Walden University

College of Health Sciences and Public Policy

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Walden University
2024

Abstract

Racial/Ethnic Differences in the Association Between Health Literacy and Quality of Life Among Breast Cancer Survivors

by

Tenesia D. Carey

MS, Walden University, 2013

BS, West Chester University, 2010

Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy
Epidemiology

Walden University
February 2024

Abstract

In the United States, among women, breast cancer is the most predominant cancer affecting all ethnic groups. The purpose of the study is whether the association between health literacy (HL) and health-related quality of life (HRQoL) among breast cancer survivors in the United States differs by race/ethnicity. Social support is a critical component of cancer survivorship, with minimal exploration of the quality of life, HL, and racial differences. The purpose of this quantitative**,** cross-sectional study was to examine whether the association between HL and HRQoL among breast cancer survivors is moderated by race/ethnicity, with consideration of the mediation influences of social support between HL and HRQoL among breast cancer survivors in the United States. Health literacy skills was the conceptual framework for this research, which examined how HL functions at the personal level, affects health-related outcomes, and influences externally at the societal level. The societal-level moderator, race/ethnicity, was examined. Linear regression was used to test the research hypotheses. Social support did not mediate the relationship between HL and HRQoL, and race/ethnicity did not moderate the association between HL and HRQoL among breast cancer survivors. Implications for positive social change include increasing awareness of the associations between HL and HRQoL among breast cancer survivors and create intervention programs focused on understanding racial and ethnic inequities to improve QoL and social support among breast cancer survivors.

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Acknowledgments

A sincere thank you to my committee members, Dr. JaMuir Michelle Robinson and Dr. Howell Crawford Sasser. First, I thank Dr. JaMuir Michelle Robinson for her guidance, patience, and positive feedback during my dissertation project. Your support is greatly appreciated and has made this journey smoother, and I am very grateful. A special thank you to Dr. Howell Crawford Sasser, as my professor of Epidemiology Topics Seminar course and now my second committee member. Thank you for your guidance, feedback, and continued support throughout my dissertation project.

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Chapter 1: Introduction to the Study

Introduction

The focus of this study was to explore the association between HL and HRQoL among breast cancer survivors, the possible moderating effects of race/ethnicity, and the possible mediating influences of social support between HL and HRQoL amongst breast cancer survivors in the United States. In the United States, among cancer-related deaths, breast cancer is the second prominent cause in African American and Hispanic women in comparison to White women (Yedjou et al., 2019). Researchers have shown racial-ethnic disparities in the QoL in breast cancer incidence among Black and White women in the United States; however, there is minimal exploration of the differences among other race/ethnicities in the United States (Miller et al., 2017; Yedjou et al., 2019). Studies have shown that HRQoL affects health behaviors amongst cancer survivors and was correlated with HL in other countries, but it has not been widely explored in the United States whether the association differs by race/ethnicity. Basic knowledge and the capability to incorporate complex thinking regarding clinical care, the social environment, and health behavior are essential to appropriately interpreting and analyzing one's QoL (Wei et al., 2021).

Breast cancer survivors who completed treatment face many challenges in managing their care, including physical and psychological impacts of symptoms related to treatment effects (Wei et al., 2021). Self-efficacy is vital in determining and executing a specific behavior to anticipate the expected result. Determining behavior and human function through cognitive or motivational processes is critical when cancer-related challenges arise and essential to understanding the determinants of HRQoL (Baik et al., 2020). When examining QoL and HL among breast cancer survivors, studies have indicated a positive correlation between self-efficacy and social support (Buffart et al., 2015; Pishkar et al., 2015; Shen et al., 2020). Social support provides social and psychological benefits through networks, including many influential persons such as family, health care providers, friends, and significant others (Lee & Oh, 2020).

Although there is an increasing amount of literature examining social support and self-efficacy between QoL and HL among breast cancer survivors (Hurtado-de-Mendoza et al., 2021; Lee & Park, 2020; Shen et al., 2020), the association between social support and QoL once treatment ends for survivors remains uncertain (Baik et al., 2020; Lee & Oh, 2020). Therefore, this study attempts to add to the limited literature examining the association between HL and HRQoL among a national sample of breast cancer survivors. I plan to assess if the association differs by race/ethnicity. In addition, I will address the mediation effect of social support between HL and HRQoL among breast cancer survivors.

