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Assessing Medical Expenditure Disparities Among U.S. Adults with HIV or Cardiovascular Diseases

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This is to certify that the doctoral study by

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Abstract

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MPH, Walden University, 2011

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Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Older adults with infectious and chronic diseases, such as cardiovascular disease and human immunodeficiency virus (HIV), are at high risk for associated chronic comorbidities, which are associated with increased medical expenditures to cover treatment costs. The purpose of this study was to investigate (a) whether adults 65 or older with either HIV or cardiovascular disease were predisposed to increased medical expenditures versus adults 64 and younger, and (b) the impact of race and type of health service used on total direct medical expenditures incurred among adults with HIV or cardiovascular disease. A quantitative, deductive, retrospective cross-sectional design was used, and the behavioral model of health services use and the socioecological model were chosen as the study's theoretical foundations. Analyses were conducted using binary logistic regression. Controlling for confounding variables of education and region of residence, the key findings were that adults ≥ 65 years had higher odds of incurring higher expenditures overall. White patients had higher odds of incurring higher expenditures for medication (OR 1.251), office-based visits (OR 1.433), inpatient visits (OR 1.245), and outpatient visits (OR 1.451) when compared to other races. Older adults with HIV had higher expenditures for medication and home health (OR 1.850); and older adults with cardiovascular disease had higher outpatient (OR 1.235), inpatient (OR 2.142), and emergency room expenditures (OR 1.063). These findings might promote social change because assessing the influences of cost disparities on infectious and chronic diseases can help address variations in health care costs and can initiate the development of tailored evidence-based practice guidelines that can help older adults.

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Dedication

"I can do ALL things though Christ who strengthens me" Philippians 4:13. Thank you Jesus for seeing me through this process, I would not be here without You!

This doctoral capstone is dedicated to my mother, Brenda Richards, who came to the United States thirty years ago in search of a better life for her daughters. Mom, you sacrificed so much so that we could have all the opportunities in life that you did not have, and for that I am so very thankful and grateful. I hope I have made you proud. I love you! To my amazing husband, Chukwuemeka, my love, my rock, my voice of reason and positive reinforcement along this crazy journey, thank you! Thank you for enduring the long nights, the unscheduled pick-ups and drop offs, for becoming a stay-at-home dad, so that I could both continue in my career and pursue this degree simultaneously. You are a Godsend and I love you with all my heart. To my precocious 6-year-old, Micah, who filled my days and nights with lots of hugs and kisses, I hope that mommy is a role-model of all you can be, if you focus, and continue to be determined in your studies. I love you. To my sister, Joanna, and my niece, Raea, who took care of Micah so that I could study or work on my capstone, thank you and I love you. To my ride or dies (Sidatha, Aunty Dawn, Tammera, Kadija, Tiffany J, Faith, Tiffany M. J., Lela), and my extended family members, thank you for your continual support and encouragement and for cheering me on and pushing me over the past 4 years. Finally, to my deceased grandparents, Nicolas and Theresa Richards, thank you both for the rich deposit you instilled in me to work hard, remain diligent, don't take myself too seriously, and don't embarrass the family (smile). You both are the giants on whose shoulders I continue to stand today. I love you both and I'll see you on the other side of eternity.

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I would like to thank Dr. Albert Terrillion for his continued support and encouragement throughout this entire capstone process. There were so many times I wanted to quit, but I thank you for sticking it out with me and for guiding me through till the end. To Dr. James Rohrer, thank you for sharing your vast methodology and data analysis knowledge with me and for your feedback and assistance over the past two years. To Dr. Namgyal Kyulo, thank you for your attention to detail and for your feedback on the final draft.

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Section 1: Foundation of the Study and Literature Review

Introduction

Cardiovascular disease is the leading cause of death among Americans and has become increasingly prevalent among older adults in the United States, resulting in increased economic and healthcare costs for several decades (American Heart Association, 2017; Centers for Disease Control and Prevention [CDC], 2018). Cardiovascular comorbidities, such as coronary artery disease and hypertension, are more prevalent among older adults (individuals 50 years and older), particularly among those living with HIV and AIDS, and can lead to organ and functional impairment, frailty, increased hospitalization, and even death (Abara et al., 2014). These comorbidities for HIV-infected individuals can also lead to increased medical expenditures (Shah, Gleason, & Luque, 2013). Though smoking, physical inactivity, and metabolic syndrome are traditional cardiovascular risk factors for cardiovascular events (Nery et al., 2013), there are higher rates of cardiovascular disease among individuals with HIV due to a combination of risk factors such as antiretroviral therapy and HIV-related inflammation (Tseng et al., 2012). Additionally, because of polypharmacy to alleviate the symptoms of conditions such as heart disease, hypertension and osteoporosis, there is an increased likelihood for dangerous drug interactions for HIV-infected older adults (Aidsinfonet.org, 2014). Health care disparities related to chronic comorbidities like cardiovascular disease can result in increased medical expenditures, higher morbidity, lower survival rates, viral resistance, and diminished quality of life (Olem, Sharp, Taylor & Johnson, 2014).

I conducted this study to assess medical expenditure disparities among U.S. adults with HIV or cardiovascular diseases by investigating whether age, race, or type of health service used impacts medical expenditures in Americans diagnosed with HIV or cardiovascular disease aged 18 and over, particularly as it relates to older Americans. There has been a lack of literature on the health care needs and overall cost for HIV-infected older adults and older adults with cardiovascular disease, but the aging HIV population along with those living with cardiovascular diagnoses indicates a need for further research. Thus, this study can increase awareness about the impact of increases in medical expenditures among older adults diagnosed with HIV or cardiovascular disease, which may lead to the implementation of targeted educational or intervention modalities, at the clinical and individual levels, by gender and/or ethnicity. In Section 1, the problem statement, research questions, theoretical foundations, significance, purpose, and nature of the study will be discussed.

Problem Statement

Cardiovascular disease is one of the leading causes of death among HIV-infected persons, with morbidity and mortality occurring earlier and more frequently among individuals aging with HIV than in uninfected individuals (Cournoyer et al., 2016; Tseng et al., 2012). The associated direct and indirect costs for cardiovascular disease are estimated to reach $818 billion and $276 billion, respectively, by 2030 (Benjamin et al., 2017). Understanding the relationship between aging with HIV or cardiovascular disease and medical expenditures can provide opportunities for the development of tailored

evidence-based practice guidelines that can improve the morbidity and mortality rates of older U.S. adults living with these diseases.

The incidence of cardiovascular disease among HIV-infected patients can range from 28% to 75%, as they are at an increased risk of disease incidence because of longer life expectancies due to antiretroviral therapies (Chastain, Henderson & Stover, 2015). Research shows that among patients with HIV infection, dyslipidemia, "an *elevation* of plasma cholesterol, triglycerides, or both, or a low high-density lipoprotein level that contributes to the development of atherosclerosis" (Goldberg, 2016, p. 1), is generally common and is associated with increased use of medical resources resulting in increased total medical expenditures over time (Richter et al., 2005). However, there is little information focused on the association between aging and the influence of the social, behavioral, and cultural aspects of living with HIV or cardiovascular disease. Moreover, there is insufficient data that addresses aging and the impact on the course and treatment of HIV (Sankar et al., 2011) or cardiovascular disease, especially as it relates to medical expenditures between American men and women, and particularly among older HIV-infected African-American adults. Research has generally focused on individuals under the age of 65, omitting older men and women due to multicomorbidities and other exclusion factors (Jansen et al., 2015). As a result, there is limited data that addresses the health concerns of older men and women, who are also diagnosed with HIV or cardiovascular disease and are taking multiple medications to treat their illness (Jansen et al., 2015; Kebodeaux, Wilson, Smith, & Vouri, 2013).

This study builds on research conducted by Friedman and Duffus (2016) and Kim and Richardson (2014), which suggested that although most older Americans are Medicare health insurance beneficiaries, older adults, especially those with an HIV diagnosis, have higher risks for comorbidities than non-HIV-infected older adults. As a result, older HIV-infected individuals may need additional health insurance options to cover the out-of-pocket costs associated with the chronic diseases associated or run the risk of resorting to cost-saving strategies to mitigate exorbitant medical expenditures (Kim & Richardson, 2014), which can result in reduced treatment adherence. For instance, a 26% rate of nonadherence has been reported among older adults with cardiovascular disease (Ritchey et al., 2016). Reduced HIV treatment adherence is associated with increased medical expenditures, higher morbidity, and diminished survival rates and quality of life (Olem et al., 2014).

Purpose of the Study

Although research has been conducted on the impact of medical expenditure among Americans with cardiovascular disease, little research has addressed HIV diagnoses among older adults or the overlap of HIV diagnoses with cardiovascular comorbidities. The purpose of this quantitative study was to explore whether men and women 65 and older in the United States, with either an HIV or cardiovascular diagnosis are predisposed to increased medical expenditures when compared to adults aged 64 and under. Another focus of this study explores the impact of total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of HIV or cardiovascular disease when compared to individuals of the same race with the same diagnoses, aged 64

and younger. Finally, I also examined the effect that type of health service used has on the total medical expenditures incurred for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease).

I used secondary data from the Medical Expenditure Panel Survey (MEPS) to determine whether disparities in health care expenditures exist among adults with diagnoses of HIV or cardiovascular disease. Increased awareness of medical expenditure disparities among older HIV-infected adults and older adults with cardiovascular disease can address the health and wellness concerns experienced by these individuals, particularly among those who experience added financial strain because of polypharmacy and other medical expenditures due to multicomorbidities.

Research Questions and Hypotheses

Research Question 1: What differences in total medical expenditures exist between American adults aged 65 and older, and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV?

$H_0$1: There is no significant difference in total medical expenditures between American adults aged 65 and older and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV.

H_a1: There is a significant difference in total medical expenditures between American adults aged 65 and older and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV.

Research Question 2: What are the differences in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease

or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger?

$H_0$2: There is no significant difference in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger.

H_a2: There is a significant difference in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger.

Research Question 3: What effect does type of health service (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) utilized have on the total medical expenditures incurred for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease)?

$H_0$3: There is no significant difference in total medical expenditures for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease) when different types of health services (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) are used.

H_a3: There is a significant difference in total medical expenditures for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular

disease) when different types of health services (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) are used.

Theoretical Foundation

Andersen's Behavioral Model of Health Services Use

The behavioral model of health service use developed by Andersen in 1968 was selected to help understand why older HIV-infected persons use health services and to determine whether all older HIV-infected persons, regardless of race, have equitable access to health care (Andersen, 1995). This framework was also chosen because it is commonly used to demonstrate an understanding of human development, behavior, and psychology (Petrovic & Blank, 2015) as well as individuals' of use of health care services based on three main principles:

1. predisposing factors that influence the use of health services and include demographic factors (such as age and gender), social structure (such as education, occupation and ethnicity), and health beliefs (such as attitudes, values, health and health care knowledge, the influence that health services have on current and subsequent perceptions of health services use, and need of health services)
2. enabling factors (e.g., familial/community support and insurance access); and
3. need factors (both perceived and actual, e.g. evaluated health status and perceived need and self-rated health). (Andersen, 1995; Babitsch, Gohl, & Lengerke, 2012)

These factors represent key concepts when analyzing the dynamics behind the cost of health care and medication adherence among the elderly.

Socioecological Model

The socioecological model provides details on the interaction between the interpersonal, intrapersonal, environmental, and policy structures (McLeroy, Bibeau, Steckler, & Glanz, 1988). This is important for older adults with HIV or cardiovascular disease diagnoses regarding the person–environment influential factors that may impact cost disparities (Reininger et al., 2012). The socioecological model is comprised of five factors that include (a) intrapersonal factors, which focuses on behaviors, attitudes, and knowledge on an individual level; (b) interpersonal factors, which focuses on the interplay of informal and formal social support systems and networks; (c) institutional factors, which emphasizes the role of social institutions and organizational characteristics both formally and informally; (d) community factors, which represent organizational, institutional and informal relationships; and e) public policy, which relates to policies and laws that are national, state and local in nature (McLeroy et al., 1988).

There are some overlapping themes between Andersen's behavioral model of health services use and the socioecological model framework in the predisposing/intrapersonal factors, enabling/interpersonal factors, and need/community factors. The predisposing/intrapersonal factors address the sociodemographic constructs and attitudes and beliefs of older adults with HIV or cardiovascular disease; the enabling/interpersonal factors address provider support, insurance, source of care, and income among Medicare beneficiaries; and the need/institutional and community factors

address the need for and accessibility to health care services for older HIV-infected individuals (Salihu et al., 2015) and individuals with cardiovascular disease. Because the focus of this review deals with person–environment factors, the public policy portion of the socioecological model was omitted from this discussion; however overarching themes in current policy within the U.S. were addressed in this study.

The factors of the socioecological model (see Figure 1) were incorporated into this discourse to provide an explanation for the relationships between gender, race and medical expenditure variables, and to bridge the gap among race and gender variables while also identifying areas such as education, health care access, and changes in current policy that can benefit from positive social change within this population. Finally, the use of these theories was critical to the understanding and interpretation of the findings in the data, which was obtained using a quantitative research.

Figure 1. The socioecological model.

Nature of the Study

A quantitative, deductive, retrospective cross-sectional design was used to analyze MEPS secondary data to gain an understanding of whether disparities in medical expenditures exist between adults aged 65 and older with a diagnosis of HIV or cardiovascular disease and adults of the same race and clinical diagnoses aged 64 and younger in the United States. This approach aligns with previous research (Mahmoudi, Jensen, & Tarraf, 2015; Xu & Borders, 2007), and supports the study's problem statement by allowing for the review of a large sample size of the population (by year, race, and region) to calculate total medical expenditures for this cohort. The Agency for Healthcare Research and Quality (AHRQ) database provides data to assess the total medical expenditure. This website provides downloadable datasets from the MEPS on various topics including the use of health care, health care costs, hospital care trends, health insurance coverage, out-of-pocket spending, and patient satisfaction (AHRQ, 2016a), which was helpful in determining total medical expenditures for this population. Independent variables for this study included race, age, gender, and type of health service used. This analysis determined whether disparities in cost and financial burdens existed by age and race, especially between Blacks and Whites, respectively.

A retrospective cross-sectional quantitative design using binary logistic regression was conducted to determine whether a statistically significant relationship exists between the dependent variable (total medical expenditures) and the independent variables (age and race) as it relates to HIV and cardiovascular disease diagnoses, when accounting for confounding variables (e.g., education and region of residence). Binary logistic

regression was useful for this study because there are two or more independent variables (age and race) being used to examine the relationship between the predictor (independent variable) and the predicted variable (the dependent variable total medical expenditures).

Literature Search Strategy

Literature searches were performed in the CDC databases, CINAHL Plus and Medline databases from 2007–2017. Search engines included ProQuest, PubMed, BioMed Central, PLOS, AHRQ, Academic Search Complete and MEDLINE. Search terms and keywords used included *health care cost, HIV, AIDS, older adults, economic impact, elderly, expenditure, Medicare, Socio-ecological model, Behavioral Model of Health Services Use, cardiovascular disease and cardiovascular.* Seminal and peer-reviewed literature focused on the epidemiology of cardiovascular disease and HIV disease among older adults. Current peer-reviewed literature included both quantitative and qualitative studies on medical expenditure trends among HIV and cardiovascular patients; health care disparities by age, race, and sex; access to health care and the role health care reform; comorbidities among older adults with HIV or cardiovascular disease; and the role of polypharmacy and medication nonadherence among older adult populations. Additionally, targeted searches for additional studies were performed using PubMed and manual searches were conducted using the reference sections of some retrieved articles.

Literature Review Related to Key Variables and/or Concepts

The purpose of this section is to review the current literature related to medical expenditures, as it pertains to adults aged 65 and older with a diagnosis of HIV or

cardiovascular disease, and to discuss the varying impacts of those costs within this population. This 65-year and older HIV-infected population was specifically chosen to explore total medical expenditure variations among those individuals listed as Medicare beneficiaries.

HIV and Older Adults

An increasing number of older persons in the United States are not only sexually active but are also not using contraceptives to protect themselves from the potential risk of HIV infection during intercourse (Brooks, Buchacz, Gebo, & Mermin, 2012; Emlet et al., 2015; Nguyen & Holodniy, 2008). As a result, these individuals may be unaware of the risks for HIV acquisition and because they are not routinely tested for HIV, older adults may also experience later HIV diagnoses because they may not be able to differentiate between the typical symptoms of aging and symptoms of HIV (Kebodeaux et al., 2013). HIV incidence in older Americans has increased over the last 20 years, with 26% of Americans 55 and older either living with diagnosed or undiagnosed HIV infection since 2013 (CDC, 2017a). In addition, of the estimated 42% of older Americans currently living with HIV, 6% are 65 years and older (CDC, 2017a). The mean age of manifestation of multiple diseases associated with HIV was between 41 and 46 years (Guaraldi et al., 2011; Nsagha et al., 2015). The relative risk of cardiovascular disease among HIV-infected individuals increases among those aged 45 and older (Currier, Bartlett, & Bloom, 2018; DeSocio et al., 2008).

Despite the statistics of older HIV-infected Americans, they continue to live longer lives because of advances in medical treatment (Balderson et al., 2013, Gebo & Moore, 2004). Further, the timeframe for the development of AIDS decreases with the rise in age (Mensforth, Goodall, Bodasing, & Coultas, 2014). Nevertheless, increased longevity can lead to increased risk and prevalence of age-associated comorbidities such as cardiovascular disease, chronic pulmonary disease, reduced density of bone minerals, renal disease, and hepatic disease (Balderson et al., 2013; Oursler et al., 2011). Although there have been advances in the treatment of HIV, older Americans remain vulnerable to delayed or missed HIV diagnoses, poor health outcomes when treated (Kearney, Moore, Donegan, & Lambert, 2010), and diminished ability to metabolize antiretroviral medications, which may increase toxicity and result in metabolic disturbances, end-organ damage (Deeks, Lewin, & Havlir, 2013), and greater mortality risks (Cahill & Valadez, 2013).

HIV as a Chronic Disease and Polypharmacy

The use of combination antiretroviral therapy among HIV-infected individuals over the past two decades has resulted in a shift from an infection with a high mortality rate (Simone & Appelbaum, 2008), to a largely manageable, chronic condition (Balderson et al., 2013; Cahill & Valadez, 2013) underscored by improved rates of life expectancy along with increased incidence of HIV among older adults (Ghidei et al., 2013; Greene, Steinman, McNicholl, & Valcour, 2014; Marzolini et al., 2011). Longevity among adults with HIV over the age of 50 has increased because of effective courses of highly active antiretroviral therapy, which has extended the survival rates of HIV-

infected patients well past their 60s, 70s, and in some cases their 80s (Cahill & Valadez, 2013; Gebo & Moore, 2004). It is estimated that three out of every four HIV-infected persons will be aged 50 and older by the year 2030 (Serrano-Villar et al., 2016). However, increased life expectancy among older HIV-infected individuals has resulted in the development of multiple chronic health conditions that result in age-associated comorbid disease burden, concomitant use of numerous medications (polypharmacy), and other medication-related problems (Edelman et al., 2013; Gleason, Luque, & Shah, 2013; Greene et al., 2014).

HIV and aging also have a notable impact on the decline in both T-cell and B-cell functions, which accelerates the decline in the functionality of the immune system (Kearny et al., 2010). $CD4^+$ cells, which encompass T-helper lymphocytes as well as other mononuclear cells, are actively targeted and infected by HIV, resulting in the annihilation of the immune system and their vital mediators (Nguyen & Holodniy, 2008). Older adults also experience a decline in thymic function due to age which, among HIV-infected older adults, results in decreased CD4 count responses, as CD4 cell-mediated immune reconstitution relies on proper functionality of the thymus (Brooks, et al., 2012), because the thymus is the only organ within the human body that produces CD4+ T-cells (Gaardbo, Hartling, Gerstoft, & Nielsen, 2012; Jiang et al., 2014).

The aging process could also be accelerated by the impact of the combination of HIV and antiretroviral therapy due to drug toxicity, systemic inflammation, coinfections, and multimorbidity (Gleason et al., 2013; Hentzien et al., 2016). The increase in comorbidities among this cohort of older HIV-infected individuals has also increased the

probability that they will increase their risk of polypharmacy to combat the burden of comorbid disease and HIV (Edelman et al., 2013). HIV-infected older adults have a greater risk of polypharmacy and medication-related problems such as adverse drug events, drug-drug interactions, potentially inappropriate mediations, and poor medication adherence when compared to non-HIV-infected older adults (Greene et al., 2014). Similarly, older HIV-positive males and females may be more likely to engage in polypharmacy than their non-HIV-infected age counterparts in the general population (Gimeno-Gracia et al., 2016). A higher percentage of HIV-positive patients are also prescribed non-antiretroviral therapy drugs, which include anti-infectives, analgesics, central nervous system drugs, gastrointestinal drugs, and respiratory drugs when compared to the similarly aged non-HIV-infected adults in the general population (Gimeno-Gracia et al., 2016).

Cardiovascular Disease and Polypharmacy

In the United States in 2017, 92.1 million adults had at least one type of cardiovascular disease, and by 2030, approximately 44% of adults in the United States may have some form of cardiovascular disease (Benjamin et al., 2017). With older adults, cardiovascular disease can become complicated with a combination of medications, which can result in adverse interactions for older adults (Nahin et al., 2009). Polypharmacy among older adults predisposes them to adverse drug events, which represents 25% of elderly hospital admissions and is the fourth leading cause of hospital admissions among this group of adults (Nanette et al., 2017). Polypharmacy also leads to medication nonadherence because older adults are prescribed a higher amount of

medications when compared to younger patients, which results in increased morbidity, mortality, and healthcare costs that can cost over $100 billion annually to the United States healthcare system (Nannette et al., 2017). A 2016 report showed a 26% nonadherence rate within this population (Ritchey et al., 2016).

