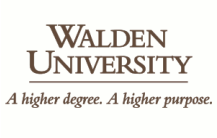

2015

Completion of Preventive Health Care Actions by Older Women with HIV/AIDS

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This is to certify that the doctoral dissertation by

Patricia Correll

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
2015

Abstract

Completion of Preventive Health Care Actions by Older Women with HIV/AIDS

by

Patricia Correll

M.S.N., Trenton State College, 1993

B.S.N., The Ohio State University, 1990

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Abstract

The widespread use of highly active antiretroviral therapy (HAART) has resulted in longer lifespans for HIV seropositive women in the United States, during which preventive health care is recommended. Failing to complete recommended cancer screening tests can result in cancer being diagnosed at a later stage with a poorer prognosis. The purpose of the study, based on the ecosocial theory, was to describe the sociodemographic and clinical variables of HIV seropositive women who failed to complete recommended screening tests for breast, cervical, and colorectal cancers and determine if the presence of hypertension, obesity, diabetes, depression, or tobacco use impacted the completion of these screening tests. The electronic medical records of 142 HIV seropositive women were reviewed. Univariate and bivariate analyses and logistic regression were conducted to create a model associated with the completion of preventive health care screening tests. For breast cancer, cervical cancer, and colorectal cancer, 69%, 71.8%, and 69.7% failed to complete screening, respectively. Number of years living with HIV infection and HIV stage were associated with breast cancer screening; distance between residence and health care facility and HIV stage were associated with cervical cancer screening; and age and marital status were associated with colorectal cancer screening. Addressing issues related to the completion of cancer screening tests over the lifespans of HIV seropositive women can result in positive social change by preventing disease and disability, which can negatively impact these women, their families, and their communities.

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Dedication

This effort has been supported by many individuals: my husband, who kept replacing my laptops and helped me to balance my commitments; my daughter, who encouraged me to finish my doctoral degree before she finished her own; my son, who brought me numerous chai teas from Starbucks and, along with Jasper, kept me company on many long nights of writing; Layla, who encouraged me to move around when I had been typing and reading for too long; my brother, who reminded me how proud my parents would be of their daughter who never finished high school. For your love and support, this work is dedicated to each of you.

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Special thanks are due Dr. Patricia Kloser for her long-time support and encouragement in all aspects of my research career and education, as well as for her unwavering friendship, and for allowing me to access the electronic medical records in her infectious disease practice, but only after IRB approval! Thank you.

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Chapter 1: Introduction to the Study

Background of the Study

Approximately 1 in every 4 of the more than 1.1 million individuals living with human immunodeficiency virus (HIV) or acquired immune deficiency syndrome (AIDS) in the United States are women (Centers for Disease Prevention and Control [CDC], 2013a), and women accounted for about one fourth of new HIV/AIDS cases diagnosed each year in the United States (CDC, 2014a). Once considered an acute disease associated with premature death, since the advent of highly active antiretroviral therapy (HAART), HIV is now viewed as a chronic illness, similar to diabetes, which requires medical management throughout an individual's lifespan (Clarke, 1994). A chronic disease is a disease with a prolonged course, without a spontaneous resolution, and for which a complete cure is rarely achieved (McKenna, Taylor, Marks, & Koplan, 1998). In the presence of a chronic illness or disease, the overall focus of health care often changes from the primary prevention of a health threat to the prevention of further disability, or secondary prevention (Clarke, 1994).

Approximately half, or 117 million, adults in the United States have one or more chronic illnesses resulting from a complex interplay of genetic, environmental, and social factors, and these illnesses are impacted further by gender, age, race or ethnicity, and socioeconomic disparities (CDC, 2014b; Morewitz, 2006), all of which should be considered when discussing the completion of preventive health care actions for women with HIV infection. Not only should preventive health care actions be considered when developing programs and policies related to women with HIV infection but also the effect a woman's health has on the entire family unit. Sixty percent of women with HIV

infection reported having at least one child, compared to 18% of men (Schuster et al., 2000), and the number of HIV seropositive women who gave birth increased about 30% between 2000 and 2006 (CDC, 2014c), so keeping HIV seropositive women as healthy as possible throughout their lifespan by developing programs to improve the completion of preventive health care actions can result in positive social change through maintenance of a healthy family unit.

Individuals with chronic illnesses, like those without a chronic illness or condition, need to maintain an optimal level of health to reduce or prevent future disability (Institute of Medicine [IOM], 2012; McKenna et al., 1998). Evidence-based preventive health care recommendations have been developed to aid health care providers in the provision of screening procedures and tests during lifespan periods when certain preventable diseases are most likely to occur (Ockene et al., 2007). However, the likelihood of receiving the preventive health care services related to these recommendations differs significantly by gender (Ferrante, Chen, Crabtree, & Wartenberg, 2007), age (Shenson, Bolen, Adams, Seeff, & Blackman, 2005), socioeconomic factors (O'Malley, Forrest, & Mandelblatt, 2002), insurance status (Ackerson & Gretebeck, 2007), and the presence of a disability (Yankashas et al., 2010), a comorbid condition (Fallon, Wilcox, & Laken, 2006), or more than one comorbid conditions (Wong, Howard, Tong, & Craig, 2011). Considering the differences between groups, preventive health care recommendations, which are aimed at the general population, may not address issues specifically related to individuals with comorbid conditions. Gonzalez, Ferrante, Van Durme, Pal, and Roetzhein (2001) found higher rates of late stage cancer diagnoses and higher mortality rates due to comorbid

conditions among 32,074 Florida residents with colorectal cancer, breast cancer, prostate cancer, or melanoma when the authors analyzed cancer registry data, indicating a possible need to adjust screening recommendations for individuals with comorbid illnesses.

Specific to HIV infection, a cancer registry-based study followed 85,268 women with HIV infection to determine the incidence of invasive cancers from 60 before to 120 months after an AIDS-defining event, including a period of time prior to the use of HAART, and found the incidence of invasive breast cancer was less than expected, but eventually equaled the incidence rate in the general population (Goedert et al., 2006). Another cancer registry-based study conducted over 12 years, 3 of which were before the use of HAART, found cervical cancer incidence was elevated (SIR = 2.9, 95% CI = 1.9, 4.2), breast cancer was the third most prevalent non-AIDS-defining cancer prior to the 5 year follow-up period, and cervical cancer incidence increased slightly pre- and post-AIDS diagnosis (RR = 2.2, 95% CI = 0.9–5.5; Engels et al., 2008). However, both studies were limited to invasive breast cancers, and breast cancer prognosis was improved when the cancer was diagnosed in a noninvasive stage.

In this study, I examined independent variables categorized according to the constructs of the ecosocial theory, described by Krieger (1994, 2002), to determine which independent variables, individually or in combination, positively or negatively impacted the dependent variables, which were the completion of preventive health care actions for breast cancer, cervical cancer, or colorectal cancer in HIV seropositive women who received health care services from an infectious disease specialist in an urban, ambulatory care center.

Chapter 1 continues with the problem statement, purpose, research questions, theoretical foundation, rationale, design, variable definitions, scope, assumptions, and limitations. In Chapter 2, I will discuss the literature review of the identified problem, the theoretical foundation, and the study variables. In Chapter 3, I will discuss the research design and rationale, sampling, development of the data abstraction instrument, data access and collection, the data analysis plan, validity and reliability issues, and the protection of data from the medical records of a protected population. Data collection will be discussed, and results presented in Chapter 4. Chapter 5 will include an interpretation of the study results, as well as limitations, and recommendations for future research.

Problem Statement

The majority of women participating in the HIV Cost and Services Utilization Study (HCSUS) reported receiving annual gynecological examinations, while other preventive health care was often lacking (RAND, 2006). Determining whether HIV seropositive women in the United States receive appropriate preventive health care is difficult due to multiple factors including: (a) frequent changes in the recommendations published by the United States Preventive Services Task Force (USPSTF); (b) a lack of standardization in the recommendations published by various agencies; (c) lack of standardized documentation, tracking, and reporting related to ordering and completion of preventive health care actions within, as well as across, different health care providers and healthcare delivery systems, such as primary care sites and medical centers; (d) the wide variety of endpoints found in published studies on the delivery of preventive health care services including whether the screening test was ordered by a health care provider

versus the client actually completed the testing; (e) a lack of studies on whether follow-up testing was ordered and/or completed if the results of the initial screening test were abnormal or inconclusive (Agency for Healthcare Research and Quality [AHRQ], U.S. Department of Health and Human Services [USDHHS], 2007); (f) the various sources of the data, such as billing, insurance claim data, or patient medical records used to track completion of preventive health care actions (Armstrong, Long, & Shea, 2004); and (g) reliability and validity of instruments, as well as the methodology, used to abstract preventive health action completion data from sources.

The identification of variables significantly related to preventive health care actions in HIV seropositive women would allow health care providers and program planners to prioritize preventive health care services and focus resources on groups who may be at risk for lower completion rates, while maintaining higher completion rates in low risk groups. Preventive health care recommendations, developed for the general population, may not be applicable to subgroups of the population with life- or health-threatening conditions, such as HIV infection. The presence of certain variables, identified during the review of the literature for this study, particularly in HIV seropositive women, indicated a possible need for agencies and professional organizations to revise preventive health care recommendations, so health care providers could recommend screening tests to these individuals at a time interval when the majority of health threats could be diagnosed earlier and outcomes associated with maintained or improved health could be realized.

Purpose of the Study

The purpose of the quantitative study was to describe, compare, and determine which independent variables differed significantly between HIV seropositive women who completed recommended preventive health care actions for breast cancer, cervical cancer, or colorectal cancer and HIV seropositive women who failed to complete those same preventive health care actions, with or without a diagnosis of one or more comorbid conditions, when seen by an infectious disease specialist at an ambulatory care center in Newark, New Jersey, three or more times during the 12 months prior to data collection.

Electronic medical records (EMRs), or the electronic versions of clinical records used for diagnosis and treatment within one health care setting, are part of, and contain less information, than electronic health records (EHRs), which often include information from more than one health care setting in more than one state (Garrett & Seidman, 2011). The study abstracted data from 142 EMRs, originally recorded in hard copy medical records then transcribed into an electronic format, as well as information originally recorded directly into the EMR, over a period of years, as related to the independent and dependent variables. Since 2004, when the federal government indicated almost every U.S. citizen should have an EHR by 2014, there was an increase in the adoption of EHRs in office-based practices and ambulatory care settings (Hing, Hall, & Ashman, 2010). In 2009, The American Recovery and Reinvestment Act became law, and a section of the law, titled the Health Information Technology for Economic and Clinical Health (HITECH) Act, allowed for incentive payments to Medicare and Medicaid providers who used certified EHRs as a method to improve the

delivery of health care services (Hing et al., 2010; Hsiao, Hing, Socey, & Cai, 2010, 2011).

The National Center for Health Statistics (NCHS) conducted the annual National Ambulatory Medical Care Survey (NAMCS) over several years. In 2001, 18.2% of responding physicians reported having an EMR/EHR system, but this percentage decreased to 17.3% in both 2002 and 2003, then increased from 20.8% in 2004 to 42.0% in 2008 (Hsiao et al., 2011). In 2006, the NAMCS queried respondents about the use of a basic EMR/EHR system. Where a minimal EMR/EHR system contained physician clinical notes, laboratory or imaging reports, and computerized orders for prescriptions or tests, a basic EMR/EHR system included patient demographics, patient health history, problem list, a comprehensive list of medications and allergies, along with the ability to view both laboratory and imaging reports, in addition to the elements of a minimal EMR/EHR system (Hsiao et al., 2011). In 2006, 10.5% of survey respondents indicated the use of a basic EMR/EHR system, with the percentage increasing steadily in 2007 (11.8%), 2008 (16.9%), 2009 (21.8%), and 2010 (24.9%; Hing et al., 2010; Hsiao et al., 2011). In 2011, 28 states equaled or exceeded the overall percentage of U.S. respondents (57%) reporting the use of any type of EMR/EHR system, and 21 states equaled or exceeded the overall U.S. percentage (33.9%) of respondents reporting the use of a basic EMR/EHR system (Hsiao et al., 2011).

Beginning in 2008, NCHS added a supplemental questionnaire to assess the use of any EMR/EHR by physicians who participated, or intended to participate, in the incentive program (Hsiao et al., 2010). In 2009, 48.3% of physicians responding to the survey indicated they used any type of EMR/EHR system in their office-based practices,

and estimated percentages for the 2010 and 2011 surveys were 50.7% and 57.0%, respectively (Hsiao et al., 2010, 2011). As EMRs become more widespread, the use of the data contained in EMRs for research studies and the evaluation of clinical care standards also becomes more widespread, which indicates yet another need to incorporate standardized terminology, definitions, scales and measurements into EMR/EHR systems (Ryge & DeVincenzi, 1983).

Defined in a later section, the constructs of the ecosocial theory includes: (a) embodiment; (b) pathways of embodiment; (c) cumulative interplay; (d) accountability and agency; and (e) analytic implications and predictions (Krieger, 1994, 2002). Independent variables associated with the construct of embodiment, and used to determine eligibility for this study, include: (a) female gender; (b) date of birth; (c) age, calculated from date of birth; (d) HIV status, categorized as HIV seropositive or HIV seronegative; and (e) seen by an infectious disease specialist at least three times during the 12 months prior to data collection. Age cohort, or group, in 10-year intervals, was used in the analyses, while census age groups were determined for comparison to statistics from national databases and the results of other studies.

Independent variables associated with the pathways of embodiment construct included: (a) race; (b) ethnicity; (c) marital status; (d) education level; (e) employment status; and (f) type of insurance. The independent variables associated with the construct of cumulative interplay included: (a) time, in years, infected with HIV, which was calculated by subtracting the year of earliest HIV diagnosis from the year of data collection; (b) the lowest CD4 cell count in the EMR; (c) history of AIDS-defining conditions, including opportunistic infections (Appendix A); (d) HIV stage determined

using the lowest CD4 count in the EMR combined with the history of opportunistic infections; (e) distance between the residence and the ambulatory care center calculated from residential and facility zip codes; (f) hypertension; (g) obesity; (h) diabetes mellitus; (i) depression; and (j) tobacco use. The independent variables associated with the construct of accountability and agency included: (a) health care provider; (b) health care facility; and (c) health care delivery model. The three accountability and agency variables were controlled by limiting EMRs on the sampling frame to those of HIV seropositive women seen by a board-certified infectious disease specialist in the same ambulatory care center in New Jersey, three times or more within the 12 months prior to data collection. In the ecosocial theory, analytic implications and predictions contribute to contingent hypotheses (Krieger, 2002), and, while prediction was beyond the scope of the study, the dependent variables associated with this construct were the completion of, or failure to complete, preventive health care screening recommendations for breast cancer, cervical cancer, or colorectal cancer.

Research Questions and Hypotheses

The research questions, alternative hypotheses, and null hypotheses were derived directly from the study purpose, and are listed below by the dependent variables. Dependent variables in the study were related to the completion of, or failure to complete, preventive health care actions, specifically breast cancer screening mammography, cervical cancer screening Pap smear, with or without HPV testing, or colorectal cancer screening by fecal occult blood testing (FOBT), sigmoidoscopy, or colonoscopy. Analyses related to each research question, which are discussed in more detail in a later section, were conducted separately on each of the dependent variables.

The research questions and hypotheses are listed in a manner to reflect the primarily univariate analyses of the data resulting from a smaller sample drawn from a single clinical practice site.

Breast Cancer Screening Research Questions

Research Question 1. Does the completion of breast cancer screening differ significantly by the embodiment variable of age cohort in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center, three or more times, during the 12 months prior to data collection?

Hypothesis *H*1a. HIV seropositive women in the youngest age cohort, seen by an infectious disease specialist at the same ambulatory care center, three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screenings compared to HIV seropositive women in older age cohorts.

Hypothesis *H*0a. HIV seropositive women in the youngest age cohort, seen by an infectious disease specialist at the same ambulatory care center, three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screenings compared to HIV seropositive women in older age cohorts.

Research Question 2. Does the completion of breast cancer screening differ significantly by the race of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*2a. White HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months

prior to data collection, will complete significantly more breast cancer screening tests compared to Black or non-White HIV seropositive women.

Hypothesis *H*0a. White HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screening tests compared to Black or non-White HIV seropositive women.

Research Question 3. Does the completion of breast cancer screening differ significantly by the ethnicity of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*3a. Non-Hispanic HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screening tests compared to Hispanic HIV seropositive women.

Hypothesis *H*0a. Non-Hispanic HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screening tests compared to Hispanic HIV seropositive women.

Research Question 4. Does the completion of breast cancer screening differ significantly by the marital status of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*4a. Married HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screening tests compared to single, partnered, divorced or widowed HIV seropositive women.

Hypothesis *H*0a. Married HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screening tests compared to single, partnered, divorced or widowed HIV seropositive women.

Research Question 5. Does the completion of breast cancer screening differ significantly by the education level of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*5a. HIV seropositive women who are college graduates, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screening tests compared to HIV seropositive women in all other education levels.

Hypothesis *H*0a. HIV seropositive women who are college graduates, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screening tests compared to HIV seropositive women in all other education levels.

Research Question 6. Does the completion of breast cancer screening differ significantly by the employment status of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*6a. Employed HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screening tests compared to HIV seropositive women in all other employment status categories.

Hypothesis *H*0a. Employed HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screening tests compared to HIV seropositive women in all other employment status categories.

Research Question 7. Does the completion of breast cancer screening differ significantly by the type of insurance in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*1a. HIV seropositive women with private or military insurance, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screening tests compared to HIV seropositive women with all other types of insurance, including no insurance, self-pay and charity care.

Hypothesis *H*0a. HIV seropositive women with private or military insurance, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screening tests compared to HIV seropositive women with all other types of insurance, including no insurance, self-pay and charity care.

Research Question 8. Does the completion of breast cancer screening differ significantly by the length of time, in quartiles, in infected with HIV in women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*8b. HIV seropositive women in the lowest or first quartile of time, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screening tests compared to HIV seropositive women infected for longer periods of time.

Hypothesis *H*0b. HIV seropositive women in the lowest or first quartile of time, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screening tests compared to HIV seropositive women infected for longer periods of time.

Research Question 9. Does the completion of breast cancer screening differ significantly by HIV stage in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*9b. HIV seropositive women in the lowest stage of HIV, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screening tests compared to HIV seropositive women at higher or more progressed HIV stages.

Hypothesis *H*0b. HIV seropositive women in the lowest stage of HIV, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screening tests compared to HIV seropositive women at higher or more progressed HIV stages.

Research Question 10. Does the completion of breast cancer screening differ significantly by CD4 cell count in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*10b. HIV seropositive women with CD4 counts of 500 cells/mm^3 or more, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screening tests compared to HIV seropositive women with CD4 counts less than 500 cells/mm^3.

Hypothesis *H*0b. HIV seropositive women with CD4 counts of 500 cells/mm^3 or more, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly

more breast cancer screening tests compared to HIV seropositive women with CD4 counts less than 500 cells/mm^3.

Research Question 11. Does the completion of breast cancer screening differ significantly by distance, in quartiles, in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*11b. HIV seropositive women in the lowest or first quartile of distance in miles, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more breast cancer screening tests compared to HIV seropositive women who live farther from the health care facility.

Hypothesis *H*0b. HIV seropositive women in the lowest or first quartile of distance in miles, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more breast cancer screening tests compared to HIV seropositive women who live farther from the health care facility.

Research Question 12. Does completion for breast cancer screening differ significantly between HIV seropositive women diagnosed with hypertension, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of hypertension?

Hypothesis *H*12. There will be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women with hypertension,

compared to HIV seropositive women without hypertension, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women with hypertension, compared to HIV seropositive women without hypertension, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 13. Does the completion of breast cancer screening differ significantly between HIV seropositive women diagnosed with obesity, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of obesity?

Hypothesis *H*13a. There will be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women with obesity, compared to HIV seropositive women without obesity, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women with obesity, compared to HIV seropositive women without obesity, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 14. Does the completion of breast cancer screening differ significantly between HIV seropositive women diagnosed with diabetes mellitus, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of diabetes mellitus?

Hypothesis *H*14. There will be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women with diabetes mellitus, compared to HIV seropositive women without diabetes mellitus, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women with diabetes mellitus, compared to HIV seropositive women without mellitus, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 15. Does the completion of breast cancer screening differ significantly between HIV seropositive women diagnosed with depression, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of depression?

Hypothesis *H*15. There will be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women with depression, compared to HIV seropositive women without depression, and seen by an infectious

disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women with depression, compared to HIV seropositive women without depression, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 16. Does completion of breast cancer screening differ significantly between HIV seropositive women who use tobacco, and have been seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women who do not use tobacco?

Hypothesis *H*16. There will be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women who use tobacco, and have been seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women who do not use tobacco.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of breast cancer screening in HIV seropositive women who use tobacco, and have been seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women who do not use tobacco.

Cervical Cancer Screening Research Questions

Research Question 1. Does the completion of cervical cancer screening differ significantly by the embodiment variable of age cohort in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center, three or more times, during the 12 months prior to data collection?

Hypothesis *H*1a. HIV seropositive women in the youngest age cohort, seen by an infectious disease specialist at the same ambulatory care center, three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screenings compared to HIV seropositive women in older age cohorts.

Hypothesis *H*0a. HIV seropositive women in the youngest age cohort, seen by an infectious disease specialist at the same ambulatory care center, three or more times, during the 12 months prior to data collection, will not complete significantly more cervical cancer screenings compared to HIV seropositive women in older age cohorts.

Research Question 2. Does the completion of cervical cancer screening differ significantly by the race of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*2a. White HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screening tests compared to Black or non-White HIV seropositive women.

Hypothesis *H*0a. White HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months

prior to data collection, will not complete significantly more cervical cancer screening tests compared to Black or non-White HIV seropositive women.

Research Question 3. Does the completion of cervical cancer screening differ significantly by the ethnicity of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*3a. Non-Hispanic HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screening tests compared to Hispanic HIV seropositive women.

Hypothesis *H*0a. Non-Hispanic HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more cervical cancer screening tests compared to Hispanic HIV seropositive women.

Research Question 4. Does the completion of cervical cancer screening differ significantly by the marital status of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*4a. Married HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screening tests compared to single, partnered, divorced or widowed HIV seropositive women.

Hypothesis *H*0a. Married HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more cervical cancer screening tests compared to single, partnered, divorced or widowed HIV seropositive women.

Research Question 5. Does the completion of cervical cancer screening differ significantly by the education level of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*5a. HIV seropositive women who are college graduates, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screening tests compared to HIV seropositive women in all other education levels.

Hypothesis *H*0a. HIV seropositive women who are college graduates, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more cervical cancer screening tests compared to HIV seropositive women in all other education levels.

Research Question 6. Does the completion of cervical cancer screening differ significantly by the employment status of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*6a. Employed HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screening tests compared to HIV seropositive women in all other employment status categories.

Hypothesis *H*0a. Employed HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more cervical cancer screening tests compared to HIV seropositive women in all other employment status categories.

Research Question 7. Does the completion of cervical cancer screening differ significantly by the type of insurance in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*1a. HIV seropositive women with private or military insurance, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screening tests compared to HIV seropositive women with all other types of insurance, including no insurance, self-pay and charity care.

Hypothesis *H*0a. HIV seropositive women with private or military insurance, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more

cervical cancer screening tests compared to HIV seropositive women with all other types of insurance, including no insurance, self-pay and charity care.

Research Question 8. Does the completion of cervical cancer screening differ significantly by the length of time, in quartiles, in infected with HIV in women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*8b. HIV seropositive women in the lowest or first quartile of time, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screening tests compared to HIV seropositive women infected for longer periods of time.

Hypothesis *H*0b. HIV seropositive women in the lowest or first quartile of time, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more cervical cancer screening tests compared to HIV seropositive women infected for longer periods of time.

Research Question 9. Does the completion of cervical cancer screening differ significantly by HIV stage in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*9b. HIV seropositive women in the lowest stage of HIV, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical

cancer screening tests compared to HIV seropositive women at higher or more progressed HIV stages.

Hypothesis *H*0b. HIV seropositive women in the lowest stage of HIV, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more cervical cancer screening tests compared to HIV seropositive women at higher or more progressed HIV stages.

Research Question 10. Does the completion of cervical cancer screening differ significantly by CD4 cell count in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*10b. HIV seropositive women with CD4 counts of 500 cells/mm^3 or more, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screening tests compared to HIV seropositive women with CD4 counts less than 500 cells/mm^3.

Hypothesis *H*0b. HIV seropositive women with CD4 counts of 500 cells/mm^3 or more, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more cervical cancer screening tests compared to HIV seropositive women with CD4 counts less than 500 cells/mm^3.

Research Question 11. Does the completion of cervical cancer screening differ significantly by distance, in quartiles, in HIV seropositive women seen by an infectious

disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*11b. HIV seropositive women in the lowest or first quartile of distance in miles, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more cervical cancer screening tests compared to HIV seropositive women who live farther from the health care facility.

Hypothesis *H*0b. HIV seropositive women in the lowest or first quartile of distance in miles, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more cervical cancer screening tests compared to HIV seropositive women who live farther from the health care facility.

Research Question 12. Does the completion of cervical cancer screening differ significantly between HIV seropositive women diagnosed with hypertension, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of hypertension?

Hypothesis *H*12. There will be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women with hypertension, compared to HIV seropositive women without hypertension, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women with hypertension, compared to HIV seropositive women without hypertension, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 13. Does the completion of cervical cancer screening differ significantly between HIV seropositive women diagnosed with obesity, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of obesity?

Hypothesis *H*13a. There will be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women with obesity, compared to HIV seropositive women without obesity, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women with obesity, compared to HIV seropositive women without obesity, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 14. Does the completion of cervical cancer screening differ significantly between HIV seropositive women diagnosed with diabetes mellitus, and seen by an infectious disease specialist at the same ambulatory care center three or more

times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of diabetes mellitus?

Hypothesis *H*14. There will be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women with diabetes mellitus, compared to HIV seropositive women without diabetes mellitus, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women with diabetes mellitus, compared to HIV seropositive women without mellitus, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 15. Does the completion of cervical cancer screening differ significantly between HIV seropositive women diagnosed with depression, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of depression?

Hypothesis *H*15. There will be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women with depression, compared to HIV seropositive women without depression, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women with depression, compared to HIV seropositive women without depression, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 16. Does the completion for cervical cancer screening differ significantly between HIV seropositive women who use tobacco, and have been seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women who do not use tobacco?

Hypothesis *H*16. There will be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women who use tobacco, and have been seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women who do not use tobacco.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of cervical cancer screening in HIV seropositive women who use tobacco, and have been seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women who do not use tobacco.

Colorectal Cancer Screening Research Questions

Research Question 1. Does the completion of colorectal cancer screening differ significantly by the embodiment variable of age cohort in HIV seropositive women seen

by an infectious disease specialist at the same ambulatory care center, three or more times, during the 12 months prior to data collection?

Hypothesis *H*1a. HIV seropositive women in the youngest age cohort, seen by an infectious disease specialist at the same ambulatory care center, three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screenings compared to HIV seropositive women in older age cohorts.

Hypothesis *H*0a. HIV seropositive women in the youngest age cohort, seen by an infectious disease specialist at the same ambulatory care center, three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screenings compared to HIV seropositive women in older age cohorts.

Research Question 2. Does the completion of colorectal cancer screening differ significantly by the race of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*2a. White HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screening tests compared to Black or non-White HIV seropositive women.

Hypothesis *H*0a. White HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to Black or non-White HIV seropositive women.

Research Question 3. Does the completion of colorectal cancer screening differ significantly by the ethnicity of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*3a. Non-Hispanic HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screening tests compared to Hispanic HIV seropositive women.

Hypothesis *H*0a. Non-Hispanic HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to Hispanic HIV seropositive women.

Research Question 4. Does the completion of colorectal cancer screening differ significantly by the marital status of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*4a. Married HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screening tests compared to single, partnered, divorced or widowed HIV seropositive women.

Hypothesis *H*0a. Married HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12

months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to single, partnered, divorced or widowed HIV seropositive women.

Research Question 5. Does the completion of colorectal cancer screening differ significantly by the education level of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*5a. HIV seropositive women who are college graduates, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screening tests compared to HIV seropositive women in all other education levels.

Hypothesis *H*0a. HIV seropositive women who are college graduates, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to HIV seropositive women in all other education levels.

Research Question 6. Does the completion of colorectal cancer screening differ significantly by the employment status of HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*6a. Employed HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12

months prior to data collection, will complete significantly more colorectal cancer screening tests compared to HIV seropositive women in all other employment status categories.

Hypothesis *H*0a. Employed HIV seropositive women, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to HIV seropositive women in all other employment status categories.

Research Question 7. Does the completion of colorectal cancer screening differ significantly by the type of insurance in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*1a. HIV seropositive women with private or military insurance, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screening tests compared to HIV seropositive women with all other types of insurance, including no insurance, self-pay and charity care.

Hypothesis *H*0a. HIV seropositive women with private or military insurance, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to HIV seropositive women with all other types of insurance, including no insurance, self-pay and charity care.

Research Question 8. Does the completion of colorectal cancer screening differ significantly by the length of time, in quartiles, in infected with HIV in women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*8b. HIV seropositive women in the lowest or first quartile of time, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screening tests compared to HIV seropositive women infected for longer periods of time.

Hypothesis *H*0b. HIV seropositive women in the lowest or first quartile of time, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to HIV seropositive women infected for longer periods of time.

Research Question 9. Does the completion of colorectal cancer screening differ significantly by HIV stage in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*9b. HIV seropositive women in the lowest stage of HIV, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screening tests compared to HIV seropositive women at higher or more progressed HIV stages.

Hypothesis *H*0b. HIV seropositive women in the lowest stage of HIV, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to HIV seropositive women at higher or more progressed HIV stages.

Research Question 10. Does the completion of colorectal cancer screening differ significantly by CD4 cell count in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*10b. HIV seropositive women with CD4 counts of 500 cells/mm^3 or more, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screening tests compared to HIV seropositive women with CD4 counts less than 500 cells/mm^3.

Hypothesis *H*0b. HIV seropositive women with CD4 counts of 500 cells/mm^3 or more, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to HIV seropositive women with CD4 counts less than 500 cells/mm^3.

Research Question 11. Does the completion of colorectal cancer screening differ significantly by distance, in quartiles, in HIV seropositive women seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection?

Hypothesis *H*11b. HIV seropositive women in the lowest or first quartile of distance in miles, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will complete significantly more colorectal cancer screening tests compared to HIV seropositive women who live farther from the health care facility.

Hypothesis *H*0b. HIV seropositive women in the lowest or first quartile of distance in miles, seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, will not complete significantly more colorectal cancer screening tests compared to HIV seropositive women who live farther from the health care facility.

Research Question 12. Does the completion of colorectal cancer screening differ significantly between HIV seropositive women diagnosed with hypertension, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of hypertension?

Hypothesis *H*12. There will be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women with hypertension, compared to HIV seropositive women without hypertension, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women with hypertension, compared to HIV seropositive women without hypertension, and seen by

an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 13. Does the completion of colorectal cancer screening differ significantly between HIV seropositive women diagnosed with obesity, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of obesity?

Hypothesis *H*13a. There will be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women with obesity, compared to HIV seropositive women without obesity, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women with obesity, compared to HIV seropositive women without obesity, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 14. Does the completion of colorectal cancer screening differ significantly between HIV seropositive women diagnosed with diabetes mellitus, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of diabetes mellitus?

Hypothesis *H*14. There will be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women with diabetes mellitus, compared to HIV seropositive women without diabetes mellitus, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women with diabetes mellitus, compared to HIV seropositive women without mellitus, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 15. Does the completion of colorectal cancer screening differ significantly between HIV seropositive women diagnosed with depression, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women without a diagnosis of depression?

Hypothesis *H*15. There will be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women with depression, compared to HIV seropositive women without depression, and seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Hypothesis *H*0. There will not be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women with depression, compared to HIV seropositive women without depression, and seen by an infectious

disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection.

Research Question 16. Does the completion of colorectal cancer screening differ significantly between HIV seropositive women who use tobacco, and have been seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women who do not use tobacco?

Hypothesis *H*16. There will be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women who use tobacco, and have been seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women who do not use tobacco.

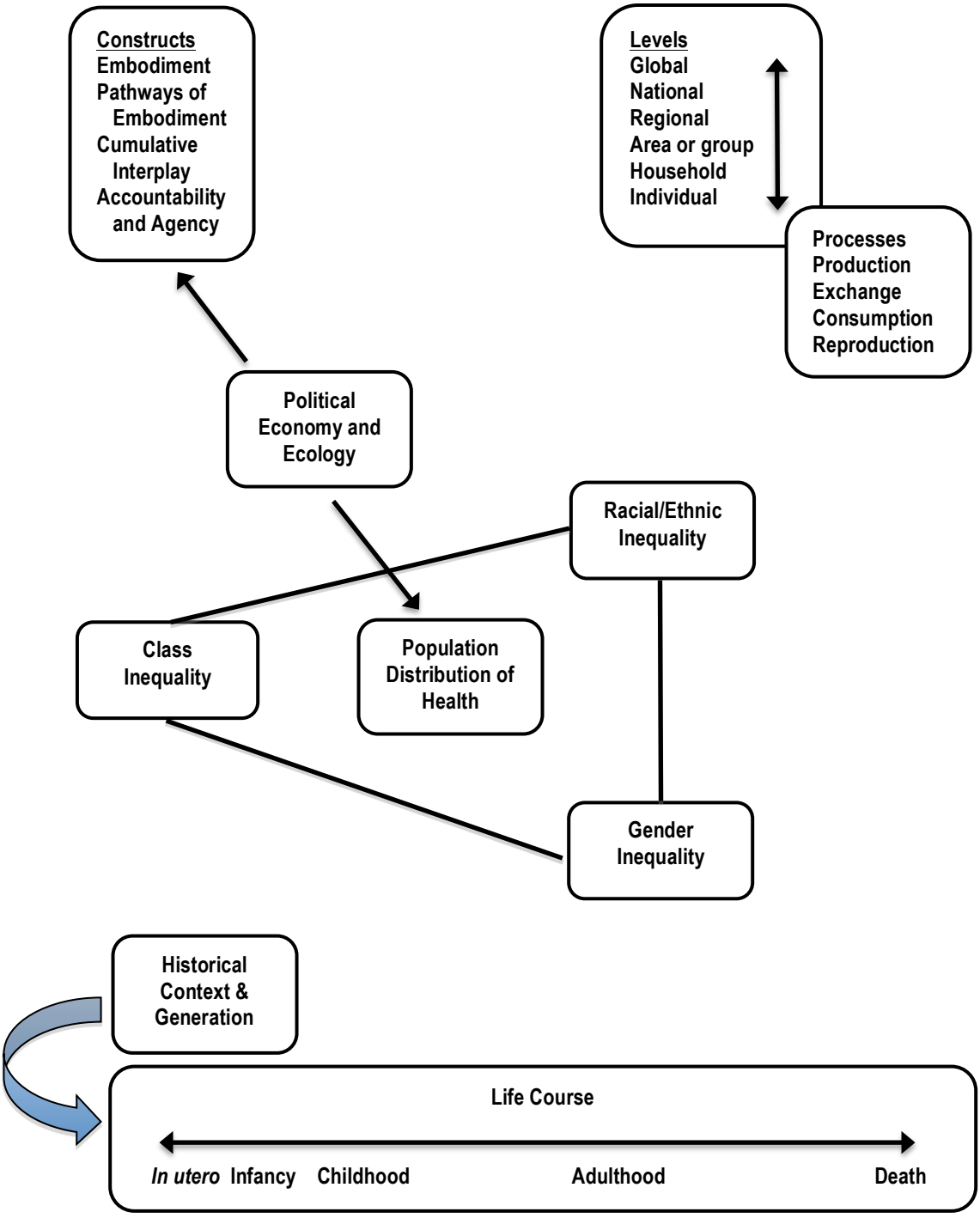
Hypothesis *H*0. There will not be a statistically significant difference in the completion of colorectal cancer screening in HIV seropositive women who use tobacco, and have been seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection, compared to HIV seropositive women who do not use tobacco.

Ecosocial Theory

The ecosocial theory (Krieger, 1994, 2008) is an epidemiological theory designed for the examination of societal patterns of health, as well as disease distributions associated with exposure, susceptibility, and resistance over the lifespan in populations (Figure 1).

Figure 1

Simplified depiction of the ecosocial theory



Note. Adapted from Krieger (2008)

The core constructs of the ecosocial theory are: (a) embodiment; (b) pathways of embodiment; (c) cumulative interplay; (d) accountability and agency; and (e) analytic implications and predictions (Krieger, 2002, 2008). The variables associated with each core concept of the ecosocial theory are discussed in the following paragraphs.

Embodiment

A concept referring to how individuals biologically incorporate the material and social world, from *in utero* to death, where no aspect of biology can be understood without knowledge of the historical context as well as individual and societal ways of living. From an epidemiological perspective, embodiment is: (a) a construct, a process, and a reality contingent upon bodily existence; (b) a multilevel phenomenon integrating soma, psyche, and society within a historical and ecological context; (c) a clue to hidden and revealed life histories; and (d) a reminder of entangled consequences associated with diverse forms of social inequality (Krieger, 2008). To reduce biological, historical, material, and social variability, the study limited the eligibility of participants, as represented by their EMRs, to HIV seropositive women aged 40 years and older seen three or more times during the 12 months prior to data collection.

Pathways of Embodiment

Pathways of embodied are "causal pathways that involve exposure, susceptibility, and resistance" (Krieger, 2008). The expression of population health comes from the knowledge of embodiment, and the causal pathways resulting from the multiple levels of embodiment across time and space must be considered in a historical context; these pathways are shaped by societal power, material conditions, and biological processes and are part of the political economy, all of which are used to

analyze population ecology (Krieger, 2008). In the study, the pathways construct was represented by the independent variables of race, ethnicity, marital status, education level, employment status, and type of insurance. In her example of hypertension in African Americans, Krieger (2001) discussed how perceived, recalled, or anticipatory racial discrimination can initiate a physical stress response resulting in hypertension and how occupational segregation is connected to economic deprivation and the consumption of foods with high fat and salt contents, all of which can contribute to hypertension, while individual and social resources, such as relations resulting from birth into a family, attending school, and getting married, are related to resistance to racial oppression and can reduce the risk of hypertension in African Americans (Krieger, 2001). Data related to each of the variables mentioned above were abstracted directly from the EMR and limited to the categories specified by the EMR software.

Cumulative Interplay

Cumulative interplay is expressed in the embodiment pathways as the presence and distribution of factors associated with exposure, susceptibility, and resistance at multiple causal levels in multiple domains on a spatiotemporal scale (Krieger, 2008). The literature review for the study compared the prevalence of HIV infection, breast cancer, cervical cancer, and colorectal cancer at the community, state, and national levels to support the choice of Newark as the location for the study. According to the New Jersey Department of Health (NJDOH, 2013), 33% of individuals living with HIV in New Jersey were females aged 13 years and older, and 4 out of 5 of those women were racial or ethnic minorities. The study was conducted at a health care facility located in Newark, New Jersey, in Essex County, where almost one-third of the state's cases of

HIV, as well as AIDS, are located (NJDOH, 2013). The literature review discusses how the area in which a HIV seropositive woman resides can affect the type of health care she receives, and location can impact the completion of preventive health care actions. Distance from a regular source of health care can impact completion of preventive health care actions; the issues associated with distance are discussed in the literature review, and in this study, distance was calculated, to the tenth of a mile, between the residence and the health care facility. Referring back to Krieger's example, African Americans may be more susceptible to hypertension because they are residentially segregated into older housing with lead-based paint in neighborhoods with stores featuring high-alcohol-containing beverages instead of fresh vegetables (Krieger, 2001).

Levels of Cumulative Interplay

Study variables were presented in relation to the three sublevels of the cumulative interplay construct: (a) exposure, (b) susceptibility, and (c) resistance.

Cumulative interplay–exposure. Variables were the year of HIV diagnosis and the number of years with HIV infection.

Cumulative interplay–susceptibility. Variables included a diagnosis of an AIDS-defining condition or opportunistic infection and the lowest CD4 cell count, which are both used to determine HIV stage, the CD4 cell count associated with each screening interval, or the CD4 cell count at the time the preventive health care action was completed or due, according to USPSTF recommendations, the HIV stage for the screening interval, distance between the residence and the health care facility, and the diagnosis of one or more comorbid conditions limited to hypertension, obesity, diabetes mellitus, and depression, and tobacco use.

AIDS-defining conditions. A complete list of AIDS-defining conditions (ADCs), including opportunistic infections (OIs), is provided in Appendix A. The more common ADCs and OIs included in the data abstraction manual, are discussed later, and were listed in bold font for easy identification.

CD4 cell count. In the pre-HAART time period, lower CD4 cell count, higher plasma HIV-1 RNA, and an AIDS-defining condition were associated with shorter survival, but not clinical outcomes in women with HIV infection (Anastos et al., 1999), while low CD4 cell counts and higher HIV-1 RNA levels were predictive of clinical outcomes, including AIDS-defining illness and death, in women with HIV infection during the post-HAART period (Anastos et al., 2004). The site of the study used a laboratory certified by the College of American Pathologists so all results for CD4 cell counts, regardless of manufacturer, were acceptable for study purposes.

HIV stage. According to the revised CDC HIV case definitions, confirmed HIV cases are classified in one of four possible HIV stages (Schneider et al., 2008). Stage 1 HIV cases had a CD4+ T-lymphocyte count of equal to, or greater than, 500 cells/µL or a CD4+ T-lymphocyte percentage to total lymphocytes equal to, or greater than, 29% in the absence of an AIDS-defining condition, as described in Appendix A. Stage 2 HIV cases had a CD4+ T-lymphocyte count of 200 to 499 cells/μL or a CD4+ T-lymphocyte percentage to total lymphocytes of 14% to 28% in the absence of an AIDS-defining condition, as described in Appendix A. Stage 3 HIV cases, or AIDS cases, had a CD4+ T-lymphocyte count of less than 200 cells/μL or a total CD4+ T-lymphocyte percentage of total lymphocytes of less than 14%, or a documented adult AIDS-defining condition, as described in Appendix A. Stage 4 HIV cases, or the unknown stage, were designated

as such because there is a lack of information for classification assignment (CDC, 2008a; Schneider et al., 2008; Sax et al., 2008).

Distance. Discussed in more detail later, as distance between residence and health care facility increased, fewer health care visits were observed in several studies.

Comorbid Conditions. Some studies discussed in the review of the literature found the increased number of health care provider visits required by a diagnosis of hypertension or diabetes mellitus increased the opportunities for preventive health care referrals, while the comorbid conditions of obesity, depression, and tobacco use were associated with resistance to the completion of preventive health care actions, as women with these conditions were more likely to avoid health care visits thereby reducing the number of contacts with referring providers. Comorbid conditions are listed in the EMR by common name, as well as by diagnostic code from the *Classification of Diseases, Functioning, and Disability: International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM*; CDC, 2010a).

Hypertension. At the time of the study, approximately 67 million U.S. adults, or 31%, had hypertension, yet less than half had their hypertension controlled (CDC, 2013b). White men and women were similarly at risk for the development of hypertension, and White women had a higher risk as age increased. However, African American and Hispanic women were more likely to develop hypertension than their male counterparts (CDC, 2013b). In a study examining comorbidity and cancer screening, hypertension was the only comorbid condition associated with an increased likelihood of completing cervical cancer screening (Kiefe, Funkhouser, Fouad, & May 1998).

