205 White and 95 Black	Found no racial difference in the Tx outcome of CRC in VA patients; patients with similar tx had similar outcomes; severity of disease at presentation and the outcome of tx not dependent on race.
(Shokar et al. 2015)	El Paso County, Texas	Against Colorectal Cancer in Our Neighborhoods (ACCION) Program	population screening; about 6,000 people	Focus on development processes and costs of a health promotion program for low-income Hispanics to inform on planning and developing new programs to reduce disease burden
(Sineshaw, Robbins, and Jemal 2014)	US	1992–2009 from 13 population-based cancer registries of NCI SEER	white 34,642 Asian 4,413 black 6,369 Hispanic 4,469	Non-Hispanic blacks, Hispanics, and older patients diagnosed with metastatic CRC have not equally benefitted from the intro/dissem. of new Txs.
(Suzuki, Wallace, and Small 2015)	US	NHIS 2010	26,704 persons aged 50 to 75 years	Examine the association between CRC screening rates and health-related quality of life (HRQOL).
(Theuer et al. 2006)	California	SEER Cancer Incidence	1992-1998	Influence of gender and race/ethnicity on the cost-effectiveness of rec. CRC screening regimen.
(Winterich et al. 2011)	US	In-depth interviews	65 AA and W men	Compare how education, race, and screening status affected men's knowledge about CRC and their views of 3 screenings: the fecal occult blood test (FOBT), sigmoidoscopy, and colonoscopy.

Figure A2. FIT Kit, UK Reply Envelope, $20 Incentive- Kroger Gift Card

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Stone, R., Stone, J.D., Collins, T., Crosby, R. (2017) Colorectal cancer screening in Clarksdale and Sheppard Square HOPE VI population, Urban Affairs Association, Annual meeting, Minneapolis, MN