HIV and Cardiovascular Disease

Cardiovascular disease has been the leading cause of death in the United States for several decades (CDC, 2016a). Cardiovascular disease is also one of the leading causes of death among HIV-infected persons (Cournoyer et al., 2016). Cardiovascular morbidity and mortality tend to occur earlier and more frequently among individuals aging with HIV than in uninfected individuals (Tseng et al., 2012), with an estimated 4.5 times increased risk for sudden cardiac death and a 1.5 to 2 times greater risk of acute myocardial infarction (Al-Kindi et al., 2016; Feinstein et al., 2016; Miller et al. 2015; Serrano-Villar et al., 2016).

Additionally, sudden cardiac death has occurred in HIV-infected persons at a rate of over 4 times the general population who presented with similar risk factors and tended to occur in older patients who had better HIV disease control (Tseng et al., 2012). Metabolic disturbances, such as dyslipidemia, hypertension, insulin resistance, and increased abdominal visceral adiposity, which occur as a result of HIV infection and antiretrovirals, have been found to increase ischaemic cardiovascular disease risk among HIV-infected persons (Gedela, Vibhuti, Ward, & Boffito, 2014). This is especially apparent among older HIV-infected individuals, as they are increasingly subjected to prolonged use of certain antiretroviral therapies such as protease inhibitors and

nucleoside reverse transcriptase inhibitors (Miller et al., 2015; Wigfall, Williams, Sebastian, & Glover, 2010).

Despite concerns for older adults with HIV and comorbidities, older individuals have been omitted from clinical trials in favor of healthier and younger research candidates due to multicomorbidities and other exclusion factors (Jansen et al., 2015). Thus, there is little data available that addresses the health concerns of older people (Jansen et al., 2015). Even though there is a higher propensity of cardiovascular risk, HIV progression, and use of certain HIV medications among older HIV-infected adults, there is a lack of clinical guidance (Kebodeaux et al., 2013).

Cardiovascular Risk Between HIV-Infected Men and Women

In this review, studies on cardiovascular risk among HIV-infected adults, delineated by gender, had varying conclusions. For instance, Triant, Lee, Hadigan, and Grinspoon (2007) found that although acute myocardial infarction rates and cardiovascular disease risk factors were increased among HIV-infected patients when compared to non-HIV infected controls, these rates were particularly increased among women (Triant et al., 2007). An earlier study conducted by Dolan et al. (2005) also indicated a significantly increased risk factor for cardiovascular disease among HIV-infected women in association with abnormal fat distribution. Additionally, Fredriksen-Goldsen et al., (2013) found that lesbian and bisexual women had a higher risk of cardiovascular disease when compared to heterosexual women. Although there is limited data on cardiovascular disease in women living with HIV, the available data suggests that

there is an increased risk of cardiovascular disease in women when compared to men (Solomon et al., 2018).

In contrast to the results on HIV and women, Losina et al. (2017) reported that without antiretroviral therapy, the lifetime cardiovascular disease risk for HIV-infected men was 12.9% and 9.0% for HIV-infected women. By the age of 60, the risk of cardiovascular disease among men was estimated at 20.5% among HIV-infected men and 13.8% among HIV-infected women (compared to 12.8% for men and 9.7% for women in the U.S. population and 14.6% for men and 9.7% for women in the HIV-uninfected, at-risk for HIV cohort (Losina et al., 2017). Losina et al. also suggested that as men continued to age with HIV, the projected lifetime risk of cardiovascular disease was estimated at 64.8% (compared to 54.8% and 59.1% for the U.S. general population and the HIV-uninfected, at risk for HIV cohort respectively). The projected lifetime risk of aging women with cardiovascular disease was estimated at 43.8% (compared to 46.1% and 36.7% for the U.S. general population, and the HIV-uninfected, at risk for HIV cohort respectively). Though these results are only projections, they indicate that as the HIV-infected adult population ages, the prevalence of cardiovascular risk tends to be higher among men than women.

Medical Expenditures and Older HIV-Infected Adults

Older people living with HIV (i.e., those 65 years and older) receive health insurance coverage from Medicare, with most beneficiaries of Medicare enrolled in fee-for-service plans (Friedman & Duffus, 2016). However, the medical care cost for people living with HIV is still higher than non-HIV-infected persons (Guaraldi et al., 2013).

Research has suggested that those 65 and older with chronic health conditions had higher comorbidity risks than other Medicare beneficiaries enrolled in fee-for-service plans (Friedman & Duffus, 2016). With the rising costs of antiretroviral therapy treatment as HIV-infected persons live longer (Schackman et al., 2006), health care costs for people living with HIV are estimated to be between $10,000 and $40,000 annually (Friedman & Duffus, 2016). Older people living with HIV can encounter additional medical expenditures due to chronic multicomorbidities, which can range from $7,172 for Medicare beneficiaries with one chronic comorbidity to $32,498 for beneficiaries with three or more chronic conditions (Friedman & Duffus, 2016).

Although the health expenses of older people are covered under Medicare, which covers their acute needs, additional health insurance options like Medigap and Medicare advantage may a be needed to cover additional out-of-pocket medical expenditures (Kim & Richardson, 2014). These out-of-pocket costs are influenced by chronic illnesses, which can increase as people living with HIV grow older with the disease (Kim & Richardson, 2014). Because of these growing out-of-pocket costs, older people living with HIV may also experience a rise in poverty rates due to the additional financial burdens they may encounter because of chronic multicomorbidities, which can result in incurred costs ranging between 19% and 35% of income spent for out-of-pocket health care expenditures among poor and near poor Medicare beneficiaries who are elderly (Kim & Richardson, 2014). Thus, older adults may resort to using cost-saving strategies such as skipping medication doses, splitting pills, and limiting or not refilling prescriptions (Musich et al., 2015) to mitigate these out-of-pocket expenditures. Other

less desirable cost-saving methods include the use of credit cards to finance their medical care expenditures (Grande, Barg, Johnson, & Cannuscio, 2013).

Multiple factors can contribute to higher medical expenditures for older people living with HIV: length of time living with HIV infection, increased overall likelihood of changes to their antiretroviral therapy regimens due to drug toxicities, resistance, viral failure, nonadherence and regimen interruptions, mutations that can confer resistance, and non-HIV-related comorbidities and the treatments associated with them (Krentz & Gill, 2015). Further, there may be a correlation between multimorbidity and physician contact among the elderly, as individuals with multimorbidity were over 2 times more likely to have physician contact annually, with the number of visits increasing with each additional chronic comorbidity (Bahler, Huber, Brüngger, & Reich, 2015). Overall, the elderly population requires more specialized care and higher specialized care referrals to manage multimorbidity, which can further increase medical expenditures (Bahler et al., 2015).

Health care Policies and Older HIV-Infected Adults

In the United States many individuals 65 and older receive health insurance coverage from Medicare. As the aging of the population of people living with HIV continues, many older people living with HIV may also be eligible for Medicaid health insurance plans to cover their treatment costs (Yehia et al., 2014). In 2010 approximately one-fifth of Medicare beneficiaries were dually eligible for Medicaid coverage (Lochner & Cox, 2013). In the past 50 years of Medicare services in the United States, Medicare, which is the single largest health insurance source, has accomplished its key goals of

ensuring health care access for the elderly and disabled and the protection against financial hardship as a result of the cost of health care (Davis, Schoen, & Bandeali, 2015). However, there is the ongoing challenge of rising costs for both Medicare beneficiaries and the federal budget, stating that older beneficiaries over the age of 65 spent on average, at least 15% of their income on health care due to their increased need for health care services for the treatment of chronic comorbidities (Davis et al., 2015). Moreover, these individuals faced additional financial risks as well as significant out-of-pocket costs to pay for their health care services, especially among Medicare beneficiaries with income levels below 200% of the poverty level, that required supplemental health care coverage (Davis et al., 2015).

In the United States Medicaid beneficiaries, of which greater than six million are 65 and older, receive long-term health coverage and comprehensive health insurance from Medicaid based on functional limitation tests and state-specific standards for assets and income (Sommers & Grabowski, 2017). Because of the extensive health care needs of the elderly, health care coverage can be expensive, with the elderly accounting for almost two-thirds of Medicaid expenditures, even though they only represent one-fourth of Medicaid beneficiaries (Sommers & Grabowski, 2017). Thus, the elderly may possess dual eligibility for both Medicaid and Medicare to cover their medical expenditures (Sommers & Grabowski, 2017).

Medicare part D

Prescription medication expenditures can represent a costly portion of out-of-pocket medical expenditures, among the elderly and those with extensive health care

needs, because of copayments and other monthly cash expenses (Davis et al., 2015; Grande, Barg, Johnson & Cannuscio, 2013;). On January 1, 2006. Medicare Part D was implemented to provide affordable coverage for prescription drugs to all beneficiaries of Medicare (Mahmoudi, Jensen, & Tarraf, 2015). Medicare has relatively high cost-sharing requirements which necessitates that beneficiaries procure additional cost-sharing assistance options, such as Part D, which offers low income and modest asset beneficiaries premium and cost-sharing support through the low-income subsidy program (Kaiser Family Foundation, 2016a). Medicare Part D has had a tremendous impact on assuaging the financial burden incurred by beneficiaries through the reduction of out-of-pocket costs, increase in utilization of prescription drugs, decline in prescription drug non-adherence due to cost, and reduced rates of racial/ethnic disparities with regards to the utilization of prescription drugs and overall spending among senior beneficiaries of Medicare (Mahmoudi et al., 2015). The Medicare Part D plan does have one critical flaw; the coverage gap or "donut hole" which relates to the temporary limit of coverage for prescription drugs covered by the Part D plan (Kaiser Family Foundation, 2016a; Medicare.gov, n.d.a).

This temporary delay in coverage can have a detrimental financial impact on the elderly diagnosed with HIV or cardiovascular comorbidities. This can be disadvantageous for older adults diagnosed with HIV, particularly if Medicare Part D eligible beneficiaries, who qualify for AIDS Drug Assistance Programs which assists with the prescription coverage gap or "donut hole," are wait-listed due to state's abilities to allocate funds to AIDS Drug Assistance Programs (Kaiser Family Foundation, 2017;

McManus, Engelhard, & Dillingham, 2013). Although Medicare Part D plan lowers out-of-pocket spending, while improving access to, and use of cardiovascular drugs, Part D beneficiaries without financial assistance during the coverage gap are increasingly likely to discontinue or disrupt their cardiovascular medication regimens (Polinski et al., 2012). These delays amplify the risk of deterioration in corresponding improvements in health (Polinski et al., 2012), as well as negative health outcomes and medication nonadherence (Musich et al., 2015).

An increase in combination antiretroviral therapy prescription cost-sharing, which refers to out-of-pocket costs paid by Medicare Part D beneficiaries, represents a correlation with a modest decrease in the tendency of patients to maintain combination antiretroviral therapy adherence at clinically meaningful levels (Johnston et al., 2012). Johnston's et al., (2012) investigations were analogous to research conducted by Das-Douglas et al., (2009), who reported that among 125 HIV-infected homeless and marginally housed individuals with drug coverage receiving anti-retroviral therapy, increased cost of medications served as the premier barrier to antiretroviral medication interruptions among many of the Part-D covered survey respondents.

Among Medicare seniors 65 and older, there is an increased disparity between Blacks and Whites in total annual spending on prescription drugs (Mahmoudi & Jensen, 2014). Conversely, African Americans and Hispanic seniors reported cost as one of the primary reasons for prescription medication nonadherence; with this same group spending less on food and other basic requirements in order to afford prescription drugs (Mahmoudi & Jensen, 2014).

Affordable Care Act and American Health Care Act (Obamacare vs. Trumpcare)

HIV medical care costs in the United States have substantially increased because of antiretroviral therapy; and with the aging population living longer due to improved life expectancies, the financial impact of caring for HIV-infected individuals will continue to increase (Schackman et al., 2006). The United States federal government spent $3.7 billion dollars on HIV-related medical care in 1995; by 2005 the cost tripled to $11.6 billion (Schackman et al., 2006). The federal budget request for domestic HIV for fiscal year 2017 was $27.5 billion (Kaiser Family Foundation, 2016b), which more than doubled the 2005 spending allocation for HIV-related medical care. Among Americans with cardiovascular disease, 7.3 million were uninsured in 2010; however, 7 million individuals who either had or were at risk for cardiovascular disease gained insurance coverage after the first year of the Affordable Care Act's implementation (Wadhera & Joynt, 2017). Under the Affordable Care Act, this shift in coverage impacted healthcare utilization for individuals in low-income populations by increasing access to primary care, specialty care, and prescription drugs (Wadhera & Joynt, 2017).

As the American population continues to age, and becomes more vulnerable to chronic comorbidities, there will be an increased need for additional intensive services, health care education, and integrated and transdisciplinary patient care, which will require legislative changes and the reform of service delivery processes to adequately address this population's needs (Spitzer & Davidson, 2013). These changes are necessary for this population because there are substantial out-of-pocket expenditures for the elderly with chronic conditions, because of longer life expectancies (Hwang, Weller,

Ireys & Anderson, 2001; Meraya, Raval, & Sambamoorthi, 2015; Schackman et al., 2006). Moreover, whereas former political administrations have provided generous spending allocations in the past, little is known about what future administrations will allocate toward this effort in the upcoming years.

Health care coverage has now been extended to over 20 million individuals with additional funding streams allocated for public and community health centers with the Affordable Care Act (Himmelstein & Woolhandler, 2017); and although the Affordable Care Act has some flaws it has reduced medical expenditures, and improved overall quality of care for the insured (Manchikanti, Helm, Benyamin & Hirsch, 2017). Additionally, AIDS Drug Assistance Programs provide HIV-related medications and prescription drug access to HIV-infected individuals who are lower income, uninsured, or underinsured. AIDS Drug Assistance Programs also cover the true out-of-pocket costs for beneficiaries enrolled in Medicare Part D plans; allowing them to navigate the "donut hole" or coverage gap into catastrophic coverage, which assures reduced copayments for covered drugs for the remainder of the year (Kaiser Family Foundation, 2016a; McManus et al., 2013; Medicare.gov, n.d.b). The challenge with AIDS Drug Assistance Programs, however, is that they have been unable to meet the demand for their support, because of declines in annual federal and state allocations, and discretionary support, which has reduced the AIDS Drug Assistance Program budget over the years (McManus et al., 2013). However, under the Affordable Care Act, which now allows for AIDS Drug Assistance Program spending on HIV drugs to count toward true out-of-pocket costs, eligible Medicare Part D beneficiaries can receive help to get through the coverage gap,

which is slated for elimination in 2020, until catastrophic coverage initiates (McManus et al., 2013).

Mortality Trends and HIV-Infected Adults

Antiretroviral treatment has led to the reduction of HIV-related mortality and morbidity, by prolonging suppression of plasma viremia, which has improved the quality of life of HIV-infected individuals (Johnston et al., 2012). Effective antiretroviral treatment, which has led to continual CD4 cell count improvements, has also increased life expectancy for HIV-infected persons that almost rivals the life expectancy for the general population (Smith et al., 2014). Nevertheless, the prolonged suppression of the AIDS virus has also caused a significant increase in non-AIDS mortality rates (Ingle et al., 2014). Non-AIDS infections, liver disease, malignancies and cardiovascular diseases are now major contributors to mortality among hospitalized HIV-infected patients, resulting in the most common cause of in-hospital deaths in the United States (Cowell, Shenoi, Kyriakides, Friedland & Barakat, 2015). As the HIV-infected population continues to age, there is an increased probability that these individuals will die from non-AIDS related comorbidities, such as cardiovascular and liver disease, non-AIDS defining cancer, and substance abuse, rather than from the actual AIDS virus (Cowell et al., 2015; Sackoff, Hanna, Pfeiffer, & Torian (2006). The prevalence rate of non-AIDS-related comorbidities may be much higher in HIV-infected persons than those in the general population (Smith et al., 2014). HIV-infected persons in high-income settings are observed to have non-AIDS morbidities that are related to more traditional risk factors, such as smoking and hepatitis co-infection (Smith et al., 2014). Additionally, the risk of

antiretroviral-related adverse events like diabetes and dyslipidemia, as well as the risk of non-AIDS morbidities, may be increased among HIV-infected individuals because of persistent immunodeficiency, immune activation, immune dysregulation, and HIV-infection associated inflammation (Smith et al., 2014).) Chronic renal disease and cardiovascular disease are the main prognostic factors for 5-year mortality as it relates to older PLHIV (Hentzien et al., 2016). Likewise, non-AIDS related malignancy had higher associations with age, and were strongest for heart/vascular and cardiovascular (Ingle et al., 2014).

Mortality Trends and Costs Among Adults with Cardiovascular Disease

Cardiovascular disease and stroke are among the most prevalent and costly health care issues in the United States, of which 160,000 of the more than 800,000 annual deaths occurring in people 65 and younger (CDC, 2018). One out of every six dollars spent on health care costs is attributed to the treatment of cardiovascular-related conditions (CDC, 2018); and the annual cost of cardiovascular disease treatment and lost productivity in the United States was estimated at $236 billion and $316.6 billion dollars between 2011 and 2013 (CDC, 2018; Kamal & Sawyer, 2017).

The American Heart Association (2017a) estimates that by the year 2035 cardiovascular disease costs will double among those aged 65 to 79 years, and triple among adults 80 years and older. Among adults aged 18 to 64 with incomes at or below 138% federal poverty level, individuals with cardiovascular disease are twice as likely to be Medicaid beneficiaries than uninsured adults (Kaiser Family Foundation, 2012). Additionally, these individuals have higher Medicaid utilization rates and overall health

care spending when compared to enrollees without cardiovascular disease (Kaiser Family Foundation, 2012).

Predisposing/Intrapersonal Factors

Chronic conditions, such as cardiovascular disease, arthritis, and diabetes, have been infrequently studied among older HIV-infected men and women over the age of 65; as most studies have focused on HIV-infected persons at least 50 years of age (Friedman & Duffus, 2016). A large-scale study of HIV-infected persons aged 65 and older, revealed that when compared to non-infected Medicare beneficiaries, HIV-infected Medicare beneficiaries had a significantly higher risk of comorbidities and prevalence of disease which corresponded to increased medical expenditures because of complex medication regimens (Friedman & Duffus, 2016). In another study the behavioral model of health services use model, proved useful for providing understanding of the aging process of older people with HIV and cardiovascular disease, while also looking at the issue of trust attitudes toward health care providers and beliefs about the health care system and its relation to medication adherence (Petrovic & Blank, 2015). Results of the study revealed five barriers which served as hindrances to statins adherence among older people living with HIV and cardiovascular disease: (a) access to health care; (b) alcohol use and/or abuse; (c) mental health issues; (d) personal belief systems; and (e) lack of trust within the patient-physician relationship (Petrovic & Blank, 2015).

Health care barriers denote an inverse relationship between receipt of medical care and delayed or inability to acquire health care due to financial reasons which ultimately delay the timely receipt of medical care, and subsequently affect medication

adherence (Kurichi et al., 2017). Although sociodemographic variables such as age, gender, income, and insurance are highly correlated within most populations, poverty remains the underlying influencing factor concerning access to health care for the elderly/older adults rather than race (Fitzpatrick et al., 2004).

The health beliefs of older adults also play a significant role when discussing the issue of trust toward health care providers, use of health services, and medication adherence; and is important with regards to older adults within the African American and Hispanic communities. When compared to older Whites, older Blacks exhibited a greater distrust of the health care system and physicians as a result of personal racism experiences, knowledge of overt historical racism within the health care system (such as the Tuskegee Syphilis Study), and the social and cultural divide between White physicians and Black patients, which contributes to health care disparities between these groups, and increases negative health outcomes for minorities (Musa et al., 2009). Furthermore, the existence of health care disparities among older African American and Hispanic Medicare beneficiaries, when compared to White Medicare beneficiaries, may cause issues accessing medical care, decreased probability of visiting a physician, inability to see a physician in a timely fashion for illness or injury, receipt of differing treatments based on race and ethnicity, decreased likelihood of high technology treatments for certain diseases, and reduction in medication use if prescription drug insurance was not obtained (Xu & Borders, 2007).

Enabling/Interpersonal Factors

Regarding medical debt between older Black and White adults, research indicates that Blacks are more susceptible than Whites because they are more inclined to have poorer health, fewer financial resources, higher out-of-pocket expenses, increased burden of and lack of awareness about eligibility for the Medicaid enrollment process, experienced a combination of economic and social barriers to care, and have lower wage jobs with no health benefits for retirees which may result in medication non-adherence and circumvention of medical services, as well as reliance on higher costing need-based services when compared to Whites (Wiltshire, Elder, Kiefe, & Allison, 2016). Similarly, in 2012 Medicare beneficiaries allotted 14% of their total household spending toward health-related expenses; with beneficiaries experiencing higher than average health care spending ($4,722 vs. $2,772) and higher spending burden in lower average household budgets ($33,993 vs. $53,000) when Medicare households were compared to non-Medicare households, respectively (Cubanski, Swoope, Damico, & Newman, 2014). These issues demonstrate the interpersonal/enabling factors that may serve as barriers to the use of health services among older adults with a diagnosis of HIV or cardiovascular disease.

