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Health Information Barriers, Weight Status, and Health Behaviors among Cancer Survivors: Exploring the Moderating Effects of Race and Ethnicity

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Health Information Barriers, Weight Status, and Health Behaviors among

Cancer Survivors: Exploring the Moderating Effects of Race and Ethnicity

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
Masters of Arts in Rehabilitation and Mental Health Counseling
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ABSTRACT

There is an increasing need for research addressing the health concerns faced in cancer survivorship. Research has indicated that racial and ethnic minority cancer survivors are at increased risk for negative health outcomes, and some findings suggest that health literacy may play a role. Yet, few studies have explored how relations among heath information barriers, weight status, and health behaviors may differ by race and ethnicity in cancer survivors. **Objectives:** 1) To explore whether health information barriers are associated with weight status, cigarette use, and alcohol use among cancer survivors, 2) To explore the moderating role of race and ethnicity on the relationships among barriers to health information, weight status, cigarette use, and alcohol use among cancer survivors. **Method:** The current study involved secondary analysis of the 2016 Behavioral Risk Factor Surveillance System survey data from Louisiana. **Results:** Bivariate analyses revealed racial and ethnic minority survivors were more likely to report difficulties understanding health-related information. Regression analyses showed that having greater difficulty understanding information from health professionals was associated with higher BMI; however, none of the three health information barriers were associated with either smoking or alcohol use after controlling for demographic variables. In the present study, the causality assumption for moderation was not met, and for this reason analyses were not conducted to test the moderating effect of race/ethnicity. **Conclusion:** Findings suggest health literacy interventions targeting obesity may help improve health outcomes for cancer survivors, and minimize racial and ethnic disparities in health literacy.

CHAPTER ONE: INTRODUCTION

Statement of the Problem

Over 15.5 million people are currently living with cancer in the United States (Noone et al., 2018). Researchers predict that by the year 2020, the number of cancer cases each year will increase by 24.1% among men, and by 20.6% among women (Weir, Thompson, Soman, Møller, & Leadbetter, 2015). It is also estimated that over one-third (38.4%) of individuals in the United States will be diagnosed with at least one type of cancer during their lifetime, and by 2026, the number of people living with cancer is projected to reach 20.3 million (Noone et al., 2018).

The number of people living with cancer is growing in part due to improvements in cancer prognosis and survival. From 1999 to 2015, cancer death rates declined for both men (-1.8%) and women (-1.4%) (Cronin et al., 2018). The decline in mortality rates translates to increases in life expectancies for people living with cancer. In 1975, 50% of adults with cancer entered long-term cancer survivorship, living five years or more after their initial diagnosis. By 2016, this number reached 67% (Noone et al., 2018). Researchers have attributed improvements in survival to earlier diagnosis, advances in cancer treatments, and improvements in lifestyle factors (including lower rates of tobacco use) (de Moor et al., 2013). Although it is important to remember that survival estimates vary by diagnosis and stage of the disease, researchers expect cancer survival rates to continue to improve.

Due to the growing population of cancer survivors, researchers and clinicians have been increasingly focusing on addressing the challenges of long-term cancer survivorship. The challenges experienced by cancer survivors are well-documented in the literature. Cancer

survivors are at increased risk for additional negative physical and mental health outcomes (Fosså, Vassilopoulou-Sellin, & Dahl, 2008). Cancer survivors experience health-related consequences as a result of the cancer disease itself, and as a result of the treatments, including chemotherapy, radiation therapy, and surgery (Fosså, Vassilopoulou-Sellin, & Dahl, 2008; Keating, Nørredam, Landrum, Huskamp, & Meara, 2005; Miller et al., 2016; Ness, Wall, Oakes, Robison, & Gurney, 2006; Stein, Syrjala, & Andrykowski, 2008).

According to the National Cancer Institute, cancer survivors may experience a range of long-term side effects and late effects from their cancer treatment (Harrington, Hansen, Moskowitz, Todd, & Feuerstein, 2010; Stein et al., 2008). Long-term side effects refer to side effects that begin during cancer treatment and remain for some time afterward. Late effects, on the other hand, emerge after the end of treatment and can persist into long-term survivorship. For cancer survivors, long-term side effects and late effects can include endocrine system changes, heart conditions, weight changes, and chronic pain (Alfano & Rowland, 2006; Harrington et al., 2010; Noone et al., 2018). In turn, these conditions can increase the risk of cancer reoccurrence, poor quality of life, poor adherence to treatment and screening recommendations, impaired functioning, and disability for cancer survivors (Alfano & Rowland, 2006; Harrington, et al., 2010; Noone et al., 2018). For these reasons, it is important that researchers work to develop effective ways to improve long-term health outcomes for cancer survivors.

Racial and Ethnic Disparities. Research has indicated that racial and ethnic minority cancer survivors face unique challenges in managing their health. There is evidence that shows that the racial and ethnic disparities that exist in cancer screening and treatment persist into long-term cancer survivorship (Mantwill, Monestel-Umaña, & Schulz, 2015; O'Keefe, Meltzer, & Bethea, 2015; Schootman, Deshpande, Pruitt, Aft, & Jeffe, 2010; Ward et al., 2004; Zeng et al.,

2015). Although health disparities result from a number of economic and sociocultural factors, some studies have found that racial and ethnic disparities in cancer outcomes remain, even after controlling for variables, such as socioeconomic status, insurance coverage, and level of education (Freedman et al., 2011; Ward et al., 2004). A growing body of literature has identified racial and ethnic disparities among long-term cancer survivors in the rates of late effects, health behaviors, cancer reoccurrence, and related health conditions (obesity, diabetes, cardiovascular conditions) (Deimling, Sterns, Bowman, & Boaz, 2005; Schmitz et al., 2013; Schootman et al., 2010; White et al., 2013). Additional research is needed in order to better understand health disparities among cancer survivors, and to develop strategies for minimizing these disparities.

Health Literacy. Health literacy has been implicated as a factor that may contribute to racial and ethnic disparities in cancer-related health outcomes. Although health literacy has been researched less in the context of cancer survivorship, researchers have begun to explore the role that health literacy may play in cancer-related outcomes and disparities (Amalraj, Starkweather, & Naeim, 2009; Davis, Williams, Marin, Parker, & Glass, 2002; Gansler et al., 2005; Husson, Mols, Fransen, van de Poll-Franse, & Ezendam, 2015; Husson, Mols, & van de Poll-Franse, 2011; Kent et al., 2012; Morris et al., 2013). Most studies have examined the relationship between health literacy and cancer-related knowledge, information-needs, and screening among non-clinical samples, while fewer studies have assessed health literacy among cancer survivors (Amalraj et al., 2009; Davis et al., 2002; Gansler et al., 2005; Husson et al., 2015; Morris et al., 2013).

Several studies have found that low health literacy is associated with higher rates of adverse health behaviors and fewer health promoting behaviors among cancer survivors (Husson et al., 2015; Papadakos et al., 2018). Furthermore, some studies have found that racial and ethnic

minority survivors are more likely to face difficulties in accessing and understanding health information, such as treatment related information, follow-up plans, and nutrition information (Beckjord et al., 2008; Burg, Lopez, Dailey, Keller, & Prendergast, 2009; Gansler et al., 2005; Janz et al., 2008; Kent et al., 2012). In a 2015 systematic review that explored the association between health literacy and health disparities, only one-sixth of the studies that were examined focused on cancer-related disparities (Mantwill et al., 2015). The authors of the review determined that findings from the studies were mixed and inconclusive, and suggested that more research is needed to clarify the relationship between health literacy and disparities in the context of cancer care and health outcomes (Mantwill et al., 2015).

Health Behaviors. A number of cancer survivorship researchers have turned their attention to studying health behavior among cancer survivors (Bellizzi, Jeffery, Rowland, & Mcneel, 2006; Nayak, Paxton, Holmes, Nguyen, & Elting, 2015; Paxton et al., 2012; Schootman et al., 2010; White et al., 2013). Many have focused on physical activity and tobacco use, with fewer studies examining nutrition and alcohol consumption (Nayak et al., 2015; Paxton et al., 2012; Schootman et al., 2010; White et al., 2013). Reducing health risk behaviors and increasing health promoting behaviors among cancer survivors can play a critical role in ameliorating current co-morbid conditions, reducing obesity, and minimizing the risk of developing related health conditions (e.g. diabetes, cardiovascular disease, etc.). This is particularly important for cancer survivors, given the relationship between obesity and cancer risk, reoccurrence, and mortality (Campbell et al., 2018; Larsson, Orsini, & Wolk, 2007; Parekh, Chandran, & Bandera, 2012; Playdon et al., 2015; Renehan & Soerjomataram, 2016; Schmitz et al., 2013; Wolin, Carson, & Colditz, 2010).

Only a limited body of research has examined racial and ethnic differences in the health behaviors of cancer survivors, and fewer published studies have explored the relationships among race and ethnicity, health literacy, and health behaviors among cancer survivors (Byrd, Agurs-Collins, Berrigan, Lee, & Thompson, 2017; Nayak et al., 2015; Paxton et al., 2012; Schootman et al., 2010; Wang, 2017; White et al., 2013; Yaghjyan, Wolin, Chang, & Colditz, 2014). Utilizing data from the 2016 Behavioral Risk Factor Surveillance System (Centers for Disease Control and Prevention [CDC], 2017), the present study's objective was to examine relations among health information barriers, weight status, and health behaviors among cancer survivors, and to explore how these relations may differ by race and ethnicity. The following section reviews the study aims in more detail.

Present Study

Cancer survivors face increased risk for additional negative health effects and this health risk is further compounded by adverse heath-related behaviors, such as tobacco and alcohol use (Fosså et al., 2008). Furthermore, low health literacy has been associated with health risk behaviors among cancer survivors, and access to health information can play an important role in implementing healthy behavior change for this population (Husson et al., 2015; Papadakos et al., 2018). Expanding upon research in this area could help inform prevention and intervention efforts for cancer survivors moving forward. As such, it is important to explore how low health literacy and barriers to health information relate to health behaviors. In addition, more research is needed to better understand health literacy and health behaviors among cancer survivors of different racial and ethnic groups.

The current study examines the relationship among the following: race and ethnicity, barriers to health information, obesity, and health behaviors among cancer survivors. Data from

the 2016 Behavioral Risk Factor Surveillance System was used for the study (CDC, 2017). The study aims and corresponding hypotheses are described below.

Study Aim 1: To explore whether health information barriers are associated with weight status, cigarette use, and alcohol use among cancer survivors.

       Hypothesis. According to prior theoretical models (Paasche-Orlow & Wolf, 2007; Sun et al., 2013), it has been posited that health literacy predicts health behavior, which in turn affects health outcomes. For this reason, it was hypothesized that having greater difficulty in accessing and understanding health information is associated with obesity, as well as higher rates of health risk behaviors (cigarette smoking and alcohol use).