This research has the potential to shape positive social change by illustrating possible differences in HL by race/ethnicity and improving HRQoL among diverse groups of breast cancer survivors. This information may inform cancer centers and health care providers in developing programs and interventions to improve this population's QoL and social support. The results of this study may be helpful to breast cancer survivors by quantifying racial and ethnic inequities, HL, and HRQoL through the survivorship continuum (Hulett et al., 2015; Lee & Oh, 2020; Miller et al., 2017).

In this chapter, I will review the background of the study, the problem statement, the study's purpose, research questions and hypotheses, a synopsis of the theoretical framework that directs the study, and a more complete dialogue regarding the theory presented in Chapter 2. Lastly, I will focus on the nature of the study, pertinent definitions, assumptions, scope and delimitations, limitations of the study, and significance. The chapter will conclude with a summary.

Background

Breast cancer affects women of all racial backgrounds in the United States. Breast cancer, compared to other cancers (i.e., prostate, lung and bronchus, colorectal cancers), has the highest incidence rate among women and gives rise to 30% of new cancers diagnosed in the United States (Siegel et al., 2019). However, breast cancer does not solely strike every racial and ethnic groups equally. The causes of racial/ethnic differences in breast cancer remain unclear. Breast cancer incidence, mortality, and survival differ among race and ethnic groups and by socioeconomic status (Miller et al., 2017; Singh & Jemal, 2017; Yedjou et al., 2019). Decreased breast cancer survival rates and mortality amongst Black women compared to other ethnic groups can be ascribed to the latent stage of breast cancer at diagnosis, access to healthcare, and prevalence of risk factors, including socioeconomic status and income (Miller et al., 2017; Yedjou et al., 2019).

Healthcare disparities play a leading role in socioeconomic differences and contribute to the increase of racial/ethnic disparities and mortality among breast cancer women (Singh & Jemal, 2017). Socioeconomic inequalities have led to disparities in breast cancer, including medical coverage and income among cancer survivors (Singh & Jemal, 2017; Yedjou et al., 2019). When comparing Black women to White women, Black women are more probable to be uninsured and depend on public insurance at an increased rate than White women (Yedjou et al., 2019). Limited or inadequate medical insurance coverage and limited access to care can lead to causes of breast cancer disparities among lower SES individuals, accounting for higher rates of late-stage cancer diagnoses among women (Singh & Jemal, 2017; Yedjou et al., 2019).

Minority and low-income women living in disadvantaged areas face increased economic challenges in accessing primary care facilities for treatment, diagnosis, and follow-up care, leading to significantly lower cancer survival (Miller et al., 2017; Singh & Jemal, 2017; Yedjou et al., 2019). Decreased rates of breast cancer screening have significantly attributed to women of low income and an increased likelihood of a later-stage diagnosis of breast cancer, leading to higher mortality and the receipt of poor or disparate treatment (Miller et al., 2017; Singh & Jemal, 2017; Yedjou et al., 2019). The continued growth in mortality and cancer disparities among Black and White women suggests a gap in current approaches and a need to address racial/ethnic disparities across population groups in breast cancer efficiently.

However, the connection between literacy and health is complex (Huang et al., 2017; Sun & Lin, 2014). Many healthcare providers who provide care in disadvantaged communities are not adequately qualified to provide proper treatment or ample information for the population they serve due to a lack of infrastructure where they practice (Singh & Jemal, 2017; Yedjou et al., 2019). HL provides individuals the capability to process and appropriately interpret the complex roles of interaction (i.e., reading health info, translating charts, decision making) in receiving clinical care, and the importance of adjusting one's behavior to change is essential to increasing the QoL among breast cancer patients (Huang et al., 2017; Sun & Lin, 2014). HL is an essential factor that can promote and increase the QoL among patients with breast cancer (Wei et al., 2021). Studies suggest HRQoL and HL are essential factors in making appropriate health decisions to ensure positive health outcomes among disadvantaged populations (Singh & Jemal, 2017; Xia et al., 2019).