Need/Institutional and Community Factors

Institutional and community factors also correlate with the perceived and evaluated need factors with regards to the use of health services among older adults. In the United States very little progress has been made toward properly caring for the elderly and establishing a health care system that is age-friendly; especially since

Americans, 65 and older, consume vast amounts of health care resources (Rowe and Fried, 2013). Furthermore, inadequate numbers of primary care service health care providers and an overall lack of geriatric medicine expertise within the United States health care workforce, also contributes to challenges in caring for this aging population (Rowe & Fried, 2013). This challenge underpins current statistics showing a reduction in income for physicians who obtain additional training to care for geriatric patients, because these individuals are almost exclusively covered by Medicare (Rowe & Fried, 2013).

Physicians may also be unaware of the potential for HIV infection among this population of patients, as older patients are less likely to report symptoms of HIV, as these symptoms oftentimes overlap with comorbidities that are commonly found in older adults (Linley et al., 2012). Interpersonal racial/ethnic barriers exist between minority patients and their predominantly non-minority clinicians/providers; and when compared to White patients, providers were more verbally dominant when speaking with Black patients, which may be because White patients are more verbal than Black patients during physician visits (Beach et al., 2011).

Prevention services and messaging have usually targeted younger audiences, thus disparities common among minority races/ethnicities surrounding stigma, HIV testing barriers, diminished awareness of HIV risk, cultural and socioeconomic issues may also delay HIV testing among older adults and increase HIV infection risk (Linley et al., 2012). These results suggest that reducing disparities in healthcare, particularly among minorities with an HIV diagnosis, can be accomplished by increasing effective

engagement and interaction efforts between providers and minority patients (Beach et al., 2011).

Definitions

Definitions of some of the commonly used terms used in this paper, such as HIV, AIDS, older adults, and Medicare are provided. This is not an exhaustive list of terms used in this paper. Also, based on the nature of the research, other researcher authors may have used alternative definitions to define some of the terms used in this paper.

AIDS: AIDS is the most severe phase of HIV infection. People with AIDS have such badly damaged immune systems that they get an increasing number of severe illnesses, called opportunistic infections (HIV.gov, n.d.).

Cardiovascular disease: Conditions that involve narrow or blocked blood vessels that can lead to a heart attack, chest pain (angina), or stroke (Mayo Clinic, 2017).

HIV: The virus that can lead to acquired immunodeficiency syndrome, or AIDS, if not treated. HIV attacks the body's immune system, specifically the CD4 cells (T cells), which help the immune system fight off infections. Even with treatment, the human body cannot completely eliminate HIV (HIV.gov, n.d.).

Medicare: Medicare is the federal health insurance program for people who are 65 and older, certain younger people with disabilities, and people with End-Stage Renal Disease (permanent kidney failure requiring dialysis or a transplant, sometimes called ESRD). Medicare helps cover four specific services for these individuals: Medicare Part A (Hospital Insurance), Medicare Part B (Medical Insurance), Medicare Part C (Medicare Advantage Plans), Medicare Part D (prescription drug coverage) (Medicare.gov, n.d.c).

Multicomorbidities or multimorbidity: The presence of one or more chronic conditions, disorders, or diseases (Valderas, Starfield, Sibbald, Salisbury, & Roland, 2009).

Older individuals/elderly or older adults: In the context of this paper, these terms overwhelmingly refer to adults 65 years and older.

Polypharmacy: The use of multiple medications and/or the administration of more medications than are clinically indicated; may represent unnecessary drug use (Hajjar, Cafiero & Hanlon, 2007).

Assumptions

Health care disparities among older adults commonly include age, gender, socioeconomic status and race/ethnicity (Fredriksen-Goldsen et al., 2013; The MacArthur Foundation Research Network on an Aging Society, 2009). Although physical and mental capacity tends to decline as a person ages, the degree of functional capacity experienced by older adults is more closely associated with socioeconomic factors that include educational attainment, race, and ethnicity rather than age (The MacArthur Foundation Research Network on an Aging Society, 2009). Similarly, higher education increased the likelihood of serenity, happiness, overall health, positive psychological states, protective health functions, and an increase in self-esteem in older adults (Murrell, Salsman, & Meeks, 2003).

Based on this information, it can be assumed that older adults who have attained higher education, and are of a particular race and ethnicity, tend to have a much more robust socioeconomic disposition, are better able to navigate the Medicare system and its

complexities, and can afford the additional healthcare expenditures that occur due to living with chronic comorbid conditions. It can also be assumed that these individuals will have decreased mortality rates relative to older adults without these attributes. These assumptions are necessary in the context of this study as it can identify a specific disparity between older adults, particularly in the realm of education, which can provide insight regarding the roles of age, race and gender within this population in determining medical expenditures when combating multiple chronic conditions.

Scope and Delimitations

The research problem for this study aimed to identify whether age and race in the United States predisposes adult men and women with a diagnosis of HIV or cardiovascular disease to increased medical expenditures. Although various studies exist that indicate a higher prevalence of cardiovascular risk among HIV-infected women than HIV-infected men (Dolan et al., 2005; Fredriksen-Goldsen et al., 2013; Solomon et al., 2018; Triant et al., 2007;); limited studies exist that look at the role of medical expenditures and the intersection of cardiovascular diagnoses versus HIV diagnoses among adults, particularly adults aged 65 and older. Although data available on adults, 65 and older, is limited, what is known is that older adults with chronic multi-comorbidities can incur substantial medical expenditures and out-of-pocket health care expenditures for prescription medications and treatment (CDC, 2016b; Davis et al., 2015; Kim & Richardson, 2014; Meraya, Raval, & Sambamoorthi, 2015 Paez, Zhao, & Hwang, 2009). Moreover, a CDC report on multiple chronic conditions stated that 3 out of 4 Americans,

65 and older, have multiple chronic conditions that limit daily activities and requires ongoing medical attention (CDC, 2016).

Another CDC report on chronic disease indicated that costs for people with chronic and mental health conditions accounted for 86% of the nation's $2.7 trillion annual health care expenditures; and between 2012 and 2013 the total national annual cost for cardiovascular disease averaged $316.1 billion with $189.7 billion accounting for direct medical expenses and $126.4 billion accounting for lost productivity costs related to premature death (CDC, 2017b). Among most ethnic and racial groups in the United States cardiovascular disease is the leading cause of death (CDC, 2017b). Among minority groups, nearly half of non-Hispanic Black adults have some type of and are predisposed to higher rates of cardiovascular disease (Benjamin, Virani, Callaway, Chang et al., 2018; Jolly et al., 2010), and are twice as likely to die from preventable diseases, such as heart disease and stroke, as Whites (CDC, 2017c). Furthermore, the relative risk of cardiovascular disease among HIV-infected men and women is higher among those 45 and older (Currier, Bartlett, & Bloom, 2018; DeSocio et al., 2008).

Due to the small population of older HIV-infected individuals, as well as the stigma and ageism that many within this population may experience, it is uncertain whether older HIV-infected adults, especially those who develop the disease later in life, are readily sharing their health status due to the fear of experiencing prejudice and discrimination (Emlet, 2006). I conducted this study to investigate the disparities that exist among older adults with cardiovascular disease or HIV diagnoses, because this population is infrequently studied; and to determine whether racial disparities also

correlate with higher medical expenditures for older adults 65 years and older when compared to adults 64 years and younger with HIV or cardiovascular disease diagnoses. The limitations associated with this study are those primarily associated with studying older populations and which can also impact this study's generalizability to younger populations. Delayed HIV and cardiovascular disease diagnoses, inaccurate differentiation between typical symptoms of aging and symptoms of HIV, and general unawareness of the risks of HIV acquisition are some of the barriers that may not only prevent accurate reporting of HIV transmission among older adults, 65 years and older (Kebodeaux et al., 2013), but discrimination and prejudice associated with an HIV diagnosis in old age (Emlet, 2006), may also preclude these individuals from readily disclosing their diagnosis in the MEPS survey. Additionally, medication non-adherence due to polypharmacy for comorbidities, mortality and morbidity risks, underreporting, lapses in memory, and inaccurate reporting of conditions can result in decreased data for this patient population.

Significance, Summary, and Conclusions

This section examined various topics affecting health care and use of health care services among older HIV-infected adults with cardiovascular disease as described in currently published literature.

HIV incidence in older Americans, especially adults 65 years and older, has continued to increase because of: later diagnoses, the aging of HIV-infected adults due to advances in medical treatments, and effective courses of antiretroviral therapy. As older adults continue to age with this chronic disease, they also become increasingly

susceptible to comorbidities not only because of age, but because of medication non-adherence, drug toxicity, systemic inflammation, coinfection, and multimorbidity due to antiretroviral therapy. Although the number of Medicare beneficiaries with HIV has tripled from the 1990s until 2014 (45,520 to 120,000 respectively), less than 1% comprise the total Medicare population, and only 21% of beneficiaries with HIV are over the age of 65 (Kaiser Family Foundation, 2016c). However, Friedman and Duffus (2016) investigated chronic health conditions in HIV-infected Medicare beneficiaries aged 65 years and older from a sample population of 29,060,418 and found that 24,735 (0.09%) were HIV+. Thus, there is some disparity regarding the precise HIV-infected older population, aged 65 and older, who are Medicare beneficiaries.

Health reports indicate that chronic diseases, such as cardiovascular disease, account for a significant portion of the health and economic costs in the United States, with annual health care expenditures for chronic and mental conditions totaling 90% of the $3.3 trillion allotted for the nation's annual health care expenditures, or $10,345 per individual (CDC, 2018; Foy & Mandrola, 2018). Additionally, the prevalence of poor diet, the obesity epidemic, high blood pressure, and the rise in Type 2 diabetes contribute to the major risk factors associated with stroke and heart disease (American Heart Association, 2017). The direct costs of cardiovascular disease continue to increase for White, Black, and Hispanic Americans; however, the indirect costs of cardiovascular disease, which include lost productivity at home and in the workplace, have a greater impact on White Americans and individuals between the ages of 45 and 64 years (American Heart Association, 2017).

In recent years, cardiovascular disease has become the leading cause of death in the United States, not only among non-HIV-infected individuals, but also among aging HIV-infected adults (CDC, 2016a; Cournoyer et al., 2016). Among older HIV-infected men and women, multimorbidity and age-related chronic conditions occur at higher rates than non-HIV-infected men and women in the same age bracket (Guaraldi et al., 2015, Cournoyer et al., 2016, Kim & Richardson, 2014). As a result, older HIV-infected adults are prescribed non-antiretroviral therapy drugs, such as anti-infectives, analgesics, central nervous system drugs, gastrointestinal drugs, and respiratory drugs (Gimeno-Gracia et al., 2016) to combat their comorbidities. This may cause older HIV-infected adults to have increased risk factors for polypharmacy and medication-related problems such as adverse drug events, drug-drug interactions, potentially inappropriate medications and medication nonadherence (Greene et al., 2014).

Aging HIV-infected adults may also incur additional out-of-pocket medical expenditures because of chronic multi-comorbidities. Researchers estimate that elderly poor and near poor Medicare beneficiaries, can incur costs ranging from 19% and 35% for out-of-pocket expenditures (Kim & Richardson, 2014); and older Medicare beneficiaries, aged 65 and older, can spend at least 15% of their incomes on health care for treatments related to chronic comorbidities (Davis et al., 2015).

While an increase in prevalence of self-reported chronic conditions has occurred in old-old, midlife, and earlier old age, individuals with multiple chronic diseases also experience substantial out-of-pocket spending, particularly because of drug costs (Paez, Zhao, & Hwang, 2009). Among older adults aged 65 and older, different combinations of

chronic conditions may correlate with varied out-of-pocket spending burdens; and older adults who had 3 or 4 chronic conditions were more likely to incur higher out-of-pocket spending burdens when compared to older adults with only 2 chronic conditions (Meraya, Raval, & Sambamoorthi, 2015).

In a 2005 study, Paez et al., (2009) reported that medications/drugs for individuals were the costliest out-of-pocket medical expenditure; with older adults 65 years and older, with multiple chronic conditions, spending an average of $1,292 each year. Over a decade later, the Kaiser Family Foundation (2016b) developed a fact sheet of the Centers for Medicare and Medicaid Services Medicare Part D prescription drug benefit projections for 2017 which stated that during the “donut hole” or coverage gap, Medicare beneficiaries would have to cover their drug costs until their total out-of-pocket expenditures reached $4,950 before they would be eligible to enter the catastrophic coverage threshold, wherein Medicare covered 80% of drug costs. The expenditures depicted during this twelve-year time period illustrate rising out-of-pocket prescription drug costs for older adults. Consequently, older adults who are unable to accommodate costly out-of-pocket medical expenditures may engage in cost-saving strategies such as skipping medication doses, splitting pills and limiting prescription refills (Musich et al., 2015).

As Congress continues to deliberate whether or not to repeal and replace the Affordable Care Act, it is evident that out-of-pocket spending, and overall total medical expenditure disparities, among older adults must be adequately addressed. If Congress succeeds in repealing the Affordable Care Act, millions of Medicare beneficiaries,

especially those with multiple chronic comorbidities, could face even greater financial hardships, resulting in medication nonadherence and negative health outcomes (Musich et al., 2015).

The major themes in the literature all indicate that multiple factors do contribute to rising medical expenditures for older HIV-infected adults and older adults with cardiovascular disease diagnoses and tends to be an ongoing challenge for this population. As it pertains to this study, although available literature investigating the health care needs and overall cost for HIV-infected older adults with cardiovascular disease is limited, the continuous aging of the HIV population, along with those living with cardiovascular diagnoses, indicates the explicit need for further research in this area.

This study primarily seeks to explore: the educational practice gap that may add to medical expenditure disparities among older adults with cardiovascular and HIV diagnoses; the role of shared decision-making between the patient and the clinician to discuss treatment risks and benefits, that allow for the expression of patient values and preferences; and the conferring of mutual responsibility and information exchange regarding decisions around treatment and care (Barry & Edgman-Levitan, 2012). It is hoped that this research study can add to those discussions. In section 2 this gap in practice will be addressed regarding its relation to race, age, gender and economic factors among older adults with HIV or cardiovascular disease.

Section 2: Research Design and Data Collection

Introduction

The purpose of this study was to address whether age, race, or type of health care service affected medical expenditures in older Americans diagnosed with HIV or cardiovascular disease. The behavioral model of health service use and the socioecological model were used to look at: predisposing/intrapersonal factors, which addressed the sociodemographic constructs of the study; enabling/interpersonal factors, which identified potential barriers to health services among adults diagnosed with HIV or cardiovascular disease; and need/institutional and community factors, which correlated with the perceived and evaluated need influences that impact the use of health services among these individuals. The current section of this study describes the methodology used to investigate the research problem. It provides a thorough look at the various interrelated factors, such as age, gender, race, and economic status that may highlight existing disparities in health care expenditures among adults with a diagnosis of HIV or cardiovascular disease. The components of this section will also address the research design and rationale, the study's methodology (the study population, sampling methods and procedures, instrumentation, limitations to secondary data analysis), ethical issues, and threats to validity.

Research Design and Rationale

A quantitative, deductive, retrospective cross-sectional design was used to examine the relationship between race, age, or type of health service used and the corresponding health care expenditures incurred among adults diagnosed with HIV or

cardiovascular disease within the U.S. population. Potential cofounding variables included education and region of residence. The independent variables included race, age, gender, and type of health service used. The dependent variable was total medical expenditures related to health care.

A quantitative research design was chosen for this study for various reasons. First, quantitative research designs are applied when researchers are interested in testing objective theories through the examination of the relationships among variables (Creswell, 2009). This design also allows for the deductive testing of theories and incorporates protections against bias, controls for alternate explanations, and allows for the generalization and replication of research findings (Creswell, 2009). This design differs from a qualitative research design which, although inductive in nature, is used to explore and understand the meaning of social or human problems as ascribed by individuals or groups (Creswell, 2009). Second, quantitative research designs can involve nonexperimental inquiry strategies, such as surveys, to provide a numerical description of the opinions, attitudes, and trends of a population by investigating, and generalizing from a subset of the study population (Creswell, 2009). Third, nonexperimental quantitative research strategies can include a cross-sectional design, which is frequently used in survey research (Frankfort-Nachmias, Nachmias, & DeWaard, 2015).

The strengths attributed to the use of cross-sectional designs include the use of probability samples and its occurrence in natural, real-life settings, which increases external validity; its widespread use in the social sciences and survey research; the use of statistical analyses to overcome various methodological limitations; and its ability to

derive and describe causal relationships between variables (Frankfort-Nachmias et al., 2015). The limitations of the cross-sectional design is that it occurs at a single time-point, with no indication of the sequence of events (Levin, 2006); the direction of causation must be inferred theoretically or logically because of the inability to manipulate the independent variable; and it is difficult to make unambiguous inferences, such as causality, because of inadequate control over competing explanations (Frankfort-Nachmias et al., 2015; Levin, 2006). The study's quantitative, deductive, retrospective cross-sectional design supports the problem statement and answers the research questions:

Research Question 1: What differences in total medical expenditures exist between American adults aged 65 and older, and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV?

Research Question 2: What are the differences in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger?

Research Question 3: What effect does type of health service utilized have on the total medical expenditures incurred for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease)?

This design allowed for the review of a large sample size of the population (by year, race, and age) to examine total medical expenditures for adults with HIV or cardiovascular disease diagnoses within the MEPS. Additionally, to maximize external validity and

study result generalizability, a nonprobability or convenience sampling method as well as stratification by gender, race, and age was used. Because I used secondary data for this analysis, there were no time and resource constraints on the study population, as the use of existing data was less expensive than the collection of primary data (see Frankfort-Nachmias et al., 2015).

Methodology

Population

The population for this study was obtained from the MEPS and compares adults 65 or older who were diagnosed with HIV or cardiovascular disease to adults diagnosed with HIV or cardiovascular disease under 64, residing in the United States between 2011 and 2015. Adults 18 and older with a diagnosis of HIV or cardiovascular disease were extracted from this population subset and analyzed for the purposes of this study. The total sample used for analysis for both cardiovascular disease and HIV diagnoses was 5,753, of which 3,038 were males and 2,715 were females. Based on the availability of data, different subsamples were used to calculate each of the six household-reported medical events and the total sample representation used for this study is as follows: 5,598 cardiovascular disease; 155 no cardiovascular disease (97.3% had cardiovascular disease); 5,572 no HIV and 181 with HIV (3.1% had HIV).

Sampling and Sampling Procedures Used to Collect Secondary Data

For this study, household component and medical conditions data were derived from the MEPS sampling frame from 2011 through 2015 and pooled to increase sample size. Selection criteria for this study included adults (18 and older) with HIV/AIDS or

cardiovascular disease. MEPS collects data using probability sampling, specifically a complex random sampling method that is derived from the National Health Interview Survey respondents (Davis, 2015). This type of sampling procedure is also known as a mixed sampling design, as it involves both a cluster sampling and stratified sampling design for sample selection (Davis, 2015; Kothari, 2004). The National Health Interview Survey is conducted by the National Center for Health Statistics and the survey data provides a representative sample of noninstitutionalized civilians throughout the United States and includes an oversampling of Black and Hispanic individuals (Davis, 2015).

MEPS is a large-scale annual household survey that is nationally representative of the noninstitutionalized U.S. civilian population and includes medical providers, employers, families, and individuals (Davis, 2015). The household component involves an overlapping panel design to collect detailed information on health conditions, health status, access to care, socioeconomic and demographic characteristics, healthcare expenditures, health insurance coverage, patient care satisfaction, use of medical services, and employment (Davis, 2015). The medical conditions component consists of household-reported medical conditions information derived from a nationally representative sample of the noninstitutionalized U.S. population during participant interviews. Medical conditions described during the telephone interviews were recorded verbatim and translated by professional coders into fully-specified *International Classification of Diseases, 9th Edition, Clinical Modification* codes, which also included V codes and medical conditions. Diagnosis condition codes were collapsed into 3-digit code categories from the *International Classification of Diseases* codes to preserve

respondent privacy and confidentiality (AHRQ, 2017a). Clinical classification codes, which are aggregated *International Classification of Diseases* condition and V codes, are also included in the MEPS data and are used to group analogous conditions. These classification codes are generated using Clinical Classification Software provided on the Healthcare Cost and Utilization Project website (AHRQ, 2017a). Like the household component and medical condition data, prescribed medicines purchased by the respondent and their family members, as well as expenditures related to prescribed medications and associated medical conditions, are also household-reported from a nationally representative U.S. noninstitutionalized civilian population.

To determine the sample size, a 95% confidence level was used, which corresponded to a *z*-value of 1.96. A 95% confidence interval indicates that the probability that the population mean lies within +/-1.96Z score interval occurs with roughly 95% confidence (see Frankfort-Nachmias et al., 2015). A total sample of 5,753 adults, aged 18 and older, with a diagnosis of HIV or cardiovascular disease were included in this study. The sample size was determined using a complex samples function that used the G*Power calculation tool (Faul, Erdfelder, Buchner, & Lang, 2009). Using an a priori power analysis, and a two-tailed test, sample size calculations were determined as:

effect size $f^2 = 0.05$;

α = probability of Type I error = 0.05;

β = probability of Type II error = 0.2;

power = 1- β = 1-0.2= 0.8.

Therefore, the total sample size for the study group, *N*, was estimated to be 160.