Obesity. Almost 36% of U.S. adults were obese at the time of the study, and the highest prevalence was observed in women aged 60 years and older (42.3%) with a significant aged-related trend ($p < 0.001$) noted when compared to women aged 20 to 30 years (Ogden, Carroll, Kit, & Flegal, 2012). Overweight and obesity were associated with a lower likelihood of cancer screening completion. Body mass index (BMI) from 18.1 to 24.9 and 25 to 29.9 was inversely related to increased age among women aged 40 to 49 years, 50 to 64 years, and 65 to 74 years, and severely obese women with a BMI greater than 40 kg/m^2 were less likely to complete breast cancer screening (*OR* = 0.50, 95% CI = 0.37, 0.68) and cervical cancer screening (*OR* = 0.43, 95% CI = 0.27, 0.70) (Ferrante et al., 2007). Data collected via chart abstraction (*N* = 1,297) between April 2003 and December 2004 from 22 family medicine practices in New Jersey and Pennsylvania indicated obese patients had a 25% decreased likelihood of being screened for colorectal cancer compared to non-obese patients (*OR* = 0.75, 95% CI = 0.62, 0.91, *p* = 0.004) and the study acknowledged a relationship between higher body mass and higher prevalence of diabetes in the general population (Ferrante et al., 2006). Data from the 2006, 2007, and 2008 BRFSS and the US Census was used to model the prevalence of obesity and diabetes in 3,141 counties in the U.S., the results of which indicated county-level obesity and diabetes prevalence were highly correlated (*r* = 0.72; CDC, 2009a). Higher body mass index was positively associated with greater likelihood of insulin resistance in women with HIV infection (El-Sadr et al., 2005; Howard et al., 2005) so data on the diagnosis of diabetes mellitus in HIV seropositive women was collected.

Diabetes mellitus. Data from the National Health Interview Survey (NHIS) indicated a steady increase in the number of U.S. females diagnosed with diabetes from 1980 to 2009 with only a slight decrease occurring in 1986, 1987, and 1995 from just over three million women to almost ten million women, respectively (CDC, 2011a). The greatest number of cases in 2008 was observed in the 45 to 64 year old age group (4,734,000) and this age group had the highest number of cases for White females (3,323,000), Black females (867,000), and Hispanic females (658,000; CDC, 2011a). The prevalence of diabetes was significantly greater in non-Hispanic Black women compared to non-Hispanic White women; the prevalence of diabetes significantly increased with age; and individuals with a diabetic parent or sibling were about four times more likely to develop diabetes compared to an individual without a family history of diabetes (adjusted OR =3.95, 95% CI = 3.25, 4.79, $p < 0.001$) (Annis, Caulder, Cook, & Duquette, 2005). This information indicated some subgroups of the population might benefit from diabetes screening including HIV seropositive individuals.

In HIV infection insulin clearance rates and insulin sensitivity are increased in peripheral tissues, while the medications used to treat OIs, such as pentamidine to prevent and treat *Pneumocystis carnii* pneumonia (PCP), can cause β-cell toxicity, hypoglycemia and later onset diabetes (Spollett, 2006). Protease inhibitor use can result in impaired glucose tolerance due to insulin resistance in up to 40% of the patients on HAART and can accelerate pre-existing glucose tolerance abnormalities prompting the International AIDS Society–U.S. Panel to develop recommendations for the screening and treatment of metabolic complications (Schambelan et al., 2002). Protease inhibitors were also found to significantly increase fasting glucose levels and double insulin levels

independently of changes in body mass index in a study pairing protease inhibitor-naïve participants with participants taking protease inhibitors (Mulligan et al., 2000). However, women with HIV infection who have not been taking protease inhibitors were found to have a greater risk for undiagnosed diabetes if they were currently taking methadone, had a body mass index of ≥25, a family history of diabetes, or were physically inactive (Howard et al., 2005).

Depression. A diagnosis of depression is usually made according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR; American Psychiatric Association [APA], 2000) and a definition of depression based on the criteria presented in the DSM-IV-TR was too lengthy for study purposes. The USPSTF did not recommend screening for depression in adults at the time of the study (USPSTF, 2009a) but the literature review noted a relationship between a diagnosis of depression and a decreased likelihood to complete preventive health screening tests. Revised statistics from the BRFSS were used to estimate depression in U.S. adults in 2006 and 2008 (CDC, 2011b). Depressive symptoms for the past two weeks were most often reported in age groups 18 to 24 years (11.1%) and 45-64 years (9.6%), females (10.2%), non-Hispanic Blacks (12.9%), individuals with less than a high school education (17.4%), previously married (14.6%), unemployed (21.5%) or those unable to work (39.3%), and the uninsured (15.2%) (CDC, 2011b). Cox proportional hazards regression models were used in a previous study to calculate adjusted hazard ratios for 4,154 health maintenance organization patients with type 2 diabetes and after adjusting for age, gender, race/ethnicity, and education level minor depression was associated with a 1.67-fold increase in mortality ($p = 0.003$) while major

depression was associated with a 2.30-fold increase in mortality ($p < 0.0001$; Katon et al., 2005). In a prospective cohort study of 4,184 patients of the Group Health Cooperative with type 2 diabetes after adjusting for demographic characteristics, clinical characteristics, and health habits major depression was associated with non-cardiovascular, non-cancer-related mortality (*HR* = 2.15, 95% CI = 1.43, 3.24) and all-cause mortality (*HR* = 1.52, 95% CI = 1.19, 1.95; Lin et al., 2009).

A qualitative study using a modified version of the Objects Content Test (OCT) adapted from the Twenty Statement Test to measure self-attitudes was conducted with 48 women with HIV infection aged 18 to 55 years and, of the 369 needs identified by the study participants, the greatest number of needs were psychologically related including support by family and friends, love and understanding, and counseling (Bunting, Bevier, & Baker, 1999). Patel et al. (2008) examined the responses of 628 individuals with HIV infection and found 55% of the sample reported being concerned about psychological symptoms during the past three months and 49% of these respondents reported being bothered by sadness or depression.

Tobacco use. Results of the 2005 and 2010 National Health Interview Surveys indicated a decrease in the overall prevalence of tobacco use among U.S. adults but decreases were not observed across all groups (King, Dube, Kaufman, Shaw, & Pechacek, 2011). Females aged 25 years to 44 years were more likely to smoke in both 2005 (21.4%, 95% CI = 20.2, 22.6) and 2010 (19.8%, 95% CI = 18.4, 21.2), were more likely to be American Indian/Alaskan Native (26.8%, 95% CI = 15.5, 38.1, and 36.0%, 95% CI = 24.1, 47.9, respectively), were less educated (44.1%, 95% CI = 37.6, 50.6 had earned a GED), and lived below the poverty level (25.7%, 95% CI = 23.6, 27.8; King et

al., 2011). I recorded self-reported tobacco use as a behavioral comorbid condition from the EMR intake record, medication log, or progress note screens.

Cumulative interplay–resistance. Associated with a lack of or decrease in the completion of preventive health care actions, resistance variables in my study were the eligibility variables of a minimum three visits during the 12 months prior to data collection with the same type of health care provider at the same health care facility.

Accountability and Agency

Krieger (2008) described this construct as the entities and individuals responsible for and able to change the current patterns of population health as expressed in terms of embodiment pathways. As a result, epidemiological studies examining similar factors and causal explanations for a phenomenon but at different causal levels and/or different spatiotemporal scales should be able to identify the benefits and limitations associated with the chosen causal level and/or spatiotemporal scale (Krieger, 2008). Referring back to Krieger's (2001) example of hypertension in African Americans, many African Americans reside in communities with a lack of health care providers or health care facilities causing a later diagnosis of hypertension and poorer medical management of the condition.

Health care provider and health care agency. In my study health care provider and health care facility were considered cumulative interplay–resistance variables because the literature review indicated seeing the same provider at the same facility improved preventive health care screening completion. However, these variables were also associated with individuals and institutions possibly responsible for health inequities. For study purposes, the primary health care provider was board-certified in both internal

medicine and infectious diseases, had practiced in the infectious disease clinic of the ambulatory care center, and maintained a private practice for over 20 years. While the organizational structure of the university-based hospital associated with the ambulatory care center changed in 2009 the health care delivery model remained unchanged. Through eligibility criteria restrictions for health care provider and health care facility I attempted to control for health care delivery model variations. A thorough examination of the accountability and agencies contributing to a decrease in the completion of preventive health care actions in HIV seropositive women is beyond the scope of the study but the study attempted to control variability in standards of practice and the type of information entered into the medical record over time by limiting EMR eligibility to board-certified infectious disease specialists and a single infectious disease clinic in an ambulatory care center in Newark, New Jersey.

U.S. Preventive Services Task Force recommendations. The recommendations published by the USPSTF may have created social inequities in health because the majority of evidentiary studies discussed in Chapter 2 upon which the recommendations are based were conducted using dominant groups, specifically White, non-Hispanic females for breast and cervical cancer and White males and females for colorectal cancer, though later studies used for evidentiary purposes have included more racial and ethnic groups. To control for variations among preventive health care recommendations published by different agencies and organizations only the USPSTF recommendations were considered in my study.

Analytic Implications and Predictions

Stated as a contingent hypothesis by Krieger (2008) analytic implications and predictions refer to the determinants of disease distributions at the population level and were not reducible to mechanisms of disease causation at the individual level (Krieger, 2002). Population patterns of health and disease are the embodied biological expressions of different lifestyles afforded by a society's political economy and ecology and the policies and practices of a society benefit and preserve the economic and social privileges of the dominant group or groups while simultaneously constraining the conditions imposed on the non-dominant group or groups (Krieger, 2008).

No variables were directly associated with the constructs of analytic implications and predictions. However, Krieger (2008) discussed contingent hypotheses resulting from different biological expressions which contributed to the various population patterns of health and illness, and the constraints on lifestyle imposed on non-dominant groups by policies and practices that preserve the economic and social privileges of the dominant group. While causation and prediction were beyond the scope of my study the results provided information on the proportion of HIV seropositive women 40 years and older who completed preventive health care actions for breast cancer, cervical cancer, and colorectal cancer and identified statistically significant independent variables associated with the completion of these preventive health care actions which can be compared to state and national statistics. Though generalizability may be limited the results may be useful to clinicians, program planners, and policymakers for the identification of HIV seropositive women at greater risk for failure to complete cancer screening in populations similar to the study sample so interventions aimed at improving

screening completion can be planned and instituted. The next section discusses the operational definitions for independent and dependent variables including the labels and coding schema used for data entry into the data analysis software. The constructs of the ecosocial theory are presented in Table 1 with the study variables and research questions. Variables for eligibility and the calculation or determination of other variables are listed by construct to aid understanding.

Table 1

Summary of Constructs and Relationships of Study Variables to Research Questions

Construct	Study Variable	Research Question
Embodiment	Gender limited to female only	Eligibility
	Date of birth	Eligibility
	Age (continuous)	Eligibility
	Age group 40-53, 54-79	RQ1
	Age cohort 40-49, 50-79	Comparison to state and national documents
	HIV status limited to seropositive by ELISA with WB confirmation	Eligibility
	Three visits during the 12 months prior to data collection	Eligibility
Pathways of Embodiment	Race	RQ2
	Ethnicity	RQ3
	Marital status	RQ4
	Education level	RQ5
	Employment status	RQ6
	Insurance	RQ7

(table continues)

(table continues)

Construct	Study Variable	Research Question
Cumulative Interplay	Year of HIV diagnosis; subtracted from year of data collection	Calculation of HIV time variable
	Time living with HIV	RQ8
	Diagnosis of AIDS-defining condition	Determination of HIV stage variable
	Lowest CD4 cell count	Determination of HIV stage variable
	HIV stage	RQ9
	CD4 cell count	RQ10
	Distance between residence and ambulatory care center	RQ11
	Diagnosis of hypertension	RQ12
	Diagnosis of obesity	RQ13
	Diagnosis of diabetes	RQ14
	Diagnosis of depression	RQ15
	Tobacco use	RQ16
Accountability and agency	Health care provider; limited to infectious disease specialist	Eligibility; study design
	Health care facility; limited to infectious disease clinic in ambulatory care center	Eligibility; study design
	Model of health care delivery; limited by health care provider and facility	Eligibility; study design
Analytic implications and predictions	Limited to USPSTF recommendations	Study design
	Incidence and prevalence of HIV/AIDS in women in Newark, New Jersey	Study design

Note: adapted from various published articles on the ecosocial theory authored by Nancy Krieger.

Nature of the Study

Based on the ecosocial theory (Krieger, 2008) my cross sectional study used observational methodology to collect and examine information extracted from the EMRs of 142 patients who received health care services from an infectious disease specialist an ambulatory care center to identify variables including comorbid conditions associated with the completion of, or failure to complete, preventive health care actions in a sample of HIV seropositive women in an urban area of the northeastern United States.

Many HIV seropositive women were not receiving preventive health care services and,when the services are actually ordered by a health care provider these women were not completing the preventive health care actions associated with the screening recommendations. In HIV seropositive women failure to complete preventive health care actions can result in higher rates of cancer or other preventable diseases, more serious types or degrees of disease, and poorer prognoses. Women with HIV infection participating in two early studies, the New York Cervical Disease Study and the HIV Epidemiology Research Study (HERS), were at least 4 times more likely to be diagnosed with cervical squamous intraepithelial lesions (SILs) when compared to HIV seronegative women (Ellerbrock et al., 2000; Schuman et al., 2003). The results the Women's Interagency HIV Study (WIHS) supported the findings of the earlier study but also identified a possible link among human papillomavirus (HPV) infection, higher plasma HIV ribonucleic acid (RNA) levels, and an increased likelihood of developing SIL over time which suggested a need for different cervical cancer screening recommendations for women with HIV infection (Ahdieh-Grant et al., 2004). The review of the literature related to preventive health care services in women with HIV

infection discussed in Chapter 2 supported the findings of HERS and WIHS , study results for HIV seronegative women, or studies where HIV infection was not a variable.

Seeing the same health care provider whether the provider is a generalist or a specialist, having a regular site where care is sought (Allen, Wieland, Griffin, & Gozalo, 2009), and the health care delivery model of the provider and/or the site such as an acute care model (Wagner et al., 2001) impacted the completion of preventive health care screening. Allen and coauthors (2009) stated their study results indicated the need for health care models focused on the continuity of both health care provider and health care site to improve the completion of preventive health services not just screenings. A simulation study examined the risks, benefits, and life expectancy of 1,000 women if each woman had one additional screening mammogram suggested the number of comorbidities should be the primary factor when determining whether to screen older women (Lansdorp-Vogelaar et al., 2014). Similarly the site in which health care was received influenced the completion of preventive health care services. The Research And Development (RAND) Corporation estimated up to 60% of individuals with HIV infection did not receive regular medical care yet women in the HCSUS had a greater likelihood of receiving gynecological care if they received gynecological care at the same place they received care for HIV infection (RAND, 2006). However, few studies found during the literature review determined whether the gynecological care received through HIV clinics was symptom-related or was care received as the result of preventive health care recommendations. Furthermore, few studies examined whether other preventive health care services such as mammography were available through the HIV care setting or offered to women with HIV infection.

Independent Variables Definitions

The information in the EMRs was originally collected for medical care purposes and not for research purposes or for this study so the variables and related categories were defined operationally according to the design of the EMR software used in the infectious disease clinic.

Embodiment Variables

The embodiment variables included female gender, age, age cohort, census age group, three visits during the 12 months prior to data collection, and diagnosis of an AIDS-defining condition or opportunistic infection.

Gender. The variable of female gender was abstracted from the EMR and used for the development of the sampling frame and eligibility purposes where female = 1, not female = 0, and all eligible EMRs had to have a gender code of 1.

Date of birth. Abstracted directly from the EMR in MM/DD/YYYY format and immediately subtracted from the year of the study to calculate the variable of age, the use of date of birth in the study was limited to sampling frame development and eligibility purposes and was not coded for analysis.

Age, age cohort, and census age group. Calculated from DOB, the continuous variable of age was recorded in whole years and eligible EMRs had to have a value of 40 or more. Age was divided by the mean to form a two-category variable (Age 2) and was also transformed into the categorical variables of age cohort, in 10-year intervals (40–49 = 1, 50–59 = 2, 60–69 = 3, 70–79 = 4, 80–89 = 5, 90 years and older = 6) for analysis, and census age group (35–44 = 1, 45–54 = 2, 55–64 = 3, 65 years and older = 4) for comparison to national databases and other studies.

Three visits in twelve months prior to data collection. The discrete, nominal variable limiting eligibility to three visits during the twelve months prior to data collection was shortened to 3VisitYr and coded as yes = 1 and no = 0 where a value of zero rendered the EMR ineligible.

HIV status. A positive ELISA and a positive Western Blot (WB) for confirmation coded as 1 must have been recorded in the EMR for abstraction into the variable of HIV status for inclusion in the study. A missing result for either the ELISA or WB was coded as 0 and the EMR was ineligible.

Pathway of Embodiment Variables

The pathway of embodiment variables included race, ethnicity, marital status, education level, employment status, and type of insurance.

Race. The discrete, nominal variable of race was limited to the categories in the proprietary EMR software. The categories and codes for race consisted of Black = 1, White = 2, Asian/Pacific Islander = 3, American Indian/Alaskan Native = 4, other = 5, and only one choice was allowed.

Ethnicity. The discrete, nominal variable of ethnicity was limited to Hispanic = 1 and non-Hispanic = 0.

Marital status. The discrete, nominal categories and codes for marital status were single or never married = 1, married, = 2, partnered = 3, separated = 4, divorced = 5, and widowed = 6.

Education level. The discrete, ordinal categories and codes for education level included less than high school = 1, high school graduate = 2, some college = 3, and college graduate = 4.

Employment status. The discrete, nominal categories and codes for employment status were unemployed = 0, employed part time = 1, employed full time = 2, self-employed = 3, disabled = 4, retired = 5, active military = 6, and other = 7.

Insurance. Insurance categories and codes included Medicare = 1, Social Security Disability = 2, Medicaid = 3, private insurance = 4, state health maintenance organization (HMO) = 5, charity care = 6, self-pay = 7, not insured = 8, and other = 9.

Cumulative Interplay Variables

The independent variables associated with the construct of cumulative interplay–exposure were HIV year and HIV Time. The independent variables associated with cumulative interplay–susceptibility were the diagnosis of an AIDS-defining condition, the lowest CD4 cell count recorded in the EMR, HIV stage, the CD4 cell count associated with each screening interval, the HIV stage associated with each screening interval, distance between residence and facility, comorbid diagnoses of hypertension, obesity, diabetes mellitus, and depression, and tobacco use. Height and weight measures were abstracted to calculate BMI and a data check variable was incorporated into the study to compare agreement between the obesity diagnosis in the EMR and the obesity diagnosis based on the BMI. The cumulative interplay–resistance variable of health care delivery model was controlled and not abstracted for analysis.

HIV year and HIV time. The year on the laboratory reports for the variable of HIV status was abstracted as a four-digit value and subtracted from the year the study was conducted to create the continuous variable of HIV time. Only HIV time was included in the analyses and HIV time was divided by the mean into two categories to form the new variable labeled Time2.

AIDS-defining conditions (ADC). ADCs include opportunistic infections (OIs), are associated with Stage3 HIV infection or AIDS, and have been identified by the CDC for the *National Notifiable Diseases Surveillance System* (Schneider et al., 2008). Some of the AIDS-defining conditions such as recurrent bacterial infections are limited to children under the age of 13 years and were omitted from the list used in my study. The EMRs were reviewed for diagnostic codes related to ACDs and OIs (Appendix A) and a diagnosis of any ADC was coded as Yes = 1 while the absence of an ADC was coded as No = 0.

Lowest CD4 cell count. The continuous variable of lowest CD4 cell count in the EMR was abstracted to determine the variable of initial HIV stage and was not analyzed.

Interval CD4 cell count. The continuous variable of CD4 cell count associated with each screening interval was abstracted to determine the variable of interval HIV stage.

HIV stage. The categorical variables for initial HIV stage and interval HIV stage were coded according to the *1993 Revised Classification System for HIV Infection and Expanded Surveillance Case Definitions for AIDS Among Adolescents and Adults* (CDC, 1992), where A1 = 1, A2 = 2, A3 = 3, B1 = 4, B2 = 5, B3 = 6, C1 = 7, C2 = 8, and C3 = 9. The stages associated with AIDS were A3, B3, C1, C2 and C3 while A1, A2 and A3 were considered asymptomatic, and B1, B2 and B3 were symptomatic without the diagnosis of an AIDS-defining condition.

Distance. The continuous variable of distance was abstracted as three whole numbers with a single decimal place and was divided by the mean of the variable to form a new categorical variable labeled Distance 2 for analysis.

Hypertension. Defined as a systolic blood pressure of 140 mmHg or higher and a diastolic blood pressure of 90 mmHg or higher for three or more times, a diagnosis of hypertension = 1 while no diagnosis of hypertension = 0.

Obesity. Though obesity is associated with multiple physiological, behavioral, and psychological causes obesity was classified as a physiological comorbid condition for study purposes, Height and weight measurements were collected from the EMR and converted into a body mass index (BMI) coefficient (USDHHS, 2015). For study purposes, obesity was defined as a BMI of 30.0 or greater or the diagnosis of obesity written in the EMR. The variable obese BMI corresponded to obese by BMI = 1 and not obese by BMI = 0. Another variable was obese by diagnosis in the EMR where a diagnosis of obesity listed in the EMR = 1 and no diagnosis of obesity in the EMR = 0. To assess agreement between the two variables a third variable was created and labeled obese by both where a diagnosis of obesity in both the EMR and by BMI calculation = 1 and a lack of agreement = 0.

Diabetes mellitus (DM). The USPSTF did not recommend screening for Type 2 diabetes mellitus in asymptomatic adults at the time of the study (USPSTF, 2008a). In the study, a diagnosis of DM was coded as 1 and no diagnosis of DM was coded as 0. Since mortality rates in individuals with diabetes were significantly increased in the presence of comorbid major depression (Katon et al., 2005; Lin et al., 2009), a diagnosis of depression was abstracted from the EMRs.

Depression (DEP). For study purposes depression was defined as a diagnosis of any type of depression, minor or major, for any length of time with or without treatment

documented in the EMR. A diagnosis of depression was coded as 1 and no diagnosis of depression was coded as 0.

Tobacco use (TOBUSE). Tobacco use in the study was defined as current or past use of any tobacco-containing product not limited to cigarettes. The USPSTF recommends smoking cessation for all individuals so the study collected data related to the use of tobacco products including ICD-9-CM codes, tobacco use documented in the list of diagnoses from the health care provider progress notes, or from the History and Physical form to determine if the HIV seropositive woman was using tobacco, which might act as a mediating variable, at the time a preventive health care action was completed or was supposed to be completed. No tobacco use was coded as 0 and a history of or current tobacco use was coded as 1.

Dependent Variable Definitions

Assessment of the dependent variables in the study included the frequency and type of preventive health care actions completed or not completed as appropriate to age, medical history, and current USPSTF recommendations (Appendix B). Completion of a preventive health screening test for breast, cervical, or colorectal cancer in the study was recorded as not completed = 0, completed on time = 1, completed early = 2, and completed late = 3. When cell counts were less than 5 the four categories were collapsed into two categories; not completed = 0 and completed = 1 without consideration for timing. The method of screening test was not evaluated in the study because this data was not routinely or uniformly recorded in the EMR. However, the following sections provide information on acceptable screening tests for each type of cancer according to

USPSTF recommendations and additional information on the preventive health care actions for breast cancer, cervical cancer, and colorectal cancer.

Breast cancer screening. Mammography sensitivity ranged from 77% to 95%, specificity ranged from 94% to 97%, and positive predictive value (PPV) increased with age (USPSTF, 2009b). Acceptable screening tests for breast cancer include screening mammography, breast ultrasound, or breast magnetic resonance imaging while clinical breast examination (CBE) and breast self-examination (BSE) are not recommended. For study purposes, the completion of a screening test for breast cancer was determined through the result of any acceptable screening test in the EMR and was coded according to completion and timeliness described above.

Cervical cancer screening. A Papanicolaou (Pap) test using either liquid-based or conventional cytology was acceptable for screening purposes. An absence of endocervical component was still acceptable for screening test completion because the lack of a testable sample was due to test methodology and not because the individual did not take the action to complete the screening test. Cervical cancer screening did not have to include human papillomavirus (HPV) screening but the result of HPV testing was recorded on the data abstraction form. HIV seropositive women with a history of cervical cancer were expected to complete cervical cancer screening tests at the interval recommended by the USPSTF until removal of the cervix was documented in the EMR (Moyer, 2012). The completion of a cervical cancer screening test was determined through the results of any acceptable screening test and was coded according to completion and timeliness described above.

Colorectal cancer screening. The USPSTF does not publish sensitivity or specificity data related to the screening tests for colorectal cancer in the agency's recommendations but sensitivity and specificity are ranked for each test from least to most. From least to most sensitive were (a) Hemoccult II; (b) fecal immunochemical tests; (c) Hemoccult SENSA and flexible sigmoidoscopy; and (d) colonoscopy (USPSTF, 2009a). From least to most specific were (a) Hemoccult SENSA; (b) fecal immunochemical tests and Hemoccult II; (c) flexible sigmoidoscopy; and (d) colonoscopy (USPSTF, 2009c). Results from any of these screening test methods were acceptable for completion of colorectal screening in my study and the completion of a colorectal cancer screening test was determined through the results of any acceptable screening test in the EMR and coded as described above.

Assumptions

A major assumption of the study was the EMR contained a complete record of every hard copy medical record and no information had been omitted; complete information in the EMR was likely untrue but verification through comparison of the hardcopy medical record to the EMR was beyond the scope of the study. The study collected data only from the EMRs of patients seen in an ambulatory care department where 29.4% of 2006 NHAMCS respondents reported using any type of EMR/EHR system and the projected use of any EMR/EHR system was estimated between 62.6% and 71.2% by 2009 (Hing, et al, 2010). No other electronic or hard copy record such as a billing database was used in the study since clinicians and researchers were not allowed to access to the billing records; the study focused on the main source of data accessible to clinicians and researchers which was the EMR for the site of the study. The

ambulatory care center where the study was conducted was in the process of converting hardcopy medical records to EMRs beginning with active patients. At the time a patient completed a visit the most recent information was captured electronically and the hardcopy medical record was flagged for transcription into electronic format. Eligibility criteria for the study limited the inclusion of EMRs to those of patients who had completed a minimum of 3 visits within the twelve months prior to data collection to reduce the likelihood of including a medical record not completely converted into the electronic format.

The data abstraction forms related to the study were designed to capture information from reports of results for (a) Pap smear; (b) vaginal culture; (c) mammogram; (d) colonoscopy; or (e) sigmoidoscopy which were reported in an electronic format for several years at the facility and were downloaded or scanned into the EMR for patients seen in the ambulatory care center. Since laboratory, procedure, and imaging reports required less labor to transfer into the EMR than handwritten progress notes requiring transcription I assumed these originally electronic documents would be in the EMR and the documents would be free of transcription errors.

Limitations

Mann (2003) described retrospective studies as lacking bias as the information on the exposure variables and outcomes of interest was collected for a purpose other than research. Inaccurate recollection of events or recall bias was a major source of bias in retrospective studies but was eliminated in the study through the use of laboratory, procedure, and imaging reports in the EMRs instead of collecting data directly from clients. The study controlled for confounding between or among independent variables

by collecting data on those variables associated with the outcome of interest identified from previous studies (Mann, 2003) and discussed in the review of the literature.

The ecosocial theory reduced some bias in study design by highlighting the importance measurement level and time (Krieger, 1999). The use of individual socioeconomic indicators instead of household-level indicators would not accurately represent the socioeconomic position of women and socioeconomic indicators related to health should be measured across the lifespan of a woman as exposures or economic disadvantage at an early age influence adult health.

A major limitation of the study could have been missing data. As noted earlier the transfer of patient information from hardcopy charts to the EMR system at the facility where the study was conducted was not complete and began with current patients as they completed recently scheduled appointments with health care providers throughout the facility. While many departments such as laboratories and surgical pathology at the facility converted to electronic reports several years prior to the conversion to EMR patients not seen in the ambulatory care center on a regular basis only had laboratory results, surgical records, procedure documents, inpatient charts, emergency room charts, information releases, and consents scanned into the EMR system. Documents not scanned routinely into the EMR included progress notes, flow charts, and health care provider order sheets for inpatient, outpatient, and physician practice offices located on the teaching hospital campus. The scanned documents or electronically reported information most commonly found in the EMR for all patients regardless of whether they had been seen recently or not were those necessary to measure the completion of preventive health care actions. I assumed any individual

documents missed in the mandatory record scanning such as a single laboratory report were randomly distributed across the study population and would not systematically bias the study findings.

There was no documentation to assist me in determining if the EMR under review was the entire patient record or only a portion of the hardcopy medical record scanned into the EMR. Study eligibility criteria stated the patient must have been seen in the ambulatory care center 3 or more times during the 12 months prior to data collection. During the development of the sampling frame information on gender, date of birth, HIV status, and number of visits was used as eligibility criteria. Some eligible records may have been omitted from the study because the patient was younger than 40 years of age or had less than three visits recorded in the EMR at the time the sampling frame was compiled. Some patients may have attained 40 years of age or the required number of visits by the time data collection was actually conducted but the time constraints of the study did not allow an investigation of the number of records that became eligible in the time interval between the sampling frame development and data collection. The maturing of the client associated with the EMR and the increased number of visits were occurrences expected to happen randomly across all EMRs in all client populations.

Scope and Delimitations

As mentioned previously, comparing the hard copy medical record to the EMR was beyond the scope of the study since I was the only data abstractor and there was no funding to cover the increased manpower needed to locate and re-file each of the hard copy medical records at the study facility. As with the occurrence of EMRs omitted between sampling frame development and data collection time, the number and type of

documents needed to determine the completion of preventive health care actions missing from the EMR but present in the hardcopy record was expected to occur randomly across all EMRs in all client populations. Due to the specialized structure of EMRs across various facilities and the specialized nature of the data abstraction instruments designed from those EMRs the findings of the study may have limited generalizability.

Significance of the Study

Determining if the preventive health care actions for breast, cervical, or colorectal cancer screening were completed by HIV seropositive women would allow clinicians to identify if a significant proportion of their client population was failing to complete recommended preventive health care actions and would allow clinicians and program planners to work with HIV seropositive women to identify barriers and facilitating factors aimed at the improvement of completion for preventive health care actions. Establishing the prevalence or proportion of women who were referred for screening compared to women not referred would be desirable for identifying facility- or provider-related factors but this information would most likely be found in the progress notes or on a document used to record health care provider orders. At the time the study was conducted these hard copy documents were not uniformly transferred into electronic format across all client medical records and for all time periods so the information was not collected. Future studies at this and other facilities may want to examine these factors once EMR systems are standardized and complete. Improvements at the agency or institutional level associated with the provision of preventive health care services and changes to facilitate the completion of preventive health care actions might include programs aimed at improving cancer screening completion in specific groups such as

older adults and racial/ethnic minorities (Shenson et al., 2005), improving continuity of care or coordination of services between different departments (O'Malley et al., 2002), or using non-physician health care providers such as nurse practitioners (Ackerson & Gretebeck, 2007).

From a public health perspective determining which groups of HIV seropositive women had a greater likelihood of failing to complete age appropriate preventive health care actions could assist program planners with the development of new programs and the revision of existing programs. Determining which variables such as comorbid conditions impact the completion of preventive health care actions in HIV seropositive women would allow surveillance personnel to incorporate these factors into routinely collected data associated with existing HIV surveillance databases so adverse trends could be identified and addressed in a timely manner. Preventive health care recommendations must be incorporated into the provision of services to individuals and groups with chronic illnesses but the cost effective delivery of those services may need to be established at the institutional and societal levels to ensure the preventive health care screening procedures and tests are available to all individuals and groups in various geographic areas. Identifying factors that facilitate, inhibit, or prevent optimal health across the lifespan could assist policy makers in the development of social policy with a positive effect on population health outcomes. If an individual is to attain optimal health the factors facilitating the attainment of optimal health must be incorporated into every level of society across the individual's lifespan. Research identifying geographical areas and subpopulations where population health has been neglected or has remained at a sub-optimal level for one or more generations can provide the data necessary to support

the enactment of policies aimed at positive social change expressed as improved population, group, and individual health.

Summary

Examining embodiment-related variables such as age, pathway-related variables including race and ethnicity, cumulative interplay variables such as HIV stage, distance from health care facility, and comorbid conditions can provide a more comprehensive picture of the issues associated with the completion or failure to complete preventive health care actions and can assist clinicians in the identification of individuals at risk for failure to complete screening tests. The medical records review methodology has been used for the identification of important variables in research studies and for program evaluation purposes, and the methodology will be discussed further in Chapter 2. As EMRs become more prevalent, as more hard copy records are replaced by electronic medical records, and the conversion process progresses across facilities establishing a consistent and accurate manner for quickly and efficiently abstracting data, EMRs will be an important and cost-effective methodology for studies developed and conducted for research, evaluation, and planning processes designed to reduce disparities across groups.

Chapter 2: Literature Review

The literature review begins with a restatement of the identified problem and purpose of the study, the search strategy used to identify the documents included in the literature review, a brief examination of the ecosocial theory, a review of HIV infection in women, preventive health recommendations associated with breast cancer, cervical cancer, and colorectal cancer including specifics relevant to HIV seropositive women, and concludes with a discussion of how comorbid conditions influence the completion of preventive health care actions measured in the study. During the literature review, several inequities associated with the completion of preventive health care actions were identified and are discussed in relation to the independent and dependent variables. Subsequent sections discuss the methodology including: (a) the data abstraction tool; (b) the abstraction process; (c) the protection of information abstracted from the medical records; and (d) a brief summary.

Problem and Study Purpose

The problem identified for research in my study was based on published research articles indicating the presence or absence of certain independent variables associated with differences in the completion of preventive health care actions. Although studies were found that compared the relevance of the USPSTF recommendations between men and women, cancer survivors, and individuals with comorbid conditions such as diabetes mellitus, a lack of research to determine if the USPSTF recommendations for breast cancer, cervical cancer, or colorectal cancer were relevant to HIV seropositive women was noted. The purpose of the quantitative study was to describe, compare, and determine which variables differed significantly between HIV seropositive women who

completed recommended preventive health care actions for breast cancer, cervical cancer, or colorectal cancer, and HIV seropositive women who failed to complete those same preventive health care actions, with or without a diagnosis of one or more comorbid conditions, when seen by an infectious disease specialist at an ambulatory care center in Newark, New Jersey, three or more times during the 12 months prior to data collection.

Search Strategy

The review of the literature was conducted using online university library resources. Research databases accessed for the study included Academic Search Premier, Cumulative Index to Nursing & Allied Health Literature (CINAHL) Plus, Educational Resource Information Center (ERIC), MEDLINE, OvidSP Health, ProQuest Central, ProQuest Health and Medical Complete, ProQuest Nursing and Allied Health Source, ProQuest Interdisciplinary Dissertations and Theses, PsycARTICLES and PsycINFO, PubMed Central, and Sage Journals Online. Several journal-specific web sites were also searched including the *Journal of the American Medical Association (JAMA)*, *Archives of Internal Medicine*, *Morbidity and Mortality Weekly Report,* and *Preventing Chronic Disease: Public Health Research, Practice, and Policy*.

An initial search of articles, editorials, and comments from journals, books, manuscripts, government and private organization publications, conference abstracts, papers and presentations, thesis and dissertation sources, bibliographies, and papers available on individual authors' web sites was conducted for the key words *HIV, women* or *female, adult* and *United States,* and the search results were limited by publication year (after 2000) and by topic to breast cancer, cervical cancer, colon cancer,

hypertension, obesity, diabetes, depression, and/or tobacco use. Articles on preventive health care actions were limited to breast cancer, cervical cancer, and colorectal cancer and included both current and historical preventive health recommendations published by the USPSTF.

Each document from the search results was examined for appropriateness, quality, and relevance to the study; links to related documents and cited documents were also examined. Changes to the study as required by the Walden University dissertation committee and reviewers were completed prior to the human subjects' review that required no changes to the study. Had changes to the study been required after approval by the Walden University human subjects institutional review board (IRB; 04-13-15-0050052), data abstraction would have been delayed until approval of the study revisions.

Theoretical Foundation

As previously discussed the core constructs of the ecosocial theory are: (a) embodiment; (b) pathways of embodiment; (c) cumulative interplay; (d) accountability and agency; and (e) analytic implications and predictions (Krieger, 2008). Krieger (2001) considered the ecosocial theory to be one of the three major theories used by social epidemiologists: (a) psychosocial theory; (b) social production of disease and/or political economy of health; and (c) ecosocial theory. According to Krieger (2001), all three theories presented constructs to explain social inequities in health and describe disease distribution and cannot be reduced to mechanism-oriented disease causation but their major differences are the emphasis each places on the social and biological condition related to population health, how social and biological explanations are

integrated, and how recommendations for actions to reduce health-related inequities are derived.

According to Krieger (2001), the psychosocial theory focuses on endogenous biological responses to human interactions and less attention is paid to the sources of psychosocial threats and buffers, how these threats and buffers are distributed, and how the distribution of the threats and buffers is determined by social, political, and economic policies. Little attention is paid to the effects of time except when referring to periods of time associated with rapid social change and Krieger (2001) uses stress as an example of a concept associated with the literature published by epidemiologists using the psychosocial theory.

Social production of disease or the political economy of health was associated with the upstream-downstream metaphor commonly used in social epidemiology and could be used to address economic and political determinants of health and illness such as structural barriers and to analyze group differences associated with who benefits from certain policies at whose cost (Krieger, 2001). An example was the negative health impacts associated with income inequality leading to the programs instituted by the International Monetary Fund and the World Bank aimed at reducing poverty and the free-trade agreements instituted by the World Trade Organization (Krieger, 2001).

The ecosocial theory is described as a multi-level, multidimensional, and dynamic explanatory framework used to guide inquiry and action and generate testable principles to analyze dynamic patterns of population health and illness at each level of organization such as individual, family, and community and on multiple scales including space and time for the development of mathematic models to illustrate and understand

the complex and unique interaction of organisms and processes (Krieger, 2001). The primary construct of the ecosocial theory is embodiment. Concepts of biologic embodiment include: (a) reproduction; (b) development; (c) growth; (d) interaction among organisms; (e) existence in time and space; and (f) evolution. The concepts of social embodiment are: (a) societal context as related to but not limited to historical period, economic trends, and political rights; (b) social position; (c) social production related to but not limited to the exchange and distribution of goods, services, and information; (d) social consumption; and (e) social reproduction or engagement in processes which sustain and modify social structures (Krieger & Smith, 2004). Low birth weight is cited as an example of an embodied expression of social inequality. Socially patterned exposures before and during the pregnancy include maternal malnutrition; exposure to toxic substances such as lead; smoking; infections; domestic violence; racial discrimination; economic adversity; inadequate medical and dental care; and inadequate prenatal care (Krieger & Smith, 2004). Actions to reduce the incidence of low birth weight and improve the outcomes of low birth weight babies need to address issues at multiple biological and social levels over time such as the provision of food programs to prevent malnutrition and improve growth and development beginning when the mother is an infant herself; the reduction of interactions with toxic substances; and increased interactions with those in social positions to provide the goods, services, ideas, and information to meet not only the basic needs for physical survival but the social needs to lead a meaningful life (Krieger & Smith, 2004).

Disparities or inequalities among groups specifically differences among racial, ethnic, social, and economic groups are concepts identified for continued research using

the ecosocial theory. Zierler and Krieger (1998) utilize the ecosocial theory to investigate the social inequities of HIV infection in terms of increased risk associated with gender. Reductions in federal spending for social programs aimed at reducing poverty, increasing economic inequalities among racial and ethnic groups, and the racially biased effort to reduce drug use which all occurred in the early 1980s were cited by the authors as factors contributing to increased susceptibility to HIV infection by women and HIV infection was a biologic expression of the social experiences associated with these three factors (Zierler & Krieger, 1998). As social programs were reduced or eliminated, more households had incomes below the poverty level and these households tended to be headed by Black and Hispanic females with low education levels; women in these households were forced to look elsewhere for economic survival such as selling illicit drugs or having sex for money which increased their risk of exposure to: (a) HIV infection; (b) violence; (c) isolation from supportive social groups; (d) racism (Zierler & Krieger, 1998). Male partners could be a source of income but could also be a source of illicit drug use; could negatively influence a woman's participation in harm-reduction activities such as participation in needle exchange programs or drug treatment programs; and could be a source of domestic abuse; to escape domestic abuse a woman might find herself homeless which could increase her chances of being raped or having unprotected sex for money with multiple partners (Zierler & Krieger, 1998).

A study in Massachusetts used 1990 census block group data, 1990 census data, and AIDS surveillance data from 1988 through 1994 to examine the association between economic deprivation and AIDS incidence. In the total population, the cumulative incidence of HIV infection was seven times higher among men and women in census

block groups where 40% of more of the population lived below the poverty line compared to census block groups where less than 2% of the population lived below the poverty line (Zierler et al., 2000). In HIV seropositive women racial inequities were pronounced. In census block groups where less than 2% of the population lived below the poverty line no White females with HIV infection were reported while 131 and 133 cases per 100,000 were reported in Hispanic and Black females, respectively. In census block groups where more than 40% of the population lived below the poverty line 13 cases per 100,000 were reported in White females while 352 and 442 cases per 100,000 were reported in Hispanic and Black females, respectively (Zierler et al., 2000). The ecosocial theory has been used to examine disparities associated with the variables identified for examination in my study and the constructs of the ecosocial theory such as agency and accountability were useful for examining the relevance of the USPSTF recommendations for breast, cervical, and colorectal screening for HIV seropositive women.

Women with HIV Infection

HIV/AIDS Incidence and Prevalence

According to the *2009 HIV Surveillance Report* women accounted for 25% of all HIV cases in the United States (CDC, 2011c) and the rate of women aged 13 years and older infected with HIV increased from 163.0 per 100,000 population in 2006 to 171.9 per 100,000 population in 2008 (CDC, 2011c). In 2009 over 11,000 women were estimated to have HIV infection in the United States and of those new HIV cases in women 57% were Black, 21% were White and 16% were Hispanic (CDC, 2011d). The rate of AIDS diagnosis in women aged 13 years and older in the United States increased

from 80.1 per 100,000 population in 2006 to 86.5 per 100,000 population in 2008 then decreased in 2009 (CDC, 2011c; CDC, 2011d). The site of my study was located in Newark, New Jersey and for HIV/AIDS reporting purposes Newark is a division of the New York-New Jersey-Pennsylvania metropolitan statistical area (MSA) which was ranked ninth highest in the United States for HIV infection and fourth highest for AIDS diagnosis at the time of study development (CDC, 2011d). According to the same *2009 HIV Surveillance Report* the estimated rate of HIV diagnosis for Newark in 2009 was 35.4 per 100,000 population and the estimated rate of AIDS diagnosis in 2009 was 26.2 per 100,000 population while the estimated rate for persons living with HIV infection at year-end 2008 was 686.1 per 100,000 population and the estimated rate for persons living with AIDS at year-end 2008 was 345.4 per 100,000 (CDC, 2011d).

HIV Treatment and Side Effects

The goals of HIV-related antiretroviral therapy (ART) are: a) prolonged suppression of HIV viral replication; b) restoration or preservation of immune function; and c) improved clinical outcome (Sax et al, 2008). A thorough discussion of ART regimes is beyond the scope of this dissertation but at the time of the study there were 31 antiretroviral medications available for use in the United States (USDHHS, 2011) and these medications are more effective when given in combination according to the *Guidelines for the Use of Antiretroviral Agent for HIV-1-infected Adults and Adolescents*. A recent National Institutes of Health (NIH) study confirmed early treatment with ART especially when the person with HIV infection presents with an opportunistic infection (OI) significantly reduce the occurrence of new OIs, suppressed

HIV plasma levels, promoted higher CD4 cell counts, and prolonged the time to AIDS progression (USDHHS, 2011; Zolopa et al., 2010).