Study Aim 2: To explore the moderating role of race and ethnicity on the relationships among barriers to health information, weight status, cigarette use, and alcohol use among cancer survivors.

       Hypothesis. Prior research has identified racial and ethnic differences in the health behaviors of cancer survivors, and there are studies that suggest racial and ethnic minorities experience more barriers to health information (Byrd et al., 2017; Hawkins et al., 2010; Li, Thompson, Richards, & Steele, 2016; Nayak et al., 2015; Satia, Walsh, & Pruthi, 2009). Given this prior research, it is hypothesized that racial and ethnic differences may influence the relationship between barriers to health information and health behaviors.

CHAPTER TWO: REVIEW OF THE LITERATURE

Due to the growing population of cancer survivors, addressing the needs of long-term cancer survivors is imperative. Cancer survivors may experience late effects that persist years after diagnosis, and have increased risk for cancer reoccurrence, heart disease, chronic pain, and other comorbidities (Fosså et al., 2008; Keating et al., 2005; Miller et al., 2016; Ness et al., 2006; Stein et al., 2008). Leach and colleagues (2014) found that long-term cancer survivors often experience multiple comorbidities. They found that cancer survivors in their sample reported on average five comorbid conditions, with only two of the five diagnosed prior to their cancer diagnosis (Leach et al., 2008). In their study, comorbidities diagnosed after cancer were associated with obesity, physical inactivity, breast or endometrial cancer diagnoses, and being 10 years post-cancer diagnosis (long-term cancer survivorship). Another study found that the most common physical late effects and comorbidities for long-term cancer survivors include a secondary cancer, cardiovascular disease, gonadal disorders, and fatigue (Fosså et al., 2008).

In addition, there is evidence in the literature that indicates racial and ethnic minority cancer survivors experience poorer health outcomes than non-Hispanic White survivors (Deimling et al., 2003; O'Keefe et al., 2015; Ward et al., 2004; White et al., 2013). However, more research is needed to understand the factors contributing to these disparities. Some researchers have suggested differences in health literacy and health behaviors may play a role in cancer survivorship disparities. The risk of negative health outcomes is increased by obesity, health risk behaviors (such as tobacco use, heavy alcohol use) and deficiencies in health promoting behaviors (such as, regular physical activity) among cancer survivors (Davies,

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Batehup, & Thomas, 2011; Fosså et al., 2008; Lemanne, Cassileth, & Gubili, 2013; LoConte, Brewster, Kaur, Merrill, & Alberg, 2018). Researchers have begun to examine health behaviors and health behavior interventions as a mechanism for improving health outcomes for cancer survivors. In the following section, theoretical models will be reviewed in relation to the present study.

Theoretical Background

Based on a definition by Ratzan and Parker (2000), Berkman, Davis, and McCormack (2010) conceptualize health literacy as: "The degree to which individuals can obtain, process, understand, and communicate about health-related information needed to make informed health decisions." Although there is some evidence that indicates there is a relationship between poor health literacy and negative health outcomes, findings remain mixed and require further study (Bevan & Pecchioni, 2008; Husson et al., 2015; Koay, Schofield, & Jefford, 2012). The present study seeks to explore the relationships among health literacy, weight status, and health behaviors, and to determine whether these relationships differ by race and ethnicity. In addition, the study aims to explore whether health literacy is related to racial and ethnic disparities in weight status, cigarette smoking, and alcohol use among cancer survivors.

There are several theories and models that have been proposed in effort to explain how health literacy influences health outcomes (Baker, 2006; Paasche-Orlow & Wolf, 2007; von Wagner, Steptoe, Wolf, & Wardle, 2009). In a conceptual pathway model, Paasche-Orlow and Wolf (2007) identified several factors, including race/ethnicity, education, and age, that have been shown to have an effect on health literacy. In their model, health literacy is shown to influence three domains: access to and utilization of health care, provider-patient interaction, and self-care (or health promoting behaviors). Paasche-Orlow and Wolf (2007) argue that it is these

three domains that lead directly to health outcomes. Although this framework has not yet been validated in the context of cancer patients and survivors, a study by Osborn, Paasche-Orlow, Bailey, and Wolf (2011) validated a segment of their model in a sample of patients with hypertension. In the simplified model, there were statistically significant paths leading from race/ethnicity to health literacy, health literacy to knowledge, and knowledge to self-efficacy. Self-efficacy then directly related to self-care, and finally self-care to self-reported health status (Osborn et al., 2011).

The present study was based on health literacy models by Paasche-Orlow and Wolf (2007) and Sun et al. (2013). Sun and colleagues (2013) have hypothesized that demographic factors, such as age, gender, and education, directly influence each step in Paasche-Orlow and Wolf's health literacy model (2007). However, in contrast to Paasche-Orlow and Wolf (2007), Sun et al. (2013) do not discuss race as one of the demographic factors in their hypothesized model. The present study sought to examine race/ethnicity as a moderator of the relationship between health literacy and weight status, and the relationship between health literacy and health behavior. See Figure 1A in Appendix A for a depiction of the present study's hypothesized health literacy model, which is based on the prior health literacy models by Paasche-Orlow and Wolf (2007) and Sun et al. (2013). The following section will provide a review of the cancer survivorship literature in the following three subject areas: health literacy and barriers to health information, weight status, and health behaviors.

Health Literacy & Barriers to Health Information

Research has indicated that racial and ethnic minority cancer survivors are at a disadvantage in terms of receiving, accessing, and understanding health information (Beckjord et al., 2008; Janz et al., 2008; Kent, Arora, Rowland, Bellizzi, Forsythe, Hamilton, Oakley-Girvan,

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Beckjord, Aziz, et al., 2012; Palmer et al., 2014). A study by Janz and colleagues (2008) explored racial and ethnic differences in the health information provided to women with breast cancer. While the overall sample (N=1,137) reported high rates of having received cancer treatment information (80% or greater), this rate dropped when it came to survivorship topics: anxiety and depression (61%), sexual function (32%), and nutrition (52%). Other survivorship topics, such as physical activity, tobacco use, and alcohol use were not examined in this study. Janz et al. (2008) also found that Latina cancer survivors with low acculturation were significantly more likely to report difficulties in understanding written health information and that the majority of the Latina survivors (75%) required assistance from others in order to understand health information.

In another study, Palmer et al. (2014) conducted a survey of survivors of breast, prostate, colorectal, ovarian, and endometrial cancers who had engaged in follow up care at least once in the previous two years. The researchers sought to examine disparities in patient-provider communication, and found that Latino and Asian cancer survivors reported poorer patient-provider care communication during follow up than their Caucasian counterparts. Moreover, Asian cancer survivors were less likely to report high quality care and reported lower self-efficacy. These results may illustrate the relationship between poor health-related communication, health information, and self-efficacy.

Kent and colleagues (2012) explored the health information needs of cancer survivors 4 to 14 years after their initial cancer diagnosis. They found that the majority of their sample had unmet information needs. Only 17.6% of the sample received a cancer follow-up plan and 64.5% of the sample reported needing information on health promotion. The results also showed that minority cancer survivors (Hispanic, African American, and Asian American/Pacific Islander)

and those who did not receive a written cancer follow-up plan had a higher number of unmet information needs. A study by Beckjord et al. (2008) had similar findings with a sample of cancer survivors 2 to 4 years after diagnosis. Minority cancer survivors reported a higher number of health information needs, and significantly more health promotion information needs, than their Caucasian counterparts.

These studies suggest that cancer survivors may not be receiving sufficient information about how to manage their health in long-term survivorship, and that minority cancer survivors more likely to experience unmet information needs. More research is needed to determine the racial and ethnic differences in barriers to health information and how it impacts health behaviors and health outcomes. In the present study low health literacy and barriers to health information were evaluated by assessing difficulties in accessing and understanding health information.

Weight Status

There is a large body of literature that has examined the relationship between obesity and cancer. Research in this area has provided evidence that obesity increases the risk for developing cancer and worsens mortality rates for those diagnosed with cancer (Chan et al., 2014; Li et al., 2009; Ma et al., 2008; Renehan, Tyson, Egger, Heller, & Zwahlen, 2008). A number of studies have identified disparities in weight status among cancer survivors of different racial and ethnic identities (Byrd et al., 2017; Li et al., 2016; Nayak et al., 2015; Paxton et al., 2012). For example, Byrd and colleagues found that in a sample of 3,367 cancer survivors, Latino and African American survivors were more likely to be overweight or obese. Seventy-five percent of Latino and 76% of African American survivors fell within the overweight or obese weight categories. In comparison, a smaller proportion of Caucasian survivors (66%) in the sample fell within the same weight categories.

A study by White et al. (2013) found that racial and ethnic differences in body mass index for a sample of breast cancer survivors significantly varied by time since diagnosis. The researchers found that among more recently diagnosed cancer survivors (less than five years post diagnosis), survivors in the "other" race category reported the lowest rate of obesity (7.8%), while the remaining racial and ethnic categories had similar rates of obesity (Whites – 26.2%, African American – 26.8%, and Latinos 28.5%). However, among long-term cancer survivors (diagnosed five or more years earlier), more African American survivors (34.8%) reported obesity in contrast to Latina (27%), White (23%) and cancer survivors of other races (22%). This means that for African American survivors and those who were in the "other" race category, there were significant differences in obesity rates based on years of survivorship (long-term vs. more recently diagnosed survivors).

These findings suggest that racial and ethnic minority long-term survivors may be at higher risk for obesity, and therefore related health conditions (cardiovascular disease, diabetes, etc.). As noted by Schmitz et al. (2013), a variety of factors (culture, psychology, behavior, biology, healthcare access and quality) may explain the racial and ethnic differences observed in obesity and cancer mortality. To further understand the racial and ethnic differences in obesity among cancer survivors, further study is needed to explore variables contributing to the disparities observed.

Health Behaviors

Researchers have examined health behaviors among cancer survivors to help inform intervention and health promotion efforts for long-term survivors. In the cancer survivorship literature, studies have most frequently focused on the following health risk and health promoting behaviors: physical activity, alcohol use, tobacco use, and fruit/vegetable intake

(meeting recommended guidelines). While there are numerous studies that have explored health behaviors and related interventions among cancer survivors, fewer have examined racial and ethnic differences in health behaviors among survivors.

For the studies that have identified racial and ethnic differences among cancer survivors in relation to health behaviors, the findings have been mixed. For example, Li et al. (2016) found that White survivors of prostate cancer reported consuming more alcoholic beverages per day than African American survivors of prostate cancer. Schootman and colleagues (2010) observed similar findings in a large sample of survivors with variety of non-melanoma cancer diagnoses. The results showed that White survivors reported higher rates of alcohol use (17.9%) as compared with African American survivors (6.1%).