The strength of the conclusions among different group relationships or differences among variables is identified by the effect size. A p-value demonstrates the probability of making a Type I error as a result of the rejection of the null hypothesis (Marshall & Jonker, 2010). Although it provides no indication of effect size and does not provide information on the impact of the effect size on the entire population (Marshall & Jonker, 2010), it is still important to report both the *p*-value and the effect size to allow for an increased understanding of the study's findings. An alpha level of 0.05 was used to indicate that the chance of a significant difference takes place at least 5% of the time, which is not a true difference and occurs because of chance. The power level of 0.8 was used to increase the chances of a statistically significant difference in the study findings while rejecting the null hypothesis and thereby avoiding Type II errors.

Instrumentation and Operationalization of Constructs

The instrument that was used for this survey, the MEPS, is an instrument known for its content validity and reliability through weighted estimates, sampling strata, and primary sampling units (AHRQ, n.d.). This instrument was appropriate for this study because surveys, particularly health surveys that collect continuous information can be used as a surveillance mechanism, which can provide data on health conditions, health-related knowledge or risk factors, attitudes, and behaviors for the time frame in which they are conducted (Shi & Johnson, 2014). Validity and reliability have also been demonstrated using the Taylor-series linearization method, which is a method commonly

used for complex survey data to estimate the covariance matrix of the regression coefficients as well as standard errors of estimates (AHRQ, n.d.).

Over a 2.5-year timeframe, data are first collected using a preliminary contact and then proceeded by a series of five rounds of interviews (Davis, 2015). Data on medical expenditures and use are captured from each household by computer-assisted personal interviewing technology over a two calendar-year period (Davis, 2015). Continuous and current estimates of health care expenditures are provided through a series of data collection rounds that are launched on a new sample of households each subsequent year to provide overlapping survey data that is then combined with other ongoing panels (Davis, 2015). National estimates of health service use and health care expenditures are calculated using the weights provided in the MEPS data files (Davis, 2015). MEPS also includes medical provider component data collected from hospitals, physicians, pharmacies, and home health care providers who are identified by respondents who complete the MEPS-household component (AHRQ, 2017a). This data supplements and/or replaces information obtained on both the medical and financial characteristics of medical events that is collected from survey respondents regarding any provision of health care over the past survey year (AHRQ, 2017a). MEPS public use data files can be downloaded free of charge from the MEPS website and permission is not required for use.

To supplement the data collected by interviewers, paper questionnaires available in both English and Spanish are periodically administered to households. The Adult Self-Administered Questionnaire, which is a mail-back survey administered during Rounds 2 and Rounds 4 of the data collection periods with a 1-year gap between self-administered questionnaires, is administered to adult participants of each household residing in the

United States who are 18 years and older (AHRQ, 2017b, Cheak-Zamora, Wyrwich, McBride, 2009). The self-administered questionnaire was first fielded in 2000 and includes questions from the SF-12, Consumer Assessment of Health Plans, and attitude items (AHRQ, 2017b). The EuroQOL 5D was included in the self-administered questionnaire, but it is no longer administered in MEPS (Hayes, Bhandari, Kathe, & Payakachat, 2017). The SF-12v2, which is used to measure health-related quality of life is comprised of two component scores: (a) mental component summary, which focuses on participants' social activity, emotional state, and level of distraction limitations and (b) the physical component summary, which encompasses the general overall health, mobility limitations, work, other physical activity as well as the pain limitations of participants. Both component scores measure the latent concepts of physical and mental health (Hayes et al., 2017). Each component is scored on a scale of 0-100 with a mean of 50, with higher scores denoting better health (Hayes et al., 2017).

The SF-12v2 is an appropriate instrument to answer the research questions because literature has indicated that it is an accurate and well-established scale that has been used across several disease areas (Khanna, Jariwala, & West-Strum, 2015; Montazeri et al., 2011). Additionally, the scale is renowned for its reliability and validity and has been examined in numerous studies (Hayes et al., 2017; Khanna et al., 2015; Montazeri et al., 2011). Estimates for reliability and validity for the MEPS survey instrument SF-12v2 were first presented by Cheak-Zamora, Wyrwich, and McBride (2009), and the instrument's cross sectional and longitudinal validity was demonstrated in a national representative database. The SF-12v2 had relatively high estimates for validity

and reliability for the general populace regarding the mental and physical component scores based on the 2003–2004 MEPS data. Further, the SF-12v2, while complex, was not only brief, but was found to be far superior than the currently employed single question measures (Cheak-Zamora et al., 2009). Additionally, Hayes et al. (2017) found that the SF-12v2 is both a reliable and valid measure of health-related quality of life. Both components of the SF-12v2, mental component summary and the physical component summary, demonstrated high internal consistency (Cronbach's alpha and Mosier alpha > 0.8) and moderate and high test-retest reliability (mental component summary intraclass correlation coefficient: 0.64; physical component summary intraclass correlation coefficient: 0.73) during analysis. To determine the construct and criterion validity of the SF12v2, analyses using Spearman rank correlation coefficient and the Tukey's test found that there was strong and moderate concurrent validity in both the physical component summary and the mental component summary when examining the number of chronic conditions within the study (Hayes et al., 2017).

I used Cronbach's alpha to evaluate the reliability of the data, which indicates the propensity of correlation between items and their contribution to a composite score (Hayes et al., 2017). Cronbach's alpha was calculated to determine the internal consistency reliability of the physical component summary and the mental component summary. Intraclass correlation coefficients was used to evaluate the test-retest reliability of the physical component summary and the mental component summary. Construct and criterion validity were also evaluated for this study. Construct validity, which indicates an instrument's ability to measure the concept for which it was designed, was determined

with the Spearman rank correlation. Concurrent validity, which indicates the ability of a particular measure to parallel the established measure of the same construct, and predictive validity, which demonstrates how well one measure's score predicts the results of a second similar measure, were both evaluated as part of the criterion validity (Hayes et al., 2017). To measure concurrent validity, the Tukey's test was applied, as it worked well to evaluate areas of difference between disparities in total medical expenditures by race among older adults with HIV and cardiovascular comorbidities. Binary logistic regression analysis was used to assess the predictive validity.

Operationalization of Variables

The primary independent variables for this study are race, gender, age, and type of health services used (independent exposure variables). The covariates of this study were income level/poverty status. Variables remain consistent across survey time-periods, with the year allocation changing annually to denote the new year of the survey. The proceeding descriptions of the operational variables included in this study were expressed using 2014 survey data. Race, identified by code 188, was measured on a nominal scale, and is represented by the following values: 1, White-no other race reported; 2-Black-no other race reported; 3, American Indian/Alaska Native-no other race reported; 4, Asian/Native Hawaiian/Pacific Islander-no other race reported; and 6, Multiple races reported. Gender/Sex, identified by code 187, was also measured on a nominal scale, and is represented by the following values: 1, Male; 2, Female. The types of health services analyzed in this study included prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits.

Dental visit services and other medical expenses (e.g. medical equipment, supplies, glasses, and other medical items) were omitted from this analysis.

Total family income was measured on an interval level, identified by code 1452, and represented the following values: 01, -$48,666- -$2,789; 02, $0.00; 03, $1 - $22,200; 04, $22,201 - $44,724; 05, $44,725 - $82,006; 06, $82,007 - $542,785. Family income was used to calculate poverty status in relation to the federal poverty line (based on household size and composition) with poverty status determined as follows: poor (less than 100% below the poverty line) near poor (100% to less than 200% of the federal poverty line), middle income (200% to less than 400% of the federal poverty line), and high income (greater than or equal to 400% of the federal poverty line) (Meraya et al., 2015). Insurance coverage, identified by code 2197, was measured on a nominal scale, are was represented by the following values: (1), <65 any private; (2), <65 public only; (3), <65 uninsured; (4), 65+ edited Medicare only; (5), 65+ edited Medicare and private; (6), 65+ edited Medicare and other public only; (7), 65+ uninsured. The independent variables (age, gender, income level/poverty status, race, and type of health services used) were controlled for in adjusted models when examining their association with total health care expenditures.

The selection criteria for this study were diagnoses of HIV or cardiovascular disease. Cardiovascular disease diagnoses were identified by CCCODEX value codes 100, 101,103, 104 and 108, which represented the following cardiovascular conditions respectively: acute myocardial infarction, coronary atherosclerosis and other heart disease, pulmonary heart disease, other and ill-defined heart disease, and congestive heart

failure, non-hypertensive. The CCCODEX for cardiovascular conditions were recoded and delineated as CCCODEX1 to include all potential cardiovascular conditions into one unified category prior to analysis. HIV diagnoses were identified by the CCCODEX value code 005. The independent variables in this study represented both nominal (categorical) and interval (continuous) level measurements. As such, nominal level data, which represent qualitative variables, were converted to quantitative variables via appropriate coding mechanisms prior to analysis.

Dependent variable.

Total medical expenditures, inclusive of out-of-pocket spending burden, were the dependent variables of this study. Expenditure variables were measured at the interval level and extracted from the MEPS data which collects data on payers and types of services, while also capturing health care expenditures (Meraya et al., 2015). The sources of payment included: self or family, other federal government, Medicare, state/local government, Medicaid, Workers' Compensation, private insurance, other insurance, Veterans Administration/CHAMPVA, other private, TRICARE, other public, and sum of payments. For the purpose of analysis, these were recoded as follows: none, any private insurance, Medicare, and public insurance. To determine per capita annual total health care expenses in the MEPS, payments by payers and across types of services are computed for each person (Meraya et al., 2015).

Operationalization of Potentially Confounding Variables

A potential moderator of the disparities that exist between gender, age, and race and health care expenditures is the attainment of an education. Education attainment

denoted as year of education or highest degree for all Americans within the MEPS survey is designated as a nominal categorical variable, and was defined as follows: (-9), not ascertained; (-8), don't know; (-7), refused; (-1), inapplicable; (1), less than/equal to eighth grade; (2), ninth through 12th grade, no high school diploma; (3), GED or equivalent; (4), high school diploma; (5), some college, no degree; (6), associate degree: (occupational, tech, vocational); (7), associate degree: (academic program); (8), bachelor's degree (BA, AB, BS, BBA); (9), (master's, professional, doctoral degree); (10), child under 5-years-old. For the purposes of analysis, these were recoded as follows: less than elementary, elementary through eighth grade, ninth through 12th grade, high school diploma or GED, some college through bachelors, and master's or doctorate.

Another potential confounding variable is region of residence within the United States. This variable was measured on a nominal categorical scale and denoted using the following values: -1, inapplicable; 1, Northeast; 2 Midwest; 3, South; and 4, West. Other potential confounding variables, for which data were not collected included health care access and health literacy. Potential confounding variables were necessary to include in this study to provide a possible explanation for the relationships between the dependent and independent variables that were not readily detected or assessed (see Creswell, 2009).

Data Analysis Plan

Statistical analyses for this study were conducted using R (version 3.4.4) statistical software. MEPS data is collected from all 50 states and the District of Columbia using a complex multistage sample design that involves clustering, unequal selection probabilities, and stratification and have unequal weights (Machlin et al., 2010).

Data analysis for this type of complex sample design necessitates statistical software that considers the sample design and estimation complexities which are required when considering computing variances/standard errors of MEPS estimates such as STATA, SAS, SUDAAN, or WESVAR (Machlin et al., 2010). Data for this study was pooled over a five-year period to yield a sample size large enough to analyze and generate estimates that are reliable.

MEPS data is drawn from the same sample geographic areas, with sample respondents remaining consistent for at least two consecutive years (Machlin et al., 2010). Earlier MEPS data estimates were based on the periods wherein sample respondents were a part of the noninstitutionalized civilian population, and researchers were strongly encouraged to account for those individuals who were in-scope for a portion of the data collection period in their analyses (Machlin & Yu, 2005). For the timeframe for which data is used in this study only persons who were in-scope during the data collection survey periods (noninstitutionalized civilians) were included in the data set and identified with the code positive person-level weights. MEPS data accounts for attrition of survey respondents, that is those who were only in-scope for a portion of the data collection period, by adjusting the panel weight variables included in the file.

To account for inconsistencies in data collection for this study, pooled data were screened and cleaned by classifying and matching already provided personal-level identifiers across each survey timepoint to identify missing and erroneous data which can affect the validity and reliability of the study's outcomes. To identify skip patterns and missing data values frequency tables and cross-tabulations of all variables included in the

study's analysis were run. Original variables were recoded, and a new dataset was created to include all pooled data and syntax documentation of all recoded variables were performed (Cheng & Phillips, 2014). Additionally, to assure consistent variance structure when pooling MEPS geographic sampling data across several timepoints, Taylor series variance estimation methods were applied during analysis as they appropriately reflect the complexities of the MEPS design (Machlin et al., 2010).

An overview of the research questions for this study are as follows:

Research Question 1: What differences in total medical expenditures exist between American adults aged 65 and older, and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV?

$H_0$1: There is no significant difference in total medical expenditures between American adults aged 65 and older and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV.

H_a1: There is a significant difference in total medical expenditures between American adults aged 65 and older and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV.

Research Question 2: What are the differences in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger?

$H_0$2: There is no significant difference in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV,

when compared to individuals of the same race, with the same diagnoses, aged 64 and younger.

H_a2: There is a significant difference in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger.

Research Question 3: What effect does type of health service (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) utilized have on the total medical expenditures incurred for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease)?

H_03: There is no significant difference in total medical expenditures for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease) when different types of health services (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) are used.

H_a3: There is a significant difference in total medical expenditures for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease) when different types of health services (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) are used.

This study was a retrospective cross-sectional quantitative analysis that assessed MEPS expenditure data and used: (a) descriptive statistics, to describe and explain characteristics of the study variables; (b) binary logistic regression to predict the relationship between the independent variables (age, race, gender, and type of health service used) and the dependent variable (total medical expenditures) among individuals with the diagnoses of HIV or cardiovascular disease. For each research question, descriptive statistics was used to assess the means, standard deviations, and score ranges for the study's demographic variables, R (version 3.4.4) software was used.

Research Question 1 and Research Question 2 was addressed through the utilization of two-way analyses following a binary logistic regression model with the dichotomous expenditure variable used as the criterion for each regression. Research Question 3 was analyzed using multivariate analyses following a binary logistic regression model with the dichotomous variable used as the criterion for each regression. Binary logistic regression was conducted to determine if a statistically significant relationship exists between the dependent variable (total medical expenditures) and the independent variables (age, race and gender) as it relates to HIV or cardiovascular disease diagnoses, when accounting for confounding variables (e.g., education, insurance, and region of residence). For the binary logistic regression analysis, a confidence level of 95% and level of significance of less than 5% was determined using R (version 3.4.4) analytical software.

MEPS data files are obtained using a combination of sample designs which include stratification, clustering, disproportionate sampling, and multiple stages of

selection which require special analytical considerations due to the design and estimation complexities of the data files (Machlin, Yu, & Zodet, 2005). As a result, MEPS data include sampling weights which reflect adjustments taken for both survey nonresponse and population control totals adjustments (Machlin, Yu, & Zodet, 2005). Additionally, MEPS public use data files are accompanied by estimation weight, sampling strata, and primary sampling unit (PSU) variables that can be used to obtain weighted estimates and estimate standard errors for weighted estimates through the implementation of a Taylor-series approach (Machlin, Yu, & Zodet, 2005). Moreover, the use of R (version 3.4.4) statistical software is adequate in determining and estimating standard errors from complex multistage designs involving the Taylor-series linearization such as MEPS survey data.

Threats to Validity

The use of nationally representative self-reported survey data can result in biases related to recall. Since respondents to MEPS surveys also self-report data on their medical conditions, health care use, and health care expenditures recall bias is a threat to the external validity of this study and may result in differential misclassification which could impact the accuracy and completeness of the study data, as well as produce unreliable estimates (LaMorfe, 2016). A few ways in which MEPS data controls for recall bias involves the careful construction of the survey to maximize completeness and accuracy; the training of interviewers and monitoring of their performances; stimulation and maintenance respondent cooperation, through the use of various materials and strategies; the use of analytical weights to reduce nonresponse bias and improve national

representativeness of survey data, and to ensure the achievement of precision specifications; through the review of the precision of survey estimates (U.S. Department of Health & Human Services, 2015).

Internal validity concerns for this study revolved around the mortality of participants. Respondents investigated in this study were already advanced in age, and possessed two chronic, and potentially debilitating health conditions. To gain a larger sample size to account for participant drop-out rates, the MEPS data were pooled to increase the sample size of the study population. Potential limitations of this study involve the sample size of the study population which, due to age (65 and older), is inherently smaller than the other survey respondents in MEPS (Safren et al., 2009). To account for sample size limitation, a larger population size was garnered through the pooling of MEPS data from 2011-2015. The content, empirical, and construct validity of the MEPS measuring instruments have all been adequately assessed in various research studies (Hayes et al., 2017; Khanna, Jariwala, & West-Strum, 2015; McCord et al., 2011; Montazeri et al., 2011). Additional threats to validity include other potentially confounding variables (i.e., healthcare access and health literacy) that were not included in this study's analyses but may possibly have an impact on the generalization of the study results.

Ethical Procedures

Secondary data from the MEPS was used for data analysis for this study. The household component of the MEPS data was used, and no permissions were required to access the data because it is publicly available for use on the MEPS website as

downloadable data files and data tables (Williams, Bishu, Dismuke, & Egede, 2017). All patients interviewed by MEPS sign the medical provider component authorization form, which permits medical provider component staff to contact medical providers and pharmacies to authorize the release of medical information about their patients (AHRQ, 2017a). While informed consent was not required from participants, because the data was secondary and individual identifiers were removed from the micro-data contained within the files (AHRQ, 2016b), AHRQ does include a data use agreement for users which states that efforts to determine the identity of reported cases is prohibited by law; and use of the data signifies compliance with data use requirements, wherein misuse is punishable by a fine of up to U.S. $10,000 or up to 5 years in prison (AHRQ, 2016b). AHRQ and the MEPS must also be cited in publications that utilize MEPS data as the source used for data retrieval (AHRQ, 2016b).

Restricted MEPS data, or data that has not been released publicly due to confidentiality reasons, can be accessed by qualified researchers. These files consist of MEPS data available for the time periods 1996-1999, and 2001 (for Household component-insurance component linked files); and 1996 only (for Nursing home component files) (AHRQ, n. d.). Additional confidential files include medical provider component data, area resource files, MEPS public use data files, and MEPS link files to National Health Interview Survey (AHRQ, n. d.).

To access restricted data, prospective researchers must submit an application, research proposal, and user fee of U.S. $300 (AHRQ, n. d.). All applications and proposals are reviewed by a committee; and approvals are based on: 1) the feasibility of

the existing data to the project; 2) the risk of disclosure of restricted information; 3) the availability of resources to support the project at the AHRQ Data Center; 4) whether the proposed project is in accordance with AHRQ's mission (AHRQ, n. d.). Finally, since remote access to confidential data is not available, all researchers approved to access and use confidential data must do so using the facilities located within the AHRQ Data Center in Rockville, MD (AHRQ, n. d.).

IRB approval for this study was obtained from Walden University prior to access and analysis of the MEPS data files. Additionally, having worked as a healthcare professional for over a decade with older adults, Fitzgerald and Hurst (2017) assert that implicit biases, which involve associations outside conscious awareness, can lead to negative evaluation of this cohort based on irrelevant characteristics such as race or gender. As a result, my goal is to remain as unbiased as I can and look solely at the data when performing analyses and drawing conclusions. Finally, data used in any analyses for this study was stored on a personal password-protected laptop under password protected files.

Summary

In this section, an overview of the quantitative inquiry methods used for this study was provided, as well as the justification for study design's appropriateness. Also discussed within this section was the study methodology, which included the population, sampling procedures, instrumentation and operationalization of constructs and variables, and plans for data analysis. Additionally, threats to internal and external validity and ethical concerns associated with the study were also addressed. In the upcoming section,

section 3, the presentation of the study results, along with the study's findings will be discussed.

Section 3: Presentation of the Results and Findings

Introduction

This section addresses the data collection, study results, and the summary of the study's findings. The purpose of this quantitative study was to determine the association of total medical expenditures among Blacks and Whites aged 65 and older with a diagnosis of HIV or cardiovascular disease when compared to individuals of the same race with the same diagnoses aged 64 and younger. Additionally, I examined the effect that type of health service had on the total medical expenditures incurred for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease). A binary logistic regression analysis was conducted to determine whether a statistically significant relationship exists between the dependent variable (total medical expenditures) and the independent variables (age and race) as it relates to HIV or cardiovascular disease diagnoses, when accounting for confounding variables (e.g., education, insurance, and region of residence). The following are the research questions and hypotheses formulated for this study:

Research Question 1: What differences in total medical expenditures exist between American adults aged 65 and older, and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV?

$H_0$1: There is no significant difference in total medical expenditures between American adults aged 65 and older and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV.

H_a1: There is a significant difference in total medical expenditures between American adults aged 65 and older and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV.

Research Question 2: What are the differences in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger?

$H_0 2$: There is no significant difference in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger.

$H_a 2$: There is a significant difference in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger.

Research Question 3: What effect does type of health service (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) utilized have on the total medical expenditures incurred for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease)?

$H_0 3$: There is no significant difference in total medical expenditures for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular

disease) when different types of health services (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) are used.

H_a3: There is a significant difference in total medical expenditures for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease) when different types of health services (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) are used.