An important consideration when discussing HIV treatments is the distinction between the highly active antiretroviral therapy (HAART) time periods: (a) pre-HAART which began with the first diagnosed case of HIV and extended to approximately 1996; and (b) post-HAART which began with the widespread use of HAART around 1996 and extended to the time of my study (Bartlett, Gallant, & Pham, 2009). The pre-HAART period is frequently divided into 3 time periods: (a) when no treatments were available; (b) when monotherapy with zidovudine (AZT) was the only treatment; and (c) when multidrug treatment regimes were available but not as effective as HAART.

A thorough discussion of the adverse reactions or side effects associated with HIV treatments is also beyond the scope of this dissertation but adverse reactions range from headache, fatigue, and nausea to virologic failure or death (Nguyen, 2009). Some comorbid conditions such as obesity and diabetes mellitus occur more frequently in clients with HIV infection who are taking HAART due to metabolic abnormalities including dyslipidemia and insulin resistance (Data Collection on Adverse Events of Anti-HIV Drugs [DAD] Study Group, 2007; De Wit et al., 2008). Adverse events can be reduced or managed when health care providers follow the aforementioned antiretroviral therapy guidelines (USDHHS, 2011) and when patients with HIV infection especially those of advanced age adhere to their medication regimes (Silverberg et al., 2007), see the prescribing health care provider as required, and immediately reported any problems to their health care provider.

HIV-Related Outcomes and Prognosis

HIV infection is a chronic condition involving progressive immunodeficiency characterized by reductions in CD4 cell count and decreased CD4 cell responsiveness, a long clinic latency period, and the appearance of opportunistic infections (Sax et al, 2008). Without treatment for HIV infection and opportunistic infections the immune system can be compromised and death can be the outcome. While a goal of treatment is to increase the time period between infection with HIV and progression to AIDS several factors influence AIDS progression particularly in women. HIV-specific factors associated with progression to AIDS include: (a) the HIV subtype (Easterbrook et al., 2010); (b) coinfection with HIV and human T lymphotropic virus type 1 (HTLV-1) or type 2 (HTLV-2; Beilke et al., 2004); and (c) HIV replication capacity (Goetz et al., 2010).

While fewer women progress to AIDS within 12 months of their HIV diagnosis (31% or 3,227) compared to men (34% or 10,541) the proportion of women who progress to AIDS 12 months or more after their HIV diagnosis (69%) was greater than the proportion of men who progressed (66%; CDC, 2011c, 2011d). One study used primates (rhesus macaques) infected with simian immunodeficiency virus (SIV) and humans infected with HIV to examine relationships between variations of the X chromosome and HIV disease progression (Siddiqui et al., 2009). Several factors influenced the progression from HIV to AIDS in women including: (a) ART during the pre-HAART era (Lemp et al., 1992; Poundstone, Chaisson, & Moore, 2001); (b) antiretroviral use during the post-HAART era (Jarrin et al., & the Concerted Action on SeroConversion to AIDS and Death in Europe [CASCADE] Collaboration, 2008;

Poundstone et al., 2001); (c) HIV disease stage at time of HAART initiation (Anastos et al., 2002; Ganesan et al., & the Infectious Disease Clinical Research Program [IDCRP] HIV Working Group, 2010); (d) adherence to ART/HAART (Ford et al., 2010); (e) pregnancy (Tai et al., 2007); (f) body mass index (Jones et al., 2003); (g) alcohol use (Baum et al., 2010); (h) crack cocaine use (Baum et al, 2010; Cook et al., 2008); (i) stimulant and non-injection drug use (Kapadia et al., 2005) and (j) tobacco smoking (Feldman et al., 2006).

Disparities in Health

HIV-Related Disparities

In 2009 the rate of new HIV cases among Black women was 15 times greater than the rate in White women and over three times the rate in Hispanic women (CDC, 2011c). The CDC estimates 1 in every 32 Black women, 1 in every 106 Hispanic women, 1 in every 182 Native American/Pacific Islander women, and 1 in every 217 American Indian/Alaska Native women in the United States will be diagnosed with HIV infection while only 1 in every 526 White or Asian women will be diagnosed with HIV infection (CDC, 2011c).

Cancer-Related Disparities

During the development of my study the percentage of deaths attributable to cancer in U.S. women remained relatively unchanged. In 2007 and 2010 cancer was the second leading cause of death in U.S. women and accounted for about 22% of all deaths (CDC, 2011e; CDC, 2014a). When race and ethnicity are considered for those same years, cancer remained the leading cause of death in Asian/Pacific Islander women (27.2% and 28.3%, respectively) and American Indian/Alaska Native women (18.8%

and 19.5%, respectively) (CDC, 2011e), and became the leading cause of death in Hispanic women in 2011 (22.6%; CDC, 2014a). In 2009 New Jersey was ranked the eleventh most populous state with an estimated 8,707,739 people (U.S. Census Bureau, 2009). By 2012 the estimated population of New Jersey had risen to 8,864,590, and approximately 277,000 people lived in Newark where the site of the study was located (U.S. Census Bureau, 2013). In 2014 New Jersey was ranked ninth in overall cancer incidence for females (450.0, 95% CI = 447.5, 452.6), ninth in female breast cancer (129.6, CI = 128.2, 131.0), fourth for female in-situ breast cancer (40.6, CI = 39.8, 41.4), fifteenth for cervical cancer (8.3, CI = 8.0, 8.7), and fourteenth in colorectal cancer in females (39.9, CI = 39.1, 40.7) while New Jersey was ranked twenty-third in overall cancer deaths for females (151.0, CI = 149.2, 153.7), third for deaths related to female breast cancer (24.6, CI = 24.0, 25.2), sixteenth in deaths related to cervical cancer (14.3, CI = 13.9, 14.7), and twenty-first for deaths related colorectal cancer in females (2.3, CI = 2.1, 2.5; U.S. Cancer Statistics Working Group [USCSWG], 2014). My study examined the completion of cancer screening for breast cancer and colorectal cancer because these are two of the most common cancers in U.S. adult women and cervical cancer screening is an AIDS-defining illness.

Breast cancer. The Surveillance Epidemiology and End Results (SEER) Cancer Statistics Review for 2006 to 2008 estimated the lifetime risk of a U.S. women being diagnosed with breast cancer regardless of race or ethnicity at 12.29%, CI = 12.23, 12.36 (USDHHS, 2011). Based on 2009 to 2011 SEER data, this lifetime risk is almost unchanged at 12.33% (CI = 12.27, 12.40; USDHHS, 2014). The lifetime risk in two recent time periods from 2006 to 2008 and 2009 to 2011 was greatest for adult White

women, 12.67%, CI [12.59, 12.74] and 12.70%, CI [12.63, 12.77] respectively than for all other races and ethnicities (USDHHS, 2011; USDHHS, 2014). According to data from the National Program of Cancer Registries (NPCR) as reported by the U.S. Cancer Statistics Working Group (USCSWG) between 2003 and 2007 breast cancer was the most commonly reported invasive cancer in adult women of all races and ethnicities in the United States with an age-adjusted incidence rate of 120.5 per 100,000 population, CI = 120.3, 120.8 (USCSWG, 2010) and incidence rates were highest in the northeastern United States (126.8 per 100,000 population; CDC, 2010b). By 2011 breast cancer was still the most commonly reported invasive cancer in U.S. adult women and the age-adjusted incidence rate had increased slightly to 122.0 per 100,000 population, CI = 121.5, 122.5 (USCSWG, 2014).

Cervical cancer. Based on SEER data collected from 2006 to 2008 the estimated lifetime risk of an adult woman in the United States developing cervical cancer was 0.68%, 95% CI [0.67, 0.70] and the risk was greater in adult Asian/Pacific Islander women, 0.71%, CI [0.65, 0.79], adult Black women, 0.84, CI [0.79, 0.89] and adult Hispanic women 1.10% (,CI = 1.04, 1.17; USDHHS, 2011). Based on SEER data collected from 2009 to 2011 the lifetime risk of a U.S. adult female developing cervical cancer was slightly lower at 0.65% (CI = 0.63, 0.66; USDHHS, 2014), between 1999 and 2011 the age-adjusted incidence rate for cervical cancer in U.S. women was 7.5, CI [7.3, 7.6], and of the top ten invasive cancers cervical cancer was only the tenth most frequently reported invasive cancer in American Indian/Alaska Native women (USCSWG, 2010). When HPV-related cervical cancer rates were reported for the years 2004-2008 cervical cancer was more common in Hispanic (11.3%; CI = 11.1, 11.6) and

Black women (9.9%; CI = 9.7, 10.2; CDC, 2014a) emphasizing the need to consider HPV infection when discussing cervical cancer disparities since cancer registries do not track the presence of HPV at the time of cervical cancer diagnosis (CDC, 2010c).

Colorectal cancer. Based on data from 2006--2008 the lifetime risk of an adult woman in the United States being diagnosed with colorectal cancer was 4.91%, 95% CI [4.87, 4.96] regardless of race and this lifetime risk increased to 5.12%, CI [5.07, 5.16] if the cancer was invasive or if the woman was Black (5.15%; CI = 5.00, 5.30) or Asian/Pacific Islander (5.04%; CI = 4.83, 5.27; USDHHS, 2010). Data from 2009--2011 showed a slight decrease in the lifetime risk of an adult woman in the United States developing colorectal cancer (4.49%; CI = 4.45, 4.53) compared to 2006--2008 data with the lifetime risk only slightly higher if the cancer was invasive (4.64; CI = 4.60, 4.69; USDHHS, 2014). The age-adjusted incidence rate for colorectal cancer in women of all races and ethnicities between 2007 and 2011 was 34.9% per 100,000 population, CI [34.6, 35.1] which made colorectal cancer the second most common cancer in Asian/Pacific Islander and Hispanic women and the third most common cancer in White, Black, and American Indian/Alaska Native women (USCSWG, 2014) with incidence rates higher in the northeastern United States (42.4 per 100,000 population; CDC, 2010b). Between 2007 and 2011 colorectal cancer was the third most common cancer-related cause of death in women of all races (24.6 per 100,000, CI = 24.0, 25.2) and colorectal cancer death rates remained significantly higher in Black women (21.0 per 100,000, CI = 20.6, 21.3) compared to all other races and ethnicities (USCSWG, 2010, 2014).

Disparities Associated with Preventive Health Care Actions

My study examined the completion of preventive health care actions specifically the completion of screening for breast, cervical, and colorectal cancers according to the USPSTF recommendations in U.S. women with HIV infection so the discussion on disparities related to preventive health care is limited to these three cancers. White women had a greater lifetime risk of developing breast cancer but Hispanic women had a greater risk of dying from breast cancer compared to other race or ethnic groups. Using pooled data from the seven-site Breast Cancer Surveillance Consortium (N = 1,010,515), 17,558 women received an initial diagnosis of breast cancer, 83.5% were classified as invasive of which 43% were stage 2 or higher and 33% were grade 3 or 4 (Smith-Bindman et al., 2006). While breast cancer rates were significantly higher, but similar in White and African American women compared to other racial and ethnic groups African American females tended to have larger tumors at a more advanced stage and a higher grade with more lymph node involvement compared to their White counterparts in the study (Smith-Bindman et al., 2006). While Hispanic and Black females had a greater lifetime risk of developing cervical cancer particularly when they were infected with HPV cervical cancer was only in the top ten cancer-related causes of death for American Indian/Alaska Native women. Black and Asian/Pacific Island women had a greater risk of being diagnosed with colorectal cancer during their lifetime and colorectal cancer was more common in Hispanic and Asian/Pacific Island women but Black women died from colorectal cancer at a much higher rate. One reason cited for the disparities associated with the risk, incidence, and mortality related to breast, cervical, and colorectal cancers among women of different racial and ethnic groups was attributed to differences in

access to, as well as the use of, preventive screening programs for these cancers. However race and ethnicity were not the only factors associated with disparities in preventive health care practices.

Levy-Storms, Bastani and Reuben (2004) surveyed 499 women aged 60 to 84 years recruited from 60 community-based meal sites, senior centers, and senior clubs in the Los Angeles area between October 1998 and September 2000. The average age of respondents was approximately 74 year, and respondents tended to have an annual income of less than $20,000 (68%), less than a high school education (18%), and only about one-fourth were married (Levy-Storms et al., 2004). Ten percent of the respondents reported they had never had a mammogram and the authors indicated their findings supported the findings of other studies. Coughlin, Uhler, Hall, and Briss (2004) examined 1999 BRFSS data to identify factors associated with nonadherence to breast and cervical cancer screening in 56,528 U.S. females aged 18 years or older. According to the study findings never having had either a mammogram or a Pap smear was associated with one or more of the following factors: (a) not being married; (b) lower education level; (c) lower household income; (d) a larger number of household members, including children; (e) being unemployed; (f) not having seen a physician in the past year; (g) a lack of health insurance; (h) a lack of other preventive health screening tests; (i) obesity; and (j) tobacco use. A usual source of care and being continuously insured for the previous 12 months were the two primary factors associated with having a mammogram in a study of 2,231 females aged 50 to 69 years conducted by Litaker and Tomolo (2007) using 1998 Ohio Family Health Survey (OFHS) data. Insurance status was also a significant factor in the study by Sabatino et al. (2008).

When the authors compared National Health Interview Survey (NHIS) data collected in 1993 and 2005 the mammography screening rates had increased. However the greatest difference in screening rates for both years was between uninsured women and those with private insurance and this difference was consistent across racial and ethnic groups (Sabatino et al., 2008). Colorectal cancer screening rates were even lower than the rates for breast and cervical cancer screening in most groups. When Trivers, Shaw, Sabatino, Shapiro, and Coates (2008) compared colorectal cancer screening rates from the 2000 and 2005 National Health Interview Survey (NHIS) they noted an increase in screening rates from 2000 (men, 38.1%; 95% CI = 36.1, 40.2; women, 37.1%; CI = 35.3, 38.9) to 2005 (men, 44.0%; CI = 41.9, 46.1; women, 44.8%; CI = 42.8, 46.8). However, colorectal cancer screening rates did not improve for Hispanic women (28.9; CI = 23.8, 34.6 in 2000 and 27.1%; CI = 22.0, 32.8 in 2005) or in uninsured women (20.6; CI = 16.5, 25.3 in 2000 and 19.3%; CI = 15.7, 23.4 in 2005). After adjusting for race, income, insurance, age, education, region of country, and years of US residence screening disparities between Hispanic and non-Hispanic men disappeared but the disparities between Hispanic and non-Hispanic women remained after statistical adjustment and insurance coverage was identified as a predictor of screening behavior independent of income particularly in women (Trivers et al., 2008). In a study of colorectal screening rates in 2000 and 2003 (Liang et al, 2006) that included women the only factor significantly associated with current screening was a dental visit in the last year ($p <$ 0.001) but a dental visit in the last year, age, gender, race, ethnicity, household income, and education was not significantly associated with ever having been screened.

Disparities Summary

When statistics presented in the preceding sections were examined HIV incidence was higher in Black and Hispanic women compared to other race or ethnic groups. Breast cancer is the most common cancer in U.S. women regardless of race or ethnicity, the leading cause of cancer death in Hispanic women, and the second leading cause of cancer death in U.S. women of other racial or ethnic groups. Colorectal cancer is the second most common cancer in Asian/Pacific Islander and Hispanic women, the third most common cancer in White, Black and American Indian/Alaska Native women, and the third leading cause of cancer death regardless of race or ethnicity (CDC, 2011e). Cervical cancer is more common in Black and Hispanic women (USCSWG, 2010) but when HPV infection was present the incidence of cervical cancer increased 3 to 4 times in Black and Hispanic women, respectively (CDC, 2010c) and HPV infection is not tracked by most cancer registries. Cervical cancer is more common in some groups of women with HIV infection. The incidence of overall cancer including breast, cervical, and colorectal cancer in women is higher in New Jersey compared to almost all other states and the overall cancer-related mortality, and the mortality associated with breast and colorectal cancer in New Jersey women is higher when compared to other states (CDC, 2011e).

A variety of factors associated with the failure to initiate and maintain the recommended schedule of preventive health care actions can lead to a delay in diagnosis, larger tumor size, invasive disease at the time of diagnosis, and higher mortality. Many of the factors associated with nonadherence to screening recommendations are discussed later in this chapter and associated data was collected in

the study since the presence of one or more of these factors can be related to the completion of preventive health care actions in women with HIV infection.

U.S. Preventive Services Task Force Recommendations

The U.S. Public Health Service convened the first USPSTF in 1984 and since 1998 the USPSTF has been sponsored by the Agency for Healthcare Research and Quality (AHRQ). The USPSTF is an independent panel of private sector experts in prevention and primary care who conduct thorough assessments of scientific evidence upon which recommendations for screening, counseling, and the use of preventive medications are based. The recommendations of the USPSTF are considered the gold standard for clinical preventive services (USPSTF, 2010a).

In my study the dependent variables included; the number and type of preventive health care actions completed or not completed as appropriate to age, medical history, and USPSTF recommendations current at the time of the preventive health care action. Appendix B contains USPSTF recommendations arranged by publication month and year. Gregory-Mercado et al. (2007) examined whether participation in more than one screening program for breast cancer improved rescreening rates in subsequent years. Almost 14,000 women participated in both the National Breast and Cervical Cancer Early Detection Program (NBCCEDP) and the Well-Integrated Screening and Evaluation for Women Across the Nation (WISEWOMAN) program between 2000 and 2004. Women enrolled in both the NBCCEDP and the WISEWOMAN programs were 2.8 times more likely to be rescreened in subsequent years than women who participated in only one of the programs

USPSTF Recommendations for Breast Cancer

The initial *Guide to Clinical Preventive Services* recommended clinical breast self-examination (CBE) for all women over the age of 40 years, mammography every one to two years beginning at age 50 years and concluding around age 75 if no cancer or cancer-related changes had been noted (USPSTF, 1989). The second edition of the *Guide to Clinical Preventive Services* recommended a mammography every one to two years with or without CBE for women aged 50 to 69 year, and screening for women aged 40 to 49 years was only recommended if the woman was at high risk for breast cancer (USPSTF, 1996). The recommendations changed again reducing the beginning age for screening mammography to 40 years with screening every one to two years (USPSTF, 2002). The *Guide* published in 2009 noted an update to the recommendations for breast cancer was in progress and when the update was published a few months later the USPSTF recommended biennial mammography for women aged 50 to 74 years (USPSTF, 2008b, 2009b, 2009d).

USPSTF recommendations were split in the *Guide* published in August 2010 when the Affordable Care Act retained the 2002 recommendations for breast cancer screening and the USPSTF supported the recommendations published in 2009 (USPSTF, 2009d, 2010b). By October 2012 no mention was made of the Affordable Care Act in the USPSTF publication but mammography was divided into two categories; film mammography; other mammography methods including digital mammography and magnetic resonance imaging (MRI) mammography which were both viewed as having insufficient evidence to support their use for screening purposes (Moyer, 2012; USPSTF, 2012a).

At the time of the study the USPSTF recommended breast cancer screening for women aged 50 to 74 years of age via film or digital mammography (USPSTF, 2009b, 2009d). Clinical breast self-examination was not recommended due to a lack of standardized approach and reporting procedures (USPSTF, 2009b). Due to changes in the recommendations over time I calculated breast cancer screening intervals for each EMR based on the date of birth to determine if a screening test was completed or not completed according to the USPSTF recommendations published over time. Breast cancer screening recommendations were limited to those released by the USPSTF even though I acknowledge the existence of recommendations by other agencies and organizations.

USPSTF Recommendations for Cervical Cancer

Initially Pap testing was recommended every one to three years for all women beginning with the onset of sexual activity and continuing until age 65 years if Pap tests were consistently normal (USPSTF, 1989). An addition to the 1996 recommendations stated a woman should have a cervix and specified at least every three years as the interval while removing the age limits due to insufficient evidence (USPSTF, 1996). The *Guide* published in 2009 noted an update to the recommendations for cervical cancer was in progress (USPSTF, 2009e) and this information was restated in the *Guide* published the following year (USPSTF, 2010b). While the publication of the update was delayed until March 2012 the publication contained some major changes including a recommendation for a Pap smear every three years for women aged 21 to 65 years and for women aged 30 to 65 years who wanted to lengthen the recommended screening

interval a combination of Pap smear with HPV testing was recommended every five years (Moyer, 2012).

At the time of the study the USPSTF recommended cervical cancer screening for women aged 21 years or when first becoming sexually active whichever was earlier and an HPV test was recommended in combination with cervical cytology in women aged 30 years to 65 years who preferred to extend the cervical cancer screening interval from 3 years to 5 years (USPSTF, 2008c, 2012b). Due to changes in the recommendations over time the study developed cervical cancer screening intervals for each EMR based on the date of birth to determine if a screening test was completed or not completed according to the USPSTF recommendations published over time. Cervical cancer screening recommendations were limited to those released by the USPSTF even though I acknowledge the existence of recommendations by other agencies and organizations.

USPSTF Recommendations for Colorectal Cancer

Early evidence for colorectal screening was insufficient to support the use of FOBT or sigmoidoscopy for colorectal screening (USPSTF, 1989). By 1996 the evidence supported a change in the recommendations to annual screening using FOBT, sigmoidoscopy, or both for all persons aged 50 years and older (USPSTF, 1996). An update to existing published recommendations included colonoscopy as a screening method and limited the upper age of screening to 75 years (USPSTF, 2008d).

USPSTF recommendations for colorectal cancer screening at the time of the study were the same for men and women; fecal occult blood testing (FOBT), sigmoidoscopy, or colonoscopy in adults beginning at age 50 years and continuing until age 75 years (USPSTF, 2009c). The intervals for each screening method differed: (a)

annual screening with FOBT; (b) flexible sigmoidoscopy every five years in combination with mid-interval FOBT; and (c) colonoscopy every ten years (USPSTF, 2009c). The study developed colorectal cancer screening intervals for each EMR based on the date of birth to determine if a screening test was completed or not completed according to the USPSTF recommendations published over time. Colorectal cancer screening recommendations were limited to those released by the USPSTF even though I acknowledge the existence of recommendations by other agencies and organizations.

Completion of Preventive Health Care Recommendations

Using data from the SEER Program collected from 2000 to 2003 Brenner, Hoffmeister, Arndt, and Haug (2007) determined the risk for colorectal cancer in average risk females occurred four to eight years later than in average risk males; the 10 year cumulative mortality for men at age 50 years is reached by women between ages 54 and 56 years. Women are less likely to develop cancer in the distal colon and rectum compared to men and life expectancy after treatment for colorectal cancer was higher in women (Brenner et al., 2007). Friedemann-Sanchez, Griffin, and Partin (2007) conducted focus groups of men and women who were primary care patients at the Minneapolis Veterans Affairs Medical Center and found significant gender differences related to enabling factors and barriers associated with the completion of colorectal cancer screening with the preparation for a colonoscopy being foremost for women. Gender differences in colorectal cancer as well as USPSTF recommendations for breast and cervical cancer screening limited to females supported my decision to limit the study to females only. The review of the literature identified several demographic or

individual characteristics that had an influence on the completion of preventive health care actions in women.

Age group. Shenson et al. (2005) examined data stratified by 49 states from 105,860 respondents aged 50 years and older to the 2002 BRFSS to determine compliance with breast cancer, cervical cancer, and colorectal cancer screening according to USPSTF recommendations. Women aged 50--64 years and 64 years or older were considered current for preventive health care screenings if they had: (a) a mammogram within the previous two years beginning at age 40 years; (b) a Pap test within the previous three years beginning at age 18 years and if they had an intact cervix; and (c) a FOBT within the past 12 months or endoscopy for colorectal cancer screening within the previous ten years beginning at age 50 years. Of the women aged 50 to 64 years; between 69.7% and 90.7% were current with breast cancer screening; between 75.3% and 94.5% were current with cervical cancer screening; and between 33.9% and 59.1% were current with colon cancer screening. Of the women aged 65 years and older; between 68.4% and 85.8% were current with breast cancer screening; between 61.2% and 87.5% were current with cervical cancer screening; and between 48.5% and 74.6% were current with colon cancer screening (Shenson et al., 2005) suggesting the completion of preventive health care recommendations declines with increased age. However in a qualitative study of 98 focus group participants held in the New York City metropolitan area and Newark, New Jersey conducted to identify barriers and supportive factors associated with cervical cancer screening women aged 50 years to 64 years were more likely to be screened than women in younger or older age

categories suggesting the influence of other factors not just age (Guilfoyle, Franco, & Gorin, 2007).

Race and ethnicity. African American, Asian, and non-Black Hispanic were significantly associated with a lower likelihood of completing preventive health screening tests (Shenson et al., 2005) though the effect of race or ethnicity may be negated in the presence of one or more comorbid conditions (Kiefe et al, 1998); comorbid conditions will be discussed in a later section. After examining 26,401 appointments for 1,086 women with HIV infection Tello et al. (2008) observed African American women were less likely to keep HIV gynecological appointments (*OR* = 0.63, 95% CI = 0.45, 0.90). Focus groups involving 55 African American men and women (56%) aged 40 years and older found a preference for colonoscopy and FOBT and identified a fear of positive test results and embarrassment as major barriers to colorectal cancer screening; colorectal cancer knowledge and awareness were viewed as actions to improve colorectal cancer screening rates in the African American community (Greiner, Born, Nollen, & Ahluwalia, 2005).

An examination of predisposing and enabling factors associated with the use of preventive care services for cervical cancer screening by ethnic minority women living in three community housing developments in Los Angeles County was conducted utilizing a sampling frame of 1,394 households identified during the previously conducted cross sectional study the Services Access in Urban Public Housing (SAUPH) study (Bazargan, Bazargan, Farooq, & Baker, 2004). Of the 418 households randomly sampled from the frame 391 households were determined to be eligible for participation 27 were ineligible because members did not speak either English or Spanish so only 287

households actually participated in the study. The secondary study was conducted between May 1998 and August 1999 using data from 230 African American and Hispanic women. Five predisposing characteristics were associated with an absence of cervical cancer screening: (a) older age; (b) being Hispanic compared to African American; (c) lower level of education; (d) able to speak English; and (e) a finding of powerful others external locus of control on the Multidimensional Health Locus of Control (MHLC) Scale while three enabling factors were associated with a lack of cervical cancer screening: (a) no medical coverage; (b) a lack of continuity of medical care; and (c) less use of public services and benefits (Bazargan et al., 2004). In a secondary analysis of data from the 2000 National Health Interview Survey Lees, Wortley, and Coughlin (2005) reported Spanish-speaking Hispanics were significantly less likely to report colorectal cancer screening compared to Whites, Blacks and English-speaking Hispanics even after adjusting for individual characteristics such as socioeconomic factors as well as access and utilization factors. Hispanic-speaking individuals can be excluded from studies in the absence of an interpreter, bilingual study staff, or Spanish language survey while non-English speaking individuals can be included in studies using EMRs. In a study conducted by Guilfoyle et al. (2007) some women reported belief in a higher power as a coping mechanism when deciding whether screening was necessary; reported prayer as a way to survive cancer; and Hispanic women were more likely to hold fatalistic beliefs or the belief a higher power controlled the development and outcome of cancer associated with cervical cancer screening when compared to other groups. Ackerson, Pohl, & Low (2008) conducted a qualitative study to explore background and personal factors associated with the utilization of cervical

cancer screening resources and the perception of vulnerability to cervical cancer in seven low-income African American women in south central Michigan. The participants who did not have routine cervical cancer screenings were influenced by important individuals in their lives such as mothers or other relatives and peers to associate seeking health care with becoming ill or increasing their risk of illness (Ackerson et al., 2008).

These findings suggest the categories of race and ethnicity may not capture the entire influence of minority group membership such as speaking a different language or dialect than the majority of individuals in an area. The influence of other individuals such as a spouse or children or the influence of a higher power with control over whether a person will develop cancer may be issues. Examining cultural and religious differences was beyond the scope of this study because information on preferred language, birthplace, citizenship status, religious preference, and number of household members is not routinely documented in the EMR; the study did collect data on marital status.

Socioeconomic status and insurance. In a study targeting women living in census tracts where more than 30% of the households reported incomes less than 200% of the federal poverty threshold 75% of 1,205 survey respondents had regular Pap smears and 65% of respondents had mammograms while only 29% of respondents had FOBTs, according to National Cancer Institute, American Cancer Society, and USPSTF recommendations (O'Malley et al., 2002). In the focus group results reported by Greiner, Born, et al (2005) 26% of participants preferred FOBTs. However when 279 study participants classified as low income or income less than $1,200 per month were surveyed in a related study fewer FOBT cards were returned if the participant was aged

40 to 49 years compared to age 50 years and older (*OR* = 1.05, 95% CI=1.01, 1.10, $p < 0.01$) and the odds of the FOBT card being returned increased 5% with each additional year of age over 50 years suggesting income may not be significantly associated with the completion of colorectal cancer screening (Greiner, James et al., 2005).

A cross sectional random subset ($n = 106$) of enrollment and baseline surveys from low income participants of the longitudinal Open Doors to Health (ODH) study was compared to medical records for colorectal cancer screening response validation purposes; type of health insurance and employment status were significantly related to the completion of colorectal cancer screening (Emmons et al., 2009). A systematic review of the literature on cervical cancer screening in African American and Hispanic women found a lack of health care insurance or insurance requiring a copay; the lack of a primary health care provider or usual source of health care; and socioeconomic factors including high school or lower education level and lower income levels were associated with lesser likelihood of having had a Pap smear (Ackerson & Gretebeck, 2007). My study planned to include an examination of socioeconomic factors including educational level, employment status, and the type of insurance. Income information was not routinely captured in the EMR at the time of my study and the protection of confidentiality related to the use of actual addresses for the determination of household income from census block data prohibited the collection of financial data for study purposes.

Continuity of care and primary health care provider. Haas et al. (2007) linked National Health Interview Survey data collected in 2000 and 2003 by hospital referral region using data from the Survey of Colorectal Cancer Screening Practices

survey to determine if regional variations in beliefs and recommendations associated with colorectal cancer screening existed. After statistical adjustment for individual characteristics colorectal cancer screening was significantly greater in regions where the majority of physicians (50% to 80%) recommended initial colorectal cancer screening at age 50 years (*OR* = 1.09, 95% CI = 1.01, 1.18) and respondents with a usual source of health care, private insurance, Medicare plus supplemental coverage, or a previous diagnosis of cancer were more likely to complete screening (Haas et al., 2007).

Continuity of care at the same facility, with the same primary health care provider, and health care insurance were factors associated with a greater likelihood of having cancer screening according to published recommendations (O'Malley et al., 2002). Having a primary or usual source of health care reduced or eliminated some of the inequities observed in health care access related to preventive health care screening. In an article written by Hills and Mullett (2005) describing different models of primary care for women the authors concluded:

> If or when health care is adjusted to follow a primary health care approach, women's interests will be well served…women should be included in planning not only because they know what services they and their families need but also because women are often the major initiators of accessing health services…primary health care professionals must also be involved to ensure that a full range of services such as cardiac care, family violence prevention, breast health, mental health, bone health, reproductive health, menopause, health promotion, and chronic care management are integrated into all primary health care serving agencies (p. 336).

After examining variations in health care provider characteristics including education, experience, and HIV knowledge as well as primary care components and patient outcomes Hecht, Wilson, Wu, Cook, and Turner for the Society of General Internal Medicine AIDS Task Force (1999) noted the need for a multidisciplinary approach to HIV care and suggested the greater expertise of an HIV specialist was associated with better patient outcomes.

To reduce the variability observed in studies related to the presence or lack of a primary health care provider or usual source of health care my study limited the inclusion of EMRs to clients who had been seen predominately by a single health care provider who was board-certified in infectious disease care, board-certified in internal medicine, and had over twenty years experience in HIV/AIDS patient care. Due to the occurrence of primary care provider vacations and illness, unscheduled visits by patients, and the multidisciplinary nature of HIV care other health care providers who were board-certified in infectious disease care saw many of the patients during the provision of health care services over time. However the facility in which the health care services were received was limited to the infectious disease clinic of the ambulatory care center where only health care providers experienced in the care of women with HIV infection attended to patients. As discussed earlier zip code was used to determine distance in miles between residence and the health care facility in the study.

Comorbid Conditions and the Completion of Preventive Health Care Actions

In a study published in 2001 Gonzalez et al. examined incidence data from the Florida Cancer Data System (FCDS) which was linked to the State of Florida Agency for Health Care Administration (AHCA) discharge abstracts for 1994 and used 1990

U.S. Census data to estimate socioeconomic measures by zip code (13%) or census tract (87%) for prostate (N = 8,659), colorectal (N = 8.035), breast (female only; N = 9,832), and melanoma (N = 1,524; total N = 34,616). Nineteen categories of comorbid conditions were identified using the Charlson comorbidity index and higher scores on the index were associated with an increased burden of comorbidity though the number of comorbidities was collapsed to three levels: (a) 0; (b) 1; (c) 2 or more during data analysis. For all four cancers cases with any comorbid conditions were more likely to be diagnosed at a later stage. While the presence of any comorbid condition was associated with later stage of colorectal cancer diagnosis an increasing number of comorbid conditions were associated with an increasing likelihood of later stage diagnosis for breast cancer depicting a dose-response relationship. Results did not change when the age of each case was restricted to the ages associated with screening recommendations for each cancer or when analyses were limited to invasive cancers only (Gonzalez et al, 2001). The authors also noted comorbidity may have had an unanticipated separate and opposing influence on screening. While the comorbidity index was highest for colorectal cancer (30%) and the majority of colorectal cancer cases were diagnosed at a later stage the effects of comorbidity on colorectal cancer were lower than any of the other three cancers examined in the study. The authors suggested the presence of one or more comorbidities may have increased the number of contacts with a primary health care provider and increased the number of opportunities for discussing or conducting screening while the absence of any comorbidity may have decreased the perceived importance of screening (Gonzalez et al., 2001).

Comorbid Conditions in Women with HIV Infection

Major comorbid conditions may act as confounding or mediating variables between HIV infection and the completion or failure to complete preventive health care recommendations. Kiefe et al. (1998) examined the influence of chronic disease on breast and cervical cancer screening adherence. The retrospective cohort study of 1,764 women aged 43 years and older revealed each one unit increase on the Charlson comorbidity index was associated with a 20% decreased likelihood of a participant completing a Pap smear ($p = 0.002$) and a 17% decreased likelihood of a participant completing a mammogram ($p = 0.005$) according to the USPSTF recommendations. While uncomplicated diabetes without end stage organ involvement was assigned a score of 1 on the Charlson index AIDS was assigned a score of 6 reflecting a three times greater likelihood of a woman with AIDS not having a Pap smear according to USPSTF recommendations (Kiefe et al., 1998).

Though HIV infection is not always considered a disability HIV infection could result in disability due to medication side effects (Werth, Jr., Borges, McNally, Maguire, & Britton, 2008) and complications related to certain infections such as cytomegalovirus (CMV) which are more common in persons with HIV infection than the general public and could cause CMV retinitis resulting in decreased visual acuity or blindness (Sax et al, 2008). Yankaskas et al. (2010) noted women with disabilities were less likely to receive preventive care recommendations from their physicians and were less likely to complete breast cancer screening tests compared to women without disabilities and the more limitations a woman experienced including hearing, visual, and physical

impairments the greater the likelihood the woman did not complete breast cancer screening according to published recommendations.

Summary

Gaps in the literature associated with the completion of preventive health actions in women were identified and discussed throughout the review; the published literature contained limited knowledge related to the completion of preventive health actions in HIV seropositive women and the existing knowledge was based on only a few valid studies many of which lacked reliability since the studies could not be replicated due to the proprietary nature of the EMRs at each facility; omissions related to the exact information abstracted from the EMRs in each study may have been the result of publication space limitations and may not have reflected a lack of methodological rigor on the part of researchers; the lack of documentation related to methodology further limited the replication of existing studies and comparison between studies was made more difficult; even with these limitations certain factors were associated with the failure to complete preventive health care actions in women: (a) older age; (b) non-White; (c) Hispanic; (d) unemployed or disabled; (e) less than high school education; (f) public insurance or no insurance; and (g) a lack of continuity of care. The study utilized variables commonly recorded in EMRs for medical care purposes to aid replication of the study in the future as well as to aid with the comparison of the study findings but the study focused on adding to the knowledge base associated with the completion of preventive health care actions by examining these variables in HIV seropositive women.

Chapter 3: Research Method

Research Design and Approach

The quantitative study used a cross sectional design to collect information on HIV seropositive women who completed or failed to complete recommended preventive health care actions for breast, cervical, and colorectal cancers; how the completion of screening tests by these women differed in the presence or absence of hypertension, obesity, diabetes, and depression and tobacco use. Data was abstracted from the EMRs of clients seen three or more times in the 12 months prior to data collection by an infectious disease specialist in an ambulatory care center in Newark, New Jersey. Data analysis included descriptive statistics for each variable; analyses determined which variables impacted the completion of or failure to complete preventive health care recommendations of HIV seropositive women.

The presentation of material in Chapter 3 begins with information on the location and setting of the study; the population from which the sample was obtained; how the sample size was calculated; how the data abstraction instrument was developed from the EMR; the manual for completing the data abstraction instrument; how validity and reliability were established; how bias and confounding were limited; the analysis plan as related to the research questions; the plan for the dissemination of the research study results.

Setting and Sample

The CDC receives reports of HIV and AIDS cases from 33 states and five US dependent areas; point estimates of the total number of individuals living with HIV or AIDS are determined. At the end of 2003 the estimated number of individuals with HIV

or AIDS living in the US, the District of Columbia, and U.S. dependent areas ranged from 1,039,000 to 1,185,000 (CDC, 2008b). By the end of 2006 the estimated number of individuals in the US with diagnosed or undiagnosed HIV infection was 1.1 million.; in 2008 the CDC changed the method in which new cases of HIV infection were estimated (CDC, 2009b). Using the new method the CDC estimated 56,300 new cases of HIV infection occurred in the US in 2006 which was significantly higher than the previous 2006 estimate of 40,000 new cases derived using the old estimation method (CDC, 2009c, 2009d). New Jersey is one of 33 states with confidential name-based HIV and AIDS reporting; New Jersey has some of the nation's highest rates per 100,000 adult population for HIV and AIDS at 488.2 and 264.8 respectively (CDC, 2013c).

Sampling frame. To ensure the existence of a large enough patient population from which to sample I accessed the EMR server: (a) acting in a consultant role; (b) under the direct supervision of an infectious disease specialist; (c) using a facility computer, (d) in a locked limited access office; (e) after obtaining permission from the University of Medicine and Dentistry of New Jersey (UMDNJ) which no longer existed at the time my study was initiated. A sampling frame was compiled from clients of infectious disease specialists seen in the ambulatory care center three or more times (n=1,959); during the previous twelve months (n = 1,496); females only (n = 684); and born in 1970 or earlier (n = 566). The EMR system did not allow for searches based on HIV status without special permission though ICD-9-CM codes were listed throughout the EMR on pages for intake, diagnoses, and problems; further review of the pages refined the number of eligible clients to 444 HIV seropositive women aged 40 years or older; first and last names of the 444 eligible females were entered alphabetically in the

sampling frame; names were replaced by medical records numbers (MRN) of EMRs corresponding to each name; a number from 1 to 444 (Appendix C) corresponding to the line number of the Excel spreadsheet (Microsoft®, 2010) containing the sampling frame was used to randomize the EMRs into the study and after the initial random selection was replaced by a patient identification number (PID; Appendix D).

Sample size calculation. The Power and Sample Size Calculator (Lenth, 2011) with a recommended alpha of .05; one-tailed; power of .80; maximum 3 degrees of freedom to encompass the four possible levels of preventive health care completion--completed on time, completed early, completed late, and not completed--was used to calculate a sample size of 52 which was considered adequate for chi square and logistic regression analyses. However Monte Carlo simulations indicated a need for a minimum of ten events per variable to reduce bias and improve precision in logistic regression (Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996). The formula of $N = 10k/p$ was used where k = number of independent variables expected in the regression model set *a priori* at three and p as the smallest proportion of cases in the population with the proportion estimated at 50% for maximum variability resulting in the smallest sample size of 60 for logistic regression (Peduzzi et al, 1996). Newton and Rudestan (1999) recommended a minimum sample size of 50 + 8k as a rule of thumb. Using this formula the sample size was increased to 50 + (8 x 3), or 74. However when calculating the significance for individual variables the same authors recommended 104 + k or a sample size of 110 (Newton & Rudestan, 1999). Another *a priori* power analysis for calculating total sample size was conducted using G*Power a free online statistics program (Faul, Erdfelder, Lang, & Buchner, 2007). The input parameters of a one-tailed test, alpha of

0.05, and power of 0.95 were used to calculate an odds ratio of 1.95 based on the proportions for the completion (58.8%) or the failure to complete (42.2%) colorectal cancer screening in a national sample (CDC, 2012). With a critical z score of 1.64 the actual power was estimated at 0.95 and the total sample size was 114. Rather than estimate a set number of additional EMRs to include in the study for possible attrition random sampling with replacement was conducted. From the initial 114 EMRs randomized for inclusion into the study ten EMRs were randomly selected for abstraction at two time periods to establish intra-rater reliability associated with the abstraction of data over the data collection time period.

Using a sampling frame based on visits with an infectious disease specialist in the ambulatory care center eliminated the records of HIV seropositive women who did not receive their primary health care from an infectious disease specialist and controlled for differences arising from variations in HIV treatment including antiretroviral (ARV) therapy regimes since infectious disease specialists practicing in the ambulatory care center typically followed the ARV therapy regimes set forth by the *Panel on Antiretroviral Guidelines for Adults and Adolescents* (USDHHS, 2009, 2011).

Instrumentation and Materials

The data abstracted from the EMRs was limited to information collected for the purpose of medical care and the data abstraction instrument was based on the EMR used in the ambulatory care center at the time of the study. The data abstraction modules and accompanying manual (Appendix E) were organized according to the EMR information associated with the study variables related to the research questions discussed earlier in Chapter 1.

Description of Data Abstraction Instrument

The data abstraction instrument was created directly from the screens and fields in the EMR so the order and categorization of the independent and dependent variables is different from the order and categories associated with the ecosocial theory as described earlier.

Characteristic Variables

Female gender was abstracted directly from the EMR for eligibility purposes and coded as female = 1 and not female = 0. All eligible EMRs had a code of 1 for gender. Date of birth was abstracted directly from the EMR and used to calculate the continuous variable of age that was recorded as a whole number. All eligible EMRs had a value for age of 40 or greater. Age was transformed into the discrete, ordinal variable of age cohort, in 10 year intervals, coded as: (a) 40-49 = 1; (b) 50-59 = 2; (c) 60-69 = 3; (d) 70-79 =4; (e) 80-89 = 5; and (f) 90 years and older = 6. The discrete, ordinal variable of census age group was also calculated from the continuous age variables and was coded as: (a) 35-44 = 1; (b) 45-54 = 2; (c) 55-64 = 3; and (d) 65 years and older = 4. Only age cohort was analyzed while census age group existed for comparison to databases and studies. The discrete, nominal variable of race consisted of: (a) Black = 1; (b) White = 2; (c) Asian/Pacific Islander = 3; and (d) American Indian/Alaskan Native = 4. Only one choice for race was allowed. The discrete, nominal variable of ethnicity was limited to Hispanic = 1 and Non-Hispanic = 0. The discrete, nominal categories and codes for marital status were: (a) single or never married = 0; (b) married = 1; (c) partnered = 2; (d) separated = 3; (e) divorced = 4; and (f) widowed = 5. The discrete, nominal categories and codes for education included: (a) less than high school graduate = 1; (b)

high school graduate = 2; (c) some college = 3; and (d) college graduate = 4. Employment was limited to one response from the discrete, nominal categories: (a) unemployed = 0; (b) employed part time = 1; (c) employed full time = 2; (d) self-employed = 3; (e) disabled = 4; (f) retired = 5; and (g) active military = 6. Insurance categories and codes included: (a) Medicare = 1; (b) Social Security Disability = 2; (c) Medicaid = 3; (d) private insurance = 4; (e) state HMO = 5; (f) charity care = 6; (g) self-pay = 7; and (h) no insurance = 8. All the variables mentioned in this section included a response for other = 666, unknown = 888, and missing = 999.