Hence, this study is needed because it will help fill a gap in the inadequate literature and investigate the topic in a way not previously explored: an examination of the association between HL and HRQoL among a nationwide sample of breast cancer survivors in the US and possible variations by race/ethnicity. By filling this gap, public health professionals could develop education strategies to manage timely access to educational material, interventions, and programs, as HL is essential in improving QoL (Xia et al., 2019).

Problem Statement

The problem focused on in this study is whether the association between HL and HRQoL among breast cancer survivors in the United States differs by race/ethnicity (Halverson et al., 2015; Lee & Park, 2020; Wei et al., 2021; Xia et al., 2019). In addition, I addressed the mediating effects of social support between HL and HRQoL among breast cancer survivors (Baik et al., 2020).

Studies suggested that when making appropriate health decisions, HRQoL and HL are important components to ensure positive health outcomes among disadvantaged populations (Xia et al., 2019; Singh & Jemal, 2017). Yedjou et al. (2019) explained that despite several new treatments, racial differences persist in breast cancer survivorship in the United States. Robust evidence suggests that improving cancer survivors' health and physical well-being is crucial as the numbers of cancer survivors continue to rise (Yedjou et al., 2019).

It is vital to explore avenues to improve health and psychological well-being through survivorship, as a number of cancer survivors are subjected to psychological pain and diminished social performance, which can adversely affect one's QoL (Yedjou et al., 2019). Cancer survivors commonly encounter adverse side effects, including pain and fatigue, decreased social functioning, psychological anguish, and premature mortality and morbidity, all of which impact HRQoL (Frensham et al., 2018; Yedjou et al., 2019). Social support is essential when providing social and emotional benefits through informal networks, including family members, associates, significant others, and formal networks, such as health care or social work practitioners. However, social support among breast cancer survivors and the role in maintaining the QoL once treatment ends for survivors are uncertain (Lee & Oh, 2020; Shen et al., 2020).

Authors suggest HRQoL and HL are essential factors in making appropriate health decisions to ensure positive health outcomes related to QoL, whereby minimal or inadequate HL can impact the imbalance of cancer-related risk among disadvantaged populations (Xia et al., 2019). In addition, individuals with poor and limited HL have challenges accessing healthcare services, leading to adverse results such as decreased health status, poor comprehension of health information, and limited interactions with physicians (Xia et al., 2019). Therefore, innovative approaches are necessary to increase breast cancer prevention to enhance cancer survivor rates, decrease breast cancer mortality, and better health outcomes among racial/ethnic groups (Yedjou et al., 2019). Through this quantitative study, I attempted to fill the gap in the literature on the association between HL and HRQoL among breast cancer survivors in the United States and possible racial/ethnic differences in this association.

Purpose of the Study

The objective of this quantitative study was to examine whether the association between HL and HRQoL among breast cancer survivors is moderated by race/ethnicity. Furthermore, I sought to identify the influence of mediating impacts of social support between HL and HRQoL among breast cancer survivors in the United States. I used the Behavioral Risk Factor Surveillance System (BRFSS) questions to operationalize the variables in this study.

The operationalization of variables included HL and HRQoL, measured as the scale variables, and race/ethnicity and social support as categorical variables. Education, health care access, marital status, income, and age served as confounders and were measured as categorical variables.

Research Questions and Hypotheses

The research questions and hypotheses follow:

RQ1: What is the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age?

$H_0$1: There is no statistically significant association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age.

H_A1: There is a statistically significant association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age.

RQ2: To what extent does race/ethnicity moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age?

$H_0$2: Race/ethnicity does not moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

H_A2: Race/ethnicity does moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

RQ3: Does social support mediate the relationship between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age?