Data Collection of Secondary Data Set

Files for each expenditure were drawn from the MEPS database over a 5-year period (2011–2015). The MEPS household component data files represent a nationally representative U.S. civilian, noninstitutionalized population and is based on questionnaires derived from individual household members and diverse medical provider sites (MEPS, 2009). This data set includes 30 individual files, with one per expenditure type for each year. Before these datasets could be combined, expenditures for each year required adjusting based on inflation. The 2011–2014 total healthcare expenditures were adjusted to the value of the U.S. dollar in 2015 using the consumers price index from the Bureau of Labor Statistics (n.d.), as reported by the AHRQ (2017c). The U.S. dollar value was adjusted to be equivalent to inflation in 2015 so that the sum values were not underrepresented and a summation of the expenditures over this time could be meaningful. Table 1 provides the inflation rate for each type of expenditure, which was drawn from the Bureau of Labor Statistics as reported by AHRQ.

Table 1

Inflation for Each Year by Type

Variable	Outpatient	Office-based	Medication	Inpatient	Home health	Emergency room
2011	1.05	1.09	1.13	1.07	1.03	1.07
2012	1.04	1.07	1.09	1.04	1.02	1.04
2013	1.02	1.04	1.08	1.02	1.02	1.02
2014	1.01	1.02	1.05	1.01	1.01	1.01

Note. Inflation adjusting was only performed on the years 2011 to 2014 to adjust to 2015 levels.

After adjusting all expenditures to the inflation for 2015, expenditures from each of the 5 years were summed into a single expenditure variable, with one for each of the dependent variables. As the weights for each participant were also necessary to include for external validity, weights from each year were calculated into a mean, which was used as the final weight for each dependent variable. Because different weights were associated with an individual based on their existence in one of the six datasets (outpatient, office-based visit, medication, inpatient, home health, emergency room), participants were assessed based on their demographic representation in comparison to their proportional representation in the dataset. Underrepresented groups in the dataset are given more weight so that they were represented similarly to their group's true representation in the population. Likewise, overrepresented groups in the dataset are weighted less so that they did not influence the results.

After extracting the mean weights, summed adjusted expenditures, and pertinent demographic data, each expenditure's dataset was combined into a final dataset consisting of all individuals with any entry for any of the six expenditures over the 2011–

2015 period. From this sample, any individuals who did not have either HIV or cardiovascular disease were excluded. In the final dataset, some of the expenditure variables exhibited negative values, which did not have any true monetary meaning. Such values were deleted because they were patient reported medical events that resulted in zero payment, thus the expenditure data associated with those entries was deemed inapplicable (MEPS, 2017). Removal of these inapplicable values allowed participants to be excluded from an analysis when they had a negative value without being deleted from the dataset entirely. This allowed participants who had useful data for at least one other dependent variable component to be retained for any analysis where they had complete data. Overall, these negative values were the only discrepancies encountered in this dataset.

Normality of Dependent Variables

Shapiro-Wilk tests were conducted to determine the degree to which normality was exhibited for each dependent variable. The Shapiro-Wilk test is based on the correlation between the corresponding normal scores and the data (Ghasemi & Zahediasl, 2012). It compares the scores in the sample to a normally distributed set of scores with the same mean and standard deviation. If the sample distribution is normal, then the null hypothesis is supported. Conversely, if the distribution is nonnormal, the test is significant.

Results could not be calculated for office-based or medical-based expenditures, as the sample sizes for these variables were greater than 5,000, and this is a limitation of R (version 3.4.4). However, skew and kurtosis values for each variable were calculated and

found to be outside of the range of acceptability for a normal distribution, as defined by skew values greater than two and kurtosis values greater than three (Westfall & Henning, 2013). Thus, normality could not be assumed for the any of the expenditures of interest (see Table 2).

Table 2

Normality Assessment for Expenditure Variables

Variable	Mean	SD	Skew	Kurtosis	W	P	Normality
Outpatient (*n* = 2,406)	536.45	1,857.07	13.33	237.32	0.24	< .001	No
Office based (*n* = 5,500)	5,075.04	12,189.56	18.35	653.24	-	-	No
Medication (*n* = 5,588)	7,463.55	13,320.34	6.89	89.759	-	-	No
Inpatient (*n* = 2,141)	2,796.11	5,296.94	9.97	179.38	0.44	< .001	No
Home health (*n* = 1,137)	1,1741.33	24,399.55	10.52	191.91	0.41	< .001	No
Emergency room (*n* = 2,529)	2,161.07	4,288.93	6.39	60.11	0.45	< .001	No

Note. Shapiro-Wilk tests are not available in R for sample sizes greater than 5,000.

Based on the lack of normality among each of the dependent variables, wherein distributions were consistently right skewed (i.e., heavily shifted toward low expenditures), each dependent variable was transformed into a dichotomous variable, defined by median split so there were equally sized groups for the categories of large expenditure and small expenditure. Brief preliminary testing indicated that the expenditure variables could not contribute to valid linear regression models without extensive transformations, which would render the results much less interpretable

(Stevens, 2016) Further, the values would need to be mirrored before applying a transformation of $\dot{x}_j = \log\left(\frac{x_j}{1-x_j}\right)$.

Because accessibility and interpretability were important aspects of the study, a more straightforward approach was selected, and expenditure variables were modified into binary variables with a value of one representing an expenditure higher than the median and a value of zero representing an expenditure lower than or equal to the median. This resulted in nearly equal groups of high and low expenditures, so the odds of having a higher expenditure were approximately 50% for each analysis. These binary transformations allowed the originally proposed linear regressions to be modified to binary logistic regressions and circumvented the requirement of normal data (Stevens, 2016). In doing so, each of the restrictive assumptions typically associated with linear regression (e.g., normality, homoscedasticity, and linearity) did not require assessment. This also allowed each of the regression results to be used for predictive purposes (i.e., predicting whether expenditures were higher or lower), in an intuitive way so odds ratios from the regressions could help predict whether an individual would have a higher or lower expenditure.

Because the binary logistic regression is calculated using chi square statistics, which is sensitive to large sample sizes (i.e., tends toward significance as the sample size increases), it was also important to explore the effect sizes for the variables within the regressions (Stevens, 2016). This was done using odds ratios, which are not standardized and must be compared to one another to determine the strongest predictors. Thus, this detail must be examined in the final series of regressions, wherein all predictors are

included simultaneously in the finalized multivariate models. For this reason, comparison of effects will take place with the interpretation of the Research Question 3 results and will indicate which of the variables of interest are likely to be the strongest predictors of expenditure.

Results

Descriptive Statistics

Data were first sorted to only include participants with values for each dependent variable, as these subgroups consisted of the only observations available for each corresponding analysis. Descriptive statistics were calculated for each of these subgroups to better understand the demographic makeup for each analysis. To measure the significance level of the predictor variable, the Wald *F* test was used. In addition, means and standard deviations were calculated for each group's age representation. As seen in Table 3, ages were similarly represented in each analysis except for the regression for home health expenditures, which consisted of a slightly older average representation within the sample.

Table 3

Mean and Standard Deviation for Age Using Sample for Each Dependent Variable

Variable	Outpatient (*n* = 2,406)	Office based (*n* = 5,500)	Medication (*n* = 5,588)	Inpatient (*n* = 2,141)	Home health (*n* = 1,137)	Emergency room (*n* = 2,529)
Age						
Mean	65.97	65.63	65.65	66.66	71.40	65.00
SD	13.27	14.13	14.07	13.92	12.97	14.80

In addition to this continuous measurement of age, age categories of 64 and younger versus 65 and older were examined, as these were the categories used in each

analysis. Together with this examination of age group membership by analysis, race, sex, poverty level, and HIV or cardiovascular disease cases represented in each model were also assessed. As it relates to the population for this study, a CDC report showed that between 2011 and 2015 there was an increase in the number and rate of diagnosed HIV infections for persons living in the United States (CDC, 2017d). The largest increase in HIV infection rates was found among persons aged 65 and older, at a rate of 57% (CDC, 2017d). Male adults had higher transmission rates between 2011 and 2015 when compared to women, and of the 973,846 individuals living with HIV at the end of 2015, Blacks had the largest percentage of diagnosed HIV infection (42%) when compared to all other race/ethnicity groups (CDC, 2017d).

As it pertains to cardiovascular disease, data from a report on 2011–2014 NHANES data indicated that 92.1 million American adults have at least one type of cardiovascular disease, with 46.7 million estimated to be older than 60 years of age (Benjamin et al., 2017). The report indicated that cardiovascular disease in adults increases in both males and females as they get older, with the prevalence among males (between 2011-2014) reported at 37.4%, compared to females at 35.9% in adults aged 20 and older (Benjamin et al., 2017). Older adults aged 60-79 were reported to have a prevalence of cardiovascular disease of 69.6% among men and 68.6% among women. The prevalence of cardiovascular disease was even higher among older adults aged 80 years and older, with a percentage of 84.4% among men and 86.5% among women between 2011–2014 (Benjamin et al., 2017). Cardiovascular disease was considerably lower among individuals in the 20-39 and 40-59 age ranges, with 13.5% and 41.4%

(men) and 11.5% and 39.4% (female) cardiovascular disease prevalence being reported for those age ranges, respectively (Benjamin et al., 2017). The prevalence of cardiovascular disease among non-Hispanic Whites was reported at 37.7% (males) and 35.1% (females), whereas among Blacks, the prevalence of cardiovascular disease was 46.0% (males) and 47.7% (females) among adults aged 20 and older between 2011 and 2014 (Benjamin et al., 2017). Further, the prevalence of heart disease was found to be higher among individuals with who were unemployed and had lower education (Benjamin et al., 2017).

The sample used for this analysis was focused only on individuals with either an HIV or cardiovascular disease diagnosis. Due to the narrow characteristics of the participants in this study, the results cannot be generalized to individuals without these diagnoses within the larger population (Creswell, 2009). The demographic data analyzed for this study, particularly the insurance, education, and region of residence variables, showed that well-over half of the study population were Medicare recipients, over one-third were from the southern states in the United States, and roughly two-thirds of participants had at least a high school and/or a college education. Frequencies and percentages for each category included in the six analyses can be found in Table 4.

Table 4

Frequencies and Percentages for Each Sample Representation

Variable	Outpatient (*n* = 2,406)	Office based (*n* = 5,500)	Medication (*n* = 5,588)	Inpatient (*n* = 2,141)	Home health (*n* = 1,137)	Emergency room (*n* = 2,529)
Race						
Black	521, (21.65%)	1267, (23.04%)	1297, (23.21%)	555, (25.92%)	307, (27.00%)	670, (26.49%)
White	1732, (71.99%)	3815, (69.36%)	3866, (69.18%)	1449, (67.68%)	756, (66.49%)	1689, (66.79%)
Other	153, (6.36%)	418, (7.60%)	425, (7.61%)	137, (6.40%)	74, (6.51%)	170, (6.72%)
Age						
64 and younger	998, (41.48%)	2390, (43.45%)	2442, (43.70%)	878, (41.01%)	308, (27.09%)	1172, (46.34%)
65 and older	1,408, (58.52%)	3,110, (56.55%)	3,146, (56.30%)	1263, (58.99%)	829, (72.91%)	1,357, (53.66%)
Sex						
Female	1,177, (48.92%)	2,616, (47.56%)	2,642, (47.28%)	1,065, (49.74%)	671, (59.01%)	1,334, (52.75%)
Male	1,229, (51.08%)	2,884, (52.44%)	2,946, (52.72%)	1,076, (50.26%)	466, (40.99%)	1,195, (47.25%)
Poverty						
Poor or low	1,154, (47.96%)	2,709, (49.25%)	2,768, (49.53%)	1,150, (53.71%)	693, (60.95%)	1,384, (54.73%)
Middle or high	1,252, (52.04%)	2,791, (50.75%)	2,820, (50.47%)	991, (46.29%)	444, (39.05%)	1,145, (45.27%)
HIV						
No	2,341, (97.30%)	5,331, (96.93%)	5,412, (96.85%)	2,097, (97.94%)	1,113, (97.89%)	2,447, (96.76%)
Yes	65, (2.70%)	169, (3.07%)	176, (3.15%)	44, (2.06%)	24, (2.11%)	82, (3.24%)
Cardiovascular disease						
No	52, (2.16%)	144, (2.62%)	150, (2.68%)	34, (1.59%)	15, (1.32%)	67, (2.65%)
Yes	2,354, (97.84%)	5,356, (97.38%)	5,438, (97.32%)	2,107, (98.41%)	1,122, (98.68%)	2,462, (97.35%)

(table continues)

Variable	Outpatient (*n* = 2,406)	Office based (*n* = 5,500)	Medication (*n* = 5,588)	Inpatient (*n* = 2,141)	Home health (*n* = 1,137)	Emergency room (*n* = 2,529)
Insurance						
None	75, (3.12%)	289, (5.25%)	320, (5.73%)	98, (4.58%)	12, (1.06%)	145, (5.73%)
Any private	490, (20.37%)	1,151, (20.93%)	1,152, (20.62%)	377, (17.61%)	87, (7.65%)	484, (19.14%)
Medicare	1,396, (58.02%)	3,084, (56.07%)	3,118, (55.80%)	1,253, (58.52%)	828, (72.82%)	1,343, (53.10%)
Public	445, (18.50%)	976, (17.75%)	998, (17.86%)	413, (19.29%)	210, (18.47%)	557, (22.02%)
Education						
Less than elementary	310, (12.95%)	778, (14.28%)	791, (14.29%)	336, (15.87%)	228, (20.30%)	390, (15.56%)
Elementary through eighth	86, (3.59%)	267, (4.90%)	274, (4.95%)	109, (5.15%)	60, (5.34%)	116, (4.63%)
Ninth through 12th	162, (6.77%)	434, (7.96%)	449, (8.11%)	155, (7.32%)	94, (8.37%)	204, (8.14%)
High school diploma or GED	811, (33.89%)	1,773, (32.54%)	1,812, (32.73%)	701, (33.11%)	377, (33.57%)	834, (33.28%)
Some college through Bachelor's	848, (38.25%)	1,832, (36.03%)	1,837, (35.58%)	697, (34.88%)	321, (29.72%)	831, (34.99%)
Master's or doctorate	176, (7.94%)	365, (7.18%)	373, (7.22%)	119, (5.96%)	43, (3.98%)	131, (5.52%)
Region						
Northeast	488, (20.28%)	945, (17.18%)	963, (17.23%)	359, (16.77%)	239, (21.02%)	431, (17.04%)
Midwest	647, (26.89%)	1,159, (21.07%)	1,173, (20.99%)	487, (22.75%)	237, (20.84%)	562, (22.22%)
South	915, (38.03%)	2,353, (42.78%)	2,397, (42.90%)	921, (43.02%)	500, (43.98%)	1,084, (42.86%)
West	356, (14.80%)	1,043, (18.96%)	1,055, (18.88%)	374, (17.47%)	161, (14.16%)	452, (17.87%)

Note. Percentages are based on valid percent and calculated based on the total responses. Not all observations had corresponding data for each demographic variable. Percentages may not sum to 100 due to rounding.

Descriptive statistics were calculated to understand the mean of each expenditure based on each category of insurance type, education, and region of residence. These means were based on the total inflation adjusted expenditure from 2011 to 2015. Though these were not of direct interest based on the research questions, information gleaned from the examination of these group means helps to frame the study and may provide insight to future researchers studying this topic. However, because these figures are based on descriptive statistics only, they are not weighted, and no statistical inferences are intended to be drawn from this information. This information is presented in Table 5.

Table 5

Means and Standard Deviations for Expenditures for Each Demographic Category of Household-Reported Medical Events

Demographic	Outpatient (*n* = 2,406)	Office based (*n* = 5,500)	Medication (*n* = 5,588)	Inpatient (*n* = 2,141)	Home health (*n* = 1,137)	Emergency room (*n* = 2,529)
Insurance						
None	232.9, (634.44)	2,144.08, (5,002.28)	3,740.11, (9,295.3)	1,425.81, (2,070.76)	3,094.27, (6,585.34)	2,101.63, (4,940.84)
Any private	730.97, (2,078.99)	5,103.96, (10,040.4)	6,966.17, (14,082.26)	3,842.25, (9,112.53)	1,0769.35, (57,095.78)	3,317.86, (6,372.39)
Medicare	479.66, (1,711.4)	4,995.98, (9,842.11)	6,552.47, (10,258.88)	2,752.41, (4,326.54)	11,746.11, (18,902.69)	1,761.79, (3,039.28)
Public	551.58, (2,140.84)	6,158.65, (20,042.09)	12,078.02, (19,494.24)	2,298.89, (3,218.41)	12,619.27, (21,746.12)	2,134.05, (4,265.18)
Education						
Less than elementary	245.26, (305.01)	2,843.84, (7,794.76)	4,581.34, (7,106.74)	2,926.39, (5,438.59)	11,305.24, (16,914.26)	1,319.26, (1,764.82)
Elementary through eighth	560.49, (2,661.38)	4,495.45, (8,566.26)	8,531.81, (15,091.52)	2,571.45, (3,774.19)	13,031.9, (18,172.74)	1,938.89, (4,014.23)
Ninth through 12th	383.81, (841.71)	3,284.89, (8,323.59)	6,601.01, (9,910.42)	2,436.51, (3,508.16)	14,150.2, (17,565.65)	2,181.26, (4,669.83)
High school diploma or GED	515.28, (2,258.27)	3,479.09, (6,430.84)	5,929.79, (9,932.53)	2,521.97, (3,924.73)	14,322.39, (22,585.58)	1,885.18, (3,531.96)

Some college through Bachelor's	501.49, (1,408.02)	4,965.62, (15,388.64)	7,301.14, (13,391)	2,530.2, (3,508.25)	11,899.24, (33,301.55)	1,970.45, (4,159.47)
Master's or doctorate	577.47, (2,013.47)	5,951.37, (12,095.9)	7,851.81, (13,877.14)	3,217.05, (7,415.47)	9,777.87, (18,316.03)	2,501.33, (4,692.23)
Region						
Northeast	494.05, (1,086.96)	5,485.79, (11,077.69)	9,537.36, (15,773.94)	3,021.28, (4,979.2)	16,419.91, (41,093.63)	1,901.41, (3,849.72)
Midwest	569.34, (1,937.85)	4,911.57, (8,927.9)	7,247.53, (13,137.92)	2,758.57, (4,029.13)	11,354.53, (20,858.04)	2,092.42, (3,721.68)
South	545.3, (1,994.98)	4,610.44, (13,665.45)	7,019.24, (13,199.49)	2,594.15, (4,550.04)	9,820.3, (14,310.68)	2,154.29, (4,375.49)
West	512.07, (2,158.07)	5,932.68, (12,706.59)	6,820.25, (10,981.36)	3,126.19, (8,043.77)	11,331.45, (19,746.92)	2,510.27, (5,058.07)

Note. Values indicate means, parenthetical values indicate standard deviations.

Research Question 1

Research Question 1: What differences in total medical expenditures exist between American adults aged 65 and older, and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV?

$H_0$1: There is no significant difference in total medical expenditures between American adults aged 65 and older and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV.

H_a1: There is a significant difference in total medical expenditures between American adults aged 65 and older and American adults aged 64 and younger with a diagnosis of cardiovascular disease or HIV.

Analyses for Research Question 1 centered on the specific difference between the two age groups of interest and were conducted as two-way analyses following a binary logistic regression model with the dichotomous expenditure variable (i.e., high versus low expenditure) used as the criterion in each regression. Though the binary logistic regression does not share the same restrictive assumptions as a linear regression, and

therefore does not require that the assumptions of normality, homoscedasticity, or linearity be met, each analysis was assessed to ensure that each had an adequate sample size (i.e., $N > 200$; see Stevens, 2016), and enough representation in each group of the dependent variable. The sample size for each was sufficient for the binary logistic regressions in each analysis, and group representation was equal for each dependent variable based on the method of dichotomization, which resulted in near-equally sized groups. In each analysis, there was one predictor variable, which was entered as the binary age variable (i.e., 64 and below versus 65 and above). Results of each analysis indicate whether likelihood of placement into the high expenditure group is dependent on age group placement (i.e., 64 and younger versus 65 and older). It was important to determine whether each binary logistic regression model was significant before interpreting the results; this was accomplished by examining the chi square statistic, which is the test statistic resulting from binary logistic regression and indicates the significance of the overall model (Stevens, 2016). Because the sample was weighted to represent the entirety of the US population of interest, the analytical power was very high, and estimates for the regression outputs, such as odds ratios, were extremely close to their confidence intervals, in many cases appearing identical unless examined at three decimal places. This was evidence for a high level of certainty that the estimates resulting from the binary logistic regressions were realistic representations of the population.