The earliest recorded date for HIV diagnosis in each EMR was abstracted as the continuous variable of HIV year and coded as a numeric value reflecting the year of the positive ELISA with WB for confirmation; all eligible EMRs had to have a valid year recorded for HIV year. The continuous variable of HIV time was calculated by subtracting HIV year from the year of data collection and was recorded as a continuous value reflecting the number of years with HIV infection. Data on ADCs including OIs for adults (Appendix A) was abstracted from the EMR and coded as Yes = 1 or No = 0. This information along with lowest CD4 cell count was used to determine HIV Stage which was coded: (a) A1 = 1; (b) A2 = 2; (c) A3 = 3; (d) B1 = 4; (e) B2 = 5; (f) B3 = 6; (g) C1 = 7; (h) C2 = 8; and (i) C3 = 9.

Clinical Variables

The independent variables of health care provider and health care facility were controlled by eligibility criteria so data related to these two variables was not abstracted. The number of miles to tenth of a mile between the residential zip code plus 4 in the EMR and the ambulatory care center zip code plus 4 was recorded; coded as a numeric

value for the continuous variable of distance; divided by the variable mean to create a discrete, ordinal form of the distance variable for analysis purposes.

Comorbid Conditions

Hypertension, diabetes mellitus, depression, and tobacco use were coded as: (a) never diagnosed or used = 0; (b) history of = 1; and (c) currently has or used = 2. The diagnostic code for obesity was abstracted directly from the EMR and was also determined by calculating the BMI from the height and weight recorded in the EMR (USDHHS, 2015) with obesity defined as a BMI of 30 or greater. As a data entry check a diagnosis of obesity from both sources was determined during data abstraction and all three variables: (a) obesity by ICD-9-CM code in the EMR; (b) obesity by BMI; and (c) obesity diagnosis from both sources were coded as No = 0 and Yes = 1.

U.S. Preventive Services Task Force Recommendations

Time intervals for the preventive health screening tests for breast cancer, cervical cancer, and colorectal cancer, were calculated from the date of birth; based on the dates on laboratory, radiological, and procedure reports for screening tests in the EMR coded as not completed = 0 or completed = 1. However for each preventive health screening interval with a completed screening test and based on the USPSTF recommendations current for the screening of each type of cancer at that time (Appendix B) a determination was made during data abstraction related to the timing associated with each interval and coded as: (a) not completed = 0; (b) completed on time = 1; (c) completed early = 2; and (d) completed late = 3. The method or type of screening test was not abstracted in the study.

Assessment of Reliability and Validity of Instrument

Reliability. Yawn and Wollan (2005) examined the agreement at 5 time periods (1 month, 3 months, 6 months, 12 months, and 24 months) for data abstracted by 9 nurse data abstractors--only 6 at any one time--over 2.5 years from more than 1,200 medical records. Medical records information for ten years prior to the defining event (myocardial infarction) were examined and three types of data were identified for the determinations related to accuracy and agreement: a) demographic data or numerical test result; b) free-text data requiring the transcription of natural language; and c) information requiring a judgment on the part of the data abstractor. At one month agreement for demographic and laboratory result data, free-text data, and judgment data was rated as very good, good, and unacceptable resulting in retraining of all data abstractors. At three months after retraining agreement for demographic and laboratory result data, free-text data, and judgment data ranged from excellent to very good with demographic and laboratory result data having the highest agreement. The authors expressed agreement among the 6 nurses as a ratio of same responses to total responses instead of using kappa statistics which the authors determined were irrelevant to the study due to the large number of responses reviewed.

As my study had a single data abstractor a variation of test-retest reliability was utilized to determine reliability. Data from the first 10 EMRs from which data was abstracted had data abstracted a second time near the end of the data collection process--and the resulting data was compared for agreement between data collected at Time 1 and Time 2-- to determine the reliability associated with the data abstraction process.

To, Estrabillo, Wang, and Cicutto (2008) conducted a secondary medical records review study to determine reliability among 10 data abstractors at 15 study sites. Data abstractors were not allowed to re-abstract the data they collected originally at Time 1 and the sample size for charts randomly selected for re-abstraction at Time 2 was calculated to allow the detection of a kappa statistic between 0.60 and 0.70. Time 1 was between September 2003 and June 2005 and Time 2 was between July 2005 and February 2006 near the close of the study; no time was allowed for retraining or adjustments in study procedures aimed at improving reliability.

Data requiring the transcription of free-text language or a judgment by the data abstractor tended to be less reliable in the Yawn and Wollan (2005) study as evidenced by less agreement between abstractors over time. To improve reliability the data abstraction instrument for my study was designed to capture responses requiring less free-text or judgment-based data.

Validity. In the study by Yawn and Wollan (2005)--discussed in the reliability section--the authors noted their study did not examine validity so while the ratio of same responses to total responses might be good (4/6) to very good (5/5) those high number of same responses used to determine reliability might all be incorrect data. To et al. (2008) added 8 simulated charts to the data re-abstraction at Time 2 in their study then compared the answers of the multiple data abstractors to the correct information in the simulated charts to address questions related to the validity of the abstracted data in addition to the kappa statistics calculated as a measure of reliability. The data abstracted from the simulated charts by the multiple data abstractors was also compared to the data abstracted from these same charts by an experienced abstractor who was considered the

data abstraction gold standard for the purpose of calculating sensitivity and specificity estimates (To et al., 2008). Other authors have supported the use of an experienced nurse as the gold standard for data abstraction from medical records (Bertelsen, 1981; Justice et al., 2006).

By limiting data abstraction to a single site and a single abstractor with experience in the abstraction of data from medical records my study sought to establish high reliability by reducing variability related to different data abstractors (Bertelsen, 1981; Yawn & Wollan, 2005; To et al., 2008); differences in medical records systems (Lemon, Zapka, Estabrook, & Benjamin, 2006; To et. al., 2008); different sources of information documented in the medical record (Tisnado et al., 2007).

The use of control charts for monitoring adherence changes in clinical settings was found superior to the use of before and after study designs where data collected at two different time points was compared and analyzed for change (Peek, Goud, & Abu-Hanna, 2008) but in a retrospective cohort study of mammogram adherence in 399 women by Armstrong, Long, and Shea (2004) self-reporting of mammogram completion tended to over-report numbers possibly due to social desirability bias and recall errors, and while administrative and billing data bases were not subject to information biases billing data underreported mammogram completion often due to coding errors; in some cases billing data limited eligible participants to those with insurance (Armstrong et al., 2004). The medical records review (MRR) was found to be the gold standard for measuring mammogram adherence; the two major sources of bias cited by the authors was missing or incomplete information and the existence of multiple records (Armstrong et al, 2004).

While reliability and validity were frequently not reported for studies utilizing EMRs both should have been reported along with measures of data quality; reliability should be calculated using kappa statistics (Engel, Henderson, Fergenbaum, & Colantonio, 2009) not just the percentage or ratio of agreement among abstractors or between time periods. Several best practice guidelines associated with the abstraction of data from EMRs were found during the review of the literature but focused on the standardization of processes associated with: (a) instrument development and testing; (b) data abstraction; (c) data recording; and (d) data analysis with the ultimate goal being a reliable and valid MRR study (Engel et al., 2009). My study sought to reduce the bias associated with self-report by determining adherence to preventive health care screening tests through the direct abstraction of data from laboratory, radiological, and procedure reports in the EMR; a manual was developed *a priori* to provide guidance during the data abstraction process; reduce the need for judgment by the abstractor; and to serve as a guidebook for future researchers.

Instrument Completion

Significant issues associated with the use of EMRs in research involve differences between the purpose of the research and the purpose of the database from which the data was abstracted (Engel et. al., 2009; VonKoss Krowchuk, Moore, & Richardson, 1995; Worster & Haines, 2004). During the development of the data abstraction instrument potential problems were identified and addressed in the manual (Appendix E) to allow the abstractor to determine where the data necessary for research purposes could be found in the EMR. For example a measureable clinical activity recorded in the EMR by more than one source was Pap smear; the date was recorded in

the Progress Notes as a procedure and in the Laboratory section as a Laboratory Result. The manual explicitly instructed the abstractor to obtain data from the Laboratory Result first followed by the information transcribed into the Progress Notes if no laboratory report was found.

The greatest concerns associated with instrument completion for the study were conflicting data and missing data. The manual reduced the amount of conflicting data by providing guidelines that prioritized which information from each source to use for each variable. Dates associated with each completed preventive health care action were taken directly from laboratory, radiological, and procedure reports to reduce duplication associated with multiple information sources and allow the resolution of conflicts identified during data abstraction.

Data was considered missing if none of the sources identified in the abstraction manual contained the information. Every effort was made to find information in the EMR such as in the case when a preventive health care screening test was ordered and documented in the Progress Notes but no result was found. If the abstractor had difficulty locating information in the EMR or found the information on source documents not listed in the abstraction manual this finding could have indicated a problem or lack of clarity with: (a) the development of the study; (b) the data abstraction instrument; or (c) the manual so this information was documented separately for review. As with other study methodologies, though, statistics were used to reduce the amount of missing data in the study. Case deletion and imputation were two methods for addressing missing data during the analysis phase of a study (Worster & Haines, 2004).

Case deletion is commonly used and involves deleting cases with missing observations from the analysis but the challenges of using this method include bias if those cases with missing data differed significantly from cases without missing data and would result in a reduced sample size (Worster & Haines, 2004). In my study case deletion was not used since the research purpose associated with the completion of preventive health care actions would involve the absence of data if an individual had not completed any preventive health care actions. Imputation used to address missing data in large databases (Worster & Haines, 2004) were described as using the average or the mode of all observations in a category to determine a value for missing data within the same category; sampling with replacement and imputation were used in my study to obtain a value for missing information not related to a preventive health care action to prevent a reduction in sample size.

Data Collection and Analysis

As discussed in several earlier sections of this paper, my study abstracted data recorded in hard copy format then transcribed into an electronic format or recorded in an electronic format from EMRs. The age of each client was used to create time intervals according to the USPSTF screening recommendations for breast, cervical, and colorectal cancers; the completion of the screening test--the dependent variable--was recorded as: (a) not completed; (b) completed on time; (c) completed early; or (d) completed late for each time interval associated with a preventive health care action. Information on gender, age, and HIV status was collected for eligibility criteria purposes. In an effort to control for continuity of care variability eligibility criteria restricted inclusion into the study to those EMRs associated with clients who had seen an infectious disease

specialist in a single ambulatory care center at least three times during the 12 months prior to data collection. The independent variables are detailed later in this chapter and included sociodemographic variables and the diagnoses of certain cormorbid conditions.

Data Analysis Software

The statistical analysis software was the Statistical Package for the Social Sciences (SPSS) version 21.0 (International Business Machines [IBM] Corporation, 2012). SPSS was based on the measurement scale classifications of nominal, ordinal, interval, and ratio (Stevens, 1946) but SPSS analyzes continuous variables at the interval level only (IBM, 2012). Stevens' classification system (1946)--also known as Stevens' scale type theory--presents guidelines limiting the use of mathematical and statistical operations based on the properties associated with each measurement scale. Adherence to Stevens' scale classifications has been debated with the majority of arguments focused on: (a) inconsistencies in Stevens' theory (Gaito, 1980); (b) limitations associated with the appropriate use of parametric versus non-parametric statistics by measurement scale when a statistical assumption has not been met (Zumbo & Zimmerman, (1993); and (c) the danger of blind allegiance to the measurement scale classifications when theory should direct research studies and the statistics used to analyze the data (Velleman & Wilkinson, 1993). The study followed the guidelines described by Stevens (1946) since nominal, ordinal, and interval or scale determinations were necessary when the data was entered into the SPSS software. Violations related to the use of statistics by measurement scale and violations associated with the assumptions related to the use of parametric statistics are noted in this paper where appropriate.

Measurement and Classification

To correctly enter the data for each EMR into SPSS each variable was labeled and defined by data type and measurement level. Appendix F lists each variable by the terminology used in the EMR; the SPSS label assigned to the term; numeric codes for each possible sublevel or value related to each independent and dependent variable; values associated with: (a) declined to answer; (b) unknown value as indicated in the EMR; (c) missing value; each variable was identified by the level or measurement for SPSS purposes as nominal, ordinal, or scale.

Independent Variables

Each variable was identified as an independent variable or a dependent variable and the levels of each variable were identified for interpretation of the data related to the research questions.

Embodiment variables. Age calculated from date of birth was a continuous variable but was collapsed into 10-year intervals to create the additional variables of age cohort for analysis (Table 2) and census age group at discrete, ordinal levels for comparison to databases and other research studies.

Table 2

Bivariate Analysis Plan for Embodiment Variables (N=114)[a]

Variable/ Label	Type/ Level	Central Tendency[b]	Inferential Statistics: Parametric[d]	Inferential Statistics: Non-Parametric[e]
		Variability/ Dispersion[c]	Sig (p)[d]	Sig(p)[e]
Age in years/ AGE	Continuous Interval	Mean Standard Deviation	Independent Samples *t* test p<0.05, CI =95%	Mann-Whitney U-test w/Hodges-Lehman estimate p<0.05, CI ~ 95%
Age cohort/ COHORT 40-49=1 50-59=2 60-69=3 70-79=4 80-89=5 90+=6	Categorical Ordinal	Mode Median Range	Independent Samples *t* test p<0.05, CI =95%	Mann-Whitney U-test w/Hodges-Lehman estimate p<0.05, CI ~ 95%

Notes. [a]Data Check: frequencies for each variable = number of EMRs reviewed; [b]Skew (positive/right = mode/median < mean; negative/left = mode/median > mean) of sample; [c]Analysis for assumption of normal distribution (SD = − 1 to 1 = 68%, SD = − 2 to 2 = 95%, SD = − 3 to 3 = 99%); [d]Normal distribution; [e]Not a normal distribution
$\alpha = 0.05$, $\beta = 0.20$, power = 0.80, effect size = 0.80.

Pathways of embodiment variables. Building upon Stevens' (1946) classifications the discrete, nominal variables associated with the pathways of embodiment construct were race, ethnicity, marital status, employment status, and insurance type while education level was measured at the discrete ordinal level (Table 3).

Table 3

Bivariate Analysis Plan for Pathways of Embodiment Variables (N=114)[a]

Variables/ Label	Type/ Level	Central Tendency[b]	Inferential Statistics: Parametric[d]	Inferential Statistics: Non-Parametric[e]
		Variability/ Dispersion[c]	Sig (p)[d]	Sig (p)[e]
Patient's race/ RACE Black=1 White=2 Asian/Pacific Islander=3 AIAN=4 Other=666 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%
Patient ethnicity/ ETHNIC Non-Hispanic=0 Hispanic=1 Declined=777 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%
Marital status/ MARITAL Single/Never Married=0 Married=1 Partnered=2 Separated=3 Divorced=4 Widowed=5 Other=666 Declined=777 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%

(table continues)

(table continues)

Variables/ Label	Type/ Level	Central Tendency[b]	Inferential Statistics: Parametric[d]	Inferential Statistics: Non-Parametric[e]
		Variability/ Dispersion[c]	Sig (p)[d]	Sig (p)[e]
Highest level of educational/ EDLEV <High School=1 High School graduate=2 Some college=3 College graduate=4 Other=666 Declined=777 Unknown=888 Missing=999	Categorical Ordinal	Median Mode Range	Independent Samples *t* test p <.05, CI =95%	Mann-Whitney U-test w/Hodges-Lehman estimate $p < 0.05$, CI ~ 95%
Employment status/ EMPLOY Unemployed= 0 Part Time=1 Full Time=2 Self employed=3 Disabled=4 Retired=5 Active Military=6 Other=666 Declined=777 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%

(table continues)

(table continues)

Variables/ Label	Type/ Level	Central Tendency[b]	Inferential Statistics: Parametric[d]	Inferential Statistics: Non-Parametric[e]
		Variability/ Dispersion[c]	Sig (p)[d]	Sig (p)[e]
Insurance type/ INSURE Medicare=1 SS Disability=2 Medicaid=3 Private Insurance=4 State HMO=5 Charity Care=6 Self-Pay=7 Other=666 Declined=777 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%

Notes. [a]Data Check: frequencies for each variable = number of EMRs reviewed; [b]Skew (positive/right = mode/median < mean; negative/left = mode/median > mean) of sample; [c]Analysis for assumption of normal distribution (SD = −1 to 1 = 68%, SD = −2 to 2 = 95%, SD = −3 to 3 = 99%); [d]Normal distribution; [e]Not a normal distribution
$\alpha = 0.05$, $\beta = 0.20$, power = 0.80, effect size = 0.80

Cumulative interplay variables. Number of years since HIV diagnosis and distance between the residence and ambulatory care center were continuous variables which were collapsed and analyzed at the discrete, ordinal level (Table 4).

Table 4

Bivariate Analysis Plan for Cumulative Interplay Variables (N=114)[a]

Variable/ Label	Type/ Level	Central Tendency[b]	Inferential Statistics: Parametric[d]	Inferential Statistics: Non-Parametric[e]
		Variability/ Dispersion[c]		
Number of years with HIV/ HIVTIME	Continuous Interval	Mean	Independent samples *t* test	Mann-Whitney U-test w/Hodges-Lehmann estimate
		Std Dev	$p < 0.05$, CI = 95%	$p < 0.05$, CI ~ 95%
Distance between residence and health care facility DISTANCE	Continuous Interval	Mean	Independent samples *t* test	Mann-Whitney U-test w/Hodges-Lehmann estimate
		Std Dev	$p < 0.05$, CI = 95%	$p < 0.05$, CI ~ 95%
CD4 cell count lowest LOWCD4, & interval INTCD4	Continuous Interval	Mean	Independent samples *t* test	Mann-Whitney U-test w/Hodgesehmann estimate
		Std Dev	$p < 0.05$, CI = 95%	$p < 0.05$, CI~ 95%

Notes. [a]Data Check: frequencies for each variable = number of eligible EMRs reviewed; [b]Skew (positive/right = mode/median < mean; negative/left = mode/median > mean) of sample; [c]Analysis for assumption of normal distribution (SD = −1 to 1 = 68%, SD = −2 to 2 = 95%, SD = −3 to 3 = 99%); [d]Normal distribution; [e]Not a normal distribution
$\alpha = 0.05$, $\beta = 0.20$, power = 0.80, effect size=0.8

Comorbid conditions—discrete, nominal variables--had dichotomous responses: (a) the absence of a comorbid condition; (b) history of or current diagnosis of a comorbid condition. The comorbid conditions my study were hypertension, obesity, diabetes mellitus, depression, and tobacco use. As a data check within each EMR the diagnosis of obesity by ICD-9-CM code in the EMR was compared to the presence of obesity via BMI calculated from height and weight recorded in the EMR and both measured as discrete, nominal variables (Table 5).

Table 5

Bivariate Analysis Plan for Cumulative Interplay - Comorbid Conditions (N=114)[a]

Variable/ Label	Type/ Level	Central Tendency[b] Variability/ Dispersion[c]	Inferential Statistics: Parametric[d] Sig (p)[d]	Inferential Statistics: Non-Parametric[e] Sig (p)[e]
Hypertension/ HTN Never=0 Hx of or Current=1 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%
Obesity in EMR/ OBSEMR Never=0 Hx of or Current=1 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%

(table continues)

(table continues)

Variable/ Label	Type/ Level	Central Tendency[b] Variability/ Dispersion[c]	Inferential Statistics: Parametric[d] Sig (p)[d]	Inferential Statistics: Non-Parametric[e] Sig (p)[e]
Obese per BMI/ OBSBMI Never=0 Hx of or Current=1 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%
Obese in EMR and BMI/ OBSBOTH Never=0 Hx of or Current=1 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%
Diabetes mellitus diagnosis/ DMDX Never=0 Hx of or Current=1 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%
Depression diagnosis/ DEPDX Never=0 Hx of/Past=1 Current=2 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%

(table continues)

(table continues)

Variable/ Label	Type/ Level	Central Tendency[b] Variability/ Dispersion[c]	Inferential Statistics: Parametric[d] Sig (p)[d]	Inferential Statistics: Non-Parametric[e] Sig (p)[e]
Tobacco use/ TOBUSE Never=0 Hx of or Current=1 Unknown=888 Missing=999	Categorical Nominal	Mode Range	Chi square $p < 0.05$, CI= 95%	Fisher's exact test $p < 0.05$, CI~ 95%

Notes. [a]Data Check: frequencies for each variable = number of EMRs reviewed; [b]Skew (positive/right = mode/median < mean; negative/left = mode/median > mean) of sample; [c]Analysis for assumption of normal distribution (SD = −1 to 1 = 68%, SD = −2 to 2 = 95%, SD = −3 to 3 = 99%); [d]Normal distribution; [e]Not a normal distribution
$\alpha = 0.05$, $\beta = 0.20$, power = 0.80, effect size = 0.80

Dependent Variables

Dependent variables in the study were related to the completion of or failure to complete preventive health care actions: breast cancer screening mammography; cervical cancer screening Pap smear with or without HPV testing; and colorectal cancer screening by FOBT, sigmoidoscopy, or colonoscopy. The values associated with the three preventive health care actions were (a) not completed; (b) completed, on time; (c) completed early; and (d) completed late. If any cell number in the contingency tables created for the data analysis was less than five the categories were collapsed into the dichotomous response categories of not completed or completed without any consideration for the timeliness of the preventive health care action.

Data Analysis Process

Data analysis began by checking the data entry accuracy and completeness. Column totals were calculated using SPSS and compared to the number of entries. Every EMR had a column entry and the number of entries equaled the number of EMRs determined from the sample size calculations. The study checked data abstraction accuracy over the length of the study period by reviewing ten EMRs twice; during the initial days of data abstraction; followed by the second review during the final days of data abstraction. Data from both abstraction times were compared for agreement using percent agreement and kappa statistics.

Frequency distributions, histograms with normal curves, and scatterplots with fit lines were calculated to determine the presence of outliers, skew, and kurtosis to evaluate the normal distribution assumption. If a distribution appeared abnormal skew and kurtosis statistics, and stem-and-leaf plots were generated. All outliers were checked for accuracy of data entry but categorical variables were within the range of values determined *a priori* and listed in Appendix F. No further effort was made to collect missing data because a comparison of the abstracted data to the actual hard copy medical record was beyond the scope of my study and would have negated the use of the EMR as the primary source for data abstraction.

Data entry was also checked through response categories. Obesity was determined by calculating BMI from height and weight measurements in the EMR and by the presence of a corresponding ICD-9-CM code listed in the EMR. A third variable was created to assess agreement between both methods for determining obesity and was used as a data check by coding responses as agreement = 1 and no agreement = 0. The

third variable described as obesity by BMI and in EMR could not have a response indicating agreement if only one of the obesity method variables had a response synonymous with no diagnosis of obesity.

Summarizing the Data

Summary analyses consisted of determining which single number best represented the data or the measure of central tendency and how much variability existed in the data.

Central tendency. Mean, median, and mode were calculated for continuous, interval variables; discrete, ordinal variables were analyzed for median and mode; only mode was calculated for discrete, nominal variables.

Variability. Range, variance, standard deviation, and interquartile range were calculated for continuous or scale variables. Since standard deviation and variance are sensitive to sample size the unbiased option in SPSS was selected. Discrete nominal and ordinal variables were analyzed for the range and distribution of observations associated with each variable and values with less than five observations were collapsed since five is the default cell count in SPSS below which analyses cannot be completed.

Inferential Analyses

The three assumptions associated with the use of parametric statistics were: (a) independent, unbiased sample; (b) normally distributed data; and (c) homogeneity of or equal variance. Independence and bias were addressed through random sampling and the study design. Analyses to evaluate normal distribution and homogeneity of variance were discussed earlier. The study used parametric statistics if the assumptions associated with their use were not violated. In the event one or more of the assumptions were

violated data was transformed in SPSS to comply with the assumptions or nonparametric statistics were used. If a parametric statistic was used when an assumption was violated the reason for using the statistic was provided in the Discussion section.

Research Questions and Hypothesis Testing

The purpose of the study was to determine if the variables associated with the constructs of embodiment, pathways of embodiment, and cumulative interplay--identified and described earlier--differed significantly between HIV seropositive women who completed or failed to complete recommended preventive health care actions for breast cancer, cervical cancer, or colorectal cancer and if the findings from previous studies were applicable to HIV seropositive women who completed or failed to complete those same preventive health care actions with or without a diagnosis of one or more comorbid conditions of hypertension, obesity, diabetes mellitus, depression, or tobacco use when seen by an infectious disease specialist at the same health care facility three or more times during the 12 months prior to data collection.

Analysis Plan

Descriptive statistics. Frequencies and percentages were reported for each variable grouped by completion of preventive health care action and timeliness when cell counts allowed. As described in Appendix F, the completion and timeliness of preventive health care actions were coded in SPSS as: (a) not completed = 0; (b) completed on time = 1; (c) completed early = 2; and (d) completed late = 3. When the three completion groups were analyzed as a single group such as when the number of observations within one of the groups was less than five the codes were completed = 1; not completed = 0.

Comparing group differences. The unpaired or independent-samples *t* test was used to compare continuous independent variables such as age in years in HIV seropositive women who completed or failed to complete the preventive health care screening tests for each of the three cancers of interest. To determine if there is a statistically significant age difference between HIV seropositive women who completed their first mammogram compared to HIV seropositive women who failed to complete their first mammogram the variable age was selected as the test variable in SPSS and the grouping variable for the first breast cancer interval or the first time interval when a mammogram was recommended by the USPSTF was completed or not completed . The window for the first breast cancer interval ranged from 39 years 6 months of age to 40 years 6 months of age. The confidence interval was set at 95%, one-tailed alpha of 0.05, and missing values were imputed on a case-by-case basis. For hypothesis testing the null hypothesis was no difference in the ages of the two groups of HIV seropositive women. SPSS produced two test statistics: Levene's test of equality of variances; *t* test for equality of means. The *F* statistic for the Levene's test was used to determine the assumption of equal variances between the two groups. When the Levene's test statistic for equal variances assumed was significant, the *t* test for equality of means for equal variances not assumed was used. The *t* test interpretation referred to the chance of observing a mean difference if the null hypothesis of no difference was true. The mean difference was the difference in the age by number of years between the two groups (IBM, 2012). If the sample data violated one or more parametric assumptions the Mann-Whitney test was used instead of the independent samples *t* test.

Fisher's exact probability was used instead of chi-square to compare differences between categorical independent variables; Fisher's exact was preferred over chi-square because Fisher's produced an exact *p* value and could be used when the number of observations in one cell was small (IBM, 2012); with either test all observations had to be independent and the degree of freedom was 2 - 1 = 1. In SPSS either test could be calculated in the crosstabulation function which provided observed and expected counts and percentages within each of the four resulting cells. If the null hypothesis to be tested indicated no difference in the diagnosis of hypertension between the two groups of HIV seropositive women related to the completion or failure to complete breast cancer screening Fisher's exact test indicated immediately if there was a significant difference between the two groups. If the percentage of observations was higher in the cell corresponding to HIV seropositive women with a history of breast cancer and HIV seropositive women who completed a mammogram the Fisher's exact test indicated the mean associated with the completion of mammograms for HIV seropositive women who had hypertension was significantly different from the mean associated with the completion of mammograms for HIV seropositive women who did not have hypertension. The chi-square statistic was used with the Yates' continuity correction to make the *p* value associated with the chi square statistic more approximate (IBM, 2012).

Contingency tables. To continue with breast cancer screening and hypertension as an example if 63 HIV seropositive women with hypertension had a mammogram and 24 failed to have a mammogram and 14 HIV seropositive women without hypertension had a mammogram while 13 failed to have a mammogram when the data was entered into a 2x2 table (Table 6) the result was determined as more HIV seropositive women with

hypertension completed a mammogram than HIV seropositive women without hypertension.

Table 6

Completion of Mammograms in HIV Seropositive Women with Hypertension

Mammogram	HTN – Yes (coded as 1)	HTN – No (coded as 0)	Totals
Yes	63 (a)	14 (b)	77
No	24 (c)	13 (d)	37
Totals	87	27	114

The odds ratio (*OR*) associated with a hypertensive HIV seropositive woman completing a mammogram compared to an HIV seropositive woman without hypertension was calculated as follows:

$$OR = (a/b)/(c/d)$$
$$= (63/14)/(24/13) = 4.5/1.85 = 2.43$$

or by using the crossproducts calculation as follows:

$$OR = (a \times d)/(b \times c)$$
$$= (63 \times 13)/(14 \times 24) = 819/336 = 2.43$$

HIV seropositive women with hypertension were 2.43 times more likely to complete a mammogram compared to HIV seropositive women without hypertension. To test for the significance of the *OR* calculated in the example above Fishers exact ratio test was conducted for a 2 x 2 table as follows:

$$p = \frac{(a + b)!\,(c + d)!\,(b + d)!}{n!a!b!c!d!}$$

where

p is the Fisher's Exact Probability

"a", "b", "c", "d" represent individual cell counts

"n" represents the total of the cell counts

Continuing with the example the Fisher's exact probability (*p*) was calculated as:

$$p = \frac{(63 + 14)!\,(24 + 13)!\,(14 + 13)!}{114!\;63!14!24!13!}$$

$$= 1.96/1.23 = 1.59$$

To interpret Fisher's exact probability a value greater than 1 indicated an event was more likely to occur and a value less than 1 indicated an event was less likely to occur. Interpretation of the Fisher's exact probability calculated in the example (*p* = 1.59) indicated HIV seropositive women with hypertension were more likely to have a mammogram compared to HIV seropositive women without hypertension. When the data no longer created a 2 x 2 table, chi-square was used instead of the Fisher's exact ratio test.

Analysis of variance (ANOVA). If the number of observations in each cell was 10 or more four groups related to the timeliness of completed preventive health care actions were used for analysis of variance (ANOVA): (a) failed to complete = 0; (b) completed on time = 1; (c) completed early = 2; and (d) completed late = 4. The grouping variable that formed the four groups based on the completion and timeliness of preventive health care actions was known as the degree variable or factor (IBM, 2012). The assumptions associated with ANOVA were independent random samples from a normally distributed population with equal variances and the statistical test examined the variability between groups as well as within groups (IBM, 2012). The null hypothesis

tested was no difference in the estimated variability between or within each group. Degree of freedom was 4 – 1 = 3 and the null hypothesis was rejected if the observed significance level was less than 0.05. The between-groups estimate of variance would only be true if the null hypothesis was true and if the between-groups estimate of variance was large the null hypothesis was usually not supported (IBM, 2012). The ANOVA table generated by SPSS displayed the sum of squares and mean square for between-groups variance and the sum of squares and mean square for within-groups variance as well as the total for the sum of squares. The *F* statistic was the ratio of the between-groups mean square to the within-groups mean square and was approximately 1 when the null hypothesis was supported. If an assumption violation was noted the Kruskal-Wallis statistic was used (IBM, 2012). In addition to the analyses conducted on individual variables logistic regression was conducted for all variables significant at $p <$ 0.20 in univariate analyses and elimination based on the Hierarchial Principle (Kleinbaum & Klein, 2002) was conducted until a parsimonious model was identified which described the variables associated with the completion or failure to complete preventive health care screening tests for each of the three cancers in HIV seropositive women. A more thorough discussion of how logistic regression was used to answer the research questions is presented in the following sections.

Regression M**odeling**

Logistic regression was chosen as the mathematical modeling approach for several reasons: a) the dependent variable could be dichotomous; completed or not completed; b) a large number of independent variables could be used for logistic regression modeling especially using SPSS; c) the logistic function *f(z)* ranged from 0 to

1 and described the probability of completing or not completing the preventive health care action; and d) the logistic model created an S-shaped logistic model with a threshold which was applicable to the multivariate nature of epidemiologic research (Kleinbaum & Klein, 2002). Regression results in SPSS were presented in tables that used the same symbols common in logistic regression modeling where the dependent variable is termed the constant or intercept (α) and the term coefficient refers to the independent variable. The letter B in the SPSS coefficients table or the slope (β) represents an imaginary line drawn through each value of the dependent variable while the constant represents where a value of the independent variable intersects the slope of the line representing the dependent variable.

Dummy variables and recoding. Dummy or binary variables were used to examine group differences on a variable. Categorical, nominal variables were recoded into binary variables indicating the presence (= 1) or absence (= 0) of a characteristic, comorbid condition, or screening test. The coefficient normally represents the change in the value of Y for every one-unit change in X but this interpretation can not be applied when dummy variables are used in the regression calculation because there is no change; there is only the presence or absence of a value or characteristic. Instead the value of the constant indicates the expected value of Y when X is zero. Ordinal variables were coded to reflect an increasing value such as age cohort or a more preferred value such as education level; ordinal variables could also be recoded to add a zero value where appropriate. Based on the literature review education level could be coded as the presence of a education beyond high school (= 1) versus the absence of education

beyond high school (= 0) the latter of which would also include women with less than a high school education.

In my study sociodemographic variables identified in the literature review associated with women who were more likely to complete the preventive health action for breast cancer specifically a mammogram tended to be: younger; White; Non-Hispanic; married; educated at a level higher than a high school graduate; employed; and have private insurance. To answer the research questions concerned with which embodiment and pathway of embodiment variables were associated with the completion of recommended preventive health actions for breast cancer each of these variables were recoded (Table 7).

Table 7

Recoding of Embodiment Variables for Regression Modeling

Old SPSS Label	New SPSS Label	Recoded Values for SPSS
COHORT	DUMCOHORT	0 = Less than 40 years 1 = 40-49 years 2 = 50-59 years 3 = 60-69 years 4 = 70-79 years 5 = 80-89 years 6 = 90 years or older
RACE	DUMRACE	0 = Non-White 1 = White
ETHNICITY	DUMETH	0 = Non-Hispanic 1 = Hispanic
MARITAL	DUMMARI	0 = Non-/Never Married 1 = Married
EDLEV	DUMEDLEV	0 = < High School 1 = ≥ High School
EMPLOY	DUMEMPLOY	0 = Not Employed 1 = Employed and Active Military
INSURE	DUMINSURE	0 = Non-Private 1 = Private

Recoding dependent variables. Binary coding was already applied to the completion of the first mammogram where completed = 1 and not completed = 0. Using SPSS the values in the missing and unknown groups could have been classified as missing without further attempts to find the data and not used in ANOVA or logistic regression calculations. Since the study was also interested socioeconomic and clinical variables associated with the timing of completed preventive health care actions the first mammogram could have been recoded to incorporate both the completion of the first mammogram as well as the timing--on time, early, or late--according to the USPSTF recommendations. The initial coding associated with variable concerned with the timing of the first mammogram variable was: not completed = 0; complete on time = 1; completed early = 2; and completed late = 3. The variable was recoded so the values increased in relation to the ideal response: not completed = 0; completed late = 1; completed early = 2; and completed on time = 3.

Regression Analysis

When each of the dummy independent variables was regressed on the dependent variable SPSS created a coefficients table. A positive coefficient indicated a positive slope while the inverse was true for a negative coefficient. If the B coefficient had a negative value when the dummy variable for timing of the first mammogram was regressed on race this finding would indicate White HIV seropositive women differed from non-White HIV seropositive women on the timing of their first mammogram completion.

Significance and parsimony in regression modeling. When an independent variable was determined to be statistically significant I referred back to the literature review to guide the determination of which variables were clinically significant and should be used to develop the models to explain the differences observed in the dependent variables. Referring back to the original example where race, education level, and insurance were associated with the completion of breast cancer screening if these three independent variables were found to be statistically significant they could have been entered into the regression model. SPSS was allowed to determine if all three variables were needed to explain the difference in the completion of breast cancer screening or if two variables provided a similar or better explanation. A more parsimonious model can save time and expense related to future data collection especially for clinical or program evaluation purposes.

Regression models for answering research questions. The first set of research questions asked which variables related to the constructs of embodiment, pathway of embodiment, and cumulative interplay in HIV seropositive women aged 40 years and older were associated with the completion or failure to complete the recommended preventive health care action for breast cancer. Regression modeling was used to answer the research questions and develop a model to determine whether the timing of screening completion for breast cancer screening was related to these variables.

To create a model to explain the variables associated with the completion of the recommended preventive health care action for breast cancer in HIV seropositive women all statistically significant categorical variables including recoded dummy variables and continuous variables were used to create a regression model to answer

each research question. For example if the categorical variable DUMRACE and the continuous variable of years since HIV diagnosis were the only variables found to be statistically significant in SPSS the regression model explaining differences in the timing of the completion of the first mammogram for breast cancer screening purposes would be:

where

Y = Timing of the completion of first mammogram
- 0 = Not Done
- 1 = Completed, On-Time
- 2 = Completed, Early
- 3 = Completed, On Time

X_1 = Years since HIV diagnosis, or HIV Time

X_2 = DUMRACE
- 0 = Non-White
- 1 = White

and

$$\hat{y} = a + b_1 x_1 + b_2 x_2$$

Hierarchial regression. Alternatively the order of variable entry into the multivariate regression model could be based on the literature review. While race might be a possible confounding variable the review of the literature indicated race was significantly related to failure to complete preventive health care actions: 1 in every 32 Black women were HIV seropositive; breast cancer was the second most common cause of death in all races after adjusting for age but Black women were typically diagnosed at a later stage with invasive breast cancers; and non-White women were less likely to complete cancer screening tests.

Ethnicity could be the second variable entered in the regression model. One in every 106 Hispanic women had HIV the second highest incidence rate in U.S. female populations; breast cancer was the primary cause of cancer death in Hispanic women; colorectal cancer was the second leading cause of cancer death in Hispanic women; HPV-related cervical cancer was more common in Hispanic women; and fewer Hispanic women were screened for any type of cancer.

No insurance was cited in several studies as a significant predictor of not completing cancer screening after adjusting for: (a) race; (b) age; (c) education level; (d) geographic region; (e) years of US residence; (f) and income. Having insurance was associated with higher rates of cancer screening test completion in women. Number of years since HIV diagnosis would be entered next into the model as more frequent contact with health care providers and a primary source of health care required for the management of HIV infection was associated with higher screening completion in women. However many HIV seropositive women require less intensive HIV management after their childbearing years or as they accommodate to their HIV disease so the number of contacts tend to decline over time resulting in less completion of preventive health care actions. Education level would be entered next into the model since education levels less than high school and high school graduation were significant predictors of lower screening completion in some studies.

Marital status specifically: being single; not partnered; separated; divorced; or widowed were associated with lower screening completion in women. Being unemployed was also associated with lower screening completion in women. Failure to complete an initial cervical cancer screening test related to either age or onset of sexual

activity was positively associated with lower screening completion because cervical cancer screening typically begins at a younger age than breast and cervical cancer screenings and may indicate an individual's willingness to comply with preventive health screening recommendations.

The comorbid condition of obesity defined as a BMI of 30 or greater was associated with lower cancer screening completion in women. Current tobacco use and a history of tobacco use were both associated with lower screening rates in women. Diabetes mellitus and hypertension both require more frequent contact with health care providers and usually result in a primary source of health care for long-term management of both comorbid conditions. However while a diagnosis of diabetes mellitus was associated with higher screening completion rates in women, hypertension was more often undiagnosed and tended to result in fewer visits with a health care provider. Most studies in the literature review considered depression as a confounding variable.

The initial breast cancer screening test though possibly occurring later in the lifespan when compared to the initial cervical cancer screening test was associated with higher screening completion rates possibly due to the availability of many free or low cost mammography programs in the inner city. The initial colorectal cancer screening test would be entered next into the regression model because the completion of one type of cancer screening test was found to improve the completion rates for other types of cancer screening. However the completion of colorectal cancer screening was not as predictive as breast cancer screening or cervical cancer screening because the preparation for sigmoidoscopy and colonoscopy screening methods was described in the

literature as intensive and uncomfortable and the preparation solution was often too expensive for low income women or women without health insurance.

Regression models for interaction. Kleinbaum and Klein (2002) recommend a three-stage procedure using hierarchical modeling: variable specification; followed by the interaction assessment; a confounding and precision assessment. The initial model was created using all lower order variables. For the research questions associated with the diagnosis of one or more comorbid conditions of hypertension (V_1), diabetes (V_2), obesity (V_3), depression (V_4), and tobacco use (V_5) reducing the likelihood a women with HIV infection would complete preventive health care action for breast cancer the dichotomous variable would become completed or not completed (E) for breast cancer screening and the initial model would be:

$$EV_1V_2V_3V_4V_5$$

There were two levels for each of the comorbid diagnoses: a) has the diagnosis; i; b) no diagnosis, j. All levels of each component would be included so the complete initial model would be:

$$EV_{1i}V_{1j}V_{2i}V_{2j}V_{3i}V_{3j}V_{4i}V_{4j}V_{5i}V_{5j}$$

The second stage of the procedure was hierarchical backward elimination and involved statistical testing to identify interaction terms with the goal being a reduction in the number of redundant components in the model. This procedure did not test for confounding which was addressed later. If a higher level component was found to be insignificant the lower level component was likely be dropped from the model. However the hierarchy principle requires all lower level components of a statistically significant higher level component remain in the model (Kleinbaum & Klein, 2002). In the analysis

$EV_{1i}V_{1j}$ would be analyzed before EV_1 and nonsignificant components of the model would be eliminated. For instance if hypertension obesity and depression were found to be statistically significant for not completing the recommended preventive health care action for breast cancer the model would be comprised of the following components:

$$EV_{1i}V_{1j}, EV_{2i}V_{2j}, EV_{4i}V_{4j}$$

Once the revised model containing statistically significant components was identified Kleinbaum and Klein (2002) recommended a single chunk test on the components with a null hypothesis as follows:

$$EV_1V_{2,}\, EV_1V_{4,}\, EV_2V_4$$

$$H_0: \sigma_1 = \sigma_2 = \sigma_4 = 0$$

Kleinbaum and Klein (2002) recommended using a likelihood ratio test involving a chi-square statistic with three degrees of freedom to compare the complete model to the revised model. If the chunk test was not significant all the terms were eliminated. However, if the chunk test was statistically significant some, but not necessarily all of the components would be retained in the model.

Backward elimination was conducted one component (EV_1, EV_2, EV_4) at a time to determine which components should remain in the final model and the researcher can decide to conduct the backward elimination procedure without conducting the chunk test. The least significant component was the first component to be considered for elimination from the model using the likelihood ratio chi-square test with one degree of freedom which compared the complete model to the model with the least significant component removed. To continue with the previous example if the component for depression was found to be the least significant then component EV_4 would first be

eliminated and the likelihood ratio would compare the complete model to the reduced model without EV_4:

Complete model: EV_1V_2, EV_1, EV_2, EV_4, V_1, V_2, V_4, V_1V_2, V_1V_4

Reduced model: EV_1V_2, EV_1, EV_2, V_1, V_2, V_4, V_1V_2, V_1V_4

If this backward elimination procedure found the component (EV_4) to be statistically nonsignificant all levels of the component would be removed from the model. However if the component was significant all levels of the component would be retained in the final model. All remaining components were subsequently tested using the likelihood ratio chi-square test with one degree of freedom eliminating components in the order of least to most significant by comparing the complete model to the reduced model without the component being tested.