In a sample of breast cancer survivors, although lower rates of heavy alcohol use were observed, the differences remained: 4.3% of White survivors, 0.9% of Black survivors, 1.0% of Latino survivors, and 1.6% of survivors in other race categories reported heavy alcohol use (White et al., 2013). In contrast, Yaghjyan and colleagues (2014) found that in a sample of breast cancer survivors, African American survivors were more likely to engage in heavy alcohol use than survivors of other races. It is important to consider that many of the studies limited their racial and ethnic categories to include only two to four racial and ethnic groups (White, African American, Latino, and other), likely due to other races not meeting sufficient representation in the study samples.

In terms of tobacco use, results have varied as well. A study by Nayak et al. (2015) found that Native American and multiracial survivors were more likely to be current smokers. While, Li and colleagues (2016) found a higher prevalence of current cigarette use among African American prostate cancer survivors (15.1%) than among White prostate cancer survivors (8.4%).

White et al. (2013) found that White breast cancer survivors were more likely to report a history of smoking than non-white breast cancer survivors. However, the differences in current smoking behavior were not significant for this sample. In addition, other studies have found no significant differences in current smoking behavior across racial and ethnic groups of cancer survivors (Schootman et al., 2010; Yaghjyan et al., 2014). While most of the studies surveyed here reveal racial and ethnic differences in health behaviors, the mixed findings indicate further research is needed to better understand how and why health behaviors among cancer survivors differ by race and ethnicity.

CHAPTER THREE: METHOD

Research Design

The current study utilized data from the Behavioral Risk Factor Surveillance System (BRFSS), a national cross-sectional survey, to examine relationships among the following variables: race and ethnicity, barriers to health information, weight status, and health behaviors. The BRFSS is an annual research project, involving a random-digit-dial telephone survey (including both landlines and cellular lines). It is conducted by the Centers for Disease Control and Prevention (CDC) in conjunction with state agencies across the United States (CDC, 2017). The BRFSS collects data on a wide-range of health topics including chronic illnesses, healthcare access, and engagement in preventative health services.

Data collection for the BRFSS was conducted by state health departments or through the use of contractors, with procedural assistance provided by the CDC (CDC, 2017). Phone interviews were offered in English or Spanish, and were facilitated by computer-assisted telephone interview (CATI) software. The CATI software provided a script for interviewers to follow for data collection. Per household, one adult was randomly selected to participate in the study. On average, the phone surveys lasted 18 minutes for the core component and an additional 10 minutes for optional modules and state-specific questions (CDC, 2017). After collection, the data was then submitted to the CDC to be processed, weighted, and analyzed.

The present study involved secondary data analysis of the 2016 BRFSS data set, which was made available in summer of 2017. In order to achieve the current study's aims, the core component of the survey along with two optional modules (cancer survivorship and health

literacy) were required for analyses. The cancer survivorship module was utilized by 10 states and one U.S. territory (CDC, 2017). While, the health literacy module was used by 15 states, the District of Columbia, and Puerto Rico (CDC, 2017). Yet, only two states, Louisiana and Kansas, administered both modules. In Kansas, the health literacy module was administered in one segment of the state population, while the cancer survivorship module was administered in a separate sample. For this reason, the current study was limited to data collected by the state of Louisiana.

Participants

In middle and late adulthood, adults experience a decrease in immunity, a rise in the rates of health concerns, and an increased risk for cancer and cancer recurrence (Deimling et al., 2003; Ory et al., 2014; Williams et al., 2016). For these reasons, the present study focused on cancer survivors 45 years old or older. BRFSS participants who met the following criteria were included in analyses: adults 45 years old or older, who reported having received a cancer diagnosis as an adult (18 years old or older), and who were no longer receiving active cancer treatment (chemotherapy, radiation, etc.).

Participants were excluded from the sample based on a number of factors. Due to the nature of the data collection method, individuals without telephone access did not participate in the study (CDC, 2017). In addition, individuals who were institutionalized at the time of the survey or who did not speak either English or Spanish were also excluded from data collection (CDC, 2017). For the purposes of the current study, participants who reported non-melanoma skin cancer as their sole cancer diagnosis were excluded. Non-melanoma skin cancer is unique from other types of cancer in its high prevalence and low mortality, which may skew the data

(Apalla, Lallas, Sotiriou, Lazaridou, & Ioannides, 2017). The final analytic sample consisted of 287 participants. For a detailed description of the study sample, please refer to Chapter 4.

Measures

Survey Instrument. The BRFSS survey is composed of a core component, optional modules, and questions added by state agencies (CDC, 2017). The core component is a set of questions that all states administer for that given year. The core component includes questions about demographic information, health status, healthcare access, and health related behaviors. The optional modules from the BRFSS include sets of questions on specific subject areas that state agencies can elect to include for data collection. In the present study, data from the cancer survivorship and the health literacy optional modules were used. State-added questions in the BRFSS survey are developed by individual states. The CDC is not involved in the development or evaluation of the data resulting from the state-added questions. For this reason, the current study will not utilize data from these items.

Demographic & Health-Related Variables (Covariates)

For the purposes of the present study, the following demographic variables were examined: gender, age, race and ethnicity, highest level of education, employment status, annual income, and health insurance coverage. Health-related variables from the core component and cancer survivorship modules were also used to describe the sample. Each demographic and health-related variable are described in detail below, except for race and ethnicity, which will be discussed under the section titled Hypothesized Moderator Variable.

Gender. According to the BRFSS survey, interviewers could determine participant gender from initial screening questions that were asked in order to conduct the random selection of one adult in the household for participation. Otherwise, participants were asked for their

gender in the demographics section of the survey (CDC, 2017). Response options were *male*, *female*, and *refused*. In the current study, 33.1% of the sample was male, 66.9% was female, and none refused to answer.

Age. In the demographics portion of the survey, participants were asked to report their current age in years. However, raw data for age was not available in the 2016 BRFSS data set. Instead, the dataset provided a categorical variable representing 5-year age ranges (45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80 or older), which were used to describe the sample and in regression analyses.

Level of Education. In the demographics portion of the survey, participants were asked, "What is the highest grade or year of school you completed?" Response options included *never attended school or only kindergarten*, *grades 1 through 8 (elementary)*, *grades 9 through 11 (some high school)*, *grade 12 or GED (high school graduate)*, *college 1 year to 3 years (some college or technical school)*, *4 years or more (college graduate)*, *refused*, *not asked or missing*. For the purposes of analyses, response options were collapsed into the following three categories: less than high school, high school graduate/GED, and some college or more.

Employment Status. For employment status, participants were read a prologue "Are you currently..." and then provided the following response options: *employed for wages*, *self-employed*, *out of work for 1 year or more*, *out of work for less than 1 year*, *a homemaker*, *a student*, *retired*, or *unable to work*. If participants declined to answer, this item was entered as refused. For the purposes of describing the sample, the eight employment status categories were collapsed into the following two categories: employed and unemployed/retired/unable to work.

Annual Household Income. For this item, participants were read a prompt "Is your annual household income from all sources:" and response options included *less than $10,000*,

$10,000 to less than $15,000, $15,000 to less than $20,000, $20,000 to less than $25,000, $25,000 to less than $35,000, $35,000 to less than $50,000, $50,000 to less than $75,000, $75,000 or more. This item was coded as *don't know/not sure* or *refused* if participants were unable to or declined to report their annual household income. For the purposes of describing the sample, the response options were collapsed into the following four categories: less than $25,000, $25,000 to $49,000, $50,000 or more, and missing.

Health Insurance Coverage. In the core component of the survey, participants were asked, "What is the primary source of your health care coverage? Is it..." and were read the following options: *a plan purchased through an employer or union*; *a plan that you or another family member buys on your own*, *Medicare*, *Medicaid or other state program*, *TRICARE (formerly CHAMPUS)/VA/military*, *Alaska Native/Indian Health Service/Tribal Health Services*, *some other source*, or *none*. This item was entered as *don't know/not sure* or *refused* if participants did not know or declined to report the status or source of their health insurance coverage. The data for this item was collapsed into the following categories: Medicare, plan purchased through employer, plan purchased directly by family, other health plan, and none/not reported.

Cancer Type. Under the cancer survivorship module, participants were asked to report what type of cancer they had been diagnosed with and if they reported more than one cancer diagnosis, they were asked to report what was their most recent type of cancer. Participants were not read response options unless they needed additional prompting. Response options included 29 different cancer diagnoses, and an "other" cancer diagnosis category. In order to describe the sample, the 29 different response options were collapsed into the following four categories: breast cancer, melanoma skin cancer, prostate cancer, and "other."

Years of Survivorship. In the cancer survivorship literature, the number of years of survivorship is defined as the number of years since initial diagnosis (National Cancer Institute, 2014). The BRFSS survey asked participants to report the age at which they were first diagnosed with cancer. However, since raw data for current age was not made available in the BRFSS data set, a calculated age variable (using imputed means from the age range categories) was used to compute years of survivorship. Thus, for the purposes of the current study, the variable for years of survivorship was calculated by subtracting the age at diagnosis from the calculated imputed age variable.

Cancer Treatment. In the cancer survivorship module, participants were asked, "Are you currently receiving treatment for cancer?" which was followed by the prompt, "By treatment, we mean surgery, radiation therapy, chemotherapy, or chemotherapy pills." Response options included *yes*; *no, I've completed treatment*; *no, I've refused treatment*; and *no, I haven't started treatment*. This item was answered *don't know/not sure* or *refused* if participants were unable to report or declined to report their status in relation to cancer treatment. This data was used to identify the relevant study sample. Participants who reported that they completed their cancer treatment and were no longer receiving treatment for their cancer were included in the sample. Participants who reported that they were currently receiving cancer treatment, refused treatment, had not yet started treatment, did not know, or declined to answer were excluded form the study sample.

Healthcare Visits in the Past 12 months. In the core component of the survey, participants were asked, "How many times have you been to a doctor, nurse, or other health professional in the past 12 months?" This item was answered with *don't know/not sure* or

refused for participants who did not report the number of times they had gone to a healthcare professional in the past year. Data from this item was used to describe the sample.

Comorbid Health Conditions. Comorbid health conditions were assessed using two items from the core component of the survey (coronary heart disease and diabetes) and one item from the cancer survivorship module (physical pain). In the core component, the following prompt was read to the participant, "Has a doctor, nurse, or other health professional ever told you that you had any of the following? For each, tell me yes, no, or you're not sure." Next, the participant was as read a series of items, each referring to a different health condition.

For coronary heart disease, participants were asked, "(Ever told) you had angina or coronary heart disease?" and response options included *yes*, *no*, *don't know* and *refused*. In relation to diabetes, participants were asked, "(Ever told) you have diabetes?" If the participant responded yes, and they were female, the interviewer asked a follow up question to determine whether the participant had been diagnosed with diabetes only during pregnancy. The response options included *yes*; *yes, but female told only during pregnancy*; *no*; *no pre-diabetes or borderline diabetes; don't know;* and *refused*. In relation to physical pain, participants were asked, "Do you currently have physical pain caused by your cancer or cancer treatment?" Response options included: *yes*, *no*, *don't know* and *refused*.