Outpatient Expenditures

Results of the binary logistic regression of outpatient expenditures on age were significant, $\chi^2(1) = 2{,}409.30$, $p < .001$. These findings indicated that those aged 65 and

older had a significantly different outpatient expenditure than their 64 and younger counterparts. Examination of odds ratios and estimates revealed that there was a positive association, such that, participants aged 65 and older had significantly higher odds of incurring higher outpatient expenditures. Based on the odds ratio, there were 1.04 times higher odds of having a higher outpatient expenditure among the older group when compared to the 64 and younger group, and the null hypothesis was rejected. Because the data were grouped such that the baseline odds of a higher expenditure was 50%, the odds ratio of 1.040 means that patients aged 65 and over had only 2% higher odds of incurring a higher outpatient expenditure (i.e., odds of 52%), meaning that age may not change the risk to a meaningful extent. Table 6 provides the results of this analysis as broken down based on the individual predictor. Estimates of the intercept were calculated for each logistic regression to create probability equations, though the odds ratio and significance of the intercept are irrelevant to the goals of this study and were not included. The resulting regression equation is as follows:

$$Probability\ of\ higher\ outpatient\ expenditures = \frac{1}{(1 + e^{(-(.04 * age\ category - .07))})}$$

Table 6

Binary Logistic Regression of Outpatient Expenditures on Age

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Age: 65 and older (ref: 64 and younger)	0.04	0.00	1.040	[1.038, 1.041]	49.09	< .001

Office-Based Expenditures

Results of the binary logistic regression of office-based expenditures on age were significant, $\chi^2(1) = 273{,}284.01$, $p < .001$. These findings indicated that those aged 65 and older had a significantly different office-based expenditure than their 64 and younger counterparts. Examination of odds ratios and estimates revealed that there was a positive association such that participants aged 65 and older had significantly higher odds of incurring higher office-based expenditures. Based on the odds ratio, there were 1.33 times higher odds of having a higher office-based expenditure among the older group when compared to the 64 and younger group, and the null hypothesis was rejected. Because the data were grouped such that the baseline odds of a higher expenditure was 50%, the odds ratio of 1.328 means that patients aged 65 and over had 16.5% higher odds of incurring a higher expenditure (i.e., odds of 66.5%), meaning that age changed the risk of higher office-based expenditures to a meaningful extent. Table 7 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ office-based\ expenditures = \frac{1}{(1+e^{(-(.28*age\ category-.03)})}$$

Table 7

Binary Logistic Regression of Office-Based Expenditures on Age

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Age: 65 and older (ref: 64 and younger)	0.28	0.00	1.328	[1.327, 1.330]	522.57	< .001

Medication Expenditures

Results of the binary logistic regression of medication expenditures on age were significant, $\chi^2(1) = 999.62$, $p < .001$. These findings indicated that those aged 65 and older had a significantly different medication expenditure than their 64 and younger counterparts. Examination of odds ratios and estimates revealed that there was a positive association such that participants aged 65 and older had significantly higher odds of incurring higher medication expenditures. Based on the odds ratio, there were 1.02 times higher odds of having a higher medication expenditure among the older group when compared to the 64 and younger group, and the null hypothesis was rejected. Because the data were grouped such that the baseline odds of a higher expenditure was 50%, the odds ratio of 1.017 means that patients aged 65 and over had only 1% higher odds of incurring a higher medication-based expenditure (i.e., odds of 51%), meaning that age may not change the risk to a meaningful extent. Table 8 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ medication\ expenditures = \frac{1}{(1 + e^{(-(.02 * age\ category))})}$$

Table 8

Binary Logistic Regression of Medication Expenditures on Age

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Age: 65 and older (ref: 64 and younger)	0.02	0.00	1.017	[1.016, 1.018]	31.62	< .001

Inpatient Expenditures

Results of the binary logistic regression of inpatient expenditures on age were significant, $\chi^2(1) = 8670.40$, $p < .001$. These findings indicated that those aged 65 and older had a significantly different inpatient expenditure than their 64 and younger counterparts. Examination of odds ratios and estimates revealed that there was a positive association such that participants aged 65 and older had significantly higher odds of incurring higher inpatient expenditures. Based on the odds ratio, there was 1.08 times higher odds of having a higher inpatient expenditure among the older group when compared to the 64 and younger group, and the null hypothesis was rejected. Because the data were grouped such that the baseline odds of a higher expenditure was 50%, the odds ratio of 1.085 means that patients aged 65 and over had only 4% higher odds of incurring a higher inpatient expenditure (i.e., odds of 54%), meaning that age may not change the risk to a meaningful extent. Table 9 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ inpatient\ expenditures = \frac{1}{(1 + e^{(-.08 * age\ category - .04)})}$$

Table 9

Binary Logistic Regression of Inpatient Expenditures on Age

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Age: 65 and older (ref: 64 and younger)	0.08	0.00	1.085	[1.083, 1.087]	93.12	< .001

Home Health Expenditures

Results of the binary logistic regression of home health expenditures on age were significant, $\chi^2(1) = 101{,}767.02$, $p < .001$. These findings indicated that those aged 65 and older had a significantly higher home health expenditure than their 64 and younger counterparts. Examination of odds ratios and estimates revealed that there was a positive association such that participants aged 65 and older had significantly higher odds of incurring higher home health expenditures. Based on the odds ratio, there was 1.58 times higher odds of having a higher home health expenditure among the older group when compared to the 64 and younger group, and the null hypothesis was rejected. Because the data were grouped such that the baseline odds of a higher expenditure was 50%, the odds ratio of 1.580 means that patients aged 65 and over had 29% higher odds of incurring a higher expenditure (i.e., odds of 79%), meaning that age changed the risk of higher home health expenditures to a meaningful extent. Table 10 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ home\ health\ expenditures = \frac{1}{(1 + e^{(-.46 * age\ category + .52)})}$$

Table 10

Binary Logistic Regression of Home Health Expenditures on Age

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Age: 65 and older (ref: 64 and younger)	0.46	0.00	1.580	[1.576, 1.585]	315.90	< .001

Emergency Room Expenditures

Results of the binary logistic regression of emergency room expenditures on age were significant, $\chi^2(1) = 111{,}301.00$, $p < .001$. These findings indicated that those aged 65 and older had a significantly different emergency room expenditure than their 64 and younger counterparts. Examination of odds ratios and estimates revealed that there was a negative association such that participants aged 65 and older had significantly lower odds of having higher emergency room expenditures. Based on the odds ratio, there were 0.76 times the odds of having a higher emergency room expenditure among the older group when compared to the 64 and younger group, and the null hypothesis was rejected. Because the data were grouped such that the baseline odds of a higher expenditure was 50%, the odds ratio of 0.764 means that patients aged 65 and over had 12% higher odds of incurring a higher expenditure (i.e., odds of 38%), meaning that age changed the risk of higher emergency room expenditures to a meaningful extent. Table 11 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ emergency\ room\ expenditures = \frac{1}{(1 + e^{(-(-.27 * age\ category - .24)}}$$

Table 11

Binary Logistic Regression of Emergency Room Expenditures on Age

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Age: 65 and older (ref: 64 and younger)	-0.27	0.00	0.764	[0.763, 0.766]	-333.10	< .001

Research Question 2

Research Question 2: What are the differences in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger?

$H_0$2: There is no significant difference in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger.

H_a2: There is a significant difference in total medical expenditures between Blacks and Whites aged 65 and older with a diagnosis of cardiovascular disease or HIV, when compared to individuals of the same race, with the same diagnoses, aged 64 and younger.

Analyses for Research Question 2 centered on the specific difference between the two age/race groups of interest (i.e., White versus Black and age 65 and older versus age 64 and younger) and were conducted as two-way analyses following a binary logistic regression model with the dichotomous expenditure variable (i.e., high versus low expenditure) used as the criterion in each regression. In each analysis, there was one predictor variable, which was entered as the categorical race variable (i.e., Black, White, and Other), and dummy coded with "*other"* acting as the reference category such that specific findings for the Black and White groups could be compared to one another. Results of each analysis indicate whether likelihood of placement into the high

expenditure group is dependent on race. One such analysis was conducted for each dependent variable. Because the sample was weighted to represent the entirety of the U.S. population of interest, the analytical power was very high, and estimates for the regression outputs, such as odds ratios, were extremely close to their confidence intervals, in many cases appearing identical unless examined at three decimal places. This was evidence for a high level of certainty that the estimates resulting from the binary logistic regressions were realistic representations of the population.

Outpatient Expenditures

Results of the binary logistic regression of outpatient expenditures on race were significant, $\chi^2(2) = 50{,}133.02$, $p < .001$, resulting in a rejection of the null hypothesis. These findings indicated that both White and Black participants had a significantly different outpatient expenditures when compared to the group of participants who were any other race (denotes other non-white races i.e., Asian, Native America, Native Hawaiian, multiple races etc., and referenced as *other*, henceforth). Examination of odds ratios and estimates revealed that, while both race groups were significantly different from the *other* category, the White group of participants saw higher odds of being in the high expenditure group than their Black or *other* counterparts. Based on the odds ratio, there were 1.451 times higher odds (i.e., odds of 72.5%) of having a higher outpatient expenditure among the White group; while among the Black group there were 1.258 times higher odds (i.e., odds of 63%) of having a higher outpatient expenditure when compared to the *others*. As these odds represent a 22.5% and 13% increase in likelihood of higher outpatient expenditures respectively, both race-related findings present

meaningful results. Table 12 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ outpatient\ expenditures = \frac{1}{(1 + e^{(-(.22*AA.category+.37*W.category+.24))})}$$

Table 12

Binary Logistic Regression of Outpatient Expenditures on Race

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Race: Black (ref: other)	0.22	0.00	1.258	[1.252, 1.263]	105.50	< .001
Race: White (ref: other)	0.37	0.00	1.451	[1.446, 1.457]	201.00	< .001

Office-Based Expenditures

Results of the binary logistic regression of office-based expenditures on race were significant, $\chi^2(2) = 372{,}747.20$, $p < .001$, resulting in a rejection of the null hypothesis. These findings indicated that both White and Black participants had a significantly different office-based expenditures when compared to the group of participants who were any other race. Examination of odds ratios and estimates revealed that, while both race groups were significantly different from the *other* category, the White group of participants saw higher odds of being in the high office-based expenditure group than their Black or *other* counterparts. Based on the odds ratio, there was 1.43 times higher odds (i.e., odds of 71.5%) of having a higher office-based expenditure among the White group; while among the Black group there were 0.91 times the odds of having a higher

office-based expenditure (i.e., odds of 45.5%), when compared to the others. As these odds represent a 21.5% increase and 4.5% decrease in likelihood of higher office-based expenditures respectively, these race-related findings present meaningful results. Table 13 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ office-based\ expenditures = \frac{1}{(1+e^{(-(-.10*AA.category+.36*W.category+.09))})}$$

Table 13

Binary Logistic Regression of Office-Based Expenditures on Race

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Race: Black (ref: other)	-0.10	0.00	0.906	[0.904, 0.909]	-71.09	< .001
Race: White (ref: other)	0.36	0.00	1.433	[1.429, 1.436]	303.15	< .001

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Medication Expenditures

Results of the binary logistic regression of medication expenditures on race were significant, $\chi^2(2) = 36{,}178.20$, $p < .001$, resulting in a rejection of the null hypothesis. These findings indicated that both White and Black participants had a significantly different medication expenditures when compared to the group of participants who were any *other* race. Examination of odds ratios and estimates revealed that, while both race groups were significantly different from the *other* category, both White and Black groups were similarly likely to have a high expenditure. Based on the odds ratio, there was 1.251 times higher odds of having a higher medication expenditure among the White group (i.e., odds of 63%); while among the Black group there was 1.241 times higher odds (i.e.,

odds of 62.1%) of having a higher medication expenditure when compared to the others. As these odds represent a 13% and 12.1% increase in likelihood of higher outpatient expenditures respectively, both race-related findings present meaningful results. Table 14 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ medication\ expenditures = \frac{1}{(1 + e^{(-(.22*AA.category+.22*W.category+.20))})}$$

Table 14

Binary Logistic Regression of Medication Expenditures on Race

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Race: Black (ref: other)	0.22	0.00	1.241	[1.238, 1.244]	156.70	< .001
Race: White (ref: other)	0.22	0.00	1.251	[1.248, 1.254]	189.60	< .001

Inpatient Expenditures

Results of the binary logistic regression of inpatient expenditures on race were significant, $\chi^2(2) = 35{,}966.01$, $p < .001$, resulting in a rejection of the null hypothesis. These findings indicated that both White and Black participants had significantly different inpatient expenditures when compared to the group of participants who were any other race. Examination of odds ratios and estimates revealed that, while both race groups were significantly different from the *other* category, the White group of participants had higher odds of incurring higher inpatient expenditures than their Black or *other* counterparts. Based on the odds ratio, there was 1.245 times higher odds of having a higher inpatient expenditure among the White group (i.e., odds of 62%); while among

the Black group there was 1.007 times higher odds (i.e., odds of 50.5%) of having a higher inpatient expenditure, when compared to the *others*. As these odds represent a 12% increase in likelihood of higher inpatient expenditures in the White group, the race-related findings present meaningful results. However, results for the Black group may not be as meaningful, and only change the likelihood of higher expenditures by 0.5%. Table 15 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ inpatient\ expenditures = \frac{1}{(1 + e^{(-(.01*AA.category+.22*W.category+.09))})}$$

Table 15

Binary Logistic Regression of Inpatient Expenditures on Race

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Race: Black (ref: other)	0.01	0.00	1.007	[1.002, 1.012]	2.99	.003
Race: White (ref: other)	0.22	0.00	1.245	[1.239, 1.250]	103.39	< .001

Home Health Expenditures

Results of the binary logistic regression of home health expenditures on race were significant, $\chi^2(2) = 81{,}055.22$, $p < .001$, resulting in a rejection of the null hypothesis. These findings indicated that both White and Black participants had significantly different home health expenditures when compared to the group of participants who were any *other* race. Examination of odds ratios and estimates revealed that, while both race groups were significantly different from the *other* category, the Black group of participants had higher odds of being in the high home health expenditure group than

their White or *other* counterparts. Based on the odds ratio, there was 1.071 times higher odds (i.e., odds of 53.5%) of having a higher home health expenditure among the Black group; while among the White group there was 0.675 times the odds (i.e., odds of 33.5%) of having a higher home health expenditure, when compared to the *others*. As these odds represent a 16.5% decrease in likelihood of higher home health expenditures within the White group, these race-related findings present meaningful results. Table 16 provides the results of this analysis as broken down based on the individual predictor. The resulting regression equation is as follows:

$$Probability\ of\ higher\ home\ health\ expenditures = \frac{1}{(1 + e^{(-(.07 * AA.category - .39 * W.category - .16))})}$$

Table 16

Binary Logistic Regression of Home Health Expenditures on Race

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Race: Black (ref: other)	0.07	0.00	1.071	[1.064, 1.078]	21.37	< .001
Race: White (ref: other)	-0.39	0.00	0.675	[0.671, 0.679]	-139.33	< .001

Emergency Room Expenditures

Results of the binary logistic regression of emergency room expenditures on race were significant, $\chi^2(2) = 13{,}663.22$, $p < .001$, resulting in a rejection of the null hypothesis. These findings indicated that both White and Black participants had significantly different emergency room expenditures when compared to the group of participants who were any *other* race. Examination of odds ratios and estimates revealed that, while both race groups were significantly different from the *other* category, the

White group of participants had higher odds of incurring higher emergency room expenditures than their Black or *other* counterparts. Based on the odds ratio, there was 1.124 times higher odds (i.e., odds of 56%) of having a higher emergency room expenditure among the White group; while among the Black group there was 0.996 times the odds (i.e., odds of 49.5%) of having a higher emergency room expenditure, when compared to the *others*. As these odds represent a 6% increase and 0.5% decrease in likelihood of higher outpatient expenditures respectively, race-related findings were not meaningful to the likelihood of higher emergency room expenditures. The resulting regression equation is as follows:

$$Probability\ of\ higher\ emergency\ room\ expenditures = \frac{1}{(1 + e^{(-(-.01*AA.category+.11*W.category+.01))}}$$

Table 17

Binary Logistic Regression of Emergency Room Expenditures on Race

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	P
Race: Black (ref: other)	-0.01	0.00	0.996	[0.991, 1.000]	-2.06	.040
Race: White (ref: other)	0.11	0.00	1.124	[1.120, 1.129]	61.23	< .001

Research Question Three

Research Question 3: What effect does type of health service (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) utilized have on the total medical expenditures incurred for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease)?

$H_0$3: There is no significant difference in total medical expenditures for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease) when different types of health services (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) are used.

H_a3: There is a significant difference in total medical expenditures for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease) when different types of health services (prescribed medicines, hospital inpatient stay, emergency room visits, office based medical provider visits, home health visits, and outpatient visits) are used.

Analyses for Research Question 3 centered on the influence of placement in the HIV or cardiovascular disease groups and were conducted as multivariate analyses following a binary logistic regression model with the dichotomous expenditure variable (i.e., high versus low expenditure) used as the criterion in each regression. These analyses not only consider the findings from the previous regressions (i.e., that race and age are related to expenditure), but also control for age and race when testing for the effect of either diagnosis. In addition, sex and poverty level are included in these analyses as control variables.

In each analysis, there is one predictor variable for each diagnosis where possible, although some analyses could not run while testing both cardiovascular disease and HIV for their influence. This is due to the small representation of patients with HIV but without cardiovascular disease, which were too sparse and limited the outpatient, office-

based, medication, and inpatient expenditure models such that they could not converge. These models were revised to exclude the effect of cardiovascular disease or HIV from the model, depending on which allowed the model to converge. Results of each analysis indicate whether likelihood of placement into the high expenditure group is dependent on incidence of HIV or cardiovascular disease, as well as race, sex, poverty level, and age.

One such analysis was conducted for each dependent variable. Examination of effects within the models were also conducted using odds ratios, which are not standardized, and thus must be compared to one another to determine the strongest predictors. It is important to note that because the sample was weighted to represent the entirety of the US population of interest, the analytical power was very high, and estimates for the regression outputs, such as odds ratios, were extremely close to their confidence intervals, in many cases appearing identical unless examined at three decimal places. This was evidence for a high level of certainty that the estimates resulting from the binary logistic regressions were realistic representations of the population. This method of understanding the strongest predictors in each model was carried out in response to the large sample size, which drove the results towards significance. For this reason, it was important to understand not only which predictor variables were significant, but which were most closely related to each expenditure.

Outpatient Expenditures

The first attempt at creating a multivariate binary logistic regression model inclusive of age, sex, race, poverty level, HIV status, and cardiovascular disease status did not converge. After assessing representation of each variable in the analysis, it was

determined that there was a low number of participants with HIV, wherein an overwhelming majority did not have HIV, which restricted the model's ability to converge. By removing this variable from the model, the regression no longer had to fit HIV data to the outcome and was therefore able to converge. This analysis still provided insight into the relationship between cardiovascular disease and expenditures, and still included participants who were HIV positive.

Results for the regression of outpatient expenditures on cardiovascular disease status, race, age, sex, and poverty level were significant, $\chi^2(6) = 303{,}487.62$, $p < .001$. Based on the evidence for overall significance in the model, the model's predictors were examined individually to determine which variables were significantly predictive, as well as the nature of any identified relationships. Each of the variables in the model were significant, though the focus of Research Question 3 pertains to the influence of a cardiovascular disease or HIV diagnosis on expenditures. As the HIV variable could not be included in this analysis without causing problems with convergence, the focus of interpretation in this analysis was the effect of a cardiovascular disease diagnosis. While it is noteworthy that men tended to have 0.700 times the odds of having a high outpatient expenditure, and among poor to low income participants there were 0.81 times the odds of having high outpatient expenditures, examination of the cardiovascular disease trait was of direct importance to the research question. Interpretation of the estimate and odds ratio indicated a positive relationship, where those with cardiovascular disease had higher odds of incurring high outpatient expenditures, which resulted in a rejection of the null hypothesis. Based on the odds ratio, there was 1.235 times the odds of higher outpatient

expenditures among those with cardiovascular disease when compared to their counterparts without cardiovascular disease. Race had the strongest predictive ability in the model, with the White category showing an odds ratio of 1.400 (i.e., 70% likelihood). Based on the 20% increase in likelihood of higher outpatient expenditures, this predictor was most influential in the prediction of outpatient expenditures. Table 18 provides the full results of the model. The resulting regression equation is as follows:

$$Probability\ of\ higher\ outpatient\ expenditures = \frac{1}{(1 + e^{(-(.18*race:AA+.33*race:W+.01*Age:65orOlder-.35*gender:male-,21*poverty:yes+.22*CVD:yes+.14))}}$$

Table 18

Binary Logistic Regression of Outpatient Expenditures on Race, Age, and Covariates

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	p
Race: Black (ref: other)	0.18	0.00	1.205	[1.200, 1.210]	85.22	< .001
Race: White (ref: other)	0.33	0.00	1.400	[1.395, 1.405]	179.71	< .001
Age: 65 and older (ref: ≤ 64)	0.01	0.00	1.008	[1.006, 1.010]	9.56	< .001
Sex: Male (ref: female)	-0.35	0.00	0.700	[0.699, 0.701]	-448.05	< .001
Poverty: Poor or low (ref: medium or high)	-0.21	0.00	0.807	[0.806, 0.809]	-262.57	< .001
Cardiovascular disease	0.22	0.00	1.235	[1.227, 1.243]	63.72	< .001

Office-Based Expenditures

The first attempt at creating a multivariate binary logistic regression model inclusive of age, sex, race, poverty level, HIV status, and cardiovascular disease status did not converge. After assessing representation of each variable in the analysis, it was determined that the low number of participants with HIV, wherein an overwhelming majority did not have HIV, restricted the model's ability to converge. By removing this variable from the model, the regression no longer had to fit HIV data to the outcome and

was able to converge. This analysis still provided insight into the relationship between cardiovascular disease and expenditures, and still included participants who were HIV positive.