$H_0$3: Social support does not mediate the relationship between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

H_A3: Social support does mediate the relationship between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

Theoretical and/or Conceptual Framework for the Study

The health literacy skills (HLS) conceptual framework used in this study theorized the associations between HL and health-related outcomes (QoL) and how HL functions at the individual level. The conceptual framework described factors that influence health status or outcomes (i.e., morbidity/mortality, QoL, or health/well-being) external at the societal level (i.e., community, health care system, media, and social support), influences of a one's development of HLS comprehension, and factors associated with health-related outcomes of QoL (Squiers et al., 2012). The HLS conceptual framework is comprised of four key components: (a) societal factors that impact the growth of HLS and the influences of health behaviors and outcomes (i.e., race and ethnicity, income, and gender), (b) health-related stimuli (ability to process health information and decision making), (c) HLS needed to attain, process, grasp, and communicate health information and accomplish a task, and (d) arbitrators between HL and health outcomes (QoL; Squiers et al., 2012). This study examined the role of a societal-level moderator (race/ethnicity) and the association between HL and HRQoL.

The HLS conceptual framework allowed for the interdependency of various environmental influences and how social aspects impact health-related behavior outcomes directly and indirectly. In addition, individual-level and societal influences are present in various places in the framework (Squiers et al., 2012). For instance, the framework allowed for hypothesizing how demographic attributes (e.g., age, income, and gender) directly and indirectly influence societal factors such as race/ethnicity to determine the strength of the relationship between HL and QoL among breast cancer survivors. Squiers indicated that societal factors are included as moderators, and at other times, they are presented as mediators. Mediating factors can affect one's capability to retain, retrieve, and employ information to stimulate health-related decisions. While several external factors influence a person's ability to grasp health-related information, social support may mediate the comprehension between health behaviors and the socioecological perspective of HL (Squiers et al., 2012). Social support for this study was presented as a mediator using this framework.

Nature of the Study

The quantitative nature of the study used a cross-sectional survey design in which I examined the association between the independent variable and the dependent using observational data obtained from a population at one point in time, as opposed to over an extended period (Wang & Cheng, 2020). Wang and Cheng (2020) pointed out additional advantages to cross-sectional studies: they are usually fast, inexpensive to conduct, and can generate hypotheses/new study designs for future research compared to other study designs such as case-control studies or cohort studies, selection of subjects is not selected from a population but based on the population relevant to the study question. Therefore, the cross-sectional design was the most appropriate for this project.

The BRFSS is commonly used for cross-sectional studies and prevalence and trend analysis in public health research. This study used a cross-sectional design using data obtained from the Centers for Disease Control and Prevention's (CDC) BRFSS (CDC, 2016). The study population was adult women who were breast cancer survivors ≥ 18 years old. BRFSS data are collected using an intricate telephone sampling scheme based on a disproportionate stratified sample (CDC, 2018).

After obtaining approval from the Walden IRB, I accessed the data needed to examine whether the association between HL and HRQoL among breast cancer survivors differs by race/ethnicity from the BRFSS. Additionally, the mediating effects of social support between HL and HRQoL among breast cancer survivors were also examined. The covariates for this study included education, health care access, marital status, income, and age.

The independent variable for this study, HL, was measured using Likert-scale responses. The dependent variable, HRQoL, was measured on a Likert-scale based on physical and mental health status responses through the past 30 days where physical health and poor mental was experienced. Both the independent and dependent are measured as continuous variables. Another important variable in the association of HL and HRQoL among breast cancer survivors was the mediating variable, social support. Social support was measured categorically using Likert-scale responses recoded into two responses: having support (yes)— and not having support (no) in the BRFSS. Social support as a mediator provided insight into the role between HL and HRQoL provided insight into the relationship between these variables. Confounding variables occur and should be modified to reduce data analysis bias. The following confounding variables was measured categorically: education, health care access, marital status, income, and age. Based on the literature review, confounding variables that influence HL and QoL for consideration in the statistical analysis include education, health care access, marital status, income, and age (Coughlin et al., 2022; Ferguson et al.,2011; Nelson,2021; Tung et al., 2014). For this study, the 2016 BRFSS data set was publicly accessible in a format for conversion into the Statistical Package for the Social Sciences (SPSS) software for statistical analysis.

Statistical analysis was used to examine the variables and determine if a relationship occurs between the independent variable, HL, and the dependent variable, HRQoL, the mediating variable, social support, and the moderating variable, race/ethnicity, using Pearson's correlation coefficient and linear regression. After addressing the first and second research questions, the final research question concluded with how social support can mediate the association between HL and HRQoL among breast cancer survivors. Structural equation modeling is a statistical test of the direct and indirect relationships among variables (Lee et al., 2016) that can be used to provide a more decisive perception regarding research question three. Definitions of the variables and terms found predominantly in the literature are provided in the subsequent section.