Hypothesized Moderator Variable

Race and Ethnicity. In the BRFSS survey, race and ethnicity were assessed using two separate items. Race was assessed with the following question, "Which one or more of the following would you say is your race?" Participants self-reported their race using the following response options and were permitted to select all that apply: 1) *White,* 2) *Black or African American,* 3) *American Indian or Alaska Native*, 4) *Asian*, and 5) *Pacific Islander*. Interviewers

entered *other* for individuals who identified with a racial group not listed as a response option. Ethnicity was assessed using the following item: "Are you Hispanic, Latino/a, or of Spanish origin?" Participants were provided the following response options: *yes*, *no*, *don't know* and *refused*. The BRFSS team used the data from the separate race and ethnicity items to create a combined race/ethnicity variable. The combined race/ethnicity variable was used for the purposes of the current study.

The combined variable included the following categories: 1) *Non-Hispanic White only,* 2) *Non-Hispanic Black only,* 3) *Non-Hispanic American Indian or Alaskan Native only*, 4) *Non-Hispanic Asian only*, 5) *Non-Hispanic Native Hawaiian or other Pacific Islander only*, 6) *Non-Hispanic other race only,* 7) *Non-Hispanic multiracial,* 8) *Hispanic,* and 9) *Don't know/Not sure/Refused.* Of the 287 participants in the sample, the majority identified as Non-Hispanic White (81.9%, *n*=235), 16% of the sample identified as Non-Hispanic Black (*n*=46), and the remaining racial and ethnic groups represented only 2.0% (*n*=6) of the sample. Due to low representation of several racial and ethnic groups, the data from this variable was recoded into a binary variable: *Non-Hispanic White* (81.9%) versus *other race/ethnicity* (18.1%).

Primary Independent Variables

Barriers to health information refer to factors that negatively affect or prevent the receipt of health information provided by a medical professional or other source (Anker, Reinhart, & Feeley, 2011). For cancer survivors, information on topics such as smoking cessation, nutrition, or physical activity, has the potential to motivate change that improves health outcomes in the long term (Kuijpers, Groen, Aaronson, & van Harten, 2013; Paasche-Orlow & Wolf, 2007; Roberts, Fisher, Smith, Heinrich, & Potts, 2017; Sun et al., 2013). In contrast, barriers to health information can result in continued health risk behaviors and prevent healthy behavior change

(Husson et al., 2015). In the present study, health information barriers were assessed using three different survey items, each capturing different dimensions of barriers to health information. The first item assessed difficulties in accessing health information, while the remaining two items assessed for challenges in understanding health information (written versus verbally provided by health professionals). Detailed information about each item is provided below.

Difficulty Accessing Health Information. Under the health literacy module of the survey, participants were asked "How difficult is it for you to get advice or information about health or medical topics if you need it?" Responses included *very easy, somewhat easy, somewhat difficult, very difficult, I don't look for health information, don't know/not sure,* and *refused*. There was low variability in the responses for this item and data for this item remained highly skewed, even after transformation. For this reason, this item was recoded into a binary variable with the following response options: *very easy* and *not very easy* (at least some difficulty).

Difficulty Understanding Health Information Provided by Health Professionals. For this variable, participants were asked, "How difficult is it for you to understand information that doctors, nurses and other health professionals tell you?" Response options included *very easy, somewhat easy, somewhat difficult, very difficult, don't know/not sure,* and *refused.* This item was recoded into a binary variable with the response options, *very easy* and *not very easy* (at least some difficulty), due to low variability in the data.

Difficulty Understanding Written Health Information. Participants were read the following prologue "You can find written information about health on the Internet, in newspapers and magazines, and in brochures in the doctor's office and clinic," and then asked, "In general, how difficult is it for you to understand written health information?" Participants

selected from following response options: *very easy, somewhat easy, somewhat difficult, very difficult, I don't pay attention to written health information, don't know/not sure,* and *refused.* The data for this variable was also recoded into dichotomous response categories (*very easy* versus *not very easy*) due to low variability and the skewness of the data.

Primary Dependent Variables

Body Mass Index. Weight status was measured using body mass index for the purposes of the present study. The BRFSS team calculated body mass index using self-reported weight and height data from the demographics portion of the survey. The calculated variable for body mass index (units=kilograms per meter squared) was utilized as a continuous variable for analyses.

Cigarette Smoking. Cigarette use, which was assessed using the following item: "Do you now smoke cigarettes every day, some days, or not at all?" Response options included: *every day*, *some days*, *not at all, don't know/not sure, refused,* and *not asked*. Only participants who reported histories of cigarette use were asked to report the frequency of their cigarette smoking. The majority of the sample (39.4%) reported not currently smoking, 10.1% reported daily cigarette use (*every day*), and only 3.5% reported occasional cigarette use (*some days*). Due to low variability in responses, the tobacco use data was recoded into a binary measure: daily/occasional cigarette smoking (*every day/some days*) versus no current cigarette use (*not at all)*.

Alcohol Use. Alcohol use was measured using the following question, "During the past 30 days, how many days per week or per month did you have at least one drink of any alcoholic beverage such as beer, wine, a malt beverage, or liquor?" Participants then provided the number of days per week, the number of days per month, or selected one of the following: *no drinks in*

the past 30 days, *don't know/not sure*, and *refused*. Due to the skewness of the continuous

alcohol use data, a recoded binary variable (alcohol use versus no alcohol use) was utilized for

analyses.

Data Analysis

  Preparatory Steps and Analyses. A dataset for the current study was compiled from the

overall 2016 BRFSS dataset (converted from SAS to SPSS) to include the variables and sample

of interest, and the dataset was reviewed for missing data. All analyses were conducted using

SPSS v.25 with significance set at .05. Next, descriptive statistics were run and the major study

variables were assessed for normality using the skewness and kurtosis indices.

  According to Kline (2011), if the skewness index is less than 3 and the kurtosis index is

less than 20, then the variable is normally distributed. As shown in Table 1, BMI along with the

three barriers to health information variables were highly screwed. These variables were

transformed using a natural log function (Tabachnick & Fidell, 2012). The transformed BMI

variable was normally distributed, while the three variables assessing health information barriers

remained highly skewed. For all three items assessing health information barriers, most

participants selected the *very easy* response option (See Appendix C for histograms). For this

reason, the three variables representing health information barriers were recoded into binary

variables: *very easy* (not at all difficult) versus *not very easy* (at least some difficulty). The

transformed BMI data and the three dichotomous barriers to health information variables were

used for the study analyses.

  Power Analyses. Power analyses were conducted for the linear multiple regression

analyses using G*Power 3.1.9.2 to determine the sample size needed to reach statistical power of

.80, with a two-tailed alpha of .05, and a total of nine predictors (Faul, Erdfelder, Buchner, &

Lang, 2009). Assuming a medium effect size of .15, a minimum of 114 participants would be needed to attain statistical power of .80. Power analyses were also conducted for the logistic regression analyses using G*Power 3.1.9.2. to determine the number of participants needed to attain statistical power of .80, with a one-tailed alpha, a medium effect size (.15), the type of predictor (binomial versus normal), and the effect of the other predictors set at zero. Findings indicated that assuming each predictor has a binomial distribution with a one-tailed alpha of .05 and an $OR=3.00$, a minimum of 103 participants would be needed to attain statistical power of .80. Assuming that each predictor has a normal distribution, a one-tailed alpha of .05, and an $OR=3.00$, a minimum of 41 participants would be needed to reach statistical power of .80. All together, these findings indicate that given medium effect sizes, the present study met sufficient power for linear regression analyses ($N=287$) and logistic regression analyses ($N=287$ for alcohol use and $N=152$ for tobacco use).

Testing of Assumptions. Prior to conducting regression analyses, the assumptions of multivariate normality, linearity, and homoscedasticity were assessed (Norusis, 1991). Multicollinearity between the predictors was also evaluated (Norusis, 1991). According to Norusis (1991), multivariate normality is fulfilled when the points in a normal probability plot cluster towards the diagonal. Linearity and homoscedasticity are fulfilled when the plot of the studentized deleted residuals by the standardized predicted values result in a random scatter. In addition, multicollinearity can be assessed via correlations and chi-square tests, or by examining tolerance values within the regression procedure. If the tolerance values fall below .20, then the multicollinearity assumption is violated (Tabachnick & Fidell, 2012).

As shown in Appendix D, multivariate normality was fulfilled as the points were clustered diagonally. The plot of the studentized deleted residuals by the standardized predicted

values yielded a random scatter, indicating that the assumptions of linearity and homoscedasticity were also satisfied. Multicollinearity was assessed by using bivariate analyses (which will be presented in greater detail in the results section) and by examining tolerance values within the regression procedure. Within the regression procedure, tolerance values were .62 or greater, indicating that the multicollinearity assumption was met. Pearson correlation coefficients, point-biserial correlation coefficients, and chi-square tests were also examined to determine which covariates to control for in subsequent analyses. Demographic variables that were significantly correlated with the dependent variables were included as controls in regression procedures.

Study Aim 1: To explore whether health information barriers are associated with weight status, cigarette use, and alcohol use among cancer survivors. First, a multiple linear regression was conducted to test whether the three variables representing health information barriers were significantly associated with BMI. Since none of the demographic variables were significantly correlated with the BMI, additional demographic variables were not included as controls in the model. Next, a multiple logistic regression procedure was conducted to test whether the three barriers to health information measures were significantly related to cigarette use (smoking versus non-smoking). Age group was included as a control variable in the model due to its significant correlation with the cigarette smoking dependent variable. Other than race/ethnicity, no other demographic variables significantly correlated with the cigarette use outcome variable. A second multiple logistic regression procedure was used to test whether the three health information barriers significantly predicted alcohol use during the past 30 days. The following demographic variables were controlled for in the model due to their significant associated with alcohol use: gender, level of education, and years of survivorship.

Study Aim 2: To explore the moderating role of race and ethnicity on the relationships among barriers to health information, weight status, cigarette use, and alcohol use among cancer survivors. Before testing the moderating effects of race and ethnicity on the relationship between health information barriers and BMI, cigarette smoking, and alcohol use, analyses were conducted to determine if the data set met Baron & Kenny's (1986) criteria for moderation. Regression analyses for study aim 1 fulfilled this first set of the analyses. First, as described in the previous paragraph, regression analyses were conducted to determine whether there is a significant association between the primary independent variables (health information barriers) and each of the primary dependent variables (BMI, cigarette use, and tobacco use).

Based on moderation methodology by Baron & Kenny (1986), in addition to direct relationships between the independent variable and the dependent variable, there must also be a significant association between the hypothesized moderator variable (race/ethnicity) and each of the dependent variables (BMI, cigarette use, and alcohol use). However, findings from bivariate analyses indicated that race/ethnicity was not significantly associated with BMI or alcohol use. Furthermore, findings from the cigarette use regression model indicated that none of the health information barriers were associated with cigarette smoking. Thus the data did not satisfy criteria for moderation regression analyses (Baron & Kenny, 1986).