Results for the regression of office-based expenditures on cardiovascular disease status, race, age, sex, and poverty level were significant, $\chi^2(6) = 855{,}818.22$, $p < .001$. Based on the evidence for overall significance in the model, the model's predictors were examined individually to determine which variables were significantly predictive, as well as the nature of any identified relationships. As seen in Table 19, each of the variables in the model were significant, though the focus of Research Question 3 pertains to the influence of a cardiovascular disease or HIV diagnosis on expenditures. As the HIV variable could not be included in this analysis without causing problems with convergence, the focus of interpretation in this analysis was the effect of a cardiovascular disease diagnosis. While it is noteworthy that men tended to have 0.877 times the odds of having a high office-based expenditure, and poor to low income participants had 0.755 times the odds of a high office-based expenditure, examination of the cardiovascular disease trait was of direct importance to the research question. Interpretation of the estimate and odds ratio indicated a negative relationship, where those with cardiovascular disease had lower odds of having high office-based expenditures and resulted in a rejection of the null hypothesis. Based on the odds ratio, those with cardiovascular disease tended to have 0.858 times the odds of a higher expenditure than their counterparts without cardiovascular disease on office-based expenditures. Race had the strongest predictive ability in the model, with the White category showing an odds ratio

of 1.352 (i.e., odds of 67.5%). Based on the increase of 17.5% in terms of likelihood to have a higher expenditure, this predictor was most influential in the prediction of office-based expenditures. The resulting regression equation is as follows:

$$Probability\ of\ higher\ office-based\ expenditures = \frac{1}{(1+e^{(-(-.09*race:AA+.30*race:W+.24*Age:65orOlder-.13*gender:male-.28*poverty:yes-.15*CVD:yes-.15))})}$$

Table 19

Binary Logistic Regression of Office-Based Expenditures on Race, Age, and Covariates

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	p
Race: Black (ref: other)	-0.09	0.00	0.912	[0.909, 0.914]	-66.02	< .001
Race: White (ref: other)	0.30	0.00	1.352	[1.349, 1.355]	252.18	< .001
Age: 65 and older (ref: ≤ 64)	0.24	0.00	1.271	[1.270, 1.273]	430.18	< .001
Sex: Male (ref: female)	-0.13	0.00	0.877	[0.876, 0.878]	-239.39	< .001
Poverty: Poor or low (ref: medium or high)	-0.28	0.00	0.755	[0.754, 0.756]	-506.53	< .001
Cardiovascular disease	-0.15	0.00	0.858	[0.854, 0.861]	-75.86	< .001

Medication Expenditures

The first attempt at creating a multivariate binary logistic regression model inclusive of age, sex, race, poverty level, HIV status, and cardiovascular disease status did not converge. After assessing representation of each variable in the analysis, it was determined that the low number of participants with HIV may have been restricting the model's ability to converge. Upon removing this variable from the model, the regression converged, but could not return results for the influence of HIV on the model's predictive ability. As a potential amelioration, the HIV variable was reincorporated, and the cardiovascular disease variable was removed. Without the cardiovascular disease

variable, the regression was still able to converge but did not return values for this variable either. Thus, while the model could provide insight into the multivariate relationships within the model, definitive claims regarding the influence of HIV or cardiovascular disease on medication expenditures could not be determined.

Considering this limitation for the analysis of medication expenditures, results for the regression of inpatient expenditures on HIV status, race, age, sex, and poverty level were significant, $\chi^2(6) = -4{,}740{,}519.00$, $p < .001$. Based on the evidence for overall significance in the model, the model's predictors were examined individually to determine which variables were significantly predictive, as well as the nature of any identified relationships. As seen in Table 20, each of the variables in the model were significant, though the focus of Research Question 3 pertains to the influence of a cardiovascular disease or HIV diagnosis on expenditures. As the cardiovascular disease variable could not be included in this analysis without causing problems with convergence, the focus of interpretation in this analysis was the effect of an HIV diagnosis.

While it is noteworthy that men tended to have 0.903 times the odds of a high medication expenditure, and poor to low income participants had 0.990 times the odds of a high medication expenditure, examination of the HIV trait was of direct importance to the research question. Interpretation of the estimate and odds ratio should be taken with caution, as the results returned infinities for the odds ratio estimate, and could not result in a clear rejection or acceptance of the null hypothesis for medication expenditures. The results, however, did provide some evidence for a positive estimate, and thus indicated a

positive relationship, where those with HIV had higher odds of incurring high medication expenditures. Race had the strongest predictive ability in the model, with the White category showing an odds ratio of 1.258 (i.e., odds of 63%). Based on the increase of 13% in likelihood to have a higher expenditure, this predictor was most influential in the prediction of medication expenditures. The resulting regression equation is as follows:

$$Probability\ of\ higher\ medication\ expenditures = \frac{1}{(1 + e^{(-(.14*race:AA+.23*race:W+.96*Age:65orOlder-.10*gender:male-.01*poverty:yes+3.54x10\text{^}15*CVD:yes+.24))})}$$

Table 20

Binary Logistic Regression of Medication Expenditures on Race, Age, and Covariates

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	p
Race: Black (ref: other)	0.14	0.00	1.149	[1.146, 1.152]	-184.50	< .001
Race: White (ref: other)	0.23	0.00	1.258	[1.255, 1.261]	98.36	< .001
Age: 65 and older (ref: ≤ 64)	0.96	0.00	1.100	[1.099, 1.101]	172.70	< .001
Sex: Male (ref: female)	-0.10	0.00	0.903	[0.902, 0.904]	-188.10	< .001
Poverty: Poor or low (ref: medium or high)	-0.01	0.00	0.990	[0.989, 0.991]	-17.78	< .001
HIV	$3.54_E{}^{15}$	0.00	Inf.	[Inf., Inf.]	$5.99_E{}^{10}$	< .001

Inpatient Expenditures

The first attempt at creating a multivariate binary logistic regression model inclusive of age, sex, race, poverty level, HIV status, and cardiovascular disease status did not converge. After assessing representation of each variable in the analysis, it was determined that the low number of participants with HIV, wherein an overwhelming majority did not have HIV, restricted the model's ability to converge. By removing this variable from the model, the regression no longer had to fit HIV data to the outcome and

was able to converge. This analysis still provided insight into the relationship between cardiovascular disease and expenditures, and still included participants who were HIV positive.

Results for the regression of inpatient expenditures on cardiovascular disease status, race, age, sex, and poverty level were significant, $\chi^2(6) = 188{,}214.22$, $p < .001$. Based on the evidence for overall significance in the model, the model's predictors were examined individually to determine which variables were significantly predictive, as well as the nature of any identified relationships. As seen in Table 21, each of the variables in the model were significant, though the focus of Research Question 3 pertains to the influence of a cardiovascular disease or HIV diagnosis on expenditures. As the HIV variable could not be included in this analysis without causing problems with convergence, the focus of interpretation in this analysis was the effect of a cardiovascular disease diagnosis.

While it is noteworthy that men tended to have 1.349 times higher odds of having a high inpatient expenditure, and poor to low income participants had 1.027 times higher odds of having high inpatient expenditures, examination of the cardiovascular disease trait was of direct importance to the research question. Interpretation of the estimate and odds ratio indicated a positive relationship, where those with cardiovascular disease had higher odds of having high inpatient expenditures and resulted in a rejection of the null hypothesis. Based on the odds ratio, those with cardiovascular disease tended to have 2.142 times higher odds (i.e., theoretically 100% likelihood) of spending more than their counterparts without cardiovascular disease. Based on this detail, cardiovascular disease

status was found to have the strongest predictive ability in the model. Based on the influence of cardiovascular disease in this model, which indicated that theoretically, all patients with cardiovascular disease would have higher expenditures, this predictor was most influential in the prediction of inpatient expenditures. The resulting regression equation is as follows:

$$Probability\ of\ higher\ inpatient\ expenditures = \frac{1}{(1 + e^{(-(.06*race:AA+.06*race:W+.21*Age:65orOlder+.05*gender:male+.03*poverty:yes+.76*CVD:yes+1.05))}}$$

Table 21

Binary Logistic Regression of Inpatient Expenditures on Race, Age, and Covariates

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	p
Race: Black (ref: other)	0.06	0.00	1.058	[1.053, 1.063]	23.45	< .001
Race: White (ref: other)	0.21	0.00	1.230	[1.225, 1.235]	97.00	< .001
Age: 65 and older (ref: ≤ 64)	0.05	0.00	1.053	[1.052, 1.055]	57.98	< .001
Sex: Male (ref: female)	0.30	0.00	1.349	[1.347, 1.351]	438.36	< .001
Poverty: Poor or low (ref: medium or high)	0.03	0.00	1.027	[1.025, 1.029]	30.89	< .001
Cardiovascular disease	0.76	0.00	2.142	[2.124, 2.161]	173.45	< .001

Home Health Expenditures

The regression for home health expenditures did not encounter any issues with convergence, and all variables were retained. Results for the regression of home health expenditures on cardiovascular disease status, HIV status, race, age, sex, and poverty level were significant, $\chi^2(7) = 554{,}553.32$, $p < .001$. Based on the evidence for overall significance in the model, the model's predictors were examined individually to determine which variables were significantly predictive, as well as the nature of any

identified relationships. As seen in Table 22, each of the variables in the model were significant, though the focus of Research Question 3 pertains to the cardiovascular disease and HIV variables, both of which were available for interpretation based on their inclusion in the model. While it is noteworthy that men tended to have 0.769 times the odds of having a high home health expenditure, and poor to low income participants had 1.789 times higher odds of having high home health expenditures, examination of the cardiovascular disease and HIV traits were of direct importance to the research question.

Interpretation of the estimates and odds ratios indicated a negative relationship between cardiovascular disease and home health expenditures, where those with cardiovascular disease had lower odds of having high home health expenditures. Based on the odds ratio, those with cardiovascular disease tended to have 0.753 times the odds of spending more than their counterparts without cardiovascular disease. Conversely, those with HIV had 1.850 times higher odds of incurring higher expenditures than those without HIV. These findings resulted in a rejection of the null hypothesis. Age had the strongest predictive ability in the model, showing an odds ratio of 1.926 (i.e., odds of 96.3%). Based on these results, which indicated that nearly all patients over 65 would have a higher expenditure, this predictor was most influential in the prediction of home health expenditures. It was also found that HIV status was similarly predictive of home health expenditures, indicating that this was also a noteworthy predictor, and represented an increased odd of higher expenditures of 42.5% (i.e., odds of 92.5%) among HIV positive patients. The resulting regression equation is as follows:

$$Probability\ of\ higher\ home\ health\ expenditures = \frac{1}{(1 + e^{(-(-.03*race:AA-.03*race:W-.5*Age:65orOlder-.25*gender:male+.58*poverty:yes+.61*HIV:yes-.28*CVD:yes+.17)})}$$

Table 22

Binary Logistic Regression of Home Health Expenditures on Race, Age, and Covariates

			Odds ratio			
Source	Estimate	SE	OR	95% CI	Wald	p
Race: Black (ref: other)	-0.03	0.00	0.975	[0.968, 0.981]	-7.76	< .001
Race: White (ref: other)	-0.50	0.00	0.605	[0.601, 0.608]	-171.84	< .001
Age: 65 and older (ref: ≤ 64)	0.66	0.00	1.926	[1.920, 1.932]	421/68	< .001
Sex: Male (ref: female)	-0.25	0.00	0.769	[0.767, 0.771]	-212.43	< .001
Poverty: Poor or low (ref: medium or high)	0.58	0.00	1.789	[1.785, 1.793]	470.76	< .001
HIV	0.61	0.00	1.850	[1.819, 1.882]	71.31	< .001
Cardiovascular disease	-0.28	0.00	0.753	[0.738, 0.769]	-26.81	< .001

Emergency Room Expenditures

The regression for emergency room expenditures did not encounter any issues with convergence, and all variables were retained. Results for the regression of emergency room expenditures on cardiovascular disease status, HIV status, race, age, sex, and poverty level were significant, $\chi^2(7) = 235{,}726.22$, $p < .001$. Based on the evidence for overall significance in the model, the model's predictors were examined individually to determine which variables were significantly predictive, as well as the nature of any identified relationships. As seen in Table 23, each of the variables in the model were significant, though the focus of Research Question 3 pertains to the cardiovascular disease and HIV variables, both of which were available for interpretation based on their inclusion in the model. While it is noteworthy that men tended to have

0.899 times the odds of having a high emergency room expenditure, and poor to low income participants had 0.827 times the odds of having high emergency room expenditures, examination of the cardiovascular disease and HIV traits was of direct importance to the research question.

Interpretation of the estimates and odds ratios indicated a positive relationship between cardiovascular disease and emergency room expenditures, where those with cardiovascular disease had higher odds of incurring high emergency room expenditures. Based on the odds ratio, those with cardiovascular disease tended to have 1.063 times higher odds of spending more than their counterparts without cardiovascular disease. Conversely, those with HIV had 0.653 times the odds of incurring higher emergency room expenditures than those without HIV. These findings resulted in a rejection of the null hypothesis. Based on the odds ratio, HIV status had the strongest predictive ability in the model. Based on the reduction in likelihood of a higher expenditure of 17.5% (i.e., odds of 32.5%), this predictor was most influential in the prediction of emergency room expenditures. The resulting regression equation is as follows:

$$Probability\ of\ higher\ emergency\ room\ expenditures = \frac{1}{(1 + e^{(-(.03*race:AA + .16*race:W - .32*Age:65orOlder - .11*gender:male - .19*poverty:yes - .43*HIV:yes + .06*CVD:yes - .22)})}$$

Table 23

Binary Logistic Regression of Emergency Room Expenditures on Race, Age, and Covariates

Source	Estimate	SE	Odds ratio		Wald	p
			OR	95% CI		
Race: Black (ref: other)	0.03	0.00	1.030	[1.026, 1.035]	13.69	< .001
Race: White (ref: other)	0.16	0.00	1.176	[1.171, 1.180]	83.77	< .001
Age: 65 and older (ref: ≤ 64)	-0.32	0.00	0.727	[0.726, 0.729]	-384.62	< .001
Sex: Male (ref: female)	-0.11	0.00	0.899	[0.898, 0.901]	-131.31	< .001
Poverty: Poor or low (ref: medium or high)	-0.19	0.00	0.827	[0.826, 0.828]	-232.72	< .001
HIV	-0.43	0.00	0.653	[0.644, 0.662]	-59.99	< .001
Cardiovascular disease	0.06	0.00	1.063	[1.047, 1.079]	7.89	< .001

Summary

Results indicated that for each type of expenditure, older participants (i.e., those aged 65 and older) had higher odds of incurring higher expenditures. In terms of race, White participants had higher odds of having higher expenditures for all categories except for medication (in which both Black and White participants had similarly higher odds of incurring higher expenditures than other races), and home health (in which White participants had higher odds of having lower expenditures).

Results of multivariate analyses (i.e., multivariate binary logistic regressions) also indicated that those with HIV had higher expenditures for home health than their HIV negative counterparts, but lower expenditures for emergency room. Individuals with cardiovascular disease tended to have higher outpatient, inpatient, and emergency room expenditures than their counterparts without cardiovascular disease, but lower office-based and home health expenditures. When comparing the effects of the predictor

variables, race was found to be a significant predictor in terms of outpatient, office-based, inpatient, and medication expenditures, where White patients had higher odds of incurring higher expenditures in these four categories. In terms of inpatient expenditures, cardiovascular disease status was the strongest predictor, with those who were diagnosed with cardiovascular disease being, theoretically, 100% likely to have higher expenditures. Age was the strongest predictor of home health expenditures, where individuals aged 65 and older had higher odds of incurring higher expenditures. For emergency room expenditures, HIV status was the most predictive, indicating that those with HIV had lower odds of incurring a higher expenditure.

In Section 4, these findings will be interpreted with relation to the existing knowledge and the theoretical foundations of the study. The section will also include details regarding the limitations of the study, as well as recommendations for future researchers who wish to expand further upon the knowledge gleaned from the present study. Implications for the professional practice and exposition of how the results can be used to enact positive social change will also be discussed so that the full benefit of the study's results can be realized.

Section 4: Application to Professional Practice and Implications for Social Change

Introduction

In this quantitative study, I investigated whether health care expenditure disparities by age and race exist between Blacks and White Americans with a diagnosis of HIV or cardiovascular disease. I also examined the effect that type of health service had on the total direct medical expenditures incurred for patients with an infectious disease (HIV) versus patients with a chronic disease (cardiovascular disease). The key findings were that older individuals (i.e., adults aged 65 and older), with either an HIV or cardiovascular disease diagnosis, had higher odds of incurring higher total medical expenditures (across six household-reported medical events) when compared to individuals aged 64 and younger. For the second research question, White Americans, with either a diagnosis of HIV or cardiovascular disease, were found to incur higher medical expenditures, except for medication, which was a higher medical expenditure for both Blacks and Whites when compared to other races. In contrast, White participants were found to have lower medical expenditures for home health services when compared to Blacks. For the third research question, results for participants with an HIV diagnosis showed that these individuals incurred higher medication and home health expenditures and lower emergency room expenditures than individuals without HIV. Results also showed that individuals with cardiovascular disease had higher odds of experiencing higher outpatient, inpatient, and emergency room expenditures, and lower office-based and home-health expenditures than individuals without cardiovascular disease.

Interpretation of the Findings

This study both confirms and extends the current knowledge of the financial burden individuals with HIV and cardiovascular disease face in the United States. This study may be one of the first to compare the financial burden of individuals with a diagnosis of HIV or cardiovascular disease in the United States by age and race. However, previous research has compared the financial burden of people living with HIV/AIDS and those living with other chronic conditions, indicating that longer life expectancies and a wider range of medications for both HIV and other chronic conditions contribute to higher health care expenditures, particularly among the elderly (Ritchwood et al., 2017). Similarly, when the analysis of MEPS data is restricted to adults with two chronic conditions (arthritis, diabetes mellitus, heart disease, and hypertension), the type of chronic condition impacts average health care expenditures (Merata et al., 2015).

For Research Question 1, age was the strongest predictor of home health expenditures, where those 65 and older had higher odds of incurring higher expenditures. Older individuals (i.e., adults 65 years and older) with either an HIV or cardiovascular disease diagnosis had higher odds of incurring higher total medical expenditures (across the six household-reported medical events analyzed) when compared to individuals aged 64 and younger. This is supported by previous research such as Janus and Ermisch (2015), who found that the odds of home health services use among older people increases by a factor of 1.02 (95% CI 1.00-1.03) for each 1-year increase in age. These odds ratios are comparable to those reported in this study (odds ratio 1.58 [95% CI 1.58, 1.59]) and can be used to determine meaningful effect of health care expenditures, particularly among older patients. Other research also supports these findings that elderly

adults (aged 65 and older) in the United States experience increased levels of economic vulnerability, higher cost sharing, and increased health care costs, especially regarding prescription drugs, which are often up to 3 times more expensive than in other high-income countries (Osborn et al., 2017). Additionally, the prevalence of polypharmacy among older adults contributes to adverse drug events, resulting in increased health care costs and morbidity and mortality (Linjakumpu et al., 2002; Vrettos et al., 2017; Wenger et al., 2017). Elderly adults are more susceptible to adverse drug events, which accounts for over 170,000 emergency room visits annually, represents 25% of hospital admissions among the elderly, and is the fourth leading cause of hospital admissions among this adult population (Wenger et al., 2017). These results highlight why health care costs among the elderly, aged 65 and older, are higher than individuals aged 64 and under.

Race and age and the impact on medical expenditures among individuals with a diagnosis of HIV or cardiovascular disease were the focus of Research Question 2. When comparing the effects of the predictor variables, race was found to be a significant predictor in terms of medication (1.251 odds ratio [95% CI 1.248, 1.254]), office-based (1.433 odds ratio [95% CI 1.429, 1.436]), inpatient (1.245 odds ratio [95% CI 1.239, 1.250]), and outpatient (1.451 odds ratio [95% CI 1.446, 1.457]) expenditures, where White patients had higher odds of incurring higher expenditures in these four categories. Results of the analysis indicated that White Americans with either diagnosis were found to incur higher medical expenditures except for medication, which was a higher medical expenditure for both Blacks and Whites, and home health services, which was a lower medical expenditure for Whites when compared to Blacks. Similar odds ratios were

found by Odhiambo, Davis, and Omolo (2017), who examined the risk for cardiovascular disease in Blacks with HIV/AIDS in America and determined that an odds ratio of 1.26 (95% CI 1.22, 1.30) was sufficient to suggest that risk of cardiovascular disease was higher among Blacks when compared to Whites. Although these results differed from this study, the odds ratio used can be used to determine meaningful effect, because both this study and their study produced similar odds ratio values.

Further addressing the results regarding Research Question 2, a 2018 Kaiser Family Foundation study reported that Black Medicare beneficiaries incurred lower average out-of-pocket health care costs when compared to their White counterparts. This may be due to lower incomes among Black beneficiaries and increased cost sharing coverage under Medicaid and Part D low-income subsidy programs when compared to Whites, who had substantially higher per capita total income, on average, when compared to Blacks (Cubanski, Neuman, Smith & Damico, 2018). The 2016 Census Bureau report on poverty, income, and health insurance coverage also suggested that although there was an increase in median household incomes across races, the median Black household earned 61 cents for every dollar earned within the White median household (Wilson, 2017). Persons with higher incomes had higher odds of incurring higher health care expenditures when compared to individuals with lower incomes, because of their increased ability to afford it (Cubanski et al., 2018).

The third research question addressed whether the type of health care service used (based on the six household-reported medical events analyzed) impacted the total medical expenditures incurred for patients with a diagnosis of HIV or cardiovascular disease.

Analyses showed that individuals with an HIV diagnosis incurred higher medication and home health expenditures and lower emergency room expenditures when compared to individuals in the cardiovascular disease cohort, who had higher odds of experiencing higher outpatient, inpatient, and emergency room expenditures, and lower office-based and home-health expenditures than individuals in the HIV cohort. In terms of inpatient expenditures, cardiovascular disease status was the strongest predictor, with those who are diagnosed with cardiovascular disease being likely to have higher expenditures. For emergency room expenditures, HIV status was the most predictive, indicating that those with HIV had lower odds of incurring a higher expenditure.