Analyses to Identify Confounding

Bivariate analysis could be used to identify confounding using the Cochran-Mantel-Haenszel method. If 65 out of every 400 Black women living in Newark, New Jersey failed to complete initial breast cancer screening tests (0.1625) while 45 out of every 600 women of all other races combined failed to complete initial breast cancer screening tests the estimated relative risk (RR) for failing to complete initial breast cancer screening tests in Black women compared to all other races would be RR = 0.1625/0.075 = 2.167 suggesting Black women in the Newark, New Jersey area were 2.17 times less likely to complete initial breast cancer screening tests compared to women of all other races living in Newark, New Jersey. In this example where the crude *RR* = 1.79 the Cochran-Mantel-Haenszel method could be used to calculate an adjusted *RR* of 1.43. A change of 10% or more in the estimated measure of association would

suggest confounding was present so (1.79 – 1.43)/1.43 = 25%. Since 25% is greater than 10%, confounding by race would exist. Similar calculations could be conducted to identify confounding among different combinations of embodiment variables, pathways of embodiment variables, and cumulative interplay variables including comorbid conditions found to be significant in bivariate testing. Confounding variables would not be entered into the initial model. Entry into the regression model would be based on highest to lowest prevalence--crude *RR*--for each independent variable associated with HIV seropositive women who had three or more visits within the 12 months prior to data collection with an infectious disease specialist in the ambulatory care center in Newark, New Jersey.

Regression models for confounding. Kleinbaum and Klein (2002) identified those components without an exposure term (*E*) in the reduced model as confounders; that interaction occurred in those components involving exposure. For my study if the example using breast cancer screening was continued, the confounders would be:

$$V_1, V_2, V_4, V_1V_2, V_1V_4$$

There is a lack of interaction components (EV_1, EV_2) including the one interaction component omitted because testing found depression (EV_4) to be statistically nonsignificant. Kleinbaum and Klein (2002) indicated confounding can be easily assessed and confounding is determined before precision. The formula for assessing confounding in the absence of interaction terms for the complete model would be:

$$\text{Logit P(X)} = \alpha + \beta E + \gamma_1 V_1 + \gamma_2 V_2 + \gamma_3 V_3 + \gamma_4 V_4 + \gamma_5 V_5$$

An estimated odds ratio would be calculated and because there were no interaction terms could be interpreted as an adjusted estimate controlling for

confounding related to the comorbid conditions. This estimated odds ratio is known as the gold standard estimate and this gold standard is the estimated odds ratio to which all other estimated odds ratios calculated from the 15 subsets of variables included in the complete model would be compared. Once estimated odds ratios or point estimates are identified as being the same or similar to the gold standard a determination of precision using the confidence interval for each estimated odds ratio is made. The narrower the confidence interval the more precise the point estimate or estimated odds ratio. Kleinbaum and Klein (2002) noted when deciding whether to use the gold standard estimate which controls confounding for all variables in the model and is considered scientifically better versus a subset of the complete model a subset with the same estimated odds ratio as the gold standard but with better precision or a narrower confidence interval should be used to control for confounding. Automatically using the gold standard estimate without examining all subsets first could reduce validity; controlling for all variation without determining whether the variation is related to confounding could reduce validity.

Assessing confounding in the presence of interaction can be done but is significantly more difficult (Kleinbaum & Klein, 2002). A complete model is created including the exposure variables (E) and all potential confounders (V_i and V_iV_j) but only the components found to be statistically significant interaction terms. For example if hypertension, obesity, and depression were found to be statistically significant interaction variables, the model would include: E_1 to E_5, V_1 to V_5; ten combinations of V_iV_j, EV_1 to EV_5; ten combinations of EV_iV_j this complete model would be the gold standard model for comparisons of subset models in the presence of interaction. The

assessment of confounding in subsets was conducted using the likelihood ratio described earlier and comparing estimated odds ratios against the estimated odds ratio of the gold standard model. However Kleinbaum and Klein (2002) stipulate beginning with lower order components including V_i and V_iV_j,; if these are found to be statistically significant all related higher level components must be retained in the revised model due to the hierarchical principle. The retention or elimination of confounders in the model is subjective even when based on estimated odds ratios and the precision of the confidence interval; I retained all potential confounders even at a loss of precision; all steps and decisions were discussed to aid replication and generalizability.

Analyses Related to Data Collection

Inter-rater reliability. One individual abstracted data reliability associated with data collection; inter-related reliability was assessed through comparison of the data abstracted during the two time periods—early and late; Kappa statistics and percent agreement were calculated.

Missing data. The percentage of missing data for each level of each variable was determined and reported along with any method used to correct for missing data, such as imputation and omission.

Protection of Human Participants

The study protocol including the data collection instrument and the data collection manual was be submitted to the IRB of Walden University; proof of the IRB approval (04-13-15-0050052) was forwarded to the infectious disease specialist. According to the University Hospital guidelines for studies involving the audit or collection of information from a client's medical records individual consent forms were

not necessary as long as prescribed steps were taken to prevent the disclosure of any information that could result in the information being linked back to a specific client. Written approval from the Walden University IRB and the infectious disease specialist served as consent to access to EMRs associated with clients of the ambulatory care center. While my study did not involve direct contact with human participants sensitive health-related information was accessed. To maintain the confidential nature of the medical records a non-linked, random participant identification (PID) number was assigned using a two-stage method (Appendices B, C) to each record; all pages of the data collection instrument featured this random number and not the participant's name, date of birth, or medical records number; this identifying information was recorded in a codebook which linked the identifying information to the random PID in case data verification was needed. The codebook remained in a locked cabinet in the limited access office of the infectious disease specialist in the ambulatory care center.

During the study data extracted from the EMRs was entered into the fields of the electronic data abstraction modules with the exception of the PID Linking Page that was not in electronic format as discussed in the Methods section. The electronic data abstraction modules were located on a password-protected, single user laptop computer during the data collection period, and after the data was entered into the SPSS software program the data abstraction modules were stored on a password-protected, encrypted external hard drive (Seagate Maxtor Black Armor, Model 9HA2AH-500) and erased through serial deletion on the internal hard drive of the laptop computer. Completed hard copies of the PID linking page were not considered part of the data abstraction instrument; were not removed from the infectious disease clinic; hard copy versions

were converted to electronic versions and stored on a compact disk in a locked desk in a limited access office within the infectious disease clinic; electronic versions of the completed data abstraction instruments on the encrypted external hard drive will be stored for a 7 years after study closure prior to destruction.

The code book was stored with the compact disk containing the PID linking pages but not with the encrypted external hard drive used to store the completed electronic versions of the data abstraction instrument, with the medical record numbers, or with billing information to prevent the accidental discovery of client information by individuals not associated with my study.

If required reports will be completed in a timely manner and submitted to the Walden University IRB according to IRB requirements for the approved study (Walden University IRB 04-13-15-0050052). In the event of an actual breach of confidentiality the Walden University IRB would have been notified within 24 hours of the event; if the breach required a change in the study protocol data collection would have been delayed until the Walden University approved study protocol changes. At the completion of my study all data collected during the study was stored as described earlier and archived according to Walden University IRB requirements with an automatic destruction date of 7 years from the date of study completion.

Dissemination of Findings

The results of the study will be disseminated through publication and presentation if the submitted manuscripts and poster abstracts are accepted by editorial boards and review committees respectively. A copy of the study findings will be

forwarded to the infectious disease clinic for application as needed, as well as to the ProQuest Dissertation database.

Summary

The cross sectional, descriptive study used observational methodology specifically data abstraction from EMRs to determine which variables associated with the concepts of embodiment, pathways of embodiment, and cumulative interplay from the ecosocial theory were significantly related to the completion of preventive health care screening tests for breast cancer, cervical cancer, and colorectal cancer in HIV seropositive women who received health care in an ambulatory care center in Newark, New Jersey. The identification of variables associated with the completion of preventive health care actions can be applied to programs aimed at maintaining or improving the health of HIV seropositive women through the improvement of screening test completion rates. Preventing disease conditions from existing or progressing in a manner which adversely affects the health and functioning of HIV seropositive women could require social change beyond the individual and facility levels but the expenditure in resources could be cost-effective over time. Since many of these HIV seropositive women were mothers, daughters, and significant others taking measures to ensure their continued health could result in healthier families and extend to all levels of society. The following chapter begins with a review of the research questions including research and null hypotheses and continues into the analysis of the data and presentation of the findings.

Chapter 4: Results

Introduction

The purpose of the cross sectional study was to describe, compare, and determine which variables differed significantly between HIV seropositive women who completed recommended preventive health care actions for breast cancer, cervical cancer, or colorectal cancer and HIV seropositive women who failed to complete those same preventive health care actions with or without a diagnosis of one or more comorbid conditions when seen by an infectious disease specialist at an ambulatory care center in Newark, New Jersey three or more times during the 12 months prior to data collection.

Research Questions and Hypotheses

Listing research questions and hypotheses by the preventive health care screening actions for breast cancer, cervical cancer, or colorectal cancer was done intentionally to acknowledge the limitations on data analysis related to low cell counts; the research questions and hypotheses are listed below in an abbreviated manner.

The null hypotheses for all research questions was no difference between HIV seropositive women grouped by the timeliness and completion of preventive health care actions. When seen by an infectious disease specialist at the same ambulatory care center three or more times during the twelve months prior to data collection, did the completion of screening tests for breast cancer, cervical cancer or colorectal cancer by HIV seropositive women differ significantly: (a) RQ1 – by age cohort; H_1 – did younger women complete more screenings than older women; (b) RQ2 – by race; H_2 – did White women complete more screenings than Black women; (c) RQ3 – by ethnicity; H_3 - did non-Hispanic women complete more screenings than Hispanic women; (d) RQ4 – by

marital status; H_4 – did married women complete more screenings than other marital status categories; (e) RQ5 – by education level; H_5 – did college graduates complete more screenings than women in other education categories; (f) RQ6 – by employment status; H_6 – did employed women complete more screenings than other employment categories; (g) RQ7 – by type of insurance; H_7 – did privately insured women complete more screenings than other insurance categories; (h) RQ8 – by length of time with HIV infection; H_8 – did women living with HIV infection for shorter lengths of time complete more screenings; (i) RQ9 – by HIV stage; H_9 – did women with HIV infection classified as non-AIDS complete more screenings; (j) RQ10 – by CD4 cell count; H_{10} – did women with CD4 cell counts of 500 cells/mm^3 or more complete more screenings; (k) RQ11 – by distance between residence and health care facility; H_{11} – did women who lived a shorter distance from the health care facility complete more screenings; (l) RQ12 – by diagnosis of hypertension; H_{12} – did women without hypertension complete more screenings; (m) RQ13 - by diagnosis of obesity; H_{13} – did non-obese-underweight, normal weight, and overweight--women complete more screenings than obese women; (n) RQ14 - by diagnosis of diabetes mellitus; H_{14} – did women without diabetes mellitus complete more screenings; (o) RQ15 – by diagnosis of depression; H_{15} – did women without depression complete more screenings; (p) RQ16 by tobacco use; H_{16} – did women who used tobacco complete fewer screenings.

As a result of high levels of missing data related to the variables of education level and employment status research questions five and six were not analyzed and will not be included in further discussions on hypothesis testing. Chapter 4 will continue with a description of the data collection process including: (a) discrepancies in the data

collection plan from the proposal; (b) description of the sample with comparisons to other populations of women particularly HIV seropositive women; (c) results of the data analysis; and (d) summary of the chapter information.

Data Collection

Recruitment and Eligibility

The target population was HIV seropositive women aged 40 years and older who were seen by an infectious disease specialist in an infectious disease clinic, in an urban area three or more times during the 12 months prior to data collection. Recruitment of participants and obtaining of consents from participants was not applicable to the study since data was abstracted from EMRs.

Eligibility for breast, cervical, and colorectal cancer was determined using the USPSTF recommendations. For timeliness related to the completion of preventive health care actions, the lowest cell count for the four levels of timeliness related to breast cancer screening was five; the late category for cervical cancer screening only had four cases; only six colorectal screenings were completed; as a result, cervical and colorectal cancer were only analyzed using two categories for not completed and completed; only breast cancer screening was analyzed for timeliness using four categories. Completion of preventive health care actions for breast cancer, cervical cancer, and colorectal cancer was 30.3%, 27.5%, and less than 1% respectively.

Time Frame

The data set for the study was compiled between October 2010 and November 2010, and updated in October 2014 at the time the data abstraction instrument, the data abstraction manual, and the sampling frame were developed. The data abstraction

instrument was created directly from the screens of the EMR and incorporated the same response categories and continuous measures recorded by clinicians and hospital staff responsible for transcribing information from the hard copy medical record into the EMR. The data abstraction instrument was reviewed by an infectious disease specialist for completeness and logical flow according to the EMR. Data was abstracted from 10 EMRs at two different times during the data collection period to assess intra-rater reliability. Abstraction of data from the data set occurred in April 2015 after study approval by the Walden University IRB. All EMRs in the data set including those designated as replacements for ineligible EMRs were used in the study for a total of 142 EMRs.

Omitted and Deceased Cases

One client on the original sampling frame was incarcerated before data collection so the related EMR was not included in the study since the IRB application did not approve the study for use with prisoners; one case had significant outliers for age (65 years), HIV time (26 years), and BMI (39.0); one case had a significant outlier for lowest CD4 cell count (1,206); one case had a significant outlier for distance (28.8 miles) after correcting for inaccurate distance data. These cases were not omitted from the analysis because: the distribution for age could only be improved through transformation and not corrected; the abnormal distribution of BMI was not significant. Twenty-three cases (16%) included in the sampling frame were deceased by the time of data collection but each case had three or more appointments during the year prior to their deaths so an independent samples *t* test was conducted to compare the deceased women to women still alive at the time of data collection. There were no statistically

significant differences between the group means and variances for categorized age (F = 2.72, p = 0.101; t = 0.20, p = − 0.147), distance without outliers (η^2 0.18, p = 0.671; t = − 0.40, p = 0.691), race (F = 1.85, p = 0.176; t = −0. 70, p = 0.481), categorized distance (F = 0.015, p = 0.904; t = −0. 447, p = 0.656), length of time with HIV infection (F = 0.108, p = 0.743; t = −1.246, p = 0.215), and HIV stage (F = 3.35, p = 0.069; t = 0.591, p = 0.556). The variables with statistically significant variances but not means between deceased groups were ethnicity (F = 3.957, p < 0.05; t = − 1.035, p < 0.05), marital status (F = 9.289, p < 0.05; t = − 1.856, p = 0.074), and type of insurance (F = 7.016, p < 0.05; t = 1.905, p = 0.067); the continuous variable age had a significant mean difference between the two groups (t = −3.02, p = 0.003) but the variances were not significantly different (F = 3.60, p = 0.060). A decision was made to leave the 23 deceased cases in the study but to add a category labeled deceased so these cases could be identified.

Missing Data

Case deletion and imputation were mentioned earlier as being two methods for addressing missing data during the analysis phase of a study (Worster & Haines, 2004). I used imputation; while no cases were deleted, two variables were not analyzed due to missing data. Six cases (4%) were missing the number of years with HIV so the mean number of years with HIV infection for the sample (M = 10.11) was rounded to 10 and substituted for the missing values. Three cases (2%) had missing marital status entries; the mode for marital status was 0 or single.; three cases had full time employment; three cases had part time employment; five cases were unemployed; the remaining 129 EMRs (91%) were missing entries for employment status. One case had an unknown education

level; one case had graduated from college; the remaining 140 EMRs (99%) were missing entries for education level; as a result the variables of education level and employment status could not be analyzed.

Two cases (1%) were missing entries for the lowest CD4 cell count. The mean lowest CD4 cell count recorded as a whole number,(M = 155.19) was rounded to 155 and substituted for the missing values. Eight cases (6%) were missing height entries so the mean height for each age cohort associated with each case was calculated and substituted for the missing values. One case (<1%) was missing an entry for weight. The height associated with the case was 66 inches so the mean weight for all women in the sample with a height of 66 inches was calculated (M = 178) and substituted for the missing value.

Data Coding

The original coding schema required changes including the addition of variables created by recoding. While the SPSS code book (Appendix F) for my study was updated to reflect the original and additional variables and their coding only changes to the original coding schema are discussed here. Age cohort had less than 5 cases in 3 of 6 categories (70 to 79 years = 2, 80 to 89 = 0 and 90+ = 0) so age cohort was not used for analysis. The continuous variable of age was collapsed into a discrete, ordinal variable labeled age2 divided by the age cohort category nearest the mean (M = 53.3) for the discrete variable of age (40-49 = 1, 50-79 = 2) to replace age cohort and maintain comparison categories. Another discrete, ordinal variable labeled age3 divided the continuous variable of age at the mean (M = 53.3) and was used for analyses.

For the discrete, nominal variable of race two cases were listed as Italian and coded as other; these cases were recoded as White, non-Hispanic. Three of the nine cells for HIV Stage had case numbers less than 5 and were recoded into three additional discrete variables labeled Stage2, Stage3, and A_nonA. HIV stage was divided by CD4 cell counts (less than 200 = 1, 200 to 499 = 2, and 500 or more = 3) to create the discrete, ordinal variables of Stage2; (b) divided by symptomatology (asymptomatic = 1, symptomatic = 2, and AIDS-defining condition = 3) to create the discrete, ordinal variable of Stage3; (c) divided by HIV stage classifications (A1/A2/B1/B2 = 0, and A3/B3/A1/A2/A3 = 1) to create the discrete, nominal variable of AIDS versus no AIDS or A_nonA. The continuous variable of BMI was recoded into the discrete, ordinal variable of BMI2 based on the BMI classification schema of the NHLI: underweight is 14.9 to 18.4 = 1; normal weight is 18.5 to 24.9 = 2; overweight is 25.0 to 29.9 = 3; and obese is 30+ = 4; USDHHS, 2010).

Outliers

Histograms overlaid with normal curves indicated several variables might not have normal distributions: age; distance; HIV time; lowest CD4 cell count; and BMI so the presence of outliers was examined. Analysis using Mahalanobis distances (${}^{crit}\chi^2$ = 20.515, $df = 5$, $p = 0.001$,) identified three outliers for age; two outliers for HIV time; two outliers for distance; and two outliers for BMI (Meyers, Gamst, & Guarino, 2013; Table 8). After checking for data entry errors the variables of age, HIV time, lowest CD4 cell count, and BMI were analyzed for skew and kurtosis, which is discussed later.

Table 8

Outliers for Cases with Significant Mahalanobis Distances (N=142)

	Mah[a]. Distance	Age	Distance	HIV Time	CD4 Cell Count	BMI[b]
Case 1	57.08	61	127.8	14	81	24.3
Case 2	42.22	60	4.8	19	1,206	26.3
Case 3	27.19	66	89.4	9	29	32.6
Case 4	25.42	52	3.3	26	204	39.0
Case 5	21.97	45	0.4	10	917	22.9

Note. [a]Mah. Distance = Mahalanobis distance; [b]BMI – body mass index; chi-square statistic = 20.515, $df = 5$, $p = 0.001$

Data Collection Discrepancies

Upon further examination of the outliers associated with the variable of distance, the data source identified eight inaccurate residential addresses; four on the coast of New Jersey, approximately 56, 73, 89 and 128 miles from the health care facility; the other four addresses were rehabilitation centers. The health care provider knew the eight clients stayed primarily with relatives in the Newark, New Jersey area due to their impaired health statuses. Rather than omit the data associated with each case, the sample mean for distance ($M = 8.0$ miles) was substituted for the four outlying values, as well as the four inaccurate addresses, a new variable was created containing the altered distance values (DISTA); the values in the discrete, ordinal distance variable were corrected.

As noted earlier, age cohort was not used in the analysis because two categories (80-89 and 90+) contained no cases, and one category (70-79) contained only two cases. Deceased cases were included if the EMR reflected three visits during the year prior to

their death, which differs from the three visits in the twelve months prior to data collection; as mentioned earlier, education level and employment status could not be analyzed because more than 90% of the data was missing. The data set did not list a CD4 cell count for each interval, and an attempt to match the date of the CD4 cell counts in the data set to the screening intervals revealed more than 50% of the intervals lacked CD4 cell counts. Similarly, the lack of CD4 cell count results, in proportion to the number of screening intervals completed or due according to USPSTF recommendations prevent an updated HIV stage to be determined for each screening interval. Mileage, to the tenth of a mile, between residence and health care facility had already been calculated for the data set to avoid a possible confidentiality breach resulting from the release of a part of the residential address. Though outliers were identified and corrected, as described earlier, there is no reason to suspect the mileage values were calculated differently than planned. Finally, instead of using BMI tables, each BMI was calculated using the online BMI calculator from the same source (USDHHS, 2015).

Timeliness related to the completion of preventive health care actions (0 = not completed, 1 = completed on time, 2 = completed early, 4 = completed late), and the results of the completed screening tests were originally two separate variables for each screening interval, but case numbers in one or more cells prohibited the analysis of completion timeliness for cervical cancer screening, and colorectal cancer screening, while breast cancer screening was analyzed in relation to completion timeliness. Due to low completion rates, and multiple outcomes related to the results of the screening tests, analysis of the results variable could not be conducted. The study protocol indicated the USPSTF recommendations relevant to each EMR would be used to determine

completion and timeliness, but several intervals had more than one completed test. Since additional tests within an interval could be follow up tests, and not screening tests, only information from the first test in the interval was abstracted for timeliness and results.

Sample and Generalizability

As mentioned in Chapter 1, over one-third of New Jersey's HIV cases, and one third of the state's AIDS cases, lived in Newark, New Jersey (NJDOH, 2013). Over 60% of the HIV seropositive females in New Jersey were non-Hispanic Black and over 40% were aged 40 to 49 years. In addition, 64% of HIV seropositive females in New Jersey, aged 50 years of age or older, were non-Hispanic Black (NJDOH, 2013). Women with a BMI of 25.0 to 29.9, also known as overweight, were significantly less likely to complete preventive health care actions for breast cancer, cervical cancer, and colorectal cancer (Ferrante et al., 2007). For the sample ($N = 142$), which included all available EMRs in the data set, the mean age was 53 years, and women in the sample tended to be Black (90.8%), non-Hispanic (92.3%), single (70.4%), with Medicaid (43.7%). After correcting for outliers, the mean distance between residence and health care facility was about eight miles, with values ranging from 0.3 miles to 28.8 miles. The average length of time the women had been living with HIV infection was about 10 years, and the majority of women were classified as HIV stage A3 (57.7%), had asymptomatic HIV infection (78.2%), and had CD4 cell counts less than 200 cells/mm^3 (73.2%). The majority of the sample did not have hypertension (54.9%), diabetes mellitus (83.1%) or depression (71.8%), and did not use tobacco (54.9%). However, the majority of HIV seropositive women in the sample were overweight (28.2%) or obese (45.1%), according to BMI categories, while fewer (30.3%) were obese according to the ICD-9-CM codes

in the EMR. One EMR indicated a diagnosis of CMV retinitis, which had caused blindness. Similar to the findings of Werth et al. (2008) and Yankaskas et al. (2010), this case had not completed any preventive health care screenings.

Statistical Assumption Evaluations

The statistical assumptions associated with the use of parametric statistics were: (a) normality, linearity, and homoscedasticity.

Normality Assumption

A visual representation of each variable was created and overlaid with the normal curve, followed by Kolmogorov-Smirnov and Shapiro-Wilk normality tests for continuous variables, the results of which were presented later in the discussion on skew and kurtosis. The Embodiment variable of age violated the assumption of normality and was subjected to $\log^{10}$ transformation; the Pathways of Embodiment variables of distance, HIV time and lowest CD4 cell count violated the normality assumption, after three methods of transformation were attempted; the result of the normality test for the Cumulative Interplay variable of BMI was not significant.

Skew and kurtosis. Examination of skew and kurtosis statistics indicated the variables: (a) age; (b) corrected distance; (c) HIV time; (d) CD4 cell count; (e) BMI were not normally distributed (Table 9). Kolmogorov-Smirnov and Shapiro-Wilk tests of normality were performed for each of the continuous variables, and the distribution of BMI was not found to be statistically significant (KS = 0.047, $df = 142$, $p = 0.200$; S-W = 0.986, $df = 142$, $p = 0.177$); the normality test statistics for the remaining variables were statistically significant, indicating the distributions had normality violations, which were confirmed by reviewing the Q-Q plots (Meyer, et al, 2013).

Table 9

Skew and Kurtosis for Continuous Variables (N = 142)

	Mean	S.E.	Skew Statistic	95% C.I	Kurtosis Statistic	95% C.I.
Age	53.30	0.613	8.01*	0.063, 0.859	0.112	-0.68, 0.904
Distance	8.01	1.36	4.676*	4.278, 5.074	26.494*	25.702, 27.286
Distance, Corrected	4.90	0.46	2.31*	2.11, 2.51	5.52*	4.73, 6.31
HIV Time	10.11	0.283	0.853*	0.455, 1.251	3.991*	3.199, 4.783
Lowest CD4 Cell Count	154.62	14.18	3.261*	2.863, 3.659	14.177*	13.385, 14.969
BMI	29.46	0.59	0.327	-0.071, 0.725	-0.57	-0.849, 0.222

Note. * - Significant for alpha of 0.05; skew standard error values (0.203), and kurtosis standard error values (0.404) were multiplied by 1.96 (0.398 and 0.792, respectively, to calculate the upper and lower limits of the 95% confidence interval for each variable.

Linearity. Scatterplots were initially created as visual representations of possible linearity between all continuous independent variables. Base $\log^{10}$ transformed age and distance did not appear to be related; base $\log^{10}$ transformed age and HIV time, base $\log^{10}$ transformed age and BMI, HIV time and low CD4 cell count were positively related. Height appeared negatively related to BMI, while weight appeared positively related to BMI, and both height and weight appeared negatively related to base $\log^{10}$ transformed age. A Pearson Product Moment Correlation, or Pearson *r,* was performed

on the log-transformed values for age and distance (r = -.036, p > 0.05), distance and HIV time (r = 0.41, p > 0.05), distance and BMI (r = 0.118, p > 0.05), and BMI and HIV time (r = 0.045, p > 0.05) confirmed the variables were not related. However, the correlations between the log-transformed values for age and HIV time (r = 0.250, p = 0.03), as well as age and BMI (r = − 0.201, p = 0.016), were statistically significant, indicating a relationship between these two sets of variables (Table 10). As many of the variables appeared to violate the assumption of linearity, Kendall's tau b was performed on the log-transformed values for age, as well as the other independent variables, in later bivariate analyses.

Table 10

Pearson Product Moment Correlation Results *(N=142)*

	$AgeLog^{10}$		Distance		HIV Time		BMI	
	r	Sig	*r*	Sig	*r*	Sig	*r*	Sig
Age Log^{10}	1	--	-.036	.674	.250**	.003	-.201*	.016
Distance	-.036	.674	1	--	.041	.631	.118	.162
HIV Time	.250**	.003	.041	.631	1	--	.045	.591
BMI	-.201*	.016	.118	.162	.045	.591	1	--

Note: * - Correlation is significant p < 0.05 level, 2-tailed; ** - Correlation is significant p < 0.01, 2-tailed.

Homoscedasticity. SPSS used the Levene statistic to test for homogeneity of variances (Meyer, 2013; IBM, 2012). The Levene statistic was significant for several independent variables across the levels of colorectal cancer screening (completed, not completed; Table 11).

Table 11

Homogeneity of Variance: Significant Levene Statistic Results

Dependent Variable	Independent Variable	Levene Statistic	*df*	*df2*	*p*[a]
Breast Cancer Screening	Time living with HIV, categorical	13.314	1	140	0.000
	HIV stage by symptoms	9.426	2	139	0.000
	Diabetes Diagnosis	6.527	1	140	0.012
Cervical Cancer Screening	Distance, categorical	9.851	1	140	0.002
	HIV stage by CD4 count	5.673	2	139	0.004
	HIV stage by symptoms	8.303	2	139	0.000
Colorectal Cancer Screening	Age, categorical	1068.472	1	140	0.000
	Race	17.068	1	140	0.000
	Ethnicity	11.299	1	140	0.001
	Marital Status	7.544	3	138	0.000
	Insurance Type	6.473	6	135	0.000
	HIV stage by symptoms	12.030	2	139	0.000
	Hypertension Diagnosis	3.979	1	140	0.048
	BMI – obese or not obese	16.441	3	138	0.000
	Depression Diagnosis	8.757	1	140	0.004

[a] Significance set *a priori* at $p < 0.05$ for analyses

Fewer independent variables were associated with significant Levene statistics across the levels of breast cancer screening and cervical cancer screening, but all three dependent variables violated the assumption associated with homoscedasticity.

Data Transformations

Log transformation. After log transformation, the skew (0.132) and kurtosis (−0.485) for age, and the skew (− 0.137) and kurtosis (0.056) for corrected distance were no longer significant ($df = 142$, $p > 0.05$). The skew (− 1.561) and kurtosis (4.923) for HIV time, and the skew (− 1.221) and kurtosis (3.247) for lowest CD4 cell count did not become more normally distributed; the skews for both variables became negative and the leptokurtic distributions remained significantly positive. For dependent variables, only log transformations created any change in the skew and kurtosis statistics, so dependent variables were only discussed here. Log transformation of the variables associated with screening test completion for breast cancer (BrCAScrng), cervical cancer (CVCaScrng), and colorectal cancer (CRCaScrng) made three significant Levene statistics non-significant (BrCaScrng X marital status, BrCaScrng X diabetes, CRCaScrng X hypertension); two non-significant Levene statistics to significant (BrCaScrng X race, BrCaScrng X ethnicity); four variables were improved, but remained significant; 16 were unchanged and significant.

Square root transformations. Performed after log transformations for the variables of age, corrected distance, HIV time and lowest CD4 cell count. Again, the skew statistic for age was no longer significant, but the distribution became negatively leptokurtic while remaining insignificant. Skew and kurtosis statistics for corrected distance remained statistically significant, and, while the skew statistic for HIV time and lowest CD4 cell count became negative, and no longer significant, the kurtosis statistics remained statistically significant.

Reflected inverse transformation. Performed after log and square root transformations failed to correct statistically significant skew and kurtosis statistics, reflected inverse transformations on the variables of age, distance, and HIV time were preceded by dividing each value of age, corrected distance and HIV time for each case by 1 prior to performing the inverse transformations, giving the resulting values an expected positive value (Meyer, et al, 2013). However, the skew and kurtosis statistics for the transformed age variable became negative and, again, no longer significant. The skew and kurtosis statistics for corrected distance remained positive and statistically significant. The skew statistics for HIV time and lowest CD4 cell count became negative and remained statistically significant, like the positive values for the kurtosis statistic.

To summarize the results of the transformations, the base 10 log transformations made the distributions more normal, and, while the direction of the skew statistics for HIV time and lowest CD4 cell count became negative, the skew statistics were no longer significant, though the kurtosis statistics remained significant (Table 12). The base 10 log transformations lessened the statistical significance of the Levene statistics for the dependent variables, even though only three significant statistics became non-significant, but the skew and kurtosis for all three dependent variables were improved. The square root and reflected inverse transformations had little impact on the shape of the distributions for each of the independent and dependent variables, so the base 10 log transformations were used for age, corrected distance, HIV time, and lowest CD4 cell count, and the three dependent variables. However, while improvements were made, violations continued so non-parametric statistical tests were used to analyze the data.

Table 12

Correlation Results for Continuous Variables After Log Transformations (N=142)

	Statistic	AgeLog10	DISTALog10	TIMELog10	CD4Log10	BMI
Age in years/ AGELog10	Pearson *r*	1	0.102	.0.178*	0.177*	−.201*
	Sig (2-tailed)		0.226	0.034	0.035	.016
	Kendall's tau b	1	0.051	0.210**	0.142*	− 0.140*
	Sig (2-tailed)		0.384	0.001	0.014	0.015
Distance/ DISTALog10	Pearson *r*	0.102	1	0.038	0.132	− 0.005
	Sig (2-tailed)	0.226		0.656	0.117	0.954
	Kendall's tau b	0.051	1	0.037	0.054	0.006
	Sig (2-tailed)	0.384		0.541	0.346	0.916
Years living with HIV infection/ TIMELog10	Pearson *r*	.0.178*	0.038	1	0.109	.045
	Sig (2-tailed)	0.034	0.656		0.196	.591
	Kendall's tau b	0.201**	0.037	1	0.082	− 0.004
	Sig (2-tailed)	0.001	0.541		0.170	0.952
Lowest CD4 cell count/ CD4Log10	Pearson *r*	0.177*	0.132	0.109	1	− 0.018
	Sig (2-tailed)	0.035	0.117	0.196		0.836
	Kendall's tau b					
	Sig (2-tailed)	0.142*	0.054	0.082	1	− 0.002
		0.014	0.346	0.170		0.968
BMI	Pearson *r*	−.201*	− 0.005	.045	− 0.018	1
	Sig (2-tailed)	.016	0.954	.591	0.836	
	Kendall's tau b	− 0.140*	0.006	− 0.004	− 0.002	1
	Sig (2-tailed)	0.015	0.916	0.952	0.968	

* - Correlation is significant at 0.05 (2-tailed)
** - Correlation is significant at 0.01 (2-tailed).

Analysis of Data

Data was abstracted using the data abstraction instrument based on the proprietary EMR software in use at the health care facility at the time of the study. The data was coded into an Excel spreadsheet (Microsoft®, 2010) with the first row containing variable labels, and each column was summed to verify the correct number of

entries ($N = 142$), which served as a data entry check. The values for certain variables were created directly in the Excel program (Microsoft®, 2010): the value for the variable to assess agreement between an obesity diagnosis based on a BMI calculation from the height and weight measurements in the EMR; obesity diagnosis from the ICD-9-CM codes in the EMR (OBSBOTH). An obesity diagnosis was coded with a value of 1 and no obesity diagnosis was coded as 0 for the variable of obesity by BMI (OBSBMI), and for the variable of obesity by ICD-9-CM code in the EMR (OBSEMR). An Excel formula (Microsoft®, 2010) was developed to multiply the value of 0 or 1 in OBSBMI by the value of 0 or 1 in OBSEMR, and enter the result in the variable of OBSBOTH, where agreement would equal 1 and a lack of agreement would equal 0. Upon completion of the data entry, the data in the Excel (Microsoft®, 2010) spreadsheet was imported into the SPSS program (IBM, 2012) for analysis.

Univariate Analysis

Frequencies were analyzed and reported as percentages with 95% confidence intervals (CI) for each variable, grouped by the constructs of the ecosocial theory (Table 13). Mean, median and mode were presented for continuous, interval variables, median and mode for discrete, ordinal variable, and only mode for discrete, nominal variables. Range was presented for discrete variables, while standard deviation was presented for continuous variables. Since standard deviation was sensitive to sample size, the unbiased option in SPSS was selected. The distribution of observations associated with discrete variables was analyzed, and values, or cells, with less than five observations were collapsed since five is the minimum default cell count in SPSS (IBM, 2012).

Table 13

Univariate Analysis: Completion of Preventive Health Care Actions in HIV Seropositive Women

Ecosocial Theory Construct (IVs) or Dependent Variables	Variable/ Coding	Mean, Median, Mode[a]	Standard Deviation, Range[b]	Frequency (Percentage)[c]	95% Confidence Interval[d]
Embodiment	Age (in years)/	53.30	± 7.3	142 (100)	52.10, 54.50
	Age, log10	1.72	±0.59	142 (100)	
	Age cohort				
	40-49=1	2	40-79	50 (35.2)	0.278, 0.434
	50-59=2			92 (64.8)	0.566, 0.722
	60-69=3			27 (19.0)	0.134, 0.263
	70-79=4			2 (1.4)	0.001, 0.053
	Age by mean				
	40-53=1	1	40-79	73 (51.4)	0.433, 0.595
	54-79=2			69 (48.6)	0.405, 0.567
Pathways of Embodiment	Race				
	Black=1	1	1-2	129 (90.8)	0.849, 0.947
	White=2			13 (9.2)	0.053, 0.152
	Ethnicity				
	Non-Hisp=0	0	0-1	131 (92.3)	0.865, 0.958
	Hispanic=1			11 (7.7)	0.043, 0.135
	Marital status				
	Single/Never Married=0	0	0-3	100 (70.4)	0.624, 0.773
	Married=1			15 (10.6)	0.064, 0.168
	Divorced=2			10 (7.0)	0.037, 0.126
	Widowed=3			17 (12.0)	0.037, 0.127

(table continues)

(table continues)

Ecosocial Theory Construct (IVs) or Dependent Variables	Variable/ Coding	Mean, Median, Mode[a]	Standard Deviation, Range[b]	Frequency (Percentage)[c]	95% Confidence Interval[d]
	Marital status, Single				
	Single=0	0	0-1	100 (70.4)	0.624, 0.773
	All other=1			42 (29.6)	0.227, 0.376
	Marital status, Married				
	Married=0	0	0-1	15 (10.6)	0.064, 0.168
	All other=1			127 (89.4)	0.832, 0.936
	Insurance [a,c,d]				
	Medicare=1	3	1-7	23 (16.2)	0.110, 0.232
	SSD=2			6 (4.2)	0.018, 0.091
	Medicaid=3			62 (43.7)	0.358, 0.519
	Private Insurance=4			13 (9.2)	0.053, 0.152
	State HMO=5			6 (4.2)	0.018, 0.091
	Charity=6			15 (10.6)	0.064, 0.168
	Self Pay=7			17 (12.0)	0.075, 0.184
	Insurance, Private				
	Private Ins=1	1	1-2	129 (90.8)	0.849, 0.947
	All other=2			13 (9.2)	0.053, 0.152
	Insurance, Medicaid				
	Medicaid=1	2	1-2	62 (43.7)	0.358, 0.519
	All other=2			80 (56.3)	0.481, 0.642
Cumulative Interplay	Distance bet residence and health care facility	4.90	$\pm$5.48	142 (100)	4.002, 5.806

(table continues)

(table continues)

Ecosocial Theory Construct (IVs) or Dependent Variables	Variable/ Coding	Mean, Median, Mode[a]	Standard Deviation, Range[b]	Frequency (Percentage)[c]	95% Confidence Interval[d]
Cumulative Interplay (continued)	Distance, in miles, by mean				
	0-4.9=1	1	1-2	104 (73.2)	0.654, 0.799
	5.0-29.0=2			38 (26.8)	0.201, 0.346
	Number of years since HIV diagnosis	10.11	±3.37	142 (100)	9.556, 10.665
	Years living with HIV, divided by mean				
	2-10=1	1	1-2	89 (62.7)	0.545, 0.702
	11-26=2			53 (37.3)	0.298, 0.455
	Lowest CD4 cell count	154.62	±168.92	142 (100)	126.835, 182.404
	HIV Stage				
	A1=1	3	1-9	7 (4.9)	0.022, 0.100
	A2=2			22 (15.5)	0.104, 0.224
	A3=3			82 (57.7)	0.495, 0.656
	B1=4			1 (0.7)	0.0001, 0.04,
	B2=5			2 (1.4)	0.0006,0.053
	B3=6			9 (6.3)	0.032, 0.118
	C1=7			1 (0.7)	0.0001,0.042
	C2=8			5 (3.5)	0.013, 0.082
	C3=9			13 (9.2)	0.053, 0.152
	HIV Stage by CD4 cell count				
	<200=1	1	1-3	104 (73.2)	0.654, 0.797
	200-499=2			29 (20.4)	0.146, 0.278
	≥500=3			9 (6.3)	0.032, 0.118

(table continues)

(table continues)

Ecosocial Theory Construct (IVs) or Dependent Variables	Variable/ Coding	Mean, Median, Mode[a]	Standard Deviation, Range[b]	Frequency (Percentage)[c]	95% Confidence Interval[d]
Cumulative Interplay (continued)	HIV Stage by Symptoms				
	Asymptom=1	1	1-3	111 (78.2)	0.706, 0.842
	Symptom=2			12 (8.5)	0.048, 0.143
	AIDS-defining=3			19 (13.4)	0.087, 0.200
	HIV Stage by AIDS versus not AIDS				
	Non-AIDS=0	1	0-1	32 (22.5)	0.164, 0.301
	AIDS=1			110 (77.5)	0.699, 0.836
	Hypertension				
	Never	1	0-1	64 (45.1)	0.371, 0.533
	Hx/Current			78 (54.9)	0.467, 0.629
	Body Mass Index[a]	29.462	$\pm$7.089	142 (100)	28.296,30.628
	BMI by category				
	Underweight=1 (14.9-18.4)	4	1-4	9 (6.3)	0.036, 0.107
	Normal weight=2 (18.5-24.9)			29 (20.4)	0.146, 0.278
	Overweight=3 (25.0-29.9)			40 (28.2)	0.214, 0.361
	Obese (30+)=4			64 (45.1)	0.371, 0.533
	BMI, obese versus not obese				
	Not Obese=0	0	0-1	78 (54.9)	0.467, 0.629
	Obese=1			64 (45.1)	0.371, 0.533

(table continues)

(table continues)

Ecosocial Theory Construct (IVs) or Dependent Variables	Variable/ Coding	Mean, Median, Mode[a]	Standard Deviation, Range[b]	Frequency (Percentage)[c]	95% Confidence Interval[d]
Cumulative Interplay (continued)	Obese per BMI				
	Never=0	0	0-1	64 (45.1)	0.371, 0.533
	Hx/Current=1			78 (54.9)	0.467, 0.629
	Obesity in EMR				
	Never=0	0	0-1	43 (30.3)	0.233, 0.383
	Hx/Current=1			99 (69.7)	0.617, 0.767
	Obese in EMR and by BMI				
	Never=0	0	0-1	37 (26.1)	0.195, 0.339
	Hx/Current=1			105 (73.9)	0.661, 0.805
	Diabetes mellitus diagnosis				
	Never=0	0	0-1	24 (16.9)	0.116, 0.240
	Hx/Current=1			118 (83.1)	0.760, 0.884
	Depression diagnosis				
	Never=0	0	0-1	40 (28.2)	0.214, 0.361
	Hx/Current=1			102 (71.8)	0.639, 0.786
	Tobacco use				
	Never=0	0	0-1	64 (45.1)	0.371, 0.533
	Hx/Current=1			78 (54.9)	0.467, 0.629
	Deceased				
	No=0	0	0-1	119 (83.8)	0.768, 0.890
	Yes=1			23 (16.2)	0.110, 0.232

(table continues)

(table continues)

Ecosocial Theory Construct (IVs) or Dependent Variables	Variable/ Coding	Mean, Median, Mode[a]	Standard Deviation, Range[b]	Frequency (Percentage)[c]	95% Confidence Interval[d]
Dependent Variables	Breast Cancer Screening				
	Not Completed	0	0-3,9	92 (64.8)	0.571, 0.726
	Completed On Time			20 (14.1)	0.093, 0.210
	Completed Early			16 (11.3)	0.070, 0.177
	Completed Late			13 (9.1)	0.054, 0.153
	Not Applicable			1 (0.7)	
	Breast Cancer Screening				
	Not Completed	0	0-1,9	92 (64.8)	0.571, 0.726
	Completed			49 (34.5)	0.274, 0.429
	Not Applicable			1 (0.7)	
	Cervical Cancer Screening				
	Not Completed	0	0-1,9	102 (71.8)	0.644, 0.791
	Completed			39 (27.5)	0.209, 0.356
	Not Applicable			1 (0.7)	
	Colorectal Cancer Screening	9	0-1,9	30 (21.1)	0.677, 0.925
	Not Completed			6 (4.2)	0.749, 0.323
	Completed			106 (74.6)	
	Not Applicable				

Notes: Analysis for assumption of exhaustive categories; analysis for assumption of mutually exclusive categories; not a normal distribution; Fisher's Exact is default for 2x2 tables when number of observations in any one cell is less than 5.