Definitions

Breast cancer survivorship: Breast cancer survivorship includes individuals who have completed hospital-required breast cancer treatments, including post-surgery, chemotherapy, and radiation treatments (Keesing et al., 2019).

Health literacy: HL is “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (Kugbey et al., 2019a). HL impacts numerous health outcomes, including physical and emotional functioning, healthcare use, vital decision-making results, and “self-care management” among patients (Kugbey et al., 2019a).

Health-related quality of life: HRQoL is a personal evaluation of one’s welfare and capability to perform societal roles or a set of expected behaviors used as a health measure in medical settings, clinical interventions, and health surveys (Xia et al., 2019). HRQoL includes one’s related health conditions, including physical and mental health, associated health conditions, functional status, social support, and socioeconomic status (CDC, 2001). HRQoL includes sociodemographic factors, including age, income, education, and physical and psychological symptoms (Halverson et al., 2015).

Race/ethnicity: Race is “a group of people sharing a common origin and physical features.” Ancestry or “ethnicity” refers to “categories as having a common descendent or national and cultural tradition” (Ferrari, 2022).

Self-efficacy: Self-efficacy refers to an individual’s faith in executing a behavior to produce a specific goal or achievement (Lee & Oh, 2020).

*Social support***:** Social support is described as one's perception and experiences of being valued, loved for, and cherished by others in an individual's life (Lee & Oh, 2020).

Assumptions

A number of assumptions was made regarding this quantitative research study. These assumptions can be classified as (a) philosophical/scientific, (b) methodological, and (c) statistical.

Quantitative research is driven by the systematic method, known as positivist epistemology, or the philosophy of "ways of knowing." Positivist epistemology relies on hypotheses derived from measures that quantitatively examine relationships between causative and illuminating aspects (independent variables) and outcomes (dependent variables; Park et al., 2020). Positivism is aligned with the hypothetico-deductive method of science. The hypothetico-deductive method in science is used in research that begins with a theory derived from literature and builds testable hypotheses (Park et al., 2020). Theories often evaluate existing theories based on empirical data when larger samples are used to generalize (Alharahsheh et al., 2020; Park et al., 2020). This method "empirically" can strengthen or refine the theory and confirm or reject the hypothesis (Park et al., 2020). Quantitative studies are based on worldly assumptions where study participants and the researcher do not interact to reduce bias and validate data collected to provide evidence or to simplify the purpose and perspective for which the measure is being used (Frongillo et al., 2019; Park et al., 2020). To that end, there is an innate assumption that when data are used in quantitative research, they address the specific phenomenon and, when statistically quantified, are measured appropriately and ethically (Alharahsheh et al., 2020).

One primary methodological assumption is that the participants answered the BRFSS questions truthfully, yielding the survey to be helpful in statistical analysis. The findings of studies can be greatly affected by social desirability bias, as participants provided answers that the person recognizes as socially desirable and acceptable (Lüke & Grosche, 2018). Studies have shown that social desirability is based on the individual and the context or environment. Social desirability varies based on different people and the circumstances that lead to diverse levels of disclosure, even for the same person (Schuetzler et al., 2018). Participants completing the instruments should have the same responses on every occasion the test is completed. Although the situation is impossible to provide a precise computation of reliability, an estimate of reliability can be examined across various measures (Heale & Twycross, 2015). As such, while developing my quantitative study, deriving a statistical plan helped me determine the proper statistical model for the selected 2016 BRFSS data set. The benefit of using multiple linear regression is that it allowed an assessment of the differences in the association between HL and HRQoL among breast cancer survivors by race and ethnicity. All factors are addressed when conducting a good-quality study (Heale & Twycross, 2015).