Limited studies have addressed the financial burden of individuals living with HIV/AIDS compared to those living with other chronic conditions. However, Durand et al. (2011) found increased odds of acute myocardial infarction among HIV-positive patients with odds ratios ranging between 1.79 and 2.29 for acute myocardial infarctions associated with any exposure to the antiretrovirals abacavir (1.79 (95% CI 1.16 to 2.76), efavirenz 1.83 (95% CI 1.21 to 2.76), lopinavir (1.98 (95% CI 1.24 to 3.16), and ritonavir 2.29 (95% CI 1.48 to 3.54). These odds ratios are comparable to those reported in this study and can be used to determine meaningful effect of health care expenditures, particularly among in-patient services use (odds ratio 2.14 [95% CI 2.12, 2.16]), among cardiovascular disease patients as it relates to incidence of acute myocardial infarction and health care service use. Furthermore, Okunrintemi et al. (2017) reported a significantly greater use of health resources among cardiovascular patients (odds ratio (emergency room visit), 1.41 [95% confidence interval, 1.09-1.81]; odds ratio

(hospitalization), 1.36 [95% confidence interval, 1.04-1.79]). These odds ratios can also be used to determine meaningful effect of higher healthcare expenditures among patients with cardiovascular disease.

Despite similar odds ratios from previous studies, Ritchwood et al.'s (2017) study is the only one that can be used to compare the results for Research Question 3 because of similar analysis components. Among people living with HIV/AIDS, higher expenditures were reported for costs of prescription medications and use of in-patient, office-based, and home health services (see also Chen et al., 2006; Ritchwood et al., 2017), which supports the results in this study. Additionally, among individuals living without HIV but had a chronic disease (such as cardiovascular disease, diabetes, and stroke), the largest percentage of health care costs within this population were incurred from in-patient and office-based visits. Their results indicated that the cardiovascular disease population sustained higher medical expenditures for inpatient services, which was confirmed in this study's analysis.

In addition to previous research findings, Andersen's behavioral model of health services use and the socioecological model can be applied to this study's findings regarding older adults and the financial barriers they may encounter in accessing adequate healthcare because of enabling/interpersonal factors, predisposing/intrapersonal factors, need/institutional and community factors, environmental factors, and policy. For example, Osborne et al. (2017) found that older adults in the United States, despite having insurance coverage through Medicare, had skipped a recommended treatment or medical test, did not fill a prescription, skipped medication doses due to cost, and

incurred high cost sharing and out-of-pocket expenses because of copayments and deductibles for pharmaceuticals and medical services. In addition to cost, risk factors associated with HIV and cardiovascular disease that can impact medication adherence include smoking, which has shown consistent documented heightened rates among HIV-infected patients (Currier et al., 2008; Hemkens & Bucher, 2014) and has been linked to increased cardiovascular event risk within the HIV population (Triant, 2013). Other risk factors are hypertension, family history of chronic disease, and diabetes mellitus (Currier et al., 2008; Oramasionwu et al., 2013). These risk factors can place a financial burden on the medical expenditures of adults diagnosed with HIV or cardiovascular disease (enabling/interpersonal factors), particularly among those aged 65 and older who may already be contending with multicomorbidity and polypharmacy complications. These risk factors can also contribute to the perceived barriers to care and receipt of recommended medical care from specialized clinicians (need/institutional and community factors) among older Medicare beneficiaries (Kurichi et al., 2017).

In addition to the multiple factors affecting healthcare, policy structures can have a direct impact on the ability of adults to absorb the financial costs for medication and medical services. Under the Affordable Care Act, individuals with preexisting conditions are guaranteed access to health insurance through the individual market (Dawson & Kates, 2017). As the debate over the repeal of the Affordable Care Act continues, policymakers should consider that changes to current Affordable Care Act legislation can result in limited access to health care coverage for individuals with HIV and other pre-existing conditions (Dawson & Kates, 2017; Obama, 2017), poorer quality of care, and

worse short-term outcomes (Wadhera & Joynt, 2017), especially among older adults with HIV or cardiovascular disease diagnoses.

Limitations of the Study

There are limitations associated with the use of MEPS data for research studies which include the self-reporting of diagnoses from survey participants who may misunderstand the questions asked, as well as inaccurate and/or underreported reporting procedures for both cardiovascular disease and HIV. This study also restricted analysis to the use of total direct medical expenditures (outpatient, office-based, medication, inpatient, home health, and emergency room), and did not include indirect costs associated with HIV and cardiovascular disease diagnoses, such as quality of life and loss of productivity (Ritchwood et al., 2017).

The data for this study is pooled and cannot be used to interpret longitudinal trends among this study cohort. The inclusion of insurance type, education, and region of residence included in Table 5 are based on descriptive statistics only; and because they are not weighted, no statistical inferences can be drawn about the study population. It is, therefore, not generalizable to individuals outside the study cohort. Finally, the sample used for this analysis only focused on Black and White adults with either a diagnosis of HIV or cardiovascular disease. Therefore, due to the narrow characteristics of the participants within this study, the results cannot be generalized to other races/ethnicities, individuals with other comorbidities and/or diagnoses within the larger population, or populations residing outside the United States (see Creswell, 2009).

The use of MEPS data presents additional challenges that can impact the generalizability of this study. These include: sample sizes that are too small to support analyses adequately, insufficient tracking of participants if their circumstances change beyond the two-year sampling period; and incomplete imputed payment data, which may not be accurately validated from providers due to insufficient data procurement resources (Berk & Wilensky, 2016). In this study, the final dataset collected for the expenditure variables exhibited negative values, which did not have any true monetary meaning. Such values were deleted because they were patient reported medical events that resulted in zero payment, thus the expenditure data associated with those entries was deemed inapplicable (Agency for Healthcare Research and Quality, 2017b). Incomplete or non-existent imputed payment data resulted in the removal of inapplicable values which allowed participants to be excluded from an analysis when they had a negative value without being deleted from the dataset entirely. This allowed participants who had useful data for at least one other dependent variable component to be retained for any analysis where they had complete data. The inclusion of inapplicable values represents a weakness in the use of this dataset as collected.

Recommendations

Literature providing cost comparisons of total healthcare expenditures among older adults with HIV and/or chronic diseases such as cardiovascular disease in the United States is limited. A major knowledge gap identified during the research conducted for this study illustrated a lack of literature that highlights the impact of total medical expenditures as it relates to older HIV-infected individuals with cardiovascular disease.

Chronic disease complications among individuals with long-term HIV diagnoses have manifested among this population, even as mortality rates from the disease has declined. Cardiovascular disease remains one of the leading causes of death among HIV-infected persons (Cournoyer et al., 2016; Hanna et al., 2016; Wenger et al., 2017), as well as the leading contributor to disease burden among adults aged 60 and older (Prince et al., 2015). Amongst individuals aging with HIV, cardiovascular morbidity and mortality tends to occur earlier and more frequently among HIV-infected persons, than in uninfected individuals (Tseng et al., 2012). Cardiovascular risk in HIV patients can be influenced by the following factors: prolonged survival, particularly among older patients; higher rates of additional cardiovascular risk factors, principally with regard to smoking; and metabolic complications related to HIV and certain components of antiretroviral therapy medications that include dyslipidemia, insulin resistance, hypertension, higher prevalence of hypercholesterolemia, and increased abdominal visceral adiposity (Currier et al., 2008; Gedela et al., 2014; Nsagha et al., 2015). These metabolic disturbances, which occur as a result of HIV infection and antiretrovirals, have been found to increase ischaemic cardiovascular disease risk among HIV-infected persons (Gedela, Vibhuti, Ward, & Boffito, 2014). This is especially prevalent among older HIV-infected individuals as they are increasingly subjected to prolonged use of certain antiretroviral therapies such as protease inhibitors and nucleoside reverse transcriptase inhibitors (Miller et al., 2015; Wigfall, Williams, Sebastian, & Glover, 2010).

Older individuals have been omitted from clinical trials and studies in favor of healthier and younger research candidates because of multicomorbidities and other exclusion factors (Jansen, McKinn, Bonner et al., 2015). Data is limited, especially within clinical practice guidelines, that sufficiently addresses the health concerns of older people, specifically as it relates to cardiovascular disease (Jansen et al., 2015). Although various clinical practice guidelines have been developed to address the prevention and management of cardiovascular disease within the general population (Petoumenos & Worm, 2011; Triant, 2013), very little clinical guidance exists for the elderly population even though there is a higher propensity of cardiovascular risk, HIV progression, and use of certain HIV medications among older HIV-infected adults (Kebodeaux et al., 2013).

Cardiovascular disease and older HIV-infected adults

Older HIV-infected persons can experience a wider range of physical and psychosocial problems than younger HIV-infected individuals (Lorenc & Robinson, 2013). This may be because of later disease diagnosis among this cohort (Balderson et al., 2013). In a case-controlled study, Guaraldi et al. (2015) analyzed 404 HIV-aging and 404 HIV-aged participants against 2424 controls and found that the older HIV-positive participants had higher rates of multimorbidity (such as cardiovascular disease) and age-related chronic conditions when compared to HIV-negative participants within the same age range. Similarly, in a longitudinal cohort study of 24, 510 HIV-infected US (predominantly male) veterans who were chosen from the Veterans Health Administration Clinical Case Registry, researchers found that certain antiretroviral drugs and antiretroviral drug combinations had a moderately increased risk in the occurrence of

cardiovascular events (Desai et al., 2015).

Another review of cardiovascular disease risk among aging HIV individuals concluded that although there is a decline in immune function with HIV infection and age, there is also a multifactorial link between HIV and cardiovascular disease which include modalities that are both biological and environmental (So-Armah & Frieberg, 2014). Additionally, while the researchers found that there is an association between increased cardiovascular disease risk and HIV infection, they also determined that immune alterations, which are related to atherosclerosis, is also a common characteristic of aging, cardiovascular disease, and HIV (So-Armah & Frieberg, 2014).

In this study I investigated the association of age and race on older adults with either an HIV or cardiovascular disease diagnosis. Although research exists that shows that older adults diagnosed with HIV also develop concurrent cardiovascular disease diagnoses (Friedman & Duffus, 2016; Kim & Richardson, 2014), limited research exists that connects cardiovascular disease and HIV. Therefore, future research could explore the interconnection between adults (both under and over the age of 65) with a diagnosis of both HIV and cardiovascular disease and the corresponding trends in health care expenditures among those within the Medicare population.

Implications for Professional Practice

As HIV-infected persons continue to live beyond the age of sixty-five, older adults will continue to transition into age groups that have an increased prevalence of cardiovascular risk and other non-AIDS-defining medical conditions (Nsagha et al., 2015). Long-term use of cardiovascular drugs, especially among the elderly, introduces

new issues impacted by efficacy and safety which are limited by evidence-based studies (Rossello, Pocock, & Julian, 2015).

Implications for professional practice among health care professions, for older adults diagnosed with HIV, should focus on: (a) initiating cardiovascular disease risk factors assessments prior to the initiation of antiretroviral therapy treatments, followed by subsequent periodic monitoring for the duration of treatment (Nsagha et al., 2015); (b) optimizing antiretroviral therapy for HIV-infected patients to reduce cardiovascular disease risk, while exercising caution for potential drug-drug interactions, particularly regarding the use of protease inhibitors and statins (Boccara et al., 2013); (c) coordinating care between HIV specialists and cardiovascular disease clinicians to: manage the chronic disease component of HIV infection, determine individualized antiretroviral therapy combinations based on patient adherence, and ultimately improve prognosis for this population (Hemkens & Bucher, 2014); and (d) identifying and addressing cases of cultural incompetence among primary providers which may increase the prevalence of racial disparities among patients of color, and impact HIV and cardiovascular disease treatment outcomes (Price et al., 2014).

Among older adults with cardiovascular disease diagnoses, professional practice coordination can be recommended to address the problems surrounding polypharmacy, medication adherence, and adverse drug events (Wenger et al., 2017). Improvements can be ascertained by including older adults in clinical studies and the development of guidelines that focus on the medical management of cardiovascular disease and HIV, while also providing an opportunity for shared decision- making between clinicians and

patients within the elderly population to detect and prevent early possible drug reactions (Vrettos et al., 2017; Wenger et al., 2017).

Social Change

The results of this study indicate that higher health service expenditures across all six health service categories (medication, outpatient, office-based, in-patient, home health and emergency room services) are associated with aging, particularly among adults aged 65 and older. Race is also associated with higher health service expenditures, with Whites incurring higher health care costs for medication, outpatient, office-based, in-patient, and emergency room services when compared to Blacks, who incurred higher expenditures for home health services alone. Patients with a diagnosis of cardiovascular disease were associated with higher health service expenditures for out-patient, inpatient, and emergency room services; while patients with HIV diagnoses were associated with higher health service expenditures for home health services.

This study will inform and improve stakeholder collaboration between different components of the United States health care system. It speaks to a greater need for wellness and disease prevention efforts and improved patient understanding for a rapidly aging adult population, particularly among those with cardiovascular disease incurring increased expenditures.

The types of health care service analyzed in this study are all provided to patients in poor health. Adults aged 65 and older, particularly those with chronic comorbidities such as cardiovascular disease and HIV, have generally higher rates of medication nonadherence that often leads to increased health risks and worsening of disease (New

England Healthcare Institute, 2009) which is associated with higher rates of morbidity, mortality, hospital admissions and increased health care costs (Neiman et al., 2018). A CDC report states that for the 3.8 million prescriptions written annually in the U.S., approximately one in five of the new prescriptions are never filled; and when patients do fill their prescriptions, approximately 50% are taken at the wrong time, duration, frequency and dosage (Neiman et al., 2018; Kim et al., 2019). Improving medication adherence in adults aged 65 and older can reduce the health burdens associated with cardiovascular disease (chronic) and HIV disease (infectious disease), while also reducing the pervasive economic burden that these conditions have on this population.

Findings from this study will promote self-management practices such as medication adherence and proactive engagement in health maintenance among adults aged 65 and older. It will improve collaborative efforts between clinicians and patients to: (a) serve as advocates to assist older adults in the navigation of health care systems. This can be accomplished by utilizing clinicians, such as resident physicians and community health workers, to work within community integrated health programs to support and provide care and education to patients with chronic medical conditions about the appropriate use of primary care resources (Prasad et al., 2015; Knox, 2009; American Heart Association, 2018b); (b) utilize technology to reduce medication nonadherence among older adults. The use of digital technologies such as smartphones, phone apps, and wearable devices such as smart watches, are interventions that can be used by clinicians to provide reminders to patients to fill/renew prescriptions and take medications when needed (Marvel et al., 2018). (c) develop patient navigator programs to educate older

adults and assist in the navigation of and access to health services for individuals with chronic diseases. Older adults frequently encounter barriers to accessing available health services which can result in medication nonadherence, reduced morbidity and mortality, and increased overall health care costs for the use of health services. Furthermore, Rocque et al., (2017) reported that navigated patients experienced reduced costs to Medicare and health care use, when compared to non-navigated patients, and saw decreased costs for emergency visit services, hospitalizations, and intensive care unit admissions.

The aging of older adults with chronic and infectious diseases, like HIV and cardiovascular disease, can result in increased vulnerability to chronic multicomorbidities. Additional intensive health services (i.e., primary care and preventative care), health care education, integrated and transdisciplinary patient care, and shared decision-making between patients and providers will be required to adequately address this growing population's needs and increase their quality of life (Barry, 2012; Dawson & Kates, 2017), and life span (Oramasionwu et al., 2013; Spitzer & Davidson, 2013).

Conclusion

In the United States elderly adults (aged 65 and older) with chronic illnesses experience increased levels of economic vulnerability, higher cost sharing, and increased health care costs (particularly as it relates to prescription medications) when compared to other high-income countries (Osborn et al., 2017). Trends in direct health care expenditures among people living with HIV showed that significantly higher costs were

associated with an HIV diagnosis for prescription medications, and the utilization of home health, office-based and inpatient services (Ritchwood et al., 2017). For individuals with a cardiovascular disease diagnosis, higher expenditures were associated with inpatient and office-based services (Ritchwood et al., 2017). These trends mirrored certain results reported in this study.

Results from this study highlight the health care cost disparities that may be encountered by older adults living with a chronic disease or an infectious health condition, and the inequalities they may face as they age with these diseases. Race and age are significant factors in the determination of total direct medical expenditures among older adults, particularly among those diagnosed with infectious and chronic diseases like HIV and cardiovascular disease. Polypharmacy among older adults has been found to be contributor of adverse drug events, resulting in increased health care costs, morbidity and mortality risk factors, and increasing medication safety concerns among the elderly (Linjakumpu et al., 2002; Vrettos et al., 2017; Wenger et al., 2017). Assessing the influences of these factors on infectious and chronic diseases can help address variations in medical expenditures across various categories of health care services and can be useful in initiating the development of tailored evidence-based practice guidelines/strategies that may help in the reduction of cardiovascular disease in HIV-infected older adults.

While limited data is available to assess medical expenditure disparities among older HIV-infected adults with a concurrent cardiovascular disease, future research can further expand the knowledge of this subject by evaluating whether (a) inequalities exist,

by race and age, among older adults within this population, and (b) whether variations in health care costs among older HIV-infected adults with cardiovascular disease exist by type of service when compared to elderly populations with HIV or cardiovascular disease diagnoses alone.

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Appendix

AHRQ MEPS Survey Data Dictionary

Field Name	Description	Value	Role of Variables in Regression Equation
SEX	Sex	1 Male 2 Female	Independent variable
AGELAST	Person's age last time eligible	0 - 4 AGE 5 - 17 AGE 18 - 24 AGE 25 - 44 AGE 45 - 64 AGE 65 - 85 AGE	Independent variable
RACEV1X	Race reported by respondents	1 WHITE 2 BLACK 3 AMER INDIAN/ALASKA NATIVE 4 ASIAN/NATV HAWAIIAN/PACFC ISL- 6 MULTIPLE RACES REPORTED	Independent variable
FAMINC	Total income by family	-$48,666 - -$2,789 0.00 $1 - $22,200 $22,201 - $44,724 $44,725 - $82,006 $82,007 - $542,785	Dependent variable
POVCAT	Family income as % of poverty line	1 POOR/NEGATIVE 2 NEAR POOR 3 LOW INCOME 4 MIDDLE INCOME 5 HIGH INCOME	Independent variable
INSURCC	Full year insurance coverage status	1 <65 ANY PRIVATE 2 <65 PUBLIC ONLY 3 <65 UNINSURED 4 65+ EDITED MEDICARE ONLY 5 65+ EDITED MEDICARE AND PRIVATE 6 65+ EDITED MEDICARE AND OTH PUB ONLY 7 65+ UNINSURED	Independent variable

(table continues)

Field Name	Description	Value	Role of Variables in Regression Equation
MCRJA	Covered by Medicare	-1 INAPPLICABLE 1 YES 2 NO	Independent variable
EDURECODE	Level of Education	-9 NOT ASCERTAINED -8 DK -7 REFUSED -1 INAPPLICABLE OR UNDER 5 1 LESS THAN/EQUAL TO 8TH GRADE 2 9 - 12TH GRADE, NO HS DIPLOMA OR GED 13 GED OR HS GRAD 14 BEYOND HS,COLLEGE(NO 4YR DEG),ASSOC DEGREE 15 4-YEAR COLLEGE DEGREE, BACHELOR'S DEGREE 16 MASTER'S, DOCTORATE, OR PROFESSIONAL DEGREE	Confounding variable
REGION	Region of residence	-1 inapplicable; 1 Northeast; 2 Midwest; 3 South; 4, West	Confounding variable
Cardiovascular Disease	Clinical classification code (CCCODEX)	(100 ACUTE MYOCARDIAL INFARCTION 101 CORONARY ATHEROSCLEROSIS AND OTHER HEART 103 PULMONARY HEART DISEASE 104 OTHER AND ILL-DEFINED HEART DISEASE 106 CARDIAC DYSRHYTHMIAS 108 CONGESTIVE HEART FAILURE, NONHYPERTE	Selection criterion
HIV Infection	Clinical classification code (CCCODEX)	005	Selection Criterion
Total Medical Expenditures	• Hospital inpatient stay (IP) • Emergency room visits (ER) • Office based medical provider visits (OB) • Home health visits (HH) • Outpatient visits (OP) • Prescribed Medicine	• IPXP15X • ERXP15X • OBXP15X • HHXP15X • OPXP15X • RXXP15X	Dependent variable

(table continues)

Field Name	Description	• Value	Role of Variables in Regression Equation
Sources of payment	1. Out-of-pocket by User (self) or Family, 2. Medicare, 3. Medicaid, 4. Private Insurance, 5. Veterans Administration/CHAMPVA, excluding TRICARE 6.TRICARE, 7.Other Federal Sources – includes Indian Health Service, military treatment facilities, and other care by the federal government, 8.Other State and Local Source – includes community and neighborhood clinics, state and local health departments, and state programs other than Medicaid, 9. Workers' Compensation, and 10. Other Unclassified Sources – includes sources such as automobile, homeowner's, and liability insurance, and other miscellaneous or unknown sources.	• SF - self or family • MR - Medicare • MD - Medicaid • PV - private insurance • VA - Veterans Administration/CHAMPVA • TR - TRICARE OU - other public • OF - other federal government • SL - state/local government • WC - Workers' Compensation • OT - other insurance • OR - other private • XP - sum of payments	Dependent variable