Table 1

Results Assessing the Univariate Normality of the Study Variables

	Skewness		Kurtosis	
Variables	**Statistic**	**Index**	**Statistic**	**Index**
BMI	.83	5.92	1.00	3.45
Difficulty accessing health information	2.67	19.07	11.09	38.24
Difficulty understanding health professionals	1.37	9.79	7.83	27.00
Difficulty understanding written health information	1.28	9.14	.97	3.34

Note. *SE* for skewness = .14 and *SE* for kurtosis = .29.

CHAPTER FOUR: RESULTS

Description of the Sample

Table 2 displays demographic characteristics of the sample. The total sample included 287 cancer survivors, 95 men (33.1%) and 192 women (66.9%). As expected, the data showed a trend of increasing sample representation as the age group increased. For example, only 4.5% of the sample consisted of participants within the 45- to 49-year-old age group, 12.2% of the sample fell within the 60 to 64 age range, and 17.8% of the sample were 80 years old or older. The majority of the study sample identified as non-Hispanic White (81.9%), while the remainder of the sample identified with another race or ethnicity (18.1%). The majority of the sample also reported having completed at least some college education (58.2%) and, at the time of the survey, most of the participants were unemployed, retired, or unable to work (76.6%). Annual household income appeared approximately equally distributed, and more than half of the sample had health insurance coverage through Medicare (57.5%).

Health-related characteristics of the sample are described in Table 3. The most common cancer diagnoses for the participant sample included breast cancer (27.2%), melanoma skin cancer (14.6%), and prostate cancer (10.1%). The mean number of years in cancer survivorship (calculated from initial diagnosis) was 12.65 (*SD*=11.65), with a range of .50 to 52.50 years. This indicated that the majority of participants in the study were long-term survivors (at minimum five years post initial cancer diagnosis). In terms of comorbidities, nearly one-third of the sample (27.9%) reported having received a diagnosis of diabetes, 15% of the sample reported having been diagnosed with coronary heart disease, and 10.5% reported experiencing physical pain

related to their cancer or cancer treatment. Data indicated participants in the sample were utilizing medical services, with the average number of visits to the doctor in the past year equaling 8.39 (*SD*=10.22).

The main study variables are also described in Table 3. The average BMI for the sample was 29.79 (*SD*=6.40), with a range of 17.32 to 55.00. According to the standard BMI weight status categories, individuals with a BMI within the 25.0 to 29.9 range are considered overweight, and having a BMI of 30.0 or higher indicates obesity (CDC, 2017b). This suggests that the average participant was overweight, approaching obesity. Nearly half (47%) of the sample either had missing data or were not administered the cigarette smoking frequency item. Of participants who had a history of tobacco use, the majority (74.3%) reported that they were not currently smoking cigarettes, while a smaller proportion (25.7%) reported smoking cigarettes either *some days* or *every day*. Thirty-four percent of the sample reported consuming alcohol in the past 30 days, while a greater portion of the sample reported no alcohol use (65.9%). In relation to health information barriers, the majority of the sample reported that it was *very easy* to: 1) access advice or information about health topics (76.7%), 2) understand health information provided by health professionals (66.2%), and 3) understand written health information (62.4%).

Bivariate Analyses

Bivariate analyses were conducted using the Pearson correlation coefficient, the point-biserial correlation coefficient, and chi-square tests of association to explore relationships among the demographic variables, independent variables, and dependent variables. The bivariate analyses are presented in Tables 4 and 5, and described in the following sections.

Variables Associated with Race/Ethnicity. Chi-square tests indicated that there were statistically significant relationships between race/ethnicity and cancer type,

χ^2 (3, N = 287) = 11.94, p =.008. As expected, non-Hispanic White survivors were more likely

than racial and ethnic minority survivors to report a melanoma skin cancer diagnosis. Non-

Hispanic White survivors were also more likely than minority survivors to report a cancer

diagnosis other than breast cancer, melanoma skin cancer, and prostate cancer.

Furthermore, non-Hispanic White survivors were more likely than minority survivors to

report no current cigarette use, χ^2 (1, N = 152) = 9.57, p = .002. Race/ethnicity was also

associated with difficulty understanding health information provided by health professionals,

χ^2 (1, N = 287) = 5.79, p =.02, and with difficulty understanding written health information,

χ^2 (3, N = 287) = 8.90, p =.003. Therefore, as compared to racial and ethnic minority survivors,

non-Hispanic White survivors were more likely to report that it was *very easy* to understand

written health information or health information provided orally by health professionals.

Variables Associated with BMI. Point-biserial correlations were conducted to assess

relations between BMI and dichotomous variables. Results showed that BMI was correlated with

alcohol use, r_{pb} = -.18, p = .002, and cigarette use, r_{pb} = -.17, p = .03. Cancer survivors with

lower BMIs were more likely to report alcohol consumption in the past 30 days and current

cigarette use. In addition, there was a statistically significant relationship between BMI and

difficulty understanding health information provided by health professionals, r_{pb} = .15, p = .01.

Cancer survivors who had more difficulty understanding information from health professionals

were more likely to have a higher BMI.

Variables Associated with Cigarette Smoking. As mentioned in an earlier, cigarette

smoking was associated with both race/ethnicity and BMI, χ^2 (1, N = 152) = 9.57, p = .002 and

r_{pb} = -.17, p = .03, respectively. In addition, cigarette smoking was significantly related to age,

χ^2 (7, N = 152) = 16.51, p = .02, and difficulty understanding written health information,

χ^2 (1, N = 152) = 5.30, p = .02. Thus, current smokers were more likely to be younger and were less likely to report that it was *very easy* to understand written understand health information.

Variables Associated with Alcohol Use. Alcohol consumption was significantly related to gender, χ^2 (1, N = 287) = 4.00, p =.04, years of survivorship, , r_{pb} = -.12, p = .04, level of education, χ^2 (2, N = 287) = 10.85, p =.004, and difficulty understanding written health information, χ^2 (1, N = 287) = 4.10, p =.04. Participants who reported no alcohol in the past 30 days were more likely to be female and longer term cancer survivors, have completed at least some college education, and report that it is *very easy* to understand written health information.

Variables Associated with Difficulty Understanding Health Information. Difficulty understanding health information provided by a health professional was associated with gender χ^2 (1, N = 287) = 4.38, p =.04, level of education, χ^2 (2, N = 287) = 13.41, p =.001, and race/ethnicity, χ^2 (1, N = 287) = 5.79, p =.02. Difficulty understanding health information provided by health professionals was also associated with BMI, r_{pb} = .15, p = .01. Those who reported that they find health information provided by a health provider *very easy* to understand were more likely to be female, identify as non-Hispanic White, report having completed a higher level of education, and have a lower BMI.

Chi-square results indicated that difficulty understanding *written* health information was associated with race/ethnicity, χ^2 (3, N = 287) = 8.90, p =.003, education, χ^2 (2, N = 287) = 19.17, p <.001, alcohol use, χ^2 (1, N = 287) = 4.10, p =.04, and cigarette use, χ^2 (1, N = 152) = 5.30, p = .02. Participants were more likely to find written health information *very easy* to understand if they identified as non-Hispanic White, and completed at least some college education. Those who found it very easy to understand written health information were also more likely to report no alcohol or cigarette use. As expected, all three health information barriers were related (as

seen in Table 4). Survivors who found it *very easy to* access health information were more likely to also find it *very easy* to understand health information (provided by health professionals or written).

Body Mass Index Model

Multiple linear regression analyses were conducted to test whether the three barriers to health information variables were significantly related to BMI. Since none of the demographic variables significantly correlated with BMI, demographic variables were not included as controls in the regression model. In addition, since race/ethnicity was not significantly associated with BMI, moderation analyses were not conducted to explore the effect of race/ethnicity on the relationship between health information barriers and BMI.

The findings shown in Table 5 indicate that only one health information barrier significantly related to BMI. Difficulty understanding health information from health professionals was significantly associated with BMI, $\beta = .16$, $p = .03$. Participants who experienced at least some difficulty understanding health professionals had significantly greater BMIs ($M = 31.02$, $SD = 6.33$), than participants who reported that it was *very easy* to understand health professionals ($M = 29.16$, $SD = 6.36$).

Cigarette Smoking Model

A multiple logistic regression analysis was conducted to test whether the three health information barriers were associated with current cigarette use, after controlling for age, and race/ethnicity. No other demographic variables were significantly correlated with cigarette smoking, and thus were not included in the regression analyses.

The results in Table 6 show that after controlling for age and race/ethnicity in the model, health information barriers were not significantly associated with cigarette use. For this reason

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moderation analyses were not conducted to test the effect of race/ethnicity on the relationship between health information barriers and cigarette smoking. However, two age groups (75 to 79 years old, and 80 years old or older) were significantly associated with the odds of current cigarette use, $OR = 0.13$, 95% CI [0.03, 0.71] and $OR = 0.15$, 95% CI [0.03, 0.77], respectively. In comparison to the odds of cigarette use for 45 to 49 year old survivors, the odds of cigarette use were 0.13 times less for 75 to 79 year old survivors, and 0.15 times less for survivors 80 years old or older. Race/ethnicity was also significantly associated with the odds of smoking, $OR = 0.34$, 95% CI [0.14, 0.82]. In comparison to the odds of cigarette use among cancer survivors of other races and ethnicities, the odds of cigarette smoking were .34 times less for non-Hispanic White survivors.

Alcohol Use Model

A multiple logistic regression was conducted to test whether the three health information barriers were significantly related to alcohol use in the previous 30 days, after controlling for demographic variables. The following demographic variables were included as controls because they were significantly associated with alcohol consumption: gender, level of education, and years of survivorship. Regression analyses testing the moderating effect of race/ethnicity on the relationship between health information barriers and alcohol use were not conducted because race/ethnicity was not significantly associated with alcohol consumption.

The overall alcohol use regression model was significant, $\chi^2 (8) = 24.86$, $p = .002$. As shown in Table 7, after controlling for demographic variables (gender, level of education, and years of survivorship), none of the health information barriers were significantly associated with alcohol use. However, two covariates were significantly associated with alcohol use in the past 30 days. Years of survivorship was significantly associated with the odds of alcohol use,

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OR = 1.03, 95% CI [1.00, 1.06]. For every additional year of survivorship, the odds of a cancer

survivor using alcohol in the past month increased by 1.03 times. Level of education was also

associated with alcohol use, *OR* = 0.39, 95% CI [0.16, 0.95]. More specifically, the odds of

alcohol use among college-educated cancer survivors were 0.39 times less than the odds of

alcohol use for survivors who did not complete high school.