The final set of assumptions refers to statistical assumptions. Multiple linear regression has several assumptions that need to be met for a reasonable interpretation of results. These assumptions include (1) linearity, (2) normal distribution, (3) homogeneity of variance, and (4) statistical independence (Flatt & Jacobs, 2019). The multiple linear regression test assumes a normal distribution within the population, variables are statistically independent, and a linear relationship exists between the dependent and independent variables. Flatt and Jacobs noted that the linearity assumption requires a straight-line correlation between two variables. Homogeneity of variance assesses the sample distributions and the population or variances between independent groups on a continuous variable (Flatt & Jacobs, 2019). Variables used, and analysis based on these assumptions are considerations for statistical analysis. Several statistical tests were performed to ensure any violations of assumptions will be statistically addressed and assumptions of multiple linear regression will be met. This will be discussed in further detail in Chapter 3.

Scope and Delimitations

The scope was to assess the association between HL and HRQoL among breast cancer survivors by race/ethnicity in the United States exist. The literature suggests the association between HRQoL and HL among breast cancer survivors has been examined in other countries but has not been widely explored in the United States and whether the association differs by race/ethnicity (Halverson et al., 2015; Lee et al., 2020; Wei et al., 2021; Xia et al., 2019). Furthermore, social support contributed to the role in QoL and has been significantly associated with breast cancer survivors (Hurtado-de-Mendoza et al., 2021; Lee & Park, 2020; Shen et al., 2020). Thus, the emphasis of this research study was to examine how social support mediated the association between HRQoL and HL among breast cancer survivors.

Limitations

Obstacles and barriers exist when conducting a secondary analysis using existing data, as the data collected do not openly speak to a certain research question or a particular hypothesis. A noted major limitation of analysis when employing existing data is how the data are collected (Cheng & Phillips, 2014). In the study, HL data were self-reported; as a result, they were subject to bias and measurement errors (Luo et al., 2020; Rutan et al., 2021). Secondly, an optional module was administered using a three-item HL questionnaire that only included participants in 14 states and territories (Alaska, Alabama, Iowa, Georgia, Illinois, Louisiana, Minnesota, Maryland, North Carolina, Mississippi, Nebraska, Pennsylvania, Virginia, and Washington, DC). Only respondents from Louisiana who completed the optional modules and met the eligibility criteria were included, thereby limiting the generalizability of the findings of this study. Also, respondents who responded "I don't look for health information" in Question 1 and "I don't pay attention to written health information" in Question 3 were excluded. This may suggest that respondents may have decreased HL (Luo et al., 2020). Often, many individuals participate in the collection process, which leads to misinterpretation of variables or missing essential details in the dataset when government agencies conduct large-scale surveys. Robust documentation of information is vital for data validity. Careful examination of the relevant document can mitigate this problem by the user (Cheng & Phillips, 2014).

Significance

Given the significant association between HL and HRQoL among breast cancer survivors in other countries., it is vital to understand whether the association in the United States is moderated by race and ethnicity, as this has not been widely explored. In addition, it is crucial to understand if social support mediates the relationship between HL and HRQoL among breast cancer survivors.

Exploration of the literature revealed racial-ethnic disparities in the QoL in breast cancer incidence among Black and White women in the United States, but the differences among other races in the United States have not been sufficiently examined (Miller et al., 2017; Yedjou et al., 2019). In addition, further exploration was needed to determine how social support mediated the effects between HL and HRQoL, but the relationship remains unclear (Hurtado-de-Mendoza et al., 2021; Lee & Park, 2020; Shen et al., 2020).

This study evaluated moderators and mediators to determine the association between HL and HRQoL among a sample of breast cancer survivors nationwide. The conclusions of this study provided vital insight into the racial and ethnic inequalities in HL and HRQoL among breast cancer survivors. The results may add to the increasing body of information on this topic to encourage cancer centers and healthcare providers to develop interventional programs to improve the QoL and increase equity in breast cancer for this population (Hulett et al., 2015; Miller et al., 2017). The results can impact positive social change by clarifying the role of HL and the mediating role of social support in improving health associated QoL among diverse breast cancer survivors (Hulett et al., 2015; Miller et al., 2017). Improving HRQoL among diverse breast cancer survivors can improve cancer management and treatment efficacy through the survivorship continuum (Hulett et al., 2015; Lee & Oh, 2020; Miller et al., 2017).