[a]Mean, median, mode appropriate to level of measurement

[b]Standard deviation, range appropriate to level of measurement

[c]Frequencies for each variable based on valid number of EMRs reviewed

[d]CI 95% calculated using modified Wald method, which is based on proportions

Bivariate Analysis

Bivariate analysis was conducted to determine relationships between the dichotomous independent variables and the dependent variables: Kruskal-Wallis tests were used to compare discrete independent variables with continuous (base log 10 transformations) and discrete, ordinal versions of the dependent variables since statistical assumptions were violated; Mann-Whitney U-tests were used to compare discrete independent variables in HIV seropositive women who completed, or failed to complete, the preventive health care screening tests for each of the three cancers of interest due to statistical assumption violations; cell observations were frequently less than five so Fisher's Exact Test, the default reported by SPSS, was used instead of chi-square. Using SPSS, a correlation matrix was constructed to examine relationships between variables (Table 14). Statistically significant independent variables for breast cancer screening were: age by cohort (40-49 and 50-79); log-transformed and discrete versions of time living with HIV infection; completion of cervical cancer screening. Statistically significant independent variables for cervical cancer screening were: log-transformed and discrete versions of distance between residence and health care facility; log-transformation of lowest CD4 cell count; HIV stage by CD4 cell count; HIV stage by symptomatology; completion of breast cancer screening. Statistically significant independent variables for colorectal cancer screening were: age by mean; age by cohort; discrete version of marital status; dichotomous version of marital status comparing single to all other categories; dichotomous version of insurance comparing Medicaid to

all other categories; log-transformed version of lowest CD4 cell count; HIV stage by symptomatology.

Table 14

Bivariate Analyses: Kruskal-Wallis and Mann-Whitney U Tests for Completion of, or Failure to Complete, Preventive Health Care Screening Actions

Independent Variable[a,b]	Breast Cancer Screening		Cervical Cancer Screening		Colorectal Cancer Screening	
	Statistic[a,b]	Sig (p)[c]	Statistic[a,b]	Sig (p)[c]	Statistic[a,b]	Sig (p)[c]
Age, Log^{10} Transformation[a]	3.755	0.053	0.420	0.517	0.223	0.637
Age, by Mean[b]	2087.00	0.403	1932.00	0.761	563.00	0.000*
Age, by Group[b]	1663.50	0.002*	1977.00	0.947	908.00	0.000*
Distance, Log Transformation[a]	2.804	0.094	5.708	0.017*	0.687	0.407
Distance by Mean	1916.00	0.057	1459.50	0.001*	1412.00	0.229
Race[b]	2067.50	0.125	1890.00	0.363	1463.00	0.191
Ethnicity[b]	2055.00	0.064	1851.00	0.171	1493.00	0.281
Marital Status[b]	2232.00	0.905	1957.50	0.857	1200.50	0.010**
Marital Status – Single[b]	2236.50	0.923	1962.00	0.875	1208.00	0.010**
Marital Status – Married[b]	2239.00	0.903	1908.00	0.485	1407.00	0.077
Insurance[b]	2091.50	0.460	1953.50	0.864	1397.50	0.291
Insurance – Private[b]	2217.50	0.752	1890.00	0.363	1445.00	0.135
Insurance – Medicaid[b]	2222.00	0.872	1858.50	0.484	1264.00	0.046*
HIV Time, Log Transformation[a]	12.132	0.000*	0.554	0.457	0.202	0.653

(table continues)

(table continues)

Independent Variable[a,b]	Breast Cancer Screening		Cervical Cancer Screening		Colorectal Cancer Screening	
	Statistic[a,b]	Sig (p)[c]	Statistic[a,b]	Sig (p)[c]	Statistic[a,b]	Sig (p)[c]
HIV Time, by Mean[b]	1624.50	0.001*	1663.50	0.073	1509.00	0.609
Low CD4, log Transformation[a]	1.744	0.187	4.389	0.036*	5.552	0.018*
HIV Stage[b]	2094.50	0.440	1854.00	0.486	1385.00	0.227
AIDS versus not AIDS[b]	2051.00	0.226	1696.50	0.063	1548.00	0.759
HIV Stage by CD4 cell count[b]	1996.00	0.150	1506.50	0.004*	1498.00	0.523
HIV Stage by Symptomatology[b]	2250.00	0.981	1576.50	0.008*	1288.50	0.027*
Hypertension[b]	2246.50	0.231	1756.50	0.214	1470.00	0.464
BMI[a]	1.433	0.340	0.000	1.000	2.084	0.149
BMI, by category[b]	2081.50	0.426	1963.00	0.898	1501.50	0.619
Diabetes[b]	2183.00	0.613	1963.50	0.857	1527.00	0.611
Depression[b]	2035.50	0.226	1923.00	0.697	1344.00	0.097
Tobacco Use[b]	2200.50	0.788	1948.50	0.828	1506.00	0.608
Breast Cancer Screening[a]	N/A	N/A	1288.00	0.000*	1479.50	0.490
Cervical Cancer Screening[a]	1720.00	0.003*	N/A	N/A	1337.00	0.080
Colorectal Cancer Screening[a]	2252.50	0.993	1820.50	0.302	N/A	N/A

[a] Kruskal-Wallis test statistic
[b] Mann-Whitney U test statistic
[c] Significance: * $p < 0.05$; ** $p < 0.01$

Kendall's tau b correlation coefficient was used to examine relationships between $\log^{10}$ transformed variables and preventive health care actions (Table 15).

Kendall's tau b, a nonparametric statistic, was used in the analysis due to outliers, which contributed to a violation of the normal distribution assumption (Meyer, et al. 2013; IBM, 2012). Significant relationships (one-tailed, $p < 0.05$) were noted between each of the preventive health care actions and several of the independent variables (Table 18). Using the more stringent tau b statistic: (a) breast cancer screening was significantly related to the log-transformed version of age, ethnicity (negatively), log-transformed version of length of time living with HIV infection, and the log-transformed version of lowest CD4 cell count; (b) cervical cancer screening was significantly related to the log-transformed version of distance between residence and health care facility (negatively), the log-transformed version of lowest CD4 cell count, and the completion of breast cancer screening; (c) colorectal cancer screening was significantly and negatively related to the log-transformed version of age, marital status, and depression.

Table 15

Bivariate Analysis: Kendall's Tau B Correlation (N=142)

Variable	Breast Cancer Screening	Cervical Cancer Screening	Colorectal Cancer Screening
Age (log^{10} trans) Sig.	.135 .021*	NS	-.578 .000**
Distance (log^{10} trans) Sig.	NS	-.173 .007**	NS
Ethnicity Sig.	-.135 .045*	NS	NS
Marital Status Sig.	NS	NS	-.237 .001**
HIV Time (log^{10} trans) Sig.	.250 .000**	NS	NS
CD4 Count (log^{10} trans) Sig.	.109 .048*	.155 .012*	NS
Hypertension Sig.	NS	NS	NS
Body Mass Index Sig. (1-tailed)	NS	NS	NS
Depression Sig.	NS	NS	-.139 .047*
Mammogram–Completed Sig.	1.00	.324 .000**	NS

Note. Log10trans = log10 transformation; NS = not significant at $p < 0.05$
* - Correlation significant at $p < 0.05$; ** - Correlation significant at $p < 0.01$ level.

Multivariate Analysis

Analysis of variance (ANOVA) was used to examine associations between continuous independent variables and dependent variables. Assumptions associated with

ANOVA were independent random samples, from a normally distributed population with equal variances, and the statistical test examined the variability between groups, as well as within groups (IBM, 2012). The Kruskal-Wallis statistic was used instead of the F statistic due to statistical assumption violations (IBM, 2012), and the null hypothesis tested was no difference in the estimated variability between ranked groups ($df = n$, $p < 0.05$). Breast cancer screening, which only had 5 or more observations for each category related to timing, was collapsed into two groups to comply with the higher number of observations (10) for each cell required for ANOVA, so the timeliness of the completed breast cancer screening was not analyzed. For breast cancer screening, significant independent variables were time living with HIV infection, and HIV stage, while significant independent variables for cervical cancer screening were distance between residence and health care facility, time living with HIV infection, and HIV stage, and the only statistically significant independent variable for colorectal cancer screening was age group (Table 16).

Table 16

Ranked Group Differences in Variance: Significant Kruskal-Wallis Chi-Square Results

Dependent Variable	Independent Variable	Kruskal-Wallis	df	Significance[a]
Breast Cancer Screening	Time living with HIV infection	11.995	1	0.001**
	HIV stage by classification schema	25.174	8	0.001**
	HIV stage by CD4 cell count	13.019	2	0.001**
	HIV stage by symptomatology	10.330	2	0.006**
Cervical Cancer Screening	Distance	10.495	1	0.001**
	Time living with HIV infection	4.001	1	0.045*
	HIV stage by classification schema	42.180	8	0.000***
	HIV stage by CD4 cell count	18.055	2	0.000***
	HIV stage by symptomatology	20.135	2	0.000***
Colorectal Cancer Screening	Age divided by mean of 53.3	44.584	1	0.000***

Note. [a]Significance: * $p < 0.05$; ** $p < 0.01$; ***$p < 0.001$

Due to the statistical assumption violations, ANOVA was conducted again using homogeneity of variance statistics and post hoc tests associated with equal variances (Bonferroni correction) and unequal variances (Tamhane's T2) because, even after base log 10 transformations, violations remained (Meyer, 2012) for the three age variables (log transformed age, age by group, age by mean), as well as corrected distance, length

of time living with HIV infection, lowest CD4 cell count, breast cancer screening, and cervical cancer screening. Post hoc tests could only be conducted for colorectal cancer screening due to violations related to the minimum number of observations per cell (two). Bonferroni corrections were run for the same independent variables, and colorectal cancer screening, but only three independent variables (distance, lowest CD4 cell count, and BMI) did not have significant homogeneity of variance statistics, and the statistics associated with the Bonferroni correction were not significant either.

One-way ANOVA was executed a third time to examine mean differences using eta squared to determine the proportion of variance accounted for by main effects and interactions, as well as error (Tabachnick & Fidell, 2012). Only statistically significant variables were identified for discussion related to eta-squared (Table 17). For breast cancer screening, age cohort explained 6.6% of the variance, time living with HIV infection explained 7.3%, HIV stage by CD4 cell count explained 9%, HIV stage by symptomatology explained 13.5%, cervical cancer screening explained 13.5%, and HIV stage by classification schema explained 26.4%. For cervical cancer screening, time living with HIV infection explained 3%, distance between residence and health care facility explained 3.4%, breast cancer screening explained 5.3%, HIV stage by CD4 cell count explained 5.7%, HIV stage by symptomatology explained 7.3%, colorectal cancer screening explained 20.8%, and HIV stage by classification schema explained 25%. For colorectal cancer screening, breast cancer screening explained 5.6%, marital status explained 6.8%, age cohort explained 15.6%, and age divided by mean explained 32% of the variance based on the eta-squared statistics.

Table 17

ANOVA – Significant Results for Completion of, or Failure to Complete, Screening for Breast, Cervical, and Colorectal Cancer Screening

Independent Variables	*F* (df)	η^2	*F*	η^2	*F*	Sig (p)	η^2
Age Cohort	9.836* (1, 140)	0.066	----	----	25.823*** (1, 140)		0.156
Age Group	----	----	----	----	65.905*** (1, 140)		0.320
Marital Status	----	----	----	----	3.375* (3, 138)		0.068
Distance	----	----	4.862* (1, 140)	0.034	----	----	----
HIV Time	11.051** (1, 140)	0.073	4.256* (1, 140)	0.030	----	----	----
HIV Stage	5.976*** (8, 133)	0.264	5.554*** (8, 133)	0.250	----	----	----
HIV Stage, by CD4	6.896** (2, 139)	0.090	4.218* (2, 139)	0.057	----	----	----
HIV Stage, by Symptoms	10.829*** (2, 139)	0.135	5.502** (2, 139)	0.073	----	----	----
Breast Cancer Screening	----	----	3.859* (2, 139)	0.053	4.094* (2, 139)	0.019	0.056
Cervical Cancer Screening	13.997*** (2, 139)	0.168	----	----	----	----	----
Colorectal Cancer Screening	----	----	18.205*** (2, 139)	0.208	----	----	----

Note: Significance: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

As note above, several statistically significant variables contained the same information grouped differently, such the discrete variable of HIV stage, which created two additional discrete variables when grouped by CD4 cell count, and by

symptomatology, as well as two dichotomous variables. When more than one subgroup of a variable was significant, the resulting variable with the highest eta-squared was chosen for further analysis. Based on univariate and bivariate analyses, the following variables, in order of descending eta-squared statistics, were used to create the regression models:

- For breast cancer screening
    - HIV stage, by classification schema (A1, A2, A3, B1, B2, B3, C1, C2, C3)
        - HIV stage, by symptomatology
        - HIV stage, by lowest CD4 cell count
    - Cervical cancer screening
    - Time living with HIV infection, divided by mean
    - Age cohort (40-49, 50-79)
- For cervical cancer screening
    - HIV stage, by classification schema (A1, A2, A3, B1, B2, B3, C1, C2, C3)
        - HIV stage, by symptomatology
        - Lowest CD4 cell count
    - Colorectal cancer screening
    - Distance between residence and health care facility, divided by mean
    - Time living with HIV infection, divided by mean
    - Breast cancer screening

- For colorectal cancer screening
    - Age, divided by mean (40-53, 54-79)
        - Age cohort (40-49, 50-79)
    - Marital status
    - Breast cancer screening

Logistic regression for the significant variables listed above was conducted using elimination based on the Hierarchial Principle (Kleinbaum & Klein, 2002) until a parsimonious model was identified, which described the variables associated with the preventive health care screening tests for breast cancer, cervical cancer, and colorectal cancer in HIV seropositive women. As mentioned in an earlier chapter, logistic regression was chosen as the mathematical modeling approach for several reasons: a) the dependent variable could be dichotomous, being completed or not completed; b) the logistic function *f(z)* ranged from 0 to 1 and described the probability of completing or not completing the preventive health care action; c) the logistic model created an S-shaped logistic model with a threshold, which was applicable to the multivariate nature of epidemiologic research (Kleinbaum & Klein, 2002).

Results of Hypothesis Testing

The results of the analyses are discussed according to the research questions and hypotheses for each preventive health care action. For each research question, hypothesis and null hypothesis, the assumption was HIV seropositive women were seen by an infectious disease specialist at the same ambulatory care center three or more times, during the 12 months prior to data collection or death. Odds ratios were calculated from contingency tables; the *p* - value and 95% confidence intervals related to each odds

ratio were determined during bivariate analyses using Kendall's tau b due to statistical assumption violations. The odds ratios for the variables retained for further analyses are presented in the next nine tables

Breast Cancer Screening

Research Question 1. Did the completion of breast cancer screening differ significantly by the embodiment variable of age cohort in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women in the youngest age cohort (40 to 49 years) would completed significantly more breast cancer screenings, compared to older HIV seropositive women, and the null hypothesis indicated no difference. More HIV seropositive women in the 50 to 79 year age cohort completed breast cancer screenings compared to women in the 40 to 49 years age cohort. However, failure to complete breast cancer was higher than completion in both women aged 40 to 49 years and women aged 50 to 79 years (Table 18).

Table 18

Odds Ratio Using Kendall's Tau B: Completion of Breast Cancer Screening by Age Group

	Breast Cancer Screening[a]		
	Completed	Not Completed	Totals
Age Group			
40-49 years	9	41	50
50-79 years	40	51	91
Totals	49	92	141

Note: [a] (a/b)/(c/d) = (9/41)/(40/51) = 0.280 (CI^{95}=0.1218, 0.643)
χ^2 = 0.024 (does not assume the null hypothesis)
T^b = 0.000 (assumes the null hypothesis)

ANOVA results indicated a statistically significant relationship between age cohort and breast cancer screening ($F = 9.836$, $df = 1, 140$, $p = 0.002$, $\eta^2 = 0.066$). Based on the odds ratio calculated from the contingency table ($OR = 1.00–0.280 = 0.72$, $CI^{95} = 0.1218, 0.643$), and using Kendall's tau b for significance ($T^b = 3.810$, $p = 0.000$), since tau b is not sensitive to outliers, HIV seropositive women in the older age cohort of 50 to 79 years, were 72% more likely to complete breast cancer screening, compared to HIV seropositive women in the younger age cohort of 40 to 49 years. While the null hypothesis of no difference was rejected, the hypothesis associated with the younger age group completing more breast cancer screenings was not supported, but the variable of age cohort was retained for further analysis

Research Question 2. Did the completion of breast cancer screening differ significantly by the race of HIV seropositive women? The hypothesis, based on the literature review, stated White HIV seropositive women would complete significantly more breast cancer screenings, compared to Black or non-White HIV seropositive women, and the null hypothesis indicated no difference. The sample contained only Black and White HIV seropositive females. Black HIV seropositive women completed more breast cancer screenings (n=48), compared to White HIV seropositive females ($n = 2$), but Black women also failed to complete more breast cancer screenings ($n = 81$), compared to White women ($n = 11$) in the study. Kruskal-Wallis and ANOVA did not indicate any statistically significant differences between Black and White HIV seropositive women and breast cancer screening. The odds ratio ($OR = 3.2593$, $CI^{95} = 0.6929, 15.3311$) was not statistically significant by Kendall's tau b ($T^b = -1.708$, $p = 0.088$) so the null of no difference was supported.

Research Question 3. Did the completion of breast cancer screening differ significantly by the ethnicity of HIV seropositive women? The hypothesis, based on the review of the literature, stated non-Hispanic HIV seropositive women would complete significantly more breast cancer screenings, compared to Hispanic HIV seropositive women, and the null hypothesis indicated no difference between the two groups. Non-Hispanic HIV seropositive women completed more breast cancer screenings ($n = 48$) than Hispanic HIV seropositive women ($n = 1$). However, non-Hispanic women failed to complete more breast cancer screenings ($n = 82$), compared to Hispanic women ($n = 10$). Kruskal-Wallis and ANOVA were not statistically significant. The odds ratio ($OR = 5.8537$; $CI^{95} = 0.7267, 47.1515$) was not statistically significant by Kendall's tau b ($T^b = -1.911$, $p = 0.056$), so the null hypothesis of no difference was supported.

Research Question 4. Did the completion of breast cancer screening differ significantly by the marital status of HIV seropositive women? The hypothesis, based on the literature review findings, stated married HIV seropositive women would complete significantly more breast cancer screening tests, compared to single, partnered, divorced or widowed HIV seropositive women, and the null hypothesis indicated no difference. No women in the sample were categorized as partnered. More single HIV seropositive women completed breast cancer screenings ($n = 35$) than married, divorced or widowed women ($n = 14$), but failed to complete far more screenings ($n = 65$), compared to married, divorced or widowed ($n = 27$) in the study. In ANOVA, the Levene's Test of Equality of Error Variances was statistically significant ($F = 2.736$, $df = 3, 138$, $p = 0.046$) so the test was repeated using Tamhane's T2 test (Meyer, et al, 2012), and the corrected model was not significant ($F = 0.682$, $df = 3,138$, $p = 0.564$). The odds ratio

comparing marital status and breast cancer screening (*OR* = 1.035, CI^{95} = 0.4831, 2.2321) was not statistically significant (T^b = 0.309, *p* = 0.757), so the null hypothesis of no significant difference in the completion of breast cancer screening by marital status in HIV seropositive women was supported.

Research Question 7. Did the completion of breast cancer screening differ significantly by the type of insurance in HIV seropositive women? The hypothesis, based on the review of the literature, stated HIV seropositive women with private or military insurance would complete significantly more breast cancer screenings, compared to HIV seropositive women with other types of insurance, including no insurance, self-pay, and charity care. The null hypothesis indicated no difference. No women in the sample had military insurance. HIV seropositive women with private insurance completed more breast cancer screenings (*n* = 45), compared to HIV seropositive with other types of insurance, as well as no insurance, self-pay, and charity care (*n* = 4), but privately insured women failed to complete more screenings (*n* = 83), compared to their counterparts (*n* = 9). The odds ratio associated with breast cancer screening and type of insurance (*OR* = 1.2199, CI^{95} = 0.3557, 4.1837) was not statistically significant (T^b = − 0.274, *p* = 0.784). The null hypothesis of no difference in breast cancer screening based on type of insurance was supported.

Research Question 8. Did the completion of breast cancer screening differ significantly by the length of time the women were infected with HIV? The hypothesis, based on the literature review, stated women infected with HIV for the shortest category of time, which was 2 to 10 years, would complete significantly more breast cancer screenings, compared to women infected with HIV for a longer period of time, which

was 11 to 26 years in the study, and the null hypothesis indicated no difference between the two age groups. Breast cancer completion was similar between women who had lived with HIV infection for a shorter time, compared to women who had lived with HIV infection for a longer time. However, more women in the shorter time period failed to complete screenings, compared to their counterparts (Table 19).

Table 19

Odds Ratio Using Kendall's Tau B: Completion of Breast Cancer Screening by Time Living with HIV Infection

	Breast Cancer Screening[a]		
	Completed	Not Completed	Totals
HIV Time Group 2-10 years	22	67	87
11-26 years	27	25	52
Totals	49	92	141

Note: [a] (a/b)/(c/d) = (22/67)/(27/25) = 0.304 (CI^{95}=0.147, 0.6287)
χ^2 = 0.002 (does not assume the null hypothesis)
T^b = 0.001 (assumes the null hypothesis)

ANOVA using ranked groups was conducted due to statistical assumption violations, and was found to be significant (Kruskal-Wallis = 11.764, *df* = 1, *p* = 0.001). The results for breast cancer screening indicated significant variability between, or among, the ranks for time living with HIV infection. ANOVA was statistically significant (*F* = 8.672, *df* = 1, 140, *p* = 0.004, η^2 = 0.087). Based on the odds ratio calculated from the contingency table (*OR* = 1.0-0.304, CI^{95} = 0.1423, 0.6042), and using Kendall's tau b for significance (T^b = 3.421, *p* = 0.001), women living with HIV infection for a longer time, 11 to 26 years, were 69.6% more likely to complete breast cancer screening, compared to women living with HIV infection for a shorter time, 2 to 10 years. While the null hypothesis of

no difference was not supported, the hypothesis of shorter time with HIV infection could not be supported either, but the relationship between breast cancer screening and a longer time with HIV infection was identified for further analysis.

Research Question 9. Did the completion of breast cancer screening differ significantly by HIV stage in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women with less progressed HIV infection would complete more breast cancer screenings than HIV seropositive women with more progressed HIV infection, and the null hypothesis was no difference. Four cells had five or fewer observations, so the ordinal variable of HIV stage by classification schema (A1, A2, A3, B1, B2, B3, C1, C2, C3) was collapsed into three three-category and three dichotomous variables based on: (a) symptomatology, where A was asymptomatic, B was symptomatic, but no AIDS-defining conditions, C was the diagnosis of an AIDS-defining condition (StageSx3), and A and B were combined and compared to C (StageSx2); (b) CD4 cell count, where 1 referred to CD4 cell counts of 500 cells/mm^3 or greater, 2 referred to CD4 cell counts between 200 and 499 cells/mm^3, 3 corresponded to CD4 cell counts lower than 200 cells/mm^3 (StageCD3), and 1 was compared to the combined 2 and 3 categories (StageCD2). In univariate analyses, one category in each of the three three-category variables had too few observations to comply with multivariate assumptions so these variables were not analyzed further. However, the three dichotomous variables had sufficient cell numbers. HIV disease progression was categorized according to symptomatology, where asymptomatic and symptomatic, but without an AIDS-defining condition, HIV infection was categorized as less progressed, while HIV infection with an AIDS-defining condition was categorized as more

progressed. Women with an AIDS-defining condition completed or failed to complete fewer screenings than women in the less progressed group (Table 20). The associated odds ratio (*OR* = 2.1916, CI^{95} = 0.6852, 7.0095) was not statistically significant (T^b = 0.249, *p* = 0.804). The results for breast cancer screening indicated significant variability between, or among, the ranks for stage of HIV infection by symptomatology (Kruskal-Wallis = 10.330, *df* = 2, *p* = 0.006).

Table 20

Odds Ratio Using Kendall's Tau B: Completion of Breast Cancer Screening by Fewer Symptoms Related to HIV Infection

	Breast Cancer Screening[a]		
	Completed	Not Completed	Totals
HIV Stage	45	77	122
Asymptomatic or Symptomatic			
AIDS-defining Dx	4	15	19
Totals	49	92	141

Note: [a] (a/b)/(c/d) = (45/77)/(4/15) = 2.192 (CI^{95} = 0.6852, 7.010)
χ^2 = 0.003 (does not assume the null hypothesis)
T^b = 0.804 (assumes the null hypothesis)

ANOVA was statistically significant for the ordinal variable of HIV stage, based on the classification schema (*F* = 5.976, *df* = 8, 133, *p* = 0.000), and the nominal variable of HIV stage, based on symptomatology (*F* = 10.829, *df* = 2, 139, *p* = 0.000). However, eta-squared for HIV stage by classification schema (η^2 = 0.264) was much larger, compared to HIV stage by symptomatology (η^2 = 0.135). Though the odds ratio was not significant using the more stringent Kendall's tau, Kruskall-Wallis and ANOVA indicated a statistically significant difference, so, while the research hypothesis was not

supported, the variables of HIV stage by classification schema and symptomatology were retained for further analyses.

Research Question 10. Did the completion of breast cancer screening differ significantly by CD4 cell count in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women with CD4 cell counts of 500 cells/mm^3 or more would complete significantly more breast cancer screenings, compared to HIV seropositive women with CD4 cell counts less than 500 cells/mm^3, and the null hypothesis indicated no difference. As mentioned in the previous section, the HIV classification schema was collapsed from a nine-category variable into dichotomous and three-category variables. For the resulting variable related to CD4 cell count, the lower category consisted of CD4 cell counts less than 500 cells/mm^3, while the higher category included CD4 cell counts of 500 cells/mm^3 or greater. HIV seropositive women with lower CD4 cell counts completed and failed to complete (n=90) more screenings than women with higher CD4 cell counts (Table 21). The results for breast cancer screening indicated significant variability between, or among, the ranks for stage of HIV infection by lowest CD4 cell count (Kruskal-Wallis = 13.029, $df = 2$, $p = 0.001$).

Table 21

Odds Ratio Using Kendall's Tau B: Completion of Breast Cancer Screening by CD4 Cell Count ≥500mm^3

	Cervical Cancer Screening[a]		
	Completed	Not Completed	Totals
HIV Stage ≥500mm^3	7	2	9
<500mm^3	42	90	132
Totals	49	92	141

Note: [a] (a/b)/(c/d) = (7/2)/(49/92) = 0.133 (CI^{95} = 0.0266, 0.6695)
χ^2 = 0.000 (does not assume the null hypothesis)
T^b = 1.264 (assumes the null hypothesis)

While the odds ratio was not significant, analysis continued using the general linear model (Meyers, et al, 2012). The Levene's Test of Equality of Error Variances was not significant in univariate analysis (F = 0.341, df = 2,139, p = 0.712). However, the between-subjects effect in the corrected model was significant (F = 6.896, df = 2,139, p = 0.001), as was the effect associated with the independent variable (F = 6.896, df = 2, 139, p = 0.001, η^2 = 0.90). The Ryan-Einot-Gabriel-Welsch post hoc test indicated CD4 cell counts of <200 cells/mm^3 and 200 to 499 cells/mm^3 did not differ significantly from one another, but values for these two groups did differ significantly from CD4 cell counts of 500 cells/mm^3 or greater. Based on the additional analyses, the research hypothesis was not supported because the direction hypothesized was incorrect, but the variable was retained for analyses.

Research Question 11. Did the completion of breast cancer screening differ significantly by distance between residence and health care facility in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women

in the shortest distance in miles category would complete significantly more breast cancer screening tests compared to HIV seropositive women who live farther from the health care facility. In the study, the shortest distance category, divided by mean, was 0 to 4.9 miles, while the farthest distance category was 5.0 to 29.0 miles. HIV seropositive women who lived a shorter distance from the health care facility completed more breast cancer screenings (n = 31), but failed to complete more screenings (n = 72), compared to women who lived farther away (n = 18 and 20, respectively). Kruskal-Wallis and ANOVA were not significant. The odds ratio (OR = 0.4784, CI^{95} = 0.223, 1.0264) was not statistically significant (T^b = 1.724, p = 0.085), so the null hypothesis of no difference was supported.

Research Question 12. Did the completion of breast cancer screening differ significantly between HIV seropositive women diagnosed with hypertension, compared to HIV seropositive women without a diagnosis of hypertension? From the review of the literature, women with hypertension completed significantly fewer breast cancer screenings when compared to women without hypertension so the hypothesis stated there would be a significant difference in the completion of breast cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with hypertension and those without hypertension. The number of breast cancer screening completed by HIV seropositive women with hypertension (n = 22) was similar to completed screenings in women without hypertension (n = 27), as were the numbers for failure to completed screening (n = 41 and 51, respectively). The odds ratio for breast cancer screening and hypertension (OR =

1.0136, CI^{95} = 0.5048, 2.0352) was not significant (T^b = 0.230, p = 0.818). No significant difference was noted in the analysis for ranked differences of variance or ANOVA, so the null hypothesis of no difference was supported.

Research Question 13. Did the completion of breast cancer screening differ significantly between HIV seropositive women diagnosed with obesity, compared to HIV seropositive women without a diagnosis of obesity? From the review of the literature, women with obesity completed significantly fewer breast cancer screenings when compared to women without obesity so the hypothesis stated there would be a significant difference in the completion of breast cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with obesity and those without obesity. For some analyses, the four BMI classifications (BMI <18.5 = underweight, 18.5-24.9 = normal weight, 25.0-29.9 = overweight, 30.0 or greater = obesity) were collapsed into two categories (obese = BMI of 30.0 or greater, not obese = BMI of less than 30.0). HIV seropositive women with obesity completed fewer breast cancer screenings (n = 20), compared to non-obese women (n = 29), but both groups failed to complete more screenings (n = 43 and 49, respectively) than were completed. The odds ratio (OR = 0.7859, CI^{95} = 0.3896, 1.5852) was not statistically significant (T^b = −0.470, p = 0.639). No significant difference was noted for Kruskal-Wallis or ANOVA, so the null hypothesis of no difference between the groups of HIV seropositive women, based on a diagnosis of obesity, was supported.

Research Question 14. Did the completion of breast cancer screening differ significantly between HIV seropositive women diagnosed with diabetes mellitus,

compared to HIV seropositive women without a diagnosis of diabetes mellitus? From the review of the literature, women with diabetes mellitus completed significantly more breast cancer screenings when compared to women without diabetes, so the hypothesis stated there would be a significant difference in the completion of breast cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with diabetes mellitus and those without diabetes mellitus. HIV seropositive women with diabetes mellitus completed fewer breast cancer screenings ($n = 9$), compared to HIV positive women without a diagnosis of diabetes mellitus ($n = 40$), but both groups failed to complete more screenings ($n = 14$ and 78, respectively) than were completed. The odds ratio ($OR = 1.2536$, $CI^{95} = 0.4995$, 3.1495) was not statistically significant ($T^b = -0.470$, $p = 0.639$). No significant difference was noted in ANOVA or in analysis for ranked differences of variance, so the null hypothesis of no difference between the groups of HIV seropositive women, based on a diagnosis of diabetes mellitus, was supported.

Research Question 15. Did the completion of breast cancer screening differ significantly between HIV seropositive women diagnosed with depression, compared to HIV seropositive women without a diagnosis of depression? From the review of the literature, women with depression completed significantly fewer breast cancer screenings when compared to women without depression, so the hypothesis stated there would be a significant difference in the completion of breast cancer screening by HIV seropositive women, but did not state which group would complete more screenings. HIV seropositive women with a diagnosis of depression failed to complete more breast

cancer screenings (n = 23) than they completed (n = 17), and a similar trend was noted in HIV seropositive women without a diagnosis of depression (n = 69 and 32, respectively). The odds ratio (OR = 1.5938, CI^{95} = 0.7497, 3.388) was not significant (T^b = 1.070, p = 0.285). The null indicated no difference in the number of completed screenings between HIV seropositive women with depression, and those without a diagnosis of depression. No significant difference was noted in ANOVA or in analysis for ranked differences of variance so the null hypothesis of no difference between the groups of HIV seropositive women, based on a diagnosis of depression, was supported.

Research Question 16. Did the completion of breast cancer screening differ significantly between HIV seropositive women who used tobacco, compared to HIV seropositive women who do not use tobacco? From the review of the literature, women who used tobacco completed significantly fewer breast cancer screenings when compared to women who abstained from tobacco use, so the hypothesis stated there would be a significant difference in the completion of breast cancer screening by HIV seropositive women, but did not state which group would complete more screenings. Fewer HIV positive women who used tobacco completed breast cancer screenings (n = 23), compared to non-users (n = 26), but more non-users failed to complete breast cancer screenings (n = 51), compared to tobacco users (n = 41). The odds ratio (OR = 1.1004, CI^{95} = 0.5489, 2.2061) was not statistically significant (T^b = 0.107, p = 0.915). The null indicated no difference in the number of completed screenings between HIV seropositive women who used tobacco, and those who did not use tobacco. No significant difference was noted in ANOVA or in analysis for ranked differences of

variance, so the null hypothesis of no difference between the groups of HIV seropositive women, based on a tobacco use, was supported.

Cervical Cancer Screening Research Questions

Research Question 1. Did the completion of cervical cancer screening differ significantly by the embodiment variable of age cohort in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women in the youngest age cohort (40 to 49 years) would completed significantly more cervical cancer screenings, compared to older HIV seropositive women, and the null hypothesis indicated no difference. More HIV seropositive women in the 50 to 79 year age cohort completed cervical cancer screenings (n = 25) compared to women in the 40 to 49 years age cohort (n = 14). However, failure to complete breast cancer was higher than completion in both women aged 40 to 49 years (n = 36) and women aged 50 to 79 years (n = 66). Analysis of ranked differences associated with variance and ANOVA were not statistically significant. The odds ratio calculated from the contingency table (OR = 1.0267, CI^{95} = 0.4753, 2.2175), was not statistically significant (T^b = 0.072, p = 0.943). As noted in the results section for breast cancer screening, Kendall's tau b was used to test significance because tau b was not sensitive to outliers or unequal variances. The null hypothesis of no difference of in cervical cancer screening completion by age cohort was supported.

Research Question 2. Did the completion of cervical cancer screening differ significantly by the race of HIV seropositive women? The hypothesis, based on the literature review, stated White HIV seropositive women would complete significantly more cervical cancer screenings, compared to Black or non-White HIV seropositive

women, and the null hypothesis indicated no difference. The sample contained only Black and White HIV seropositive females. Black HIV seropositive women completed more cervical cancer screenings ($n = 34$), compared to White HIV seropositive females ($n = 5$), but Black women also failed to complete more cervical cancer screenings ($n = 94$), compared to White women ($n = 8$) in the study. Kruskal-Wallis and ANOVA did not indicate any statistically significant difference between Black and White HIV seropositive women and the completion of cervical cancer screening. The odds ratio ($OR = 0.5787$, $CI^{95} = 0.1771, 1.8913$) was not statistically significant by Kendall's tau b ($T^b = -0.776$, $p = 0.438$). The null hypothesis of no difference in screening completion based on the race of HIV seropositive women was supported.

Research Question 3. Did the completion of cervical cancer screening differ significantly by the ethnicity of HIV seropositive women? The hypothesis, based on the review of the literature, stated non-Hispanic HIV seropositive women would complete significantly more cervical cancer screenings, compared to Hispanic HIV seropositive women, and the null hypothesis indicated no difference between the two groups. Non-Hispanic HIV seropositive women completed more cervical cancer screenings ($n = 34$) than Hispanic HIV seropositive women ($n = 5$). However, non-Hispanic women failed to complete more cervical cancer screenings ($n = 96$), compared to Hispanic women ($n = 6$). The odds ratio ($OR = 2.3529$; $CI^{95} = 0.6744, 8.2096$) was not statistically significant by Kendall's tau b ($T^b = -1.138$, $p = 0.255$) so the null hypothesis of no difference in cervical cancer screening completion associated with ethnicity was supported.

Research Question 4. Did the completion of cervical cancer screening differ significantly by the marital status of HIV seropositive women? The hypothesis, based on

the literature review findings, stated married HIV seropositive women would complete significantly more cervical cancer screening, compared to single, partnered, divorced or widowed HIV seropositive women, and the null hypothesis indicated no difference. No women in the sample were categorized as partnered. More single HIV seropositive women completed cervical cancer screenings (*n*=27) than married, divorced or widowed women (*n*=12), but failed to complete far more screenings (*n*=72), compared to married, divorced or widowed (*n*=30) in the study. Analysis for ranked differences of variance and ANOVA were not statistically significant. The odds ratio comparing marital status and cervical cancer screening ($OR = 0.9375$, $CI^{95} = 0.4202, 2.0914$) was not statistically significant ($T^b = 0.035$, $p = 0.972$), so the null hypothesis of no difference in screening completion based on marital status was supported.

Research Question 7. Did the completion of cervical cancer screening differ significantly by the type of insurance in HIV seropositive women? The hypothesis, based on the review of the literature, stated HIV seropositive women with private or military insurance would complete significantly more cervical cancer screenings, compared to HIV seropositive women with other types of insurance, including no insurance, self-pay, and charity care. The null hypothesis indicated no difference. No women in the sample had military insurance. HIV seropositive women with private insurance completed more cervical cancer screenings ($n = 34$), compared to HIV seropositive with other types of insurance, as well as no insurance, self-pay, and charity care ($n = 5$), but privately insured women failed to complete more screenings ($n = 94$), compared to their counterparts ($n = 8$). Analysis for ranked differences of variance and ANOVA were not statistically significant. The odds ratio associated with cervical cancer

screening and type of insurance ($OR = 0.5787$, $CI^{95} = 0.1771, 1.8913$) was not statistically significant ($T^b = -0.089$, $p = 0.438$). The null hypothesis associated with no difference in screening completion based on type of insurance was supported.

Research Question 8. Did the completion of cervical cancer screening differ significantly by the length of time the women were infected with HIV? The hypothesis, based on the literature review, stated women infected with HIV for the lowest, or shortest, category of time, which was 2 to 10 years, would complete significantly more cervical cancer screenings, compared to women infected with HIV for a longer period of time, which was 11 to 26 years in the study, and the null hypothesis indicated no difference between the two age groups. Analysis for ranked group differences in variance between length of time living with HIV infection and cervical cancer screening indicated significant variability between, or among, the ranks of time living with HIV infection (Kruskal-Wallis = 4.001, $df = 1$, $p = 0.045$). ANOVA was statistically significant ($F = 4.256$, $df = 1, 140$, $p = 0.041$, $\eta^2 = 0.030$). The odds ratio ($OR = 0.5034$, $CI^{95} = 0.2372, 1.0685$) was not significant ($T^b = 1.948$, $p = 0.051$). However, given the statistically significant results for ranked group differences and ANOVA, and the near-significant results for the stringent Kendall's tau b associated with the odds ratio, the variable of length of time living with HIV infection was included in modeling, but, based on the outcome of the odds ratio, the null hypothesis of no difference was supported.

Research Question 9. Did the completion of cervical cancer screening differ significantly by HIV stage in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women with less progressed HIV infection

would complete more cervical cancer screenings than HIV seropositive women with more progressed HIV infection, and the null hypothesis was no difference. In the study, HIV disease progression was determined by HIV stage and was categorized according to symptomatology. Analysis for ranked group differences in variance indicated cervical cancer screening had significant variability between, or among, the ranks for stage of HIV infection by classification schema, and stage of HIV infection by symptomatology (Kruskal-Wallis = 20.135, $df = 2$, $p = 0.000$). ANOVA was statistically significant for HIV stage based on classification schema ($F = 5.554$, $df = 8, 133$, $p = 0.000$) and HIV stage based on symptomatology ($F = 5.502$, $df = 2, 139$, $p = 0.005$), but the effect size for HIV stage based on classification schema ($\eta^2 = 0.250$) was larger than the effect size for HIV stage based on symptomatology ($\eta^2 = 0.073$). Based on the odds ratio calculated from the contingency table, using Kendall's tau b for significance (Table 22), HIV seropositive women who were asymptomatic, or had symptoms not associated with an AIDS-defining condition, were 6.8 times more likely to complete cervical cancer screening, compared to HIV seropositive women with an AIDS-defining condition. The research hypothesis indicating a difference in screening completion based on HIV disease progression was supported.

Table 22

Odds Ratio Using Kendall's Tau B: Completion of Cervical Cancer Screening by Fewer Symptoms Related to HIV Infection

	Cervical Cancer Screening[a]		
	Completed	Not Completed	Totals
HIV Stage	89	34	123
Asymptomatic or Symptomatic			
AIDS-defining Dx	5	13	18
Totals	94	47	141

Note: [a] (a/b)/(c/d) = (89/34)/(5/13) = 1.0068 (CI^{95} = 0.336, 3.0383)
χ^2 = 0.000 (does not assume the null hypothesis)
T^b = 2.646 (assumes the null hypothesis)

Research Question 10. Did the completion of cervical cancer screening differ significantly by CD4 cell count in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women with CD4 cell counts of 500 cells/mm^3 or more would complete significantly more cervical cancer screenings, compared to HIV seropositive women with CD4 cell counts less than 500 cells/mm^3, and the null hypothesis indicated no difference. Analysis for ranked group differences in variance indicated significant variability between, or among, the ranks for stage of HIV infection by CD4 cell count for cervical cancer screening (Kruskal-Wallis = 18.055, *df* = 2, *p* = 0.000). ANOVA was statistically significant (*F* = 4.218, *df* = 2, 139, 0.017, η^2 = 0.057). Based on the odds ratio calculated from the contingency table using Kendall's tau b for significance, HIV seropositive women whose lowest CD4 cell count was less than 500mm^3 were 26 times more likely to complete cervical cancer screening, compared to HIV seropositive women whose lowest CD4 cell count was 500mm^3 or

greater (Table 23). The null hypothesis of no difference could not be rejected, even when statistical results were found due to the direction of research hypothesis, where HIV seropositive women with lowest CD4 cell counts of $500mm^3$ or greater would complete more screening tests.

Table 23

Odds Ratio Using Kendall's Tau B: Completion of Cervical Cancer Screening by CD4 Cell Count $\geq 500mm^3$

	Cervical Cancer Screening[a]		
	Completed	Not Completed	Totals
HIV Stage $\geq 500mm^3$	8	1	9
$<500mm^3$	31	101	132
Totals	39	102	141

Note: [a] (a/b)/(c/d) = (8/1)/(31/101) = 26.065 (CI^{95} = 3.1364, 216.6024)
χ^2 = 0.000 (does not assume the null hypothesis)
T^b = 0.006 (assumes the null hypothesis)

Research Question 11. Did the completion of cervical cancer screening differ significantly by distance between residence and health care facility in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women in the shortest distance in miles category would complete significantly more cervical cancer screening tests compared to HIV seropositive women who live farther from the health care facility. In the study, the shortest distance category was 0 to 4.9 miles, while the farther distance category was 5.0 to 29.0 miles. HIV seropositive women who lived a shorter distance from the health care facility completed more cervical cancer screenings (n = 36), compared to women who lived farther (n = 3), but women who lived a shorter distance away failed to complete more screenings (n = 67), compared to women in the

farther distance group (n = 35). Analysis of ranked group differences in variance indicated significant variability between, or among, the ranks for distance between residence and health care facility, and cervical cancer screening (Kruskal-Wallis = 10.495, df = 1, p = 0.001). The odds ratio (OR = 6.2687, CI^{95} = 1.8019, 21.8084) was statistically significant (T^b = −4.054, p = 0.000), so the research hypothesis was supported.