Table 2

Sample Characteristics (N=287)

Variables	n	%
Gender		
Men	95	33.1
Women	192	66.9
Age group (in years)		
45 to 49	13	4.5
50 to 54	16	5.6
55 to 59	33	11.5
60 to 64	35	12.2
65 to 69	45	15.7
70 to 74	54	18.8
75 to 79	40	13.9
80 or older	51	17.8
Race/Ethnicity		
Non-Hispanic White	235	81.9
Other race/ethnicity	52	18.1
Highest level of education completed		
Some high school or less	38	13.2
High school graduate/GED	32	28.6
Some college or more	167	58.2
Employment status		
Employed	67	23.4
Unemployed/retired/unable to work	220	76.6
Annual household income		
Less than $25,000	84	29.3
$25,000 to $49,000	83	28.9
$50,000 or more	85	29.6
Missing	35	12.2
Primary health insurance		
Medicare	165	57.5
Plan purchased through employer	60	20.9
Plan purchased directly by family	27	9.4
Other health plan	25	8.7
None or Not Reported	10	3.5

Table 3

Health-Related Characteristics (N=287)

Variables	*n*	% or *M* (*SD*)	Range
Cancer diagnosis			
Breast cancer	78	27.2	
Melanoma skin cancer	42	14.6	
Prostate cancer	29	10.1	
Other	138	48.19	
Years of cancer survivorship		12.65 (11.65)	.50 to 52.50
Comorbid conditions			
Coronary heart disease	43	15	
Diabetes	80	27.9	
Physical pain related to cancer or cancer treatment	30	10.5	
BMI		29.79 (6.40)	17 to 55
Cigarette use[1]			
Non-smoking	113	74.3	
Smoking	39	25.7	
Alcohol consumption in past 30 days			
No	189	65.9	
Yes	98	34.1	
Number of healthcare visits in past year[2]		8.39 (10.22)	0 to 75
Difficulty accessing health information			
Very easy	220	76.7	
Not very easy	67	23.3	
Difficulty understanding health professionals			
Very easy	190	66.2	
Not very easy	97	33.8	
Difficulty understanding written health information			
Very easy	179	62.4	
Not very easy	108	37.6	

[1]*N* = 152.
[2]*N* = 264.

Table 4

Chi-Square Results Testing Associations between Study Variables (N = 287)

Variables	1	2	3	4	5	6	7	8	9
1 Gender									
2 Age Group	12.29								
3 Race/ethnicity (non-Hispanic White vs. other)	0.52	6.54							
4 Education level	1.69	10.13	4.96						
5 Cancer type	111.16***	16.10	11.94**	11.04					
6 Cigarette smoking	2.49	16.51*	9.57**	3.25	4.08				
7 Alcohol use	4.00*	8.54	3.46	10.85**	6.46	0.42			
8 Difficulty accessing health information	2.05	9.99	0.60	5.18	7.33	0.93	1.30		
9 Difficulty understanding health professionals	4.38*	0.63	5.79*	13.41**	4.69	0.83	3.51	32.60***	
10 Difficulty understanding written health information	1.85	2.92	8.90**	19.17***	6.07	5.30*	4.10*	32.48***	98.33***

Notes. [1]$N = 152$

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 5

Pearson and Point-Biserial Correlations between Study Variables (N = 287)

Variables	BMI	Years of Survivorship
1 BMI		
2 Years of cancer survivorship	-.80	
3 Gender (Male vs. Female)	-.10	.17 *
4 Race/ethnicity (Non-Hispanic White vs. other)	-.90	.02
5 Cigarette smoking vs. non-smoking[1]	-.17 *	.05
6 Alcohol use vs. no alcohol use	-.18 **	-.12 *
7 Difficulty accessing health information	.06	.05
8 Difficulty understanding health professionals	.15 *	-.05
9 Difficulty understanding written health information	-.06	.01

Notes. [1]*N* = 152

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 6

Linear Regression Results for the BMI Model (N = 287)

Variables	B	SE	β	t	p
Race/ethnicity					
Other race/ethnicity	ref	ref	ref	ref	ref
Non-Hispanic White	-0.04	0.03	-0.08	-1.36	0.02 *
Difficulty accessing health information					
Very easy	ref	ref	ref	ref	ref
Not very easy	0.02	0.03	0.03	0.54	0.59
Difficulty understanding health professional					
Very easy	ref	ref	ref	ref	ref
Not very easy	0.07	0.03	0.16	2.15	0.03 *
Difficulty understanding written health information					
Very easy	ref	ref	ref	ref	ref
Not very easy	-0.03	0.03	-0.06	-0.81	0.42

Notes. Overall model $F(4, 282) = 2.13$, $p = .078$, $R^2 = .029$. Tolerance values ranged from .62 to .95.

Ref = reference group.

$^*p < .05$.

Table 7

Logistic Regression Results for the Cigarette Smoking Model (N = 152)

Variables	B	SE	Wald	df	p	OR	95% CI for OR Lower	Upper
Age								
45 to 49	ref	ref	12.63	7	0.08	ref	ref	ref
50 to 54	-0.27	0.95	0.08	1	0.78	0.77	0.12	4.90
55 to 59	0.15	0.65	0.06	1	0.81	1.16	0.32	4.13
60 to 64	-0.41	0.65	0.40	1	0.53	0.66	0.19	2.38
65 to 69	-0.98	0.61	2.57	1	0.11	0.38	0.11	1.24
70 to 74	-0.24	0.63	0.15	1	0.70	0.78	0.23	2.71
75 to 79	-2.01	0.85	5.59	1	0.02 *	0.13	0.03	0.71
80 or older	-1.88	0.83	5.18	1	0.02 *	0.15	0.03	0.77
Race/ethnicity								
Other race/ethnicity	ref	ref	ref		ref	ref	ref	ref
Non-Hispanic White	-1.07	0.46	5.74	1	0.02 *	0.34	0.14	0.82
Difficulty accessing health information								
Very easy	ref	ref	ref		ref	ref	ref	ref
Not very easy	0.17	0.49	0.12	1	0.73	1.19	0.46	3.07
Difficulty understanding health professional								
Very easy	ref	ref	ref		ref	ref	ref	ref
Not very easy	-0.27	0.57	0.23	1	0.63	0.76	0.25	2.34
Difficulty understanding written health information								
Very easy	ref	ref	ref		ref	ref	ref	ref
Not very easy	0.93	0.54	2.98	1	0.08	2.53	0.88	7.28

Notes. Overall model $\chi^2(11) = 64.92$, $p < .001$.

Ref = reference group; *OR* = odds ratio.

*$p < .05$.

Table 8

Logistic Regression Results for the Alcohol Use Model (N = 287)

Variables	B	SE	Wald	df	p	OR	95% CI for OR Lower	Upper
Gender								
Male	ref	ref	ref		ref	ref	ref	ref
Female	0.52	0.28	3.52	1	.061	1.68	0.98	2.90
Education level								
Some high school or less	ref	ref	8.28	2	.016 *	ref	ref	ref
High school graduate/GED	-0.18	0.49	0.14	1	.710	0.84	0.32	2.17
Some college or more	-0.94	0.45	4.35	1	.037 *	0.39	0.16	0.95
Years of survivorship	0.03	0.01	4.39	1	.036 *	1.03	1.00	1.06
Race/ethnicity								
Other race/ethnicity	ref	ref	ref		ref	ref	ref	ref
Non-Hispanic White	-0.49	0.38	1.68	1	.195	0.61	0.29	1.28
Difficulty accessing health information								
Very easy	ref	ref	ref		ref	ref	ref	ref
Not very easy	0.16	0.35	0.20	1	.655	1.17	0.59	2.30
Difficulty understanding health professional								
Very easy	ref	ref	ref		ref	ref	ref	ref
Not very easy	0.31	0.35	0.75	1	.388	1.36	0.68	2.71
Difficulty understanding written health information								
Very easy	ref	ref	ref		ref	ref	ref	ref
Not very easy	0.11	0.35	0.10	1	.751	1.12	0.56	2.22

Notes. Overall model $\chi^2(8) = 24.86$, *p* =.002.

Ref = reference group; *OR* = odds ratio.

*p < .05.

CHAPTER FIVE: DISCUSSION & CONCLUSION

Discussion of Hypotheses

Study Aim 1: To explore whether health information barriers are associated with weight status, cigarette use, and alcohol use among cancer survivors. Based on the health literacy models by Sun et al. (2013) and Paasche-Orlow & Wolf (2007), it was hypothesized that more difficulty in accessing and understanding health information (limited or low health literacy) would be associated with obesity and adverse health behaviors (cigarette smoking and alcohol use). Findings from the BMI regression model provided some support for this hypothesis.

Results from the BMI regression model showed that having greater difficulty understanding health information provided by health professionals was associated with higher BMI. It is important to note that no demographic variables were controlled for in the model because bivariate analyses revealed that there were no significant relationships between the demographic variables and BMI in this sample. This finding was consistent with those found in a study by Geboers, Reijneveld, Jansen, and de Winter (2016), in which the relationships between health literacy, health behaviors, BMI, and social support were explored in a sample of adults 65 years old or older. They found that low health literacy was associated with obesity and related health behaviors, such as low physical activity and diet (Geboers et al., 2016). However, in contrast to the current study, the study by Geboers et al. (2016) was not limited to cancer survivors and assessed health literacy using a validated 3-question instrument that focused on the

comprehension of written health information (as opposed to information communicated verbally by a healthcare professional).

A recent systematic review noted that while there are discrepant findings in the literature, there is evidence that suggests that low health literacy is related to difficulties with maintaining a healthy weight status (Michou, Panagiotakos, & Costarelli, 2018). The authors found that out of the 22 research studies that were included in their review, 17 studies found that low health literacy was significantly associated with overweight and obesity (Michou et al., 2018). The authors also highlighted that discrepancies in findings may be attributable to challenges in methodology, such as small sample sizes, and differences in the methods of measurement for both health literacy and weight status. Still, none of the studies included in the systematic review focused on adult cancer survivors. More research is needed to explore the relationship between health literacy and weight status in the context of cancer survivorship.

In relation to health behaviors, in the current study, bivariate analyses suggested that difficulty understanding written health information was correlated with both cigarette smoking and alcohol use. However, after controlling for demographic variables, regression analyses indicated that none of the three health information barriers were associated with either smoking or alcohol use. This indicates that the associations between difficulty understanding written health information and the primary dependent variables (cigarette smoking and alcohol use) were perhaps better explained by demographic variables, such as gender, age, and/or race and ethnicity, in this study sample.

Still, there are mixed findings in the health literacy literature. A systematic review of 96 studies by Berkman et al. (2011) examined the relationship between low health literacy and health outcomes. The authors found that there was inconsistent and discrepant evidence for

relationship between low health literacy and smoking behavior, and low health literacy and alcohol consumption (Berkman et al., 2011). The current study's findings were in contrast with at least one study in which the relationship between health literacy and tobacco use was examined (Husson et al., 2015). In a sample of colorectal cancer survivors, Husson and colleagues (2015) found that lower self-rated health literacy was associated with smoking more frequently, lower levels of physical activity, and reduced health-related quality of life.