Research Question 12. Did the completion of cervical cancer screening differ significantly between HIV seropositive women diagnosed with hypertension, compared to HIV seropositive women without a diagnosis of hypertension? From the review of the literature, women with hypertension completed significantly fewer cervical cancer screenings when compared to women without hypertension so the hypothesis stated there would be a significant difference in the completion of cervical cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with hypertension and those without hypertension. The number of cervical cancer screening completed by HIV seropositive women with hypertension (n = 21) was similar to completed screenings in women without hypertension (n = 18), as were the numbers for failure to completed screening (n = 43 and 59, respectively). The odds ratio for breast cancer screening and hypertension (OR = 1.6008, CI^{95} = 0.7621, 3.3624) was not significant (T^b = 1.053, p = 0.292). No significant difference was noted in ANOVA or in analysis for ranked differences of variance so the null hypothesis of no difference was supported.

Research Question 13. Did the completion of cervical cancer screening differ significantly between HIV seropositive women diagnosed with obesity, compared to HIV seropositive women without a diagnosis of obesity? From the review of the literature, women with obesity completed significantly fewer cervical cancer screenings when compared to women without obesity so the hypothesis stated there would be a significant difference in the completion of cervical cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with obesity and those without obesity. As mentioned in relation to cervical cancer screening, for some analyses, the four BMI classifications were collapsed into two categories (obese = BMI of 30.0 or greater, not obese = BMI of less than 30.0). HIV seropositive women with obesity completed fewer cervical cancer screenings ($n = 16$), compared to non-obese women ($n = 23$), but both groups failed to complete more screenings ($n = 48$ and 54, respectively) than were completed. The odds ratio ($OR = 1.6521$, $CI^{95} = 0.7826, 1.6521$) was not statistically significant ($T^b = -0.067$, $p = 0.946$). No significant difference was noted in ANOVA or in analysis for ranked differences of variance so the null hypothesis of no difference between the groups of HIV seropositive women, based on a diagnosis of obesity, was supported.

Research Question 14. Did the completion of cervical cancer screening differ significantly between HIV seropositive women diagnosed with diabetes mellitus, compared to HIV seropositive women without a diagnosis of diabetes mellitus? From the review of the literature, women with diabetes mellitus completed significantly more cervical cancer screenings when compared to women without diabetes, so the hypothesis

stated there would be a significant difference in the completion of cervical cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with diabetes mellitus and those without diabetes mellitus. HIV seropositive women with diabetes mellitus completed fewer cervical cancer screenings ($n = 7$), compared to HIV positive women without a diagnosis of diabetes mellitus ($n = 32$), but both groups failed to complete more screenings ($n = 17$ and 85, respectively) than were completed. The odds ratio ($OR = 1.0938$, $CI^{95} = 0.4148$, 2.8839) was not statistically significant ($T^b = -0.810$, $p = 0.418$). No significant difference was noted in ANOVA or in analysis for ranked differences of variance so the null hypothesis of no difference between the groups of HIV seropositive women, based on a diagnosis of diabetes mellitus, was supported.

Research Question 15. Did the completion of cervical cancer screening differ significantly between HIV seropositive women diagnosed with depression, compared to HIV seropositive women without a diagnosis of depression? From the review of the literature, women with depression completed significantly fewer cervical cancer screenings when compared to women without depression, so the hypothesis stated there would be a significant difference in the completion of cervical cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with depression, and those without a diagnosis of depression. HIV seropositive women with a diagnosis of depression failed to complete more cervical cancer screenings ($n = 28$) than they completed ($n = 12$), and a similar trend was noted

in HIV seropositive women without a diagnosis of depression (n = 74 and 27, respectively). The odds ratio (OR = 1.1746, CI^{95} = 0.524, 2.6329) was not significant (T^b = 0.267, p = 0.790). The null indicated no difference in the number of completed screenings between HIV seropositive women with depression, and those without a diagnosis of depression. No significant difference was noted in ANOVA or in analysis for ranked differences of variance so the null hypothesis of no difference between the groups of HIV seropositive women, based on a diagnosis of depression, was supported.

Research Question 16. Did the completion for cervical cancer screening differ significantly between HIV seropositive women who used tobacco, compared to HIV seropositive women who do not use tobacco? From the review of the literature, women who used tobacco completed significantly fewer cervical cancer screenings when compared to women who abstained from tobacco use, so the hypothesis stated there would be a significant difference in the completion of cervical cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women who used tobacco, and those who did not use tobacco. Fewer HIV positive women who used tobacco completed cervical cancer screenings (n = 18), compared to non-users (n = 21), but more non-users failed to complete breast cancer screenings (n = 57), compared to tobacco users (n = 45). The odds ratio (OR = 1.0857, CI^{95} = 0.5175, 2.2779) was not statistically significant (T^b = 0.418, p = 0.676). The null indicated no difference in the number of completed screenings between HIV seropositive women who used tobacco, and those who did not use tobacco. No significant difference was noted in ANOVA or in analysis for ranked differences of

variance so the null hypothesis of no difference between the groups of HIV seropositive women, based on a tobacco use, was supported.

Colorectal Cancer Screening Research Questions

Research Question 1. Did the completion of colorectal cancer screening differ significantly by the embodiment variable of age cohort in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women in the youngest age cohort would completed significantly more colorectal cancer screenings, compared to older HIV seropositive women, and the null hypothesis indicated no difference. In the study, for minimum cell numbers to be realized, the original six age cohorts were collapsed into two cohorts, specifically 40 to 49 years and 50 to 79 years. Since the USPSTF did not recommend colorectal cancer screening for women until 50 years of age, the continuous variable of age was divided by the variable mean of 53.3 years to form two age groups, 40 to 53 years and 54 to 79 years, for the hypothesis testing of age related to colorectal cancer screening. Of the 142 HIV seropositive women in the sample, only 36 met the USPSTF preventive health screening recommendations for colorectal cancer screening. The older age group of 54 to 79 years did not complete any colorectal cancer screenings ($n = 0$), while the younger age group of 40 to 53 years completed a few more ($n = 6$) and failed to completed significantly more ($n = 29$). Analysis for ranked group differences in variance indicated statistically significant variability between age group, divided by the mean of the continuous age variable, and colorectal cancer screening (Kruskal-Wallis = 44.584, $df = 1$, $p = 0.000$). ANOVA was statistically significant for age cohort, or ages 40 to 49 years and 50 to 79 years, and age group by mean, specifically 40 to 53 years and 54 to 79 years ($F = 25.823$, $df = 1, 140$, p

= 0.000 and $F = 65.905$, $df = 1, 140$, $p = 0.000$, respectively), but the eta-squared was higher for age group divided by mean ($\eta^2 = 0.320$), compared to age cohort ($\eta^2 = 0.156$). The odds ratio and confidence intervals were not interpretable due to the zero value in one cell, but the associated Kendall's tau b statistically significant ($T^b = -7.956$, $p = 0.000$). As noted in the results sections for breast and cervical cancer screening, Kendall's tau b was used to test significance because tau b was not sensitive to outliers or unequal variances. The null hypothesis of no difference in colorectal cancer screening by age was not supported.

Research Question 2. Did the completion of colorectal cancer screening differ significantly by the race of HIV seropositive women? The hypothesis, based on the literature review, stated White HIV seropositive women would complete significantly more colorectal cancer screenings, compared to Black or non-White HIV seropositive women, and the null hypothesis indicated no difference. The sample contained only Black and White HIV seropositive females, and, as mentioned before, only 36 HIV seropositive women met the USPSTF preventive health screening recommendations for colorectal cancer screening. Black HIV seropositive women completed more colorectal cancer screenings ($n = 6$), compared to White HIV seropositive females ($n = 0$), but Black women also failed to complete more cervical cancer screenings ($n = 29$), compared to White women ($n = 1$) in the study. Initial univariate analyses did not indicate any statistically significant difference between Black and White HIV seropositive women and cervical cancer screening. Results from the analysis for ranked group differences in variance and ANOVA were not significant. The odds ratio was not interpretable due to the zero value in one cell, and was not statistically significant by

Kendall's tau b ($T^b = 1.954$, $p = 0.051$). The null hypothesis of no difference in screening completion based on the race of HIV seropositive women was supported.

Research Question 3. Did the completion of colorectal cancer screening differ significantly by the ethnicity of HIV seropositive women? The hypothesis, based on the review of the literature, stated non-Hispanic HIV seropositive women would complete significantly more colorectal cancer screenings, compared to Hispanic HIV seropositive women, and the null hypothesis indicated no difference between the two groups. Of the 142 HIV seropositive women in the sample, only 36 met the USPSTF preventive health screening recommendations for colorectal cancer screening. Non-Hispanic HIV seropositive women completed more colorectal cancer screenings ($n = 6$) than Hispanic HIV seropositive women ($n = 0$). However, non-Hispanic women failed to complete more colorectal cancer screenings ($n = 29$), compared to Hispanic women ($n = 1$). Results from the analysis for ranked group differences in variance and ANOVA were not significant. The odds ratio ($OR = 0.000$; $CI^{95} = 0.000$, NaN) was not interpretable due to an absence of cases in one cell, and was not statistically significant by Kendall's tau b ($T^b = -1.588$, $p = 0.112$) so the null hypothesis of no difference in cervical cancer screening completion associated with ethnicity was supported.

Research Question 4. Did the completion of colorectal cancer screening differ significantly by the marital status of HIV seropositive women? The hypothesis, based on the literature review findings, stated married HIV seropositive women would complete significantly more colorectal cancer screening tests, compared to single, partnered, divorced or widowed HIV seropositive women, and the null hypothesis indicated no difference. No women in the sample were categorized as partnered, and only 36 met the

USPSTF preventive health screening recommendations for colorectal cancer screening. ANOVA indicated a statistically significant difference between the categories of marital status ($F = 3.375$, $df = 3, 138$, $p = 0.020$, $\eta^2 = 0.068$), in relation to colorectal cancer screening, and the odds ratio was statistically significant for single versus other marital status (Table 24), while the odds ratio for married versus other marital status was not interpretable due to an absence of cases in one cell, and was not significant ($T^b = -1.281$, $p = 0.200$).

Table 24

Odds Ratio Using Kendall's Tau B: Completion of Colorectal Cancer Screening by Marital Status, Single Versus Others

	Colorectal Cancer Screening[a]		
	Completed	Not Completed	Totals
Marital Status			
Single	2	16	18
Married, Divorced, Widowed	4	14	18
Totals	6	30	36

Note: [a] (a/b)/(c/d) = (2/16)/(4/14) = 0.438 ($CI^{95} = 0.0693, 2.7623$)
$\chi^2 = 0.005$ (does not assume the null hypothesis)
$T^b = 2.747$ (assumes the null hypothesis)
[2] $n = 36$; 106 cases were not applicable to USPSTF recommendations for colorectal cancer screening

The null hypothesis of no difference was supported by default because the research question hypothesized being married would be associated with colorectal cancer screenings. However, the marital status associated with never been married, or single, was used in later analyses.

Research Question 7. Did the completion of colorectal cancer screening differ significantly by the type of insurance in HIV seropositive women? The hypothesis, based on the review of the literature, stated HIV seropositive women with private or military insurance would complete significantly more colorectal cancer screenings, compared to HIV seropositive women with other types of insurance, including insurance, self-pay, and charity care. The null hypothesis indicated no difference. No women in the sample had military insurance, and only 36 met the USPSTF preventive health screening recommendations for colorectal cancer screening. More HIV seropositive women with private insurance completed colorectal cancer screenings (n = 6), compared to women with other types of insurance, including no insurance, self-pay and charity care (n = 0). However, more women with private insurance failed to complete colorectal cancer screening (n = 25), when compared to other insurance, no insurance, self-pay and charity care (n = 5). The odds ratio associated with private insurance and colorectal cancer screening was not interpretable due to a zero value in one cell, and was not significant ($T^b = -1.077$, $p = 0.281$). Though an odds ratio could be calculated when the eligible HIV seropositive women (n = 36) were categorized by Medicaid, the most frequently reported type of insurance, and other insurances, no insurance, self-pay and charity care ($OR = 5.5$, $CI^{95} = 0.8389, 36.0598$), the odds ratio was not significant ($T^b = 1.691$, $p = 0.091$). The null hypothesis of no difference in type of insurance and colorectal cancer screening completion was supported.

Research Question 8. Did the completion of colorectal cancer screening differ significantly by the length of time the women were infected with HIV? The hypothesis, based on the literature review, stated women infected with HIV for the lowest, or

shortest, category of time, which was 2 to 10 years, would complete significantly more colorectal cancer screenings, compared to women infected with HIV for a longer period of time, which was 11 to 26 years in the study, and the null hypothesis indicated no difference between the groups. To review, the USPSTF recommendations for colorectal cancer screening only applied to 36 HIV seropositive women. HIV seropositive women in the shortest time group completed fewer screenings ($n = 2$), and failed to complete more screenings ($n = 18$), compared to women in the longer time group ($n = 4$ and 12, respectively). Analyses for ranked group differences in variance between length of time living with HIV infection and colorectal cancer screening, as well as ANOVA, were not statistically significant. The odds ratio ($OR = 0.3333$, $CI^{95} = 0.0525, 2.1155$) was not significant ($T^b = -0.870$, $p = 0.385$). The null hypothesis of no difference between time living with HIV infection, and colorectal cancer screening completion was supported.

Research Question 9. Did the completion of colorectal cancer screening differ significantly by HIV stage in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women with less progressed HIV infection would complete more colorectal cancer screenings than HIV seropositive women with more progressed HIV infection, and the null hypothesis was no difference. In the study, HIV disease progression was determined by HIV stage and was categorized according to symptomatology. The USPSTF recommendations for colorectal cancer applied to only 36 HIV seropositive women in the sample; HIV seropositive women in the asymptomatic and symptomatic group completed more colorectal cancer screenings ($n = 4$), and failed to complete more screenings ($n = 29$), compared to women in the AIDS-defining condition group ($n = 2$ and 1, respectively).

Table 25

Odds Ratio Using Kendall's Tau B: Completion of Colorectal Cancer Screening by Fewer Symptoms Related to HIV Infection

	Colorectal Cancer Screening[a]		
	Completed	Not Completed	Totals
HIV Stage Asymptomatic or Symptomatic	4	29	33
AIDS-defining Dx	2	1	3
Totals	6	30	36

Note: [a] (a/b)/(c/d) = (4/29)/(2/1) = 14.5 (CI^{95} = 1.0575, 198.8211)
χ^2 = 0.119 (does not assume the null hypothesis)
T^b = 0.023 (assumes the null hypothesis)
n = 36; 106 cases were not applicable to USPSTF recommendations for colorectal cancer screening.

Analyses for ranked group differences in variance and ANOVA were not statistically significant for HIV stage based on classification schema or classification by symptomatology; the odds ratio for HIV symptomatology groupings was significant (Table 25). Based on the odds ratio, the null hypothesis of no difference was not supported for HIV stage by symptomatology and colorectal cancer screening.

Research Question 10. Did the completion of colorectal cancer screening differ significantly by CD4 cell count in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women with CD4 cell counts of 500 cells/mm^3 or more would complete significantly more colorectal cancer screenings, compared to HIV seropositive women with CD4 cell counts less than 500 cells/mm^3, and the null hypothesis indicated no difference. USPSTF recommendations applied to only 36 HIV seropositive women in the sample. HIV seropositive women with CD4 cell

counts of 500 cells/mm^3 or more completed fewer screenings (n = 1) and failed to completed fewer screenings (n = 2), compared to women with CD4 cell counts less than 500 cells/mm^3 (n = 5 and 28, respectively). Analyses for ranked group differences in variance and ANOVA were not statistically significant. The odds ratio (OR = 2.8, CI^{95} = 0.217, 37.0345) was not statistically significant (T^b = 0.018, p = 0.985). The null hypothesis of no difference for CD4 cell count and colorectal cancer screening was supported.

Research Question 11. Did the completion of colorectal cancer screening differ significantly by distance between residence and health care facility in HIV seropositive women? The hypothesis, based on the literature review, stated HIV seropositive women in the shortest distance in miles category would complete significantly more colorectal cancer screening tests compared to HIV seropositive women who live farther from the health care facility. In the study, the shortest distance category was 0 to 4.9 miles, while the farther distance category was 5.0 to 29.0 miles, and the USPSTF recommendations for colorectal screening only applied to 36 HIV seropositive women. HIV seropositive women in the shorter distance group completed more colorectal cancer screenings (n = 6), but failed to complete more screenings (n = 19), compared to women who lived farther away (n = 0 and 11, respectively). Analyses for ranked group differences in variance and ANOVA were not statistically significant. The odds ratio was not interpretable due to the lack of observations in one cell, and the Kendall's tau b was not statistically significant (T^b = −0.752, p = 0.452), so the null hypothesis of no difference was supported.

Research Question 12. Did the completion of colorectal cancer screening differ significantly between HIV seropositive women diagnosed with hypertension, compared to HIV seropositive women without a diagnosis of hypertension? From the review of the literature, women with hypertension completed significantly fewer colorectal cancer screenings when compared to women without hypertension so the hypothesis stated there would be a significant difference in the completion of colorectal cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with hypertension and those without hypertension. USPSTF recommendations for colorectal screening only applied to 36 HIV seropositive women. Failure to complete screening was the same for both groups ($n = 15$), while HIV seropositive women with hypertension completed more screenings ($n = 4$), compared to women without a diagnosis of hypertension ($n = 2$). Analyses for ranked group differences in variance and ANOVA were not statistically significant. The odds ratio ($OR = 2.0$, $CI^{95} = 0.317, 12.6198$) was not statistically significant ($T^b = -0.983$, $p = 0.326$) so the null hypothesis of no difference was supported.

Research Question 13. Did the completion of colorectal cancer screening differ significantly between HIV seropositive women diagnosed with obesity, compared to HIV seropositive women without a diagnosis of obesity? From the review of the literature, women with obesity completed significantly fewer colorectal cancer screenings when compared to women without obesity so the hypothesis stated there would be a significant difference in the completion of colorectal cancer screening by HIV seropositive women, but did not state which group would complete more

screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with obesity and those without obesity. USPSTF recommendations for colorectal screening only applied to 36 HIV seropositive women. Only one HIV seropositive woman had completed colorectal cancer screening, while five without obesity had completed screening. Women with obesity failed to complete fewer screenings (n = 11), compared to women with obesity (n = 19). Analyses for ranked group differences in variance and ANOVA were not statistically significant. The odds ratio (OR = 0.3455, CI^{95} = 0.0356, 3.35) was not statistically significant (T^b = 1.564, p = 0.118) so the null hypothesis of no difference was supported.

Research Question 14. Did the completion of colorectal cancer screening differ significantly between HIV seropositive women diagnosed with diabetes mellitus, compared to HIV seropositive women without a diagnosis of diabetes mellitus? From the review of the literature, women with diabetes mellitus completed significantly more colorectal cancer screenings when compared to women without diabetes, so the hypothesis stated there would be a significant difference in the completion of colorectal cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with diabetes mellitus and those without diabetes mellitus. USPSTF recommendations for colorectal screening only applied to 36 HIV seropositive women. HIV seropositive women with diabetes completed fewer screenings (n = 1) and failed to complete fewer screenings (n = 6), compared to women without diabetes mellitus (n = 5 and 24, respectively). Analyses for ranked group differences in variance and ANOVA were not statistically significant. The odds ratio

(*OR* = 0.8, CI^{95} = 0.0781, 8.1895) was not statistically significant (T^b = −0.470, *p* = 0.638) so the null hypothesis of no difference in colorectal screening completion based on a diagnosis of diabetes mellitus was supported.

Research Question 15. Did the completion of colorectal cancer screening differ significantly between HIV seropositive women diagnosed with depression, compared to HIV seropositive women without a diagnosis of depression? From the review of the literature, women with depression completed significantly fewer colorectal cancer screenings when compared to women without depression, so the hypothesis stated there would be a significant difference in the completion of colorectal cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women with depression, and those without a diagnosis of depression. USPSTF recommendations for colorectal screening only applied to 36 HIV seropositive women. HIV seropositive women with depression completed fewer screenings (*n* = 2) and failed to complete fewer screenings (*n* = 12), compared to women without a diagnosis of depression (n=4 and 18, respectively). Analyses for ranked group differences in variance and ANOVA were not statistically significant. The odds ratio (*OR* = 0.75, CI^{95} = 0.1182, 4.7599) was not statistically significant (T^b = −1.573, *p* = 0.116), so the null hypothesis of no difference was supported.

Research Question 16. Did the completion of colorectal cancer screening differ significantly between HIV seropositive women who used tobacco, compared to HIV seropositive women who do not use tobacco? From the review of the literature, women who used tobacco completed significantly fewer colorectal cancer screenings when

compared to women who abstained from tobacco use, so the hypothesis stated there would be a significant difference in the completion of colorectal cancer screening by HIV seropositive women, but did not state which group would complete more screenings. The null indicated no difference in the number of completed screenings between HIV seropositive women who used tobacco, and those who did not use tobacco. USPSTF recommendations for colorectal screening only applied to 36 HIV seropositive women. Of the HIV positive women who used tobacco, 4 completed colorectal cancer screenings, and 12 failed to complete screenings, while women who abstained from tobacco completed 2 screenings, but failed to complete 18 colorectal cancer screenings. Analyses for ranked group differences in variance and ANOVA were not statistically significant. The odds ratio ($OR = 3.0$, $CI^{95} = 0.4727, 19.0395$) was not statistically significant, so the null hypothesis of no difference in the completion of colorectal cancer screening based on tobacco use was supported.

Additional Research Questions

In the study of 142 HIV seropositive women, 34.8% completed breast cancer screening, 27.7% completed cervical cancer screening, and 16.7% completed colorectal cancer screening when laboratory, radiological and procedure reports were compared to screening intervals based on the USPSTF recommendations. During the review of the literature, questions arose pertaining to whether completing one type of preventive health care screening might increase or decrease the completion of other screening tests in HIV seropositive women. Data was analyzed to determine if a statistically significant difference in completion, or failure to complete, screening tests existed between breast cancer screening and cervical cancer screening, breast cancer screening and colorectal

cancer screening, and cervical cancer screening and colorectal cancer screening in HIV seropositive women. In binomial and one-sample chi-square tests, statistically significant differences were noted between the two groups, completed and failed to complete, in each variable associated with preventive health care screenings for the breast cancer ($\chi^2 = 13.113$, $p < 0.000$), cervical cancer ($\chi^2 = 16.00$, $p < 0.000$), and colorectal cancer ($\chi^2 = 16.00$, $p < 0.000$). Kruskal-Wallis and ANOVA using Kendall's tau b were conducted to examine relationships between the three cancer screenings, and the results are reported below.

Research Question A1. Did the completion, or failure to complete, breast cancer screening increase or decrease the likelihood of cervical cancer screening? Kruskal-Wallis indicated a statistically significant difference in breast cancer screening between the different levels of cervical cancer screening ($\chi^2 = 8.881$, $df = 1$, $p = 0.003$), and the Kendall's tau b was also statistically significant ($T^b = 0.323$, 1-tailed, $p = 0.000$)

Research Question A2. Did the completion, or failure to complete, breast cancer screening increase or decrease the likelihood of colorectal cancer screening? Kruskal-Wallis and Kendall's tau b did not indicate statistically significant differences in breast cancer screening and colorectal cancer screening.

Research Question A3. Did the completion, or failure to complete, cervical cancer screening increase or decrease the likelihood of breast cancer screening? Kruskal-Wallis and Kendall's tau b indicated statistically significant differences in cervical cancer screening between the different levels of each breast cancer screening variable: (a) breast cancer screening, by timeliness ($\chi^2 = 14.553$, $df = 1$, $p = 0.000$; $T^b = 0.925$, 1-

tailed, $p = 0.000$); (b) breast cancer screening, dichotomous ($\chi^2 = 9.039$, $df = 1$, $p = 0.003$; $T^b = 0.267$, 1-tailed, $p = 0.001$).

Research Question A4. Did the completion, or failure to complete, cervical cancer screening increase or decrease the likelihood of colorectal cancer screening? Kruskal-Wallis and Kendall's tau b did not indicate statistically significant differences in cervical cancer screening and colorectal cancer screening.

Research Question A5. Did the completion, or failure to complete, colorectal cancer screening increase or decrease the likelihood of breast cancer screening? Kruskal-Wallis indicated a statistically significant difference in colorectal cancer screening between the different levels of breast cancer screening, by timeliness ($\chi^2 = 5.895$, $df = 1$, $p = 0.015$), but Kendall's tau b was not statistically significant. For the dichotomous variable of breast cancer screening, Kruskal-Wallis and Kendall's tau b were not statistically significant.

Research Question A6. Did the completion, or failure to complete, colorectal cancer screening increase or decrease the likelihood of cervical cancer screening? Kruskal-Wallis indicated a statistically significant difference in colorectal cancer screening between the different levels of cervical cancer screening ($\chi^2 = 13.413$, $df = 1$, $p = 0.000$), but Kendall's tau b was not statistically significant.

Results of Regression Modeling

Variables used in the three regression models were examined for violations of regression assumptions. Casewise diagnostics was used to remove outliers from the variables, and Durban-Watson statistics were calculated to determine independence. Stepwise forward regression modeling began by entering the significant independent and

dependent variables for each preventive health care screening test, established by η^2 statistics, in descending order. Some variables were not related to a statistically significant change, and some significant variables, such as age and time living with HIV infection, had more than one statistically significant form, so the form of the variable, which created the greatest change, was left in the model. When a variable was entered, which did not result in a statistically significant change, the addition of variables ended.

Breast Cancer Screening Model

Confounding and interaction were assessed before the regression model was finalized. For breast cancer screening, previous bivariate analyses identified HIV stage by classification schema, HIV stage by symptomatology, HIV stage by CD4 cell count, cervical cancer screening, time living with HIV infection, and age cohort (40-49 years) as statistically significantly related. As expected, statistically significant covariance was noted amount HIV stage by classification schema, HIV stage by symptomatology, and HIV stage by CD4 cell count. According to the analysis plan outlined earlier, sublevels of variables could be removed if not significant in the model, but, if sublevels were significant, the main variable must be retained (Kleinbaum & Klein, 2002). HIV stage by CD4 cell count had a greater effect (partial $\eta^2 = 0.111$), compared to HIV stage by symptomatology (partial $\eta^2 = 0.001$), when examined together, and HIV stage by CD4 cell count indicated a statistically significant interaction with HIV stage by symptomatology ($p < 0.001$), while HIV stage by symptomatology was no longer statistically significant ($p = 0.778$). When cervical cancer screening was added to the model, statistically significant interaction was noted between the HIV stage by CD4 cell count and cervical cancer screening ($p < 0.001$) and the effect increased ($\eta^2 = 0.182$, or

18.2%). When HIV time, or the number of years living with HIV infection, was added, HIV stage by CD4 cell count was no longer statistically significant in the model, but the adjusted η^2statistic increased (0.182 to 0.254). Upon further examination, HIV stage by CD4 cell count and HIV time were statistically significantly related ($p < 0.001$), and the combination of HIV stage by CD4 cell count, HIV time, and cervical cancer screening explained less of the variance in breast cancer screening ($\eta^2 = 0.253$) than just HIV time and cervical cancer screening ($\eta^2 = 0.254$) so HIV stage by CD4 cell count was replaced by HIV stage by classification schema. HIV stage by classification schema was not statistically significant, as was the interaction between cervical cancer screening and HIV time, so HIV stage by classification schema, as well as the subgroups of HIV stage by symptomatology and HIV stage by CD4 cell count, was removed from the model to lessen interaction among the predictor variables and increase the variance explained by the total model. Log^{10} transformed age was added, and the eta-squared statistic increased, $\eta^2 = 0.286$, but the prior statistical significance for each variable in the model became non-significant, while the sublevels of age group and age cohort, increased to $\eta^2 = 0.268$ and $\eta^2 = 0.306$, respectively, without confounding.

The regression model, which best explained the completion of breast cancer screening in HIV seropositive women, was comprised of age by cohort (40-49 and 50-79 years), HIV time (2-26 years), and cervical cancer screening (0-1). Age cohort, $F(1, 140) = 6.467$, $p = 0.012$, cervical cancer screening, $F(2, 138) = 7.615$, $p = 0.001$, and HIV time, $F(18, 123) = 15.161$, $p = 0.000$, explained 56.1% of the variance in breast cancer screening, adjusted $R^2 = 0.355$ (Table 26).

Table 26

Regression Model for Completion of Breast Cancer Screening in HIV Seropositive Women (N=142)

Variable	R Square (Adj R Sq)	Odds Ratio	CI^{95}	*F*-Statistic	*P*-Value
Age Cohort	0.279 (0.258)	8.0633	1.0226, 63.5801	6.467	0.012
Cervical Cancer Screening	0.187 (0.175)	48.630	6.0884, 388.415	7.615	0.001
Time Living with HIV Infection	0.248 (0.232)	0.4066	0.1328, 1.245	15.161	0.000

Note: $R^2 = 0.561$; adjusted $R^2 = 0.355$

Cervical Cancer Screening Model

For confounding and interaction assessment, the $\log^{10}$ transformation of age, age cohort, and age, divided by mean, were not statistically significantly related to marital status, marital status, single versus others, or marital status, married versus others. The variables in the regression model, which best explained the completion of cervical cancer screening in HIV seropositive women, were the completion of breast cancer screening, distance between residence and health care facility, HIV stage by CD4 cell count, and HIV stage by symptomatology (Table 27). The completion of breast cancer screening, $F(1, 140) = 27.776$, $p < 0.001$, explained 16% of the variance in cervical cancer screening. Distance between residence and health care facility, $F(1, 139) = 23.009$, $p < 0.000$, explained another 7.8%, while HIV stage by CD4 cell count, $F(1, 138) = 18.623$, $p < 0.000$, and HIV stage by symptomatology, $F(1, 137) = 16.079$, $p < 0.000$, explained 3.5% and 2.7%, respectively. The total model explained 31.9% of the variance in cervical cancer screening completion, adjusted $R^2 = 0.273$.

Table 27

Regression Model for Completion of Cervical Cancer Screening in HIV Seropositive Women (N=142)

Variable	R Square (Adj R Sq)	Odds Ratio	CI^{95}	*F*-Statistic	*P*-Value
Breast Cancer Screening	0.166 (0.160)	2.9365	1.3581, 6.3492	27.776	0.000
Distance	0.249 (0.238)	6.2687	1.8019, 21.8084	23.009	0.000
HIV Stage by CD4	0.288 (0.273)	0.0384	0.0046, 0.3188	18.623	0.000
HIV Stage by Symptom	0.319 (0.319)	0.9933	0.3291, 2.9975	16.079	0.000

Note: $R^2 = 0.319$; adjusted $R^2 = 0.273$

Colorectal Cancer Screening Model

Confounding and interaction were assessed before creating the regression model. The variables of age group, divided by mean, and marital status, single verses others, were identified earlier as being statistical significantly related to colorectal cancer screening. Interaction by age, divided by mean, was statistically significant, $F(1, 141) = 56.439$, $p > 0.05$, for colorectal cancer screening, but the interaction of marital status, single versus others, was not statistically significant, $F(1, 140) = 0.457$, $p > 0.000$, so the interaction of age group, divided by mean, is not dependent on marital status, single versus others. A third variable, breast cancer screening, previously found to be statistically significantly related to colorectal cancer screening, was not statistically significant, $F(1, 139) = 1.154$, $p < 0.000$, lowered the effect of the model, and was eliminated as a possible confounding variable. After adjusting for marital status, single

versus others, there was a statistically significant difference in colorectal cancer screening by age group, divided by mean.

The two variables of age group, divided by mean, coded as 1 for ages 40 to 53 years and 2 for ages 54 to 79 years, and marital status, single, coded as 1, versus others, including married, divorced and widowed, coded as 0, best explained the completion of colorectal cancer screening in HIV seropositive women (Table 28). Age, divided by mean, $F(1, 140) = 65.905$, $p < 0.000$, explained 31.5% of the variance in colorectal cancer screening, while single marital status, $F(1, 139) = 35.949$, $p < 0.000$, explained an additional 1.6% of the variance. The total model explained 33.2%, adjusted R^2, of the variance in colorectal cancer screening completion.

Table 28

Regression Model for Completion of Colorectal Cancer Screening in HIV Seropositive Women (N=142)

Variable	R Square (Adj R Sq)	Odds Ratio	CI^{95}	*F*-Statistic	*P*-Value
Age, divided by Mean	0.320 (0.315)	N/A[1]	N/A[a]	65.905	0.000
Marital Status, Single	0.341 (0.331)	0.4375	0.0693, 2.7623	35.949	0.000

Note: [a] one cell had zero observations so OR and CI^{95} could not be calculated; $R^2 = 0.332$; adjusted $R^2 = 0.323$.

Summary of Findings

For breast cancer screening, HIV seropositive women in the older age cohort (50 to 79 years), who lived longer with HIV infection (11 to 26 years), had more progressed HIV infection, and their lowest CD4 cell count was less than 499 cell/mm^3 were likely to complete more breast cancer screening tests. For cervical cancer screening, HIV

seropositive women, who had lived a shorter length of time with HIV infection (2 to 10 years), had more progressed HIV infection, a lowest CD4 cell count of 499 cell/mm^3 or less, and lived a shorter distance from the health care facility completed significantly more cervical screening tests. For colorectal cancer, HIV seropositive women in the younger age group (40 to 53 years), who were single, were more likely to complete colorectal screening tests. The independent variables of race, ethnicity, type of insurance, and the comorbid diagnoses of hypertension, obesity and diabetes mellitus, as well as tobacco use, were not significantly related to the completion of screenings tests for breast cancer, cervical cancer or colorectal cancer.

Breast cancer screening was related to cervical cancer screening, but not colorectal cancer screening. Cervical cancer screening was related to breast cancer screening, but not colorectal cancer screening. Colorectal cancer screening was related to breast cancer screening, but not cervical cancer screening. Possible reasons for the asymmetrical relationship between colorectal cancer screening and breast cancer screening are discussed in the following chapter, as part of the interpretation of findings, implications for public health and clinical practice, and recommendations for future research.

Chapter 5: Discussion, Conclusions, and Recommendations

The purpose of the quantitative study was to describe, compare and determine which independent variables differed significantly between HIV seropositive women who completed, or failed to complete, recommended preventive health care actions for breast cancer, cervical cancer or colorectal cancer, with or without a diagnosis of one or more comorbid conditions. Based on the ecosocial theory (Krieger, 2008), the cross sectional study used observational methodology to collect and analyze information extracted from the EMRs of 142 patients, who received health care services from an infectious disease specialist in an ambulatory care center in Newark, New Jersey, three or more times during the 12 months prior to data collection or death. Identification of variables related to the completion of, or failure to complete, cancer screening tests over the lifespans of HIV seropositive women could indicate a need for practice and policy changes at individual, agency/institutional, local, and regional levels, aimed at positive social change for the prevention of disease and disability, which can negatively impact these women, their families and their communities.

Summary of Findings

The findings of the study were summarized by the constructs of the ecosocial theory.

Embodiment Variables

Age cohort was found to be statistically significant for breast cancer screening, but not as hypothesized. HIV seropositive women in the older cohort, aged 50 to 79 years were 72% more likely to complete breast cancer screening, compared to HIV seropositive women, aged 40 to 49 years. Age, age group, and age cohort were not

significantly related to the completion of, or failure to complete, cervical cancer screening in HIV positive women. For colorectal cancer screening, HIV seropositive women in the younger age cohort (40 to 49 years) and younger age group (40 to 53 years) completed significant more screening tests, compared to older HIV seropositive women. However, age group accounted for more of the variance between the completion of, or failure to complete, colorectal cancer screenings in HIV seropositive women.

Pathway of Embodiments Variables

More Black HIV seropositive women completed more breast, cervical and colorectal cancer screenings, compared to White HIV seropositive women, but race was not significantly related to breast, cervical or colorectal cancer screenings by the HIV seropositive women in the study. Non-Hispanic HIV seropositive women completed more breast, cervical and colorectal cancer screenings, but ethnicity was not found to significantly effect cancer screenings by the HIV seropositive women in the study. The study hypothesized married women would complete more breast, cervical and colorectal cancer screenings, but more single women completed screenings. Marital status was not significantly related to breast or cervical cancer screening in HIV seropositive women in the study. However, while not in the hypothesized direction, marital status, specifically married, was significantly associated with colorectal cancer screening in HIV seropositive women. Education level and employment status could not be assessed in the study due to missing information. As hypothesized, more HIV seropositive women with private insurance completed breast, cervical and colorectal cancer screenings, compared to women with other types of insurance, including no insurance, self-pay and charity

care, but the difference between type of insurance and screening completion was not statistically significant.

Cumulative Interplay Variables

Length of time living with HIV infection was statistically significant for breast cancer screening, but not as hypothesized, which stated women living with HIV infection for a shorter period of time would complete more breast cancer screenings. According to the study, women who had lived a longer period of time with HIV infection, which was 11 to 26 years, completed significantly more breast cancer screenings. While the hypothesized direction of the relationship between length of time living with HIV infection and the completion of breast cancer screenings was not supported, the inverse direction was statistically significant, so the variable of HIV time was retained for further analysis. Length of time living with HIV infection was not significant for cervical cancer screening, but, as hypothesized, HIV seropositive women, who had lived with HIV infection for a shorter length of time completed significantly more colorectal cancer screenings, compared to women who had lived with HIV infection for a longer period of time. As mentioned earlier, the nine-category HIV staging classification schema was collapsed into several additional variables. HIV stage by classification schema, and HIV stage by symptomatology were statistically significant in some analyses, the research hypothesis, but not in the direction hypothesized. HIV seropositive women, who were asymptomatic or had symptoms, but not an AIDS-defining condition, were 2.2 times more likely to complete breast cancer screening, compared to HIV seropositive women with an AIDS-defining condition. HIV stage by classification schema, and HIV stage by symptomatology were significantly

related to cervical cancer screenings. HIV stage by symptomatology was significantly related to colorectal cancer screenings in HIV seropositive women in the study.

In the analyses to examine the relationship between lowest CD4 cell count, and breast or cervical cancer screenings, the additional analyses, which included post hoc tests, supported the research hypothesis of a difference between CD4 cell counts and screening completion. However, the research hypothesis stated HIV seropositive women with CD4 cell counts of 500 cells/mm^3 or greater would complete more cancer screenings than HIV seropositive women with CD4 cell counts less than 500 cells/mm^3, and these hypothesized relationships were not supported; in the study, HIV seropositive women with CD4 cell counts of 499 cells/mm^3 or less completed more breast, cervical and colorectal cancer screenings. Distance between residence and health care facility was measured to the tenth of a mile, and the research question hypothesized HIV seropositive women, who lived a shorter (0.3 to 10 miles) distance from the health care facility, would complete more breast cancer screenings, compared to women who lived a longer (11 to 29 miles) distance away. For breast cancer screening, the null hypothesis was supported, as no difference associated with distance between residence and health care facility was found. However, for cervical cancer screening, HIV seropositive women who lived a shorter distance from the health care facility did complete more screenings. There was no statistically significant difference in the distance between residence and health care facility and the completion of, or failure to complete, colorectal cancer screenings in HIV seropositive women.

No statistically significant difference was found for breast, cervical or colorectal cancer screening completion between HIV seropositive women with hypertension,

compared to HIV seropositive women without hypertension. Obesity, defined as a BMI of 30.0 or greater, was not significantly related to the completion of breast, cervical or colorectal cancer screenings in HIV seropositive women in the study. A diagnosis of diabetes mellitus was not significantly related to the completion of breast, cervical or colorectal cancer screenings in HIV seropositive women in the study. Likewise, a diagnosis of depression was not significantly related to the completion of, or failure to complete, breast, cervical or colorectal cancer screenings in HIV seropositive women in the study. Tobacco use was not significantly related to the completion of, or failure to complete, breast, cervical or colorectal cancer screenings in HIV seropositive women in the study.

Interpretation of the Findings

The findings were interpreted according to the constructs of the ecosocial theory, including embodiment, pathways of embodiment, and cumulative interplay.

Embodiment Variables

The independent variables associated with the embodiment were age, as a continuous variable, the ordinal variable of age cohort, and the dichotomous variables of age cohort (40-49 years and 50-79 years), and age group (40-53 years and 54-79 years). Previous studies found conflicting results, suggesting the completion of preventive health care screening for breast, cervical and colorectal cancers declines with increased age (Shenson et al., 2005), and women aged 50 years to 64 years were more likely to be screened for cervical cancer than women in younger or older age categories, (Guilfoyle, et al., 2007). For age group, older age was related to completion of breast cancer screening, while younger age in both the age group and age cohort variables were related

to colorectal cancer screening, suggesting HIV seropositive women may complete the baseline colorectal cancer screening, or the colorectal procedures completed and recorded in the EMR were not for screening purposes. In addition, since the USPSTF recommendations are age-based, variables other than age, or not just age, may influence the completion of preventive health care actions.

Pathway of Embodiment Variables

The independent variables associated with societal arrangements, biological constraints, and the trajectories of biological and social development included race, ethnicity, marital status, and type of insurance. As noted earlier, in 2009, the rate of new HIV cases was fifteen times greater in Black women, compared to White women, and over three times the rate, compared to Hispanic women (CDC, 2011c). Over 90% of the HIV seropositive women were Black, and almost 8% were Hispanic. While colorectal screening rates improved between 2000 and 2005, after adjusting for multiple factors, colorectal screening rates did not improve in non-Hispanic and Hispanic females, and insurance was identified as a predictor of screening behavior independent of income (Trivers et al., 2008). From BRFSS data, non-adherence to breast cancer, cervical cancer and/or colorectal cancer screening was associated with not being married, and/or a lack of health insurance (Bazargan et al., 2004; Coughlin et al., 2004; Sabatino et al., 2008; Trivers et al., 2008). A systematic literature review on cervical cancer screening in African American and Hispanic women found a lack of health care insurance, or having insurance which required a copay, was associated with a lesser likelihood of completing cervical cancer screening (Ackerson & Gretebeck, 2007). The majority of HIV seropositive women in the study were younger, Black, non-Hispanic, had Medicaid, and

over 70% of the HIV seropositive women were single, or never married, while almost 11% were married.

Cumulative Interplay Variables

The independent variables associated with exposure, susceptibility and resistance were the year of HIV diagnosis, stage of HIV disease, the lowest CD4 cell count, the distance between the residence and the health care facility, and the presence of one or more comorbid conditions limited to hypertension, obesity, diabetes mellitus, and depression, as well as tobacco use. In the study, obesity was determined by the height and weight recorded in the EMR, as well as the ICD-9-CM code, to check for agreement between the two methods. A previous study suggested the effects of race and ethnicity on the completion of preventive health care screenings were made non-significant when the individual had one or more comorbid conditions (Kiefe et al., 1998). In addition, the presence of one or more comorbidities was thought to have increased the number of contacts with a health care provider, which increased the number of opportunities for discussion and screening (Gonzalez et al., 2001). Obesity and tobacco use have been associated with failure to complete preventive health screenings for breast and cervical cancer (Coughlin et al., 2004). From an earlier study, HIV infection, while not considered a disability, could result in disability related to medication side effects or complications from AIDS-defining conditions or opportunistic infections, and having a disability was associated with a reduced likelihood of completing preventive health care screenings (Werth, Jr. et al., 2008; Yankaskas et al., 2010).