The results from study aim 1 contribute to the existing literature by examining how health information barriers may affect BMI, cigarette use, and tobacco use among cancer survivors specifically. Few health literacy studies have focused on cancer survivors and the findings in the literature remain inconsistent. Still there is growing evidence that suggests cancer survivors may benefit from health literacy interventions to reduce overweight and obesity (Husson et al., 2015). Husson and colleagues (2015) emphasized the need for healthcare providers to learn how to identify cancer patients with low health literacy, as it can impact their adherence to healthcare recommendations.

Interventions that work to improve health literacy and reduce health information barriers (including limited access to accurate health information, poor comprehension of written health information, and poor patient-provider communication) could help cancer survivors gain the knowledge needed to make effective decisions about their health and implement healthy behavior changes. In the context of prior research, the current study's findings suggest that more research is needed to clarify the relationship between health information barriers (low health literacy), and cigarette smoking and alcohol use among cancer survivors. Furthermore, research exploring additional factors that may contribute to a cancer survivors' health behavior can provide a more comprehensive understanding, and can help inform intervention development.

Study Aim 2: To explore the moderating role of race and ethnicity on the relationships among barriers to health information, weight status, cigarette use, and alcohol use among cancer survivors. It was originally hypothesized that race and ethnicity would modify the relationship between barriers to health information and health-related behaviors and help explain the racial and ethnic disparities that have been well documented in the literature (Byrd et al., 2017; Li et al., 2016; Nayak et al., 2015; Paasche-Orlow & Wolf, 2007; Sun et al., 2013). In the current study, after controlling for race/ethnicity and age, the health information barriers (the primary independent variables) were not significantly associated with cigarette smoking (one of the primary dependent variables). In addition, race/ethnicity (the hypothesized moderator) was not significantly associated with BMI or alcohol use (two of the three primary dependent variables). As a result, these findings indicate that the causality assumption for moderation was not met, and for this reason, regression analyses were not conducted to test moderating effect of race/ethnicity.

Additional Study Findings

Bivariate analyses revealed a number of findings in relation subgroups within the sample. Racial and ethnic minority survivors were more likely to report greater difficulty in understanding health information (provided by a health professional or provided in written form). In addition, race/ethnicity was associated with cigarette smoking. Participants who identified with a minority race/ethnicity were more likely to report smoking cigarettes than participants who identified as non-Hispanic White. These results provide evidence that racial and ethnic differences in health literacy and health behaviors exist among cancer survivors in Louisiana. Although additional research is needed, this data suggests that racial and ethnic

minority survivors may benefit from tailored health literacy interventions to help reduce these disparities.

Additional analyses indicated that there is a relationship between the number of years of survivorship and health behaviors. Alcohol use in the past month was associated with having a fewer number of years of survivorship. This finding provides preliminary evidence of differences in the health behaviors of more recently diagnosed cancer patients in comparison to longer-term cancer survivors. For this reason, it may be beneficial to further explore how health behaviors may change of the course of cancer survivorship.

Limitations

The present study had several limitations. The study utilized an existing data set from the 2016 BRFSS survey. As such, the variables selected for analyses were limited to the method of measurement utilized in the survey. Secondly, the way variables were recoded for analyses may have further limited the study. For example, the alcohol use item on the survey asked participants to report the number of days in the past month on which they consumed at least one alcoholic beverage. Due to little variability in the data, alcohol use was dichotomized for analyses. As a result, one data point could have two very different meanings. A participant who endorsed alcohol use could have consumed one alcoholic beverage in the past month *or* 10 alcoholic beverages *daily* in the past month. As a result, dichotomous data does not provide information about the range in health behaviors. In addition, the study findings may have been limited by the statistical approach utilized. For instance, covariates were included in the regression models based solely on bivariate analyses. However, including covariates based on conceptual rationale and utilizing a multivariate approach may have been yielded associations that were not detected by the bivariate analyses.

More generally, the BRFSS survey relies on self-reported data, which may be subject to error due to factors such as underreporting of health risk behaviors and poor recall. The dataset is also affected by selection bias. The survey excluded individuals who did not speak English or Spanish, who did not have a residential telephone line (landline or cellular), and those who were unreachable after a certain number of attempts. Also, since the current study is cross-sectional in nature, the findings are not able to reveal patterns or changes in health behaviors over time.

Lastly, the study sample was limited in size and lacked diversity in relation to several factors (race/ethnicity, gender, cancer diagnosis, and level of education). The sample for the current study was neither nationally representative nor representative of the state of Louisiana. According to the U.S. Census, in the state of Louisiana 58.7% of the population is Non-Hispanic White, 32.6% is Non-Hispanic Black, and 5.2% identify as Hispanic (U.S. Census Bureau, 2018). In the present study's sample, 81.9% of the sample identified as non-Hispanic White, only 16% of the sample identified as non-Hispanic Black, and less than 1% of the sample identified as Hispanic. The sample also consisted of cancer survivors who were on average highly educated (with a greater number of participants having completed at least some college), and the majority of the sample reported that they found health information *very easy* to understand. For this reason, a replication of this study with a more representative sample may yield different results.

Implications for Future Research

There is evidence that suggests that in comparison to the nation as a whole, Louisiana experiences poorer health outcomes in relation to cancer than the nation as a whole (American Cancer Society, 2018; Robert Wood Johnson Institute, 2019). For example, Louisiana has an incidence rate of 28% for breast cancer, yet it has the second highest breast cancer mortality rate in the United States (Louisiana Cancer Control & Prevention Programs, 2017). There are a

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number of factors that may play a role in the negative health outcomes observed in Louisiana. Louisiana has the fourth highest rate of current cigarette smoking (23%), and the sixth highest rate of obesity prevalence (36.2%) in the country (American Cancer Society, 2018; Robert Wood Johnson Institute, 2019). For these reasons especially, the current study has important implications for cancer-related health interventions in the state of Louisiana.

The current study indicates that there is a relationship between health information barriers and weight status. This data suggests that in order to reduce obesity rates among cancer survivors, it may be beneficial to develop health literacy interventions that reduce barriers to health information. This, in turn, may have the possibility of improving health outcomes overall for cancer survivors in Louisiana. In addition, the findings suggested that racial and ethnic minority cancer survivors may experience more difficulties understanding health information and may be more likely to engage in current cigarette use. This suggests that additional research is needed to further assess racial and ethnic disparities in health literacy among cancer survivors, and to explore the conditions that may lead to and result from disparities in health information barriers.

Overall, replicating the current study with a larger, more representative study sample may help address some of the limitations of the current study. In addition, it may be helpful to focus on specific cancer diagnoses (i.e. breast, prostate, or colorectal cancers) in order to be able to identify findings unique to diagnosis-specific experiences. Moreover, exploring group differences can be useful. For example, examining differences between long term and more recently diagnosed survivors, or survivors of different age groups (young adults versus older adults), could help inform how interventions are tailored to address the needs of different populations.

Furthermore, utilizing validated instruments to assess health literacy, tobacco use, and alcohol use could offer more in-depth information about these variables among cancer survivors (Anker, Reinhart, & Feeley, 2011). More specifically, it may useful to collect data from cancer survivors *and* their health providers to determine what and how information is being delivered to survivors about health-related behaviors, *and* to what extent survivors are understanding and applying such information. Further study in this area would provide a more comprehensive understanding that could help inform intervention development.

More research is needed to better understand the relationship between race and ethnicity, health literacy, weight status, and health behaviors. Future cancer survivorship research should focus on further clarifying the mechanisms leading to racial and ethnic disparities in health literacy and health outcomes. Health literacy interventions targeting health behaviors may be one way to reduce these racial and ethnic disparities, as well as improve health outcomes for all cancer survivors.

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HEALTH LITERACY MODEL
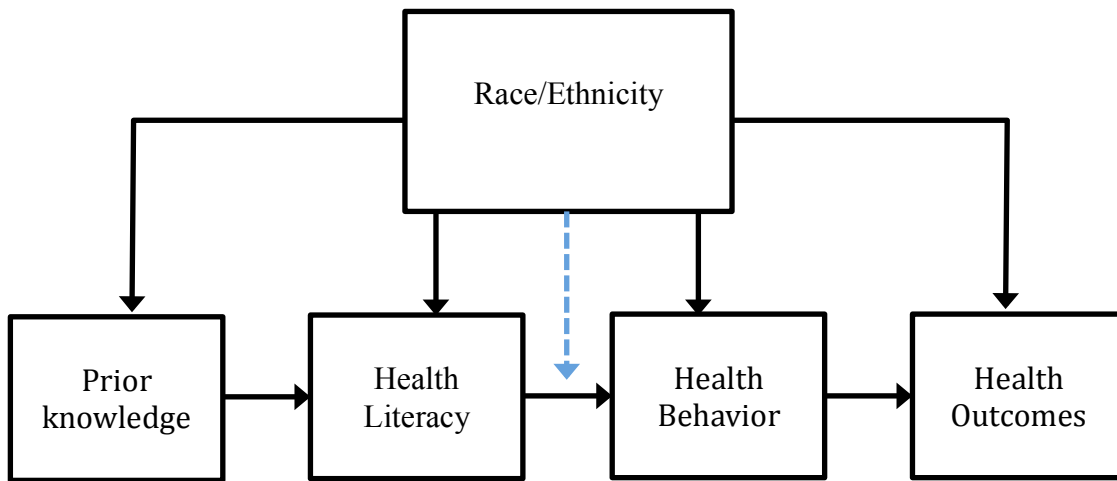
Figure 1A. Theoretical health literacy model depicting a pathway from health literacy to health behavior, with race/ethnicity as the hypothesized moderator.[*]