In my study, the diagnosis of one or more comorbid conditions was not related to the completion of, or failure to complete, preventive health care screenings in HIV

seropositive women. However, having HIV infection for fewer years (2 to 10 years) was associated with a greater likelihood of failing to complete breast cancer screening, while living a shorter distance (0.3 to 10 miles) from the health care facility, having a CD4 cell count of less than $<500mm^3$, and asymptomatic HIV infection was associated with a greater likelihood of failing to complete cervical cancer screening. Older age (50 to 79 years), and single marital status were associated with a greater likelihood of failing to complete colorectal cancer screening.

Accountability and agency variables. The independent variables associated with the entities responsible for creating, contributing or rectifying disparities in health will be controlled by limiting the inclusion of EMRs in the study to those of patients seen by an infectious disease specialist in the ambulatory care center, and only the preventive health care recommendations published by the USPSTF will be used for the study. The lack of a primary health care provider or usual source of health care, having not seen a physician in the past year, and continuity of care were examined in previous studies (O'Malley et al., 2002; Bazargan et al., 2004; Coughlin et al., 2004; Ackerson & Gretebeck, 2007; Litaker & Tomolo, 2007), and region of the country was a variable in an earlier study (Trivers et al., 2008). These variables were controlled in the study by limiting eligibility to the EMRs of HIV seropositive women seen three or more times during the 12 months prior to data collection at a single facility in the northeastern United States.

Dependent Variables

According to the findings of a study examining BRFSS data, never having had either a mammogram or a Pap smear was associated with a lack of other preventive

health screening tests (Coughlin et al., 2004). In the study, dependent variables were related to the completion of, or failure to complete, preventive health care actions, specifically breast cancer screening mammography, cervical cancer screening Pap smears, with or without HPV testing, or colorectal cancer screening by FOBT, sigmoidoscopy or colonoscopy. Each dependent variable was analyzed separately, as well as together.

Breast cancer screening. In an earlier study, 90% of the respondents had a mammogram for breast cancer screening, the mean age of respondents was 74 years, and one-fourth were married (Levy-Storms et al., 2004). In the current study, the mean age calculated from the date of birth recorded in the EMRs was 53 years, one-tenth of the women were married, and having HIV infection for fewer years (2 to 10 years) was associated with a greater likelihood of failing to complete breast cancer screening. Over 34% of the HIV seropositive women in the study completed breast cancer screening, and, of those completed breast cancer screenings, 14% were on time, 11% were early, and 9% were late, according to the screening intervals developed for study purposes.

Cervical cancer screening. In the current student, living a shorter distance (0.3 to 10 miles) from the health care facility, having a CD4 cell count of less than $<500mm^3$, and asymptomatic HIV infection was associated with a greater likelihood of failing to complete cervical cancer screening. Earlier studies have noted a statistically significant positive relationship between the completion of breast cancer screening and cervical cancer screening, where the completion of one type of screening test increased the likelihood another type of screening test would be completed (Coughlin, et al., 2004;

Gregory-Mercado et al., 2007), and this statistically significant relationship was found in the current study.

Colorectal cancer screening. Unlike the synergistic relationship between breast and cervical cancer screening completion, colorectal screening rates tend to fall well below those for breast and cervical cancer screening (Trivers et al., 2008), and Black women have a greater risk of being diagnosed with colorectal cancer, as well as a higher mortality rate, compared to other racial groups (Smith-Bindman et al., 2006). In the current study, over 90% of the EMRs had Black checked for racial group. In addition, older age (50 to 79 years), and single marital status were associated with a greater likelihood of failing to complete colorectal cancer screening in the current study.

Limitations of the Study

Previous studies have mentioned the possibility of race and ethnic categories failing to capture the influence of culture, religion, preferred language, birthplace, citizenship status, years of US residence, and external locus of control issues related to the completion of preventive health screenings and examinations (Ackerson & Gretebeck, 2007; Ackerson et al., 2008; Bazargan et al., 2004; Guilfoyle et al., 2007; Trivers et al., 2008). The current study was not able to obtain information related to these factors, as the information was not routinely recorded in the EMR, though EMR screens contained areas to record the most of the information when reported by a patient. In addition, income information was not recorded in the EMR, and the data set only included distance in miles, to the tenth of a mile, between residence and the health care center, and not an address and/or zip code from which a census tract block could be determined, and used to estimate household income. Lower education, lower household

income and shorter length of time having insurance were associated with nonadherence to breast and cervical cancer screening recommendations in earlier studies (Ackerson & Gretebeck, 2007; Coughlin et al., 2004; Litaker & Tomolo, 2007; Trivers et al., 2008); these variables could not be examined in the current study due to missing information.

Generalizability

As mentioned earlier, breast, cervical, and colorectal cancer incidence in women was higher in New Jersey, compared to almost all other states, and the mortality associated with breast and colorectal cancer in women in New Jersey was higher when compared to other states (CDC, 2011e). While data related to cancer incidence and prevalence in these HIV seropositive women was not abstracted, the statistics reported by the CDC emphasize the need for breast, cervical, and colorectal cancer screening in this population of women.

Due to the specialized structure of EMRs across various facilities, and the specialized nature of the instruments designed from those EMRs, the data abstraction instrument, as well as the findings of the study, may have limited generalizability. However, many previous studies have lacked documentation related to methodology, making comparison to, and replication of, those studies difficult. The methodology used to design the data abstraction instrument and the data abstraction manual from the EMR can be adapted for use at most facilities providing patient care and preventive health services. The independent and dependent variables, as well as the categories within the variables, should allow for replication and comparison across departments and facilities, as well as local and national agencies.

Reliability and Validity

The data abstraction instrument was designed to capture information from the EMR not recorded in a free-text or judgment-based format because the abstraction of free-text information, as well as information regarding a judgment by the abstractor, resulted in less reliable data (Yawn & Wollan, 2005). A data abstraction manual was developed *a priori* to provide guidance during the data abstraction process, and reduce judgment by the abstractor. As noted earlier, by limiting data abstraction to a single site and a single abstractor with MRR experience, the study sought to establish high reliability by reducing variability related to different data abstractors (Bertelsen, 1981; To et al., 2008; Yawn & Wollan, 2005), differences in medical records systems (Lemon et al., 2006; To et. al., 2008), and differences associated with the source of information documented in the medical record (Tisnado et al., 2007), while the MRR was the gold standard for measuring adherence to preventive health care recommendations (Armstrong et al, 2004). Obesity, calculated using the height and weight recorded in the EMR, as well as the ICD-9-CM code, served as a check for agreement between the two methods.

Reliability. The first ten EMRs from which data was abstracted (Time 1) had data abstracted a second time on the last day of data abstraction (Time 2). The abstracted data was compared for information accuracy, and the accuracy of completion information (completed = 1, not completed = 0) assigned to a preventive health care action interval. Agreement between Time 1 and Time 2 was used to determine the reliability associated with the data abstraction process. Unlike the secondary MRR study (To et al., 2008), where data abstractors were not allowed to re-abstract the data they

collected originally at Time 1, this study had only one abstractor, and, while retraining for improved reliability occurred in the aforementioned study (To et al., 2008), the study discussed in this paper did not incorporate added time for retraining or review of the data abstraction process. In addition to the percentage of agreement between time periods, kappa statistics were calculated for reliability (Engel et al., 2009).

In the current study, there were sixteen data points associated with variables for embodiment, pathways of embodiment and cumulative interplay constructs, as well as five calculations for age from date of birth, HIV stage from lowest CD4 cell count and diagnosis of AIDS-defining conditions, BMI from height and weight, and a determination of agreement related to obesity by BMI versus obesity recorded in the EMR. In addition, breast cancer screening had a maximum of fourteen time intervals, cervical cancer screening had a maximum of seven time intervals, and colorectal cancer screening had a maximum of four time intervals. Information added to the EMRs between Time 1 and Time 2 was not included in the calculations. However, data abstracted at Time 1 and corrected at Time 2 was coded as an error in data collection. A total of six data abstraction errors or discrepancies were found across the ten charts for the forty-one possible data points per EMR, and were found in two categories: (a) earliest date of HIV infection; (b) height. Percent agreement was 98.5% between Time 1 and Time 2. The kappa statistic for agreement between Time 1 and Time 2 was -0.970, indicating strong agreement (Meyers, 2013), and was not statistically significant so the null hypothesis was not supported.

Validity. The use of an experienced research nurse, such as the doctoral student, has been supported as the gold standard for data abstraction from medical records

(Bertelsen, 1981; Justice et al., 2006). Agreement and accuracy between data collection times were compared using percent agreement and kappa statistics. At the time the study was conducted, hard copy medical records were being transferred into electronic format across all departments, and the information may not been uniformly transferred. While missing data was limited, the study was designed to minimize the amount of missing data, such as the assignment of a code for not completed to a screening interval when no laboratory, radiological or procedure report was available. Over the time period for data collection, additional information was transferred into the electronic record, explaining why the amount of information abstracted at Time 2 was greater than at Time 1 for the ten EMRs, which were abstracted twice.

Recommendations

The ecosocial theory was helpful in emphasizing the level of measurement, and measurement over time (Krieger, 1999). Future studies on the preventive health actions in HIV seropositive women may benefit from a prospective design and additional data abstractors, as well as comparisons between the EMR and hard copy medical record, especially for information documented on a screen or sheet other than a laboratory, radiological or procedure note, such as a physician's order.

When transcribing information from the hard copy medical record to the EMR, a log of information transcribed might be useful, particularly related to laboratory, radiological and procedure reports, so an assessment can be made as to the portion of the medical record transcribed, as well as the earliest date of care contained in both records. A prospective design would avoid problems associated with an absence or the inaccuracy of transcribed information in the EMR. A prospective design could be used

to test the incorporation of a separate screen for the surveillance of preventive health care actions, including the date and type of test ordered, if the test was ordered for screening or due to a problem, the date the test was completed, and the results of the screening test.

Comparing the hard copy medical record to the EMR was beyond the scope of the study since the doctoral student was the only data abstractor and there was no funding to cover the increased manpower needed to locate and re-file each of the hard copy medical records at the study facility. However, future studies should abstract information from the hard copy of the medical record, as well as the EMR, to assess the level of transfer, as well as the accuracy of the information transfer, within the facility during the data collection time.

Implications for Positive Social Change

Establishing the prevalence or proportion of women who were referred for screening, compared to women not referred, would be desirable for identifying facility- or provider-related factors, but this information would most likely be found in the progress notes or on a document used to record health care provider orders. Again, comparison between the EMR and the hard copy medical record would be useful, and a future study with more data abstractors and/or more time could compare the completion of preventive health care screenings based on the number of orders for the screening tests, as documented in the EMR.

If certain health care providers are not ordering the preventive health care screening tests, improvements at the agency or institutional level associated with the provision of preventive health care services, as well as changes to facilitate the

completion of preventive health care actions, might be necessary to improve cancer screening rates in specific groups, such as older adults and racial or ethnic minorities (Shenson et al., 2005), to improve continuity of care or coordination of services across different departments (O'Malley et al., 2002), or provide the foundation necessary to support the use of non-physician health care providers, such as nurse practitioners (Ackerson & Gretebeck, 2007).

As noted earlier, in the current study, fewer years (2 to 10 years) with HIV infection was associated with a greater likelihood of failing to complete breast cancer screening. Living a shorter distance (0.3 to 10 miles) from the health care facility, having a CD4 cell count of less than <500 cells/mm^3, and having asymptomatic HIV infection was associated with a greater likelihood of failing to complete cervical cancer screening. Older age (50 to 79 years), and single marital status were associated with a greater likelihood of failing to complete colorectal cancer screening. Determining which groups of HIV seropositive women have a greater likelihood of failing to complete age-appropriate preventive health care screenings could assist program planners at agencies, including health departments, as well as health care facilities, in the development of new programs, and the expansion or revision of existing programs. Identifying variables, which can impact the completion of preventive health care actions, would allow surveillance personnel to incorporate these factors into routinely collected information, so adverse trends could be identified quickly and addressed before an impact on individual, family, and community health is realized.

Finally, the Patient Protection and Affordable Care Act, which became effective on March 23, 2010, was incorporated into health care practice during the time frame of

the study, and may account for the absence of a statistically significant relationship between private insurance and the completion of preventive health care actions. Future researchers are advised to assess and/or comment on similar legislative and policy changes, which may positively or negatively impact, not only the findings of their study, but the findings of previous studies, since, unlike most earlier studies, private insurance was not statistically significantly related to preventive health care actions in the study.

Conclusion

Preventive health care recommendations must be incorporated into the provision of services to groups with chronic illnesses, such as HIV infection, but the value of those services, as well as the cost of not providing preventive health care services, may need to be established at the societal level, and not just at the institutional level, where the main focus may be on cost-effective delivery of services. Research identifying geographical areas and subpopulations, where population health has been neglected or has remained at a sub-optimal level for one or more generations, can provide the data necessary to support the enactment of policies aimed at positive social change, expressed as improved population, group and individual health.

Preventive health care screening procedures and tests should be made available to all groups in all geographic areas, across the lifespan. However, resources related to those services, remain limited, so identifying factors that facilitate, not just those which inhibit or prevent, optimal health across the lifespan could result in the development of social policy with a positive effect on population health outcomes. If an individual is to attain optimal health, the factors facilitating the attainment of optimal health must be incorporated into every level of society across the individual's lifespan.

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Appendix A: AIDS-Defining Conditions for Adults 18 Years or Older

Candidiasis of bronchi, trachea, or lungs

Candidiasis of esophagus

Cervical cancer, invasive

Coccidioidomycosis, disseminated or extrapulmonary

Cryptococcosis, extrapulmonary

Cryptosporidiosis, chronic intestinal (duration longer than 1 month)

Cytomegalovirus disease (other than liver, spleen, or nodes), onset at greater than 1 month of age

Cytomegalovirus retinitis (with loss of vision)

Encephalopathy, HIV-related

Herpes simplex: chronic ulcers (duration greater than 1 month) or bronchitis, pneumonitis, or esophagitis (onset at greater than 1 month of age)

Histoplasmosis, disseminated or extrapulmonary

Isosporiasis, chronic intestinal (duration longer than 1 month)

Kaposi sarcoma

Lymphoma, Burkitt (or equivalent term)

Lymphoma, immunoblastic (or equivalent term)

Lymphoma, primary, of brain

Mycobacterium avium complex or *Mycobacterium kansasii,* disseminated or extrapulmonary

Mycobacterium tuberculosis of any site, pulmonary, disseminated, or extrapulmonary

Mycobacterium, other species or unidentified species, disseminated or extrapulmonary

Pneumocystis jirovecii pneumonia

Pneumonia, recurrent

Progressive multifocal leukoencephalopathy

Salmonella septicemia, recurrent

Toxoplasmosis of brain (onset at greater than 1 month of age)

Wasting syndrome attributed to HIV

Appendix B: USPSTF A and B Recommendations by Publication Month and Year

	Breast cancer screening	Cervical cancer screening	Colorectal cancer screening
October 1989	Women over 40 years – annual clinical breast exam (CBE); mammography every 1-2 years beginning at age 50 and concluding at age 75 in absence of pathology; mammography before age 50 for women at high risk for breast cancer	Pap smear with onset of sexual activity; repeat every 1-3 years; discontinue at age 65 if previous Pap smears were consistently normal	Insufficient evidence to recommend for or against fecal occult blood testing (FOBT) or sigmoidoscopy in asymptomatic men and women
1989	Mammography alone or with annual CBE every 1-2 years for women ages 50-69	Pap smear with onset of sexual activity in women with a cervix; repeat at least every 3 years	All persons ages 50 and older – annual FOBT or sigmoidoscopy or both (periodicity unspecified
2002	Mammography with or without CBE every 1-2 years for women ages 40 years and older	USPSTF strongly recommends Pap smear for sexually active women with a cervix	USPSTF strongly recommends women 50 years and older be screened
2003	USPSTF strongly recommends mammography with or without CBE every 1-2 years for women ages 40 and older	USPSTF strongly recommends Pap smear for sexually active women with a cervix	USPSTF strongly recommends women 50 years and older be screened
October 2008			USPSTF recommends FOBT, sigmoidoscopy or colonoscopy beginning at age 50 years and concluding at age 75
November 2009	USPSTF recommends film mammography		

	every 2 years in women ages 50-74	
August 2010	Affordable Care Act implemented using 2002 recommendations	
March 2012		USPSTF recommends Pap smear every 3 years in women ages 21 to 65; to lengthen screening interval, Pap smear with HPV testing every 5 years in women ages 30-65
October 2012		Pap smear every 3 years for women ages 21 to 65; Pap smear with HPV testing every 5 years for women ages 30 to 65

Note: 1984 – establishment of the United States Preventive Services Task Force by the US Department of Health and Human Services for the development of clinical preventive services recommendations based on evidence from published clinical research studies.

Appendix C: Random Numbers Table: Assignment By Line Number

Initial 114:
179 214 435 216 312 259 416 390 141 328 093 026 437 092 237 364 103 441 078 280
236 043 059 337 065 111 181 090 361 438 443 428 027 225 283 345 160 271 264 402
433 013 386 155 285 221 086 375 395 127 370 409 084 054 351 022 239 240 029 102
209 005 173 440 201 354 131 356 008 400 112 413 163 024 116 166 133 233 378 060
125 138 218 421 376 183 199 034 087 252 321 231 057 016 021 007 050 365 424 041
182 411 405 098 012 035 408 178 425 244 226 071 418 149

Order for Sampling with Replacement:
067 432 106 195 048 045 380 381 169 242 349 146 313 136 342 051 154 052 031 422
135 109 304 164 256 307 274 373 074 083 266 278 359 117 399 206 340 174 228 392
017 371 198 157 162 147 190 062 002 064 323 108 427 121 152 176 105 318 122 384
249 212 114 290 207 128 247 335 188 185 076 403 192 383 046 168 010 159 038 073
294 193 171 119 275 250 444 187 397 003 414 070 097 223 406 419 055 140 095 347
036 197 368 089 040 394 220 297 302 288 330 202 143 204 019 130 124 261 293 316
245 015 144 081 389 234 255 430 230 269 387 032 211 326 217 100 332 079 068 309
150 299 219 388 412 110 358 004 350 039 282 404 246 429 407 355 042 423 189 305
333 291 331 272 324 276 186 094 080 366 053 037 317 222 061 268 118 336 315 091
415 006 227 208 377 329 262 156 339 314 072 279 295 129 301 153 263 075 137 396
056 177 391 077 322 167 362 320 258 265 338 001 241 367 148 348 205 260 352 369
025 170 296 374 113 023 257 243 215 277 203 196 334 200 018 385 303 224 431 284
281 172 372 134 287 096 099 165 310 319 058 151 353 191 442 132 410 020 184 253
434 393 426 298 238 300 115 343 270 341 401 306 145 420 175 030 011 180 346 142
235 363 213 104 066 101 028 251 123 248 325 232 047 158 289 344 273 417 014 360
107 327 120 308 139 311 292 398 082 379 267 033 229 382 194 161 088 085 044 049
069 210 439 126 063 436 009 254 286 357

Note: This table of random numbers was generated according to the following specifications - numbers were randomly selected from within the range of 1 to 444. Duplicate numbers were not allowed. Each random number generated in this table, and not in numerical order, will be used to replace the Excel spreadsheet line number associated with the alphabetically-ordered sampling frame. Once the line number has been replaced with a random number, a new list will be generated in numerical order prior to assigning a patient identification number (PID).

Appendix D: Random Numbers Table: Assignment by Non-Linked PID

Initial 114:
5556445 5550905 5552213 5553601 5559436 5551933 5551758 5554883 5555590
5559124 5554522 5559329 5552253 5550824 5557767 5554283 5554736 5558688
5554176 5555056 5557727 5557060 5553749 5556338 5551225 5551251 5556485
5558128 5550544 5555951 5559730 5555738 5550371 5553815 5558795 5553855
5556018 5554843 5558367 5555137 5559516 5553678 5558448 5559583 5558835
5551078 5554349 5557192 5558662 5558942 5550758 5555310 5554308 5559970
5550330 5556592 5557807 5551505 5553067 5551038 5557126 5556205 5556312
5555992 5556953 5554069 5555377 5556765 5559944 5555097 5554949 5558047
5556098 5556632 5555030 5559837 5555417 5551332 5550931 5557447 5555244
5559196 5557340 5555564 5558235 5550224 5556912 5556846 5554389 5554415
5559649 5551292 5553708 5559115 5552894 5558901 5553535 5556979 5559303
5557019 5556526 5555351 5558876 5558301 5552680 5559542 5551612 5552747
5551999 5554242 5557513 5557701 5551826 5552106

Remainder for Sampling with Replacement:
5554745 5551826 5551478 5553494 5559756 5556098 5552922 5558474 5554817
5550971 5557192 5558942 5553067 5551332 5557019 5556526 5555351 5558876
5552680 5552747 5551478 5553494 5559756 5550374 5553472 5554179 5554713
5553111 5557917 5550842 5559413 5556355 5552871 5553324 5557276 5552764
5553645 5556315 5558304 5552337 5554926 5552470 5559840 5555074 5559372
5559133 5554540 5550974 5554326 5551615 5552403 5557383 5552444 5554606
5553431 5556956 5556381 5550761 5554967 5559693 5558171 5557424 5559667
5552937 5555781 5559906 5557530 5559346 5553899 5552897 5558558 5558919
5555181 5559052 5550094 5551656 5559626 5555715 5557450 5557556 5557236
5558197 5552657 5553965 5555354 5551188 5553685 5553538 5556635 5557343
5557877 5556275 5551081 5554006 5552577 5559519 5556035 5556488 5550440
5555928 5556809 5559479 5558812 5555501 5558090 5552978 5553004 5558238
5559880 5552297 5557704 5551483 5557490 5552123 5555567 5550547 5555608
5557770 5556595 5550120 5556890 5551269 5558131 5550201 5551335 5550588
5552831 5556101 5558945 5550414

Note: This table of random numbers was generated on June 18, 2011, using StatTrek (2011), according to the following specifications - numbers were randomly selected from within the range of 5550000 to 5559999. Duplicate numbers were not allowed. Each random number generated in this table is a non-linked patient identification number (PID) and will be used to replace the medical records number (MRN) linked to each electronic medical record (EMR).

Appendix E: Manual for Electronic Medical Records (EMR) Review

Completion of Recommended Preventive Health Care Actions by Women with HIV/AIDS

Manual for Electronic Medical Records (EMR) Review

Primary Information Source: Citrix Centricity (AKA Logitian) Physician Office EMR

Purpose(s) of EMR: (1) Determine the completion rates for preventive health care actions associated with breast cancer screening, cervical cancer screening and colorectal cancer screening in HIV seropositive women aged 40 years and older; (2) Determine whether HIV seropositive women aged 40 years and older are completing the preventive health care actions associated with breast cancer screening, cervical cancer screening and colorectal cancer screening early, late or on-time.

Study List Linking PID with Patient Identifiers

Participant Identification Number (PID): 9-digit non-linked number assigned during randomization of eligible patients from frame created during the initial EMR screening phase. List of PIDs linked to patient first and last names, as well as medical record number, must be maintained and stored in locked file cabinet within the Infectious Disease specialist's office in the ambulatory care center affiliated with University Hospital. This linked list must never be removed from the office and must reflect all current participants including those later found to be ineligible. PIDs cannot be reassigned from an ineligible participant to an eligible participant; for this reason, more PIDs exist than eligible participants.

Patient Identifier 1 - Patient First Name and Last Name: Must be obtained from Home Page screen, Summary tab.

Patient Identifier 2 - Medical Records Number (MRN): Must be obtained from Home Page screen, Summary tab, and checked for consistency across all screen elements (pages, laboratory reports, flow sheets, etc.)

Patient Identifier 3 - Date of Birth (DOB): Must be obtained from Home Page screen, Summary tab, and converted to age in years at time of data collection.

Zip Code – Must be obtained from Home Page screen, Summary tab. Information must include the entire zip code (first 5 digits and plus-four).

NOTE: The three Patient Identifiers are recorded on both the linked Study List and on the PID Linking Page only; none of the Patient Identifiers are to be recorded on the data collection modules. Zip code plus 4 information should be transferred to the appropriate section of the PID Linking Page and then

transferred to the appropriate section on the data collection module for Characteristics.

PID Linking Page

The Study List linking PID numbers with Patient Identifiers, described above, lists patient identification information by PID number. In the event additional information is required, or data recorded on a module during data collection needs to be confirmed or clarified, the data abstractor may prefer locating the participant's medical record number by last name. The PID Linking Page is specific to a single eligible patient and is alphabetized by last name.

PID: Must be obtained from the Study List linking PID numbers and recorded on the first page of the data collection module, which is the Characteristics Module.

Medical Records Number (MRN): Must be obtained from the Study List linking PID numbers, which was obtained from the Home Page Screen and checked for consistency across all screen elements (pages, laboratory reports, flowsheets, etc.)

Patient Last Name: Must be obtained from the Study List linking PID numbers, which was obtained from the Home Page screen, Summary tab

Patient First Name: Must be obtained from the Study List linking PID numbers, which was obtained from the Home Page screen, Summary tab

Date of Birth (DOB): Must be obtained from the Study List linking PID numbers, which was obtained from the Home Page screen, Summary tab, and converted to age in years at time of data collection.

******NOTE: The three Patient Identifiers must be recorded on the Study List and on the PID Linking Page only; the Patient Identifiers must not be recorded on the data collection modules.**

Data Collection Modules

Instructions: Complete the data collection modules using black or blue permanent ink only, using capital letters, and entering one capital letter or number in each space provided on the module. Dates should be formatted as MM/DD/YYYY. Only standardized abbreviations (see separate page) should be used.

If an error is made, cross out the error with a single line completely through the information recorded in error and initial the error on the right end of the single line. Write the correct information on the next data entry line.

If the number of individual data entries exceeds the number of lines on the module, use a new module page and add lower case letters next to the page numbers printed on each module page. For example, page 1 of 2 would become page 1a of 2 and 1b of 2.

Modules are arranged in the order of the information contained in the electronic medical record to aid in data collection. The order of data collection should not be changed because necessary data may be accidentally omitted and would increase the amount of missing data.

Characteristics Module

NOTE: The data recorded on the Characteristics Module will be used to confirm study eligibility.

PID: Recorded at the time the PID Linking Page was completed. After completion of the Characteristics Module, and confirmation of study eligibility, the abstractor is advised to enter the PID on all remaining study module pages in order to avoid or reduce errors associated with incorrect module page completion, particularly errors involving the recording of one participant's information in another participant's module.

Gender: Obtained from the Home Page screen, Summary tab. For study eligibility, the participant's gender should be female.

Age: Calculated from the DOB on the PID Linking Page, the age, in years, should be recorded as the participant's age at the time of data collection. For study eligibility, the participant's age should be 40 years or older.

Race: Only categories from the Home Screen Page screen, Summary tab are included, along with a line for "Other" and "Unknown". Do not record ethnicity in this section, only race.

Ethnicity: Record ethnicity from the Home Screen Page screen, Summary tab.

Marital Status: Only categories from the Home Screen Page screen, Summary tab are included, along with a line for "Other" "None" and "Unknown" If an individual's marital status has changed, record the most recent.

Education Level: Only categories from the Home Screen Page screen, Summary tab are included, along with a line for "Unknown" If an individual's education level has changed, record the most recent.

Employment Status: Only categories from the Home Screen Page screen, Summary tab are included, along with a line for "Unknown" If an individual's employment status has changed, record the most recent.

Insurance: Obtained from the Home Page screen, Summary tab. The majority of insurance and payment options accepted by the ambulatory care center, as well as University Hospital, are captured on the Characteristic Module. There are two spaces provided for insurance or payment options not listed on the module page.

Distance: The distance from the patient's zip code plus 4 (recorded in the previous section) to the ambulatory care center zip code plus 4 should be recorded in tenths of a mile in this section of the Characteristic Module.

Diagnostic Coding Module

Instructions: Data recorded on the Diagnostic Coding Module should be obtained from the Home Page screen, Problems tab, and listed by ICD-9-CM or ICD-10-CM code format. A list of ICD-9-CM codes commonly used in the ambulatory care center and University Hospital is listed on the module page. However, a more complete list of ICD-9-CM codes for study purposes can be found in the appendices at the end of this manual. There are blank spaces provided for other ICD-9-CM codes not listed on the module page, but the use of these spaces should be limited. Date should be recorded in MM/DD/YYYY format.

HIV Status: The ICD-9-CM or ICD-10-CM code for HIV infection should be obtained from the Home Page screen, Problems tab. Only patients with a positive HIV ELISA test and a Western Blot test for confirmation are eligible for study participation. The patient's HIV classification stage will be recorded later in this study module.

Opportunistic Infections (OIs): The ICD-9-CM or ICD-10-CM code for Category B Symptomatic Conditions or Category C AIDS Defining Conditions, also known as OIs, should be obtained from the Home Page screen, Problems tab. This information, along with CD4 cell counts, will be used to determine the individual's HIV Stage Classification in the event a cancer is detected during screening. A list of Category B Symptomatic Conditions and Category C AIDS-Defining Conditions, also known as AIDS Indicator Conditions, is provided on the second page of the Diagnostic Coding Module.

HIV Stage: Using the initial CD4 count and any OIs recorded in the previous section, clearly mark the box corresponding to the individual's earliest HIV Stage.

Hypertension: The ICD-9-CM or ICD-10-CM code for hypertension should be obtained from the Home Page screen, Problems tab. The date of the diagnosis should also be recorded. If the date is missing, enter N.D. for no date in the box reserved for the date. Record the results of the ELISA and Western Blot if these tests were conducted six months before or anytime after the diagnosis of hypertension and record the date corresponding to the test results. Record the CD4 count result and/or HIV PCR result within six months of the hypertension diagnosis, if applicable. Note that the date corresponding to the different diagnosis and test results must be on a new line and the results should correspond to the date line.

Obesity: The ICD-9-CM or ICD-10-CM code for obesity should be obtained from the Home Page screen, Problems tab. The date of the diagnosis should also be recorded. If the date is missing, enter N.D. for no date in the box reserved for the date. Record the results of the ELISA and Western Blot if these tests were conducted six months before or anytime after the diagnosis of obesity and record the date corresponding to the test results. Record the CD4 count result and/or HIV PCR result within six months of the obesity diagnosis, if applicable. Note that the date corresponding to the different diagnosis and test results must be on a new line and the results should correspond to the date line.

A diagnosis of obesity can also be determined by calculating the BMI. Using the most current height and weight recorded from the Home Page screen, calculate the BMI using the tables in the appendix of this manual, record the BMI and determine if the BMI is associated with any level of obesity then mark yes or no, as appropriate.

Diabetes Mellitus: The ICD-9-CM or ICD-10-CM code for diabetes mellitus should be obtained from the Home Page screen, Problems tab. The date of the diagnosis should also be recorded. If the date is missing, enter N.D. for no date in the box reserved for the date. Record the results of the ELISA and Western Blot if these tests were conducted six months before or anytime after the diagnosis of diabetes mellitus and record the date corresponding to the test results. Record the CD4 count result and/or HIV PCR result within six months of the diabetes mellitus diagnosis, if applicable. Note that the date corresponding to the different diagnosis and test results must be on a new line and the results should correspond to the date line.

Depression: The ICD-9-CD or ICD-10-CD code for depression should be obtained from the Home Page screen, Problems tab. The date of the diagnosis should also be recorded. If the date is missing, enter N.D. for no date in the box reserved for the date. Record the results of the ELISA and Western Blot if these tests were conducted six months before or anytime after the diagnosis of depression and record the date corresponding to the test results. Record the CD4 count result and/or HIV PCR result within six months of the

depression diagnosis, if applicable. Note that the date corresponding to the different diagnosis and test results must be on a new line and the results should correspond to the date line.

Tobacco Use: The ICD-9-CM or ICD-10-CM code for tobacco use should be obtained from the Home Page screen, Problems tab. The date of the diagnosis should also be recorded. If the date is missing, enter N.D. for no date in the box reserved for the date. Record the results of the ELISA and Western Blot if these tests were conducted six months before or anytime after the diagnosis of tobacco use and record the date corresponding to the test results. Record the CD4 count result and/or HIV PCR result within six months of the tobacco use diagnosis, if applicable. Note that the date corresponding to the different diagnosis and test results must be on a new line and the results should correspond to the date line.

Tobacco use on the Home Page screen, Problems tab should be recorded as Current, Ever or Never. Mark “yes”, “no” or “unknown” for the appropriate tobacco use, as determined from the EMR.

NOTE: Information recorded in the Home Page screen, Medications tab SHOULD NOT be used to determine a diagnosis not recorded on the Home Page screen, Problems tab. Only information recorded in the Home Page screen, Problems tab has been verified via review by personnel in the Billing Office and Medical Records Department. Information contained on the Home Page screen, Problems tab is maintained by the Billing Office and Medical Records Department, making this information the most current and accurate diagnostic information available in electronic medical records.

Breast Cancer Screening Module

Breast Cancer: The ICD-9-CM or ICD-10-CM code for breast cancer should be obtained from the Home Page screen, Problems tab, as well as a review of the progress notes. Mammogram data is recorded in one of three sections: a) mammograms between ages 40-49; b) mammograms between ages 50-74; c) problem-focused mammograms. If abstractor is unable to determine if a mammogram was completed for screening versus problem-focused reasons, the mammogram data should be recorded as a screening test in the appropriate age section.

Date should be recorded in MM/DD/YYYY format. Description should list the type of screening test. Result should restate the interpretation/summary information on the report. The CD4 and/or HIV PCR data should reflect any of these tests conducted nearest to the date of the mammogram, preferably within six (6) months of the mammogram and/or prior to the mammogram. Timing is determined based on the age at completion of the mammogram, as appropriate to the U.S.P.S.T.F. screening recommendations at the time of the mammogram.

Note: N should be circled for each section in which no mammogram was completed. U should be circled if the review of the progress notes indicates a mammogram was ordered, but no report is found in the EMR. Y should be circled for each section in which a mammogram was completed. N/A should be circled if the section is not relevant to the participant, such as the participant if less than 50 years of age or no problem-focused mammogram was completed.

Cervical Cancer Screening Module

Cervical Cancer: The ICD-9-CM or ICD-10-CM code for cervical cancer should be obtained from the Home Page screen, Problems tab. PAP smear data should be obtained from a review of the progress notes. PAP smear data is recorded in one of two sections: a) PAP smears for screening purposes; b) PAP smears for problem-focused purposes. If the abstractor is unable to determine if a PAP smear was completed for screening versus problem-focused reasons, the PAP smear data should be recorded as a screening test in the appropriate age section.

HPV Testing data should be obtained from a review of the laboratory reports. HPV Testing data should be recorded in one of two sections: a) HPV Testing for screening purposes; b) HPV Testing for problem-focused purposes. If the abstractor is unable to determine if a HPV Test was completed for screening versus problem-focused reasons, the HPV Test data should be recorded as a screening test in the appropriate section.

Date should be recorded in MM/DD/YYYY format. Description should list the type of screening test, if any, conducted during the HPV Testing. Result should restate the interpretation/summary information on the report. The CD4 and/or HIV PCR data should reflect any of these tests conducted nearest to the date of the HPV Testing, preferably within six (6) months of the HPV Test and/or prior to the HPV Test. Timing is determined based on the age at completion of the HPV Test, as appropriate to the U.S.P.S.T.F. screening recommendations at the time.

Note: N should be circled for each section in which no PAP smear or HPV Test was completed. U should be circled if the review of the progress notes indicates a PAP smear or HPV Test was ordered, but no report is found in the EMR. Y should be circled for each section in which a PAP smear or HPV Test was completed. N/A should be circled if the section is not relevant to the participant, such as the participant who had a hysterectomy with removal of the cervix or the participant was diagnosed with HPV infection at the time of a PAP smear for screening purposes.

Colorectal Cancer Screening Module

Colorectal Cancer: The ICD-9-CM or ICD-10-CM code for colorectal cancer should be obtained from the Home Page screen, Problems tab. Colorectal screening data should be obtained from a review of the progress notes. Colorectal screening test results are recorded in one of two sections: a) colorectal results at age 50 years; b) colorectal results

for problem-focused purposes. If the abstractor is unable to determine if a colorectal screening test was completed for screening versus problem-focused reasons, the colorectal screening data should be recorded as a screening test in the appropriate age section.

Date should be recorded in MM/DD/YYYY format. Description should list the type of screening test, such as FOBT, sigmoidoscopy or colonoscopy, conducted. The CD4 and/or HIV PCR data should reflect any of these tests conducted nearest to the date of the colorectal screening test, preferably within six (6) months of the colorectal screening test and/or prior to the colorectal screening test.

Note: N should be circled for each section in which no colorectal screening test was completed. U should be circled if the review of the progress notes indicates a colorectal screening test was ordered, but no report is found in the EMR. Y should be circled for each section in which a colorectal screening test was completed. N/A should be circled if the section is not relevant to the participant.

Conclusion

Date Completed and Initials: At the bottom of each page of each module, the date each module page was completed should be recorded, as well as the initials of the person completing the module. If the module was completed over more than one day, the last day, or the day on which all the information in the module was recorded, should be used. If either the date or the initials are missing, the page should be reviewed and checked against the EMR for completeness, then the reviewer should date and initial the page.

Modules for Data Entry: <u>The PID Linking Page Module should not be kept with the remainder of the modules at any time.</u> Prior to sending the completed modules to data entry, the abstractor and/or reviewer should examine each set for completeness, including date completed and the initials of the person completing the form. The following modules should be forwarded to data entry when complete:

Characteristics Module (2 pages) – confirm eligibility
Diagnostic Coding Module (3 pages)
Breast Cancer Screening Module (2 pages)
Cervical Cancer Screening Module (2 pages)
Colon Cancer Screening Module (1 page)

Appendix F: Updated SPSS Code Book

Variable	SPSS Label	Values/ Codes	Data Type/ Measurement Level
Female Gender	FEMGEN	No=0 Yes=1	Discrete/Nominal
HIV Status	HIV	No=0 Yes=1	Discrete/Nominal
Age	AGE	In years	Continuous/Interval
Age – 2 Groups	AGE3	40-53=1 54-80=2	Discrete/Ordinal
Age Cohort	COHORT	40-49=1 50-59=2 60-69=3 70-79=4 80-89=5 ≥ 90 =6	Discrete/Ordinal
Age – 2 Cohorts	AGE2	40-49=1 50-79=2	Discrete/Ordinal
Census Age Group	CENSAGE	35-44=1 45-54=2 55-64=3 ≥ 65 =4	Discrete/Ordinal
Distance	DIST	0.0-28.8	Continuous/Interval
Distance – Corrected	DISTA	0.0-28.8	Continuous/Interval
Distance – 2 Groups	DIST2	0.3-6.6=1 ≥ 6.7 =2	Discrete/Ordinal

Variable	SPSS Label	Values/ Codes	Data Type/ Measurement Level
Race	RACE	Black=1 White=2 API=3 AIAN=4 Other=666 Unknown=888 Missing=999	Discrete/Nominal
Ethnicity	ETHNIC	Non-Hispanic=0 Hispanic=1 Declined=777 Unknown=888 Missing=999	Discrete/Nominal
Marital Status	MARITAL	Single/ Never Married=0 Married=1 Partnered=2 Separated=3 Divorced=4 Widowed=5 Other=666 Declined=777 Unknown=888 Missing=999	Discrete/Nominal
Education	EDLEV	Omitted	
Employment	EMPLOY	Omitted	
Insurance	INSURE	Medicare=1 SS Disability=2 Medicaid=3 Private Insurance=4 State HMO=5 Charity Care=6 Self-Pay=7 Other=666 Declined=777 Unknown=888 Missing=999	Discrete/Nominal

Variable	SPSS Label	Values/ Codes	Data Type/ Measurement Level
Deceased	DECEASE	Not Decreased=0 Deceased=1	Discrete/Nominal
Earliest Year of HIV Diagnosis	HIVYR	In YYYY format Unknown=888 Missing=999	Continuous/Ratio
Years Since HIV Dx	HIVTIME	In whole years Unknown=888 Missing=999	Continuous/Ratio
AIDS-Defining Conditions/ Opportunistic Infections	OPINF	No=0 Yes=1 Unknown=888 Missing=999	Discrete/Nominal
HIV Stage	HIVSTAGE	A1=1 A2=2 A3=3 B1=4 B2=5 B3=6 C1=7 C2=8 C3=9 Missing=999	Discrete/Ordinal
AIDS vs. Not AIDS	A_NonA	Non-AIDS=0 AIDS=1	Discrete/Nominal
HIV Stage by CD4	STAGE2	< 200=1 200-499=2 ≥ 500=3	Discrete/Ordinal
HIV Stage by Symptoms	STAGE3	Asymptomatic=1 Symp/Non-AIDS=2 ADC/OI=3	Discrete/Ordinal

Variable	SPSS Label	Values/ Codes	Data Type/ Measurement Level
Hypertension	HTNDX	Never=0 Hx of/Past=1 Current=2 Unknown=888 Missing=999	Discrete/Nominal
Body Mass Index	BMI	In 00.0 format, from height and weight measures	Continuous/Interval
BMI Categories	BMI2	14.9-18.4=1 18.5-24.9=2 25.0-29.9=3 ≥ 30.0=4	
Obese Per BMI	OBSBMI	No=0 Yes=1 N/A=9 Unknown=888 Missing=999	Discrete/Nominal
Obesity Listed in EMR	OBSEMR	No=0 Yes=1 N/A=9 Unknown=888 Missing=999	Discrete/Nominal
Obese in EMR and by BMI	OBSBOTH	No=0 Yes=1 N/A=9 Unknown=888 Missing=999	Discrete/Nominal
Diabetes Mellitus	DMDX	No=0 Yes=1 Unknown=888 Missing=999	Discrete/Nominal
Depression	DEPDX	No=0 Yes=1 Unknown=888 Missing=999	Discrete/Nominal

Variable	SPSS Label	Values/ Codes	Data Type/ Measurement Level
Tobacco Use	TOBUSE	No=0 Yes=1 Unknown=888 Missing=999	Discrete/Nominal
Base Mammogram at age 40	BASE40	No=0 Yes=1 Not Applicable=9 Unknown=888 Missing=999	Discrete/Nominal
Base Mammogram at age 50	BASE50	No=0 Yes=1 Unknown=888 Missing=999	Discrete/Nominal
Mammogram at interval x	MTx (MT1-MT12)	Not Done=0 On Time=1 Early=2 Late=3 Not Applicable=9 Unknown=888 Missing=999	Discrete/Ordinal
HPV Positive	HPV	No=0 Yes=1 Not Applicable=9 Unknown=888 Missing=999	Discrete/Nominal
Hysterectomy	HYSTER	No=0 Yes=1 Not Applicable=9 Unknown=888 Missing=999	Discrete/Nominal

Variable	SPSS Label	Values/ Codes	Data Type/ Measurement Level
Pap Smear at interval x	PAPTx (PAPT1-PAPT7)	Not Done=0 On Time=1 Early=2 Late=3 Not Applicable=555 Unknown=888 Missing=999	Discrete/Ordinal
Colorectal Cancer Screening at Interval x	CRCTx (CRCT1-CRCT4)	Not Done=0 On Time=1 Early=2 Late=3 Not Applicable=555 Unknown=888 Missing=999	Discrete/Ordinal