[*]*Based on a heath literacy models by Paasche-Orlow and Wolf (2007) and Sun et al. (2013).*
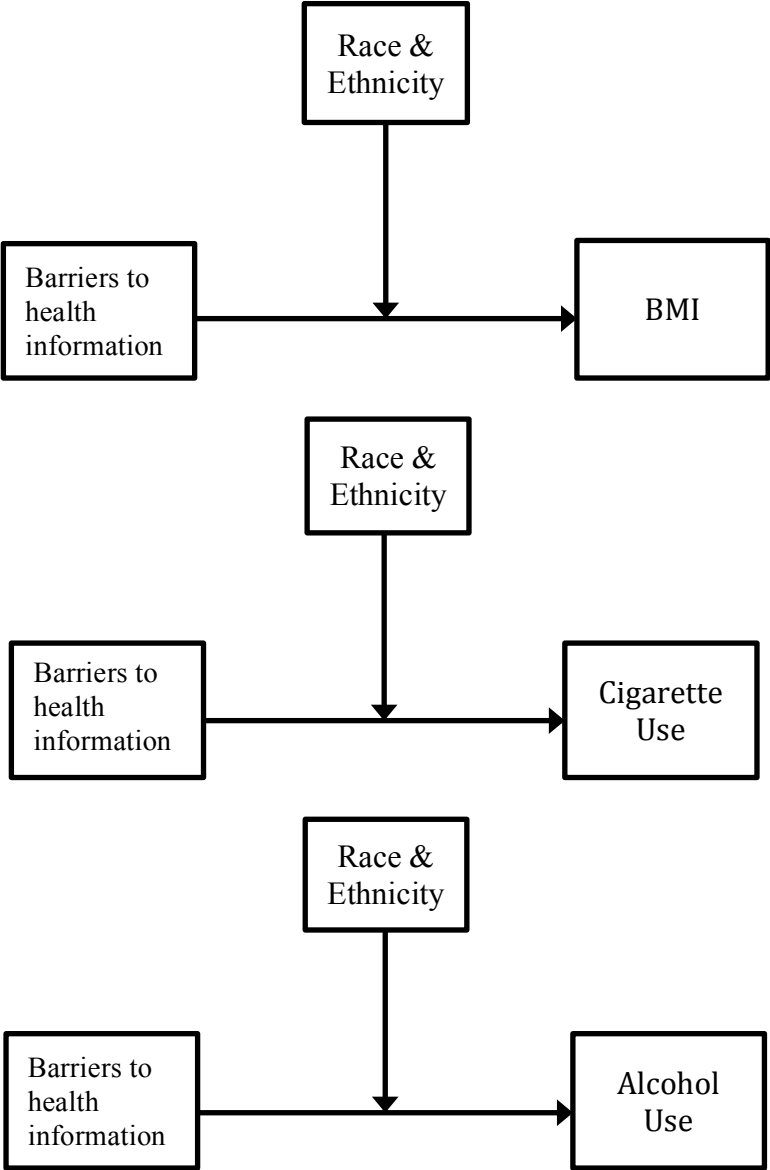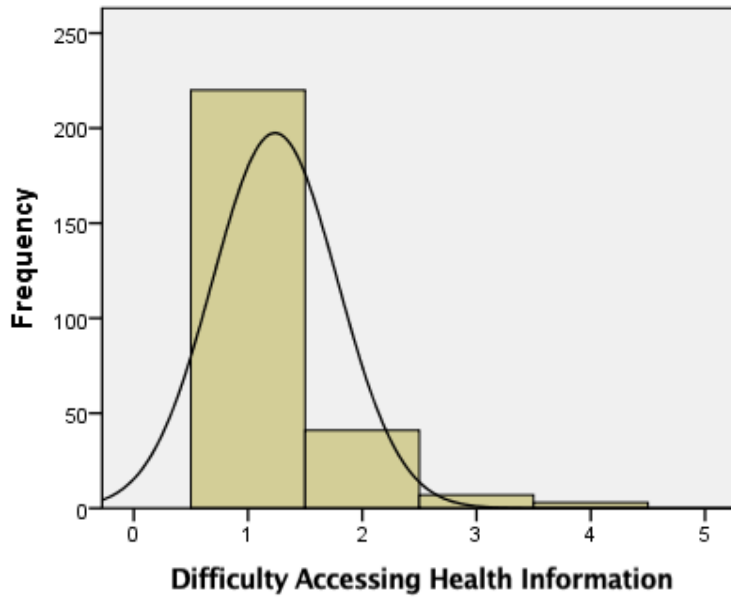
MODERATION MODELS

Figure 2A. Moderation models depicting race/ethnicity as the hypothesized moderator between health information barriers and the three dependent variables.
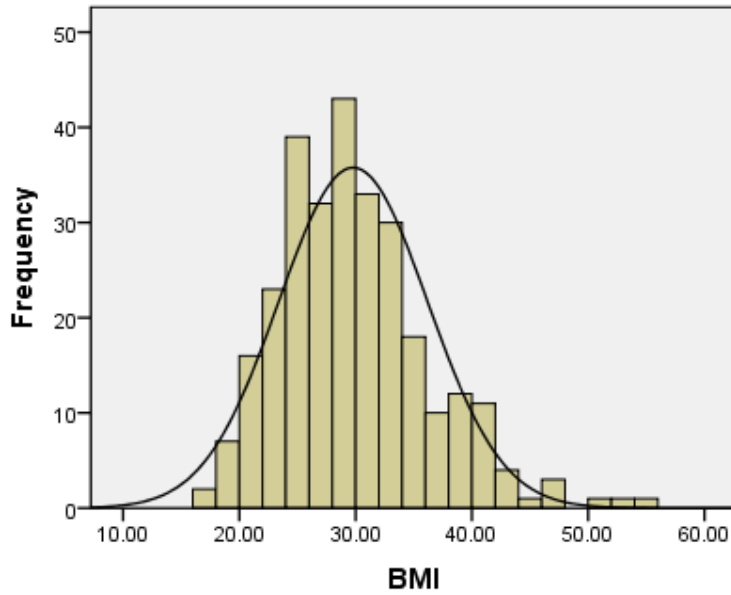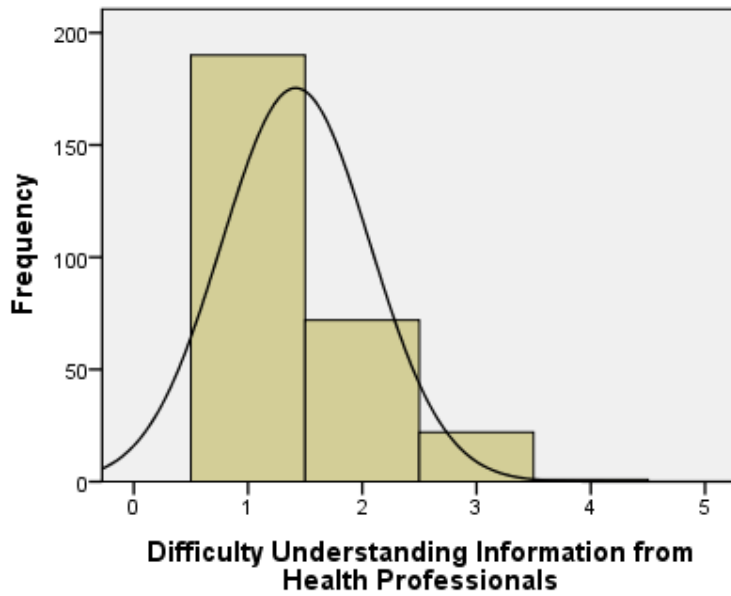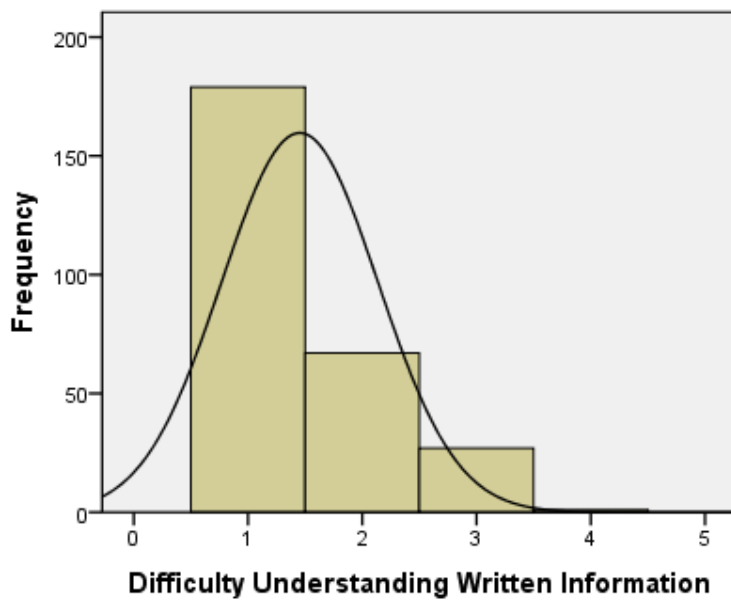
Figure 3A. Histogram for BMI.

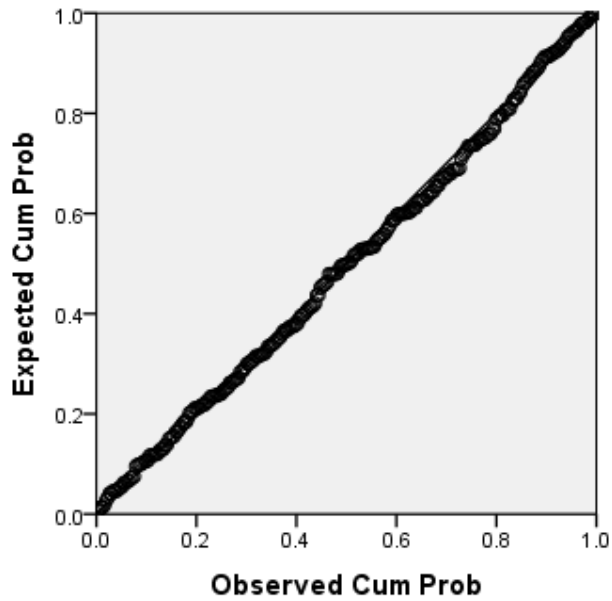**Figure 4A.** Histogram for difficulty accessing health information.

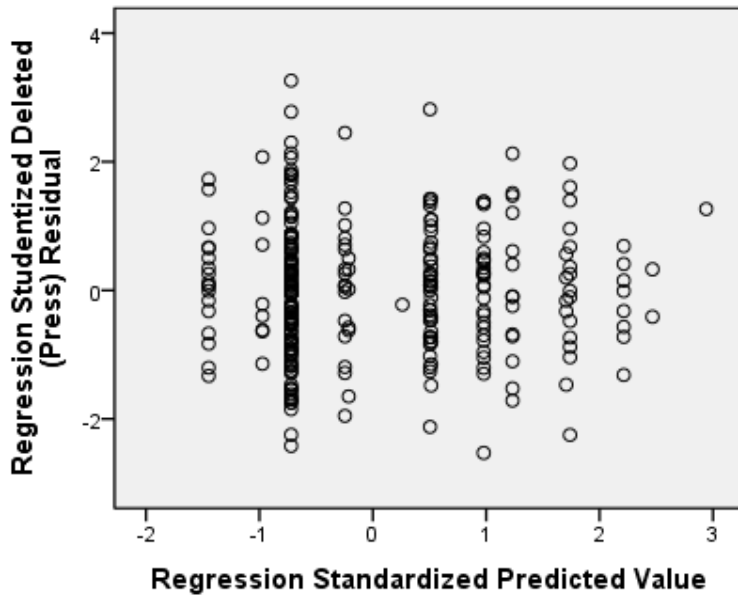**Figure 5A.** Histogram for difficulty understanding information from health professionals.

Figure 6A. Histogram for difficulty understanding written health information.

STATISTICAL PLOTS FOR THE BMI MODEL

Figure 7A. Normal probability plot for the BMI model.

Figure 8A. Scatterplot for the BMI model.