Summary

Previous research has shown racial-ethnic differences in the QoL in breast cancer incidences among Black and White women in the United States; however, minimal exploration has been conducted to examine the disparities between other races in the United States. HL and HRQoL have been shown to impact the health of cancer survivors' behaviors in other countries, but minimal exploration has been conducted in the United States. Social support plays a significant role in QoL; however, the significance and role social support contributes to QoL are uncertain. Therefore, this quantitative research aimed to assess if the association between HL and HRQoL among breast cancer survivors varies by race/ethnicity and the mediating effects of social support between HL and HRQoL amongst breast cancer survivors in the United States. The conceptual framework used in this study was the HLS conceptual framework.

A cross-sectional design was used to explore the differences in the association between HL and HRQoL in breast cancer. Also, it was used to clarify the association between HL and the mediating role of social support in improving HRQoL among diverse breast cancer survivors (Hulett et al., 2015; Miller et al., 2017). Chapter 2 includes a literature review of HL, HRQoL, and the role of social support in breast cancer survivors. A comprehensive explanation of the HLS framework and its relevance to this study is also provided.

Chapter 2: Literature Review

Introduction

The purpose of this study was to examine whether the association between HL and the HRQoL amongst breast cancer survivors was moderated by race/ethnicity and the mediating effects of social support between HL and HRQoL, including breast cancer survivors. An absence of knowledge of the relationships between HL and HRQoL could negatively impact health outcomes among patients with breast cancer (Wei et al., 2021). Although researchers have found direct relations between individuals' HLS and health outcomes, many considerations that may mediate the relationship, including health status, motivation, and self-efficacy, exacerbated by environmental influences such as social support, remain unclear. For this study, the following confounding variables was included: education, healthcare access, marital status, income, and age.

Baik et al, (2020) indicated many factors such as self-efficacy and one's capability to perform a specific behavior to generate an anticipated result, may be difficult to modify without understanding the determinants of HRQoL. The authors noted that self-efficacy plays an integral part in determining behavior related to human functioning through cognitive or motivational processes that are essential components when cancer-related challenges and demands occur. In China, inadequate HL was thought to contribute to the inequivalent burden of cancer-associated complications such as pain and fatigue, decreased social functioning, psychological anguish, and premature mortality and morbidity, all of which can impact HRQoL among disadvantaged populations (Freshman, 2018; Xia et al., 2019).

Researchers have shown that HRQoL influences health behaviors among cancer survivors and was associated with HL in other countries, but it has not been widely explored in the United States whether the association differs by race/ethnicity. The problem addressed in this study is whether the association between HL and HRQoL among breast cancer survivors differs in the United States by race/ethnicity (Halverson et al., 2015; Lee & Park., 2020; Wei et al., 2021; Xia et al., 2019). In addition, I addressed the mediating effects of social support between HL and HRQoL among breast cancer survivors (Baik et al., 2020). In this chapter, I deliver a summary of the literature on HRQoL, social support, and HL among breast cancer patients and an overview of the HLS framework (Squiers et al., 2012), which served as the theoretical framework for this study.

Literature Search Strategy

I searched for relevant literature from Cochrane Library, Academic Search Complete, APA PsycInfo, PubMed/Medline, Cumulative Index to Nursing, and Allied Health Literature (CINAHL) databases. Also, an internet search was performed using Google Scholar. A search using peer-reviewed scholarly journals conducted within the last five years provided a recent literature review using key search terms that included *health literacy*, *literacy*, *racial/ethnic disparities in breast cancer*, *breast cancer survivorship*, *race/ethnicity*, and *quality of life*, *race/ethnicity and health literacy*, *health literacy and quality of life*, *health-related quality of life*, *social support and quality of life*, *breast cancer and social support*, *breast cancer and self-efficacy*, *social influences on breast cancer survivors*, and *health literacy among cancer patients*. Although a wideranging literature search generated seven articles older than ten years, this information was used only to provide perspective and only when appropriate to the theoretical framework. Fifty-one studies are included in the final synthesis. Duplicates were excluded based on titles. Most studies investigated racial/ethnic disparities, HL, and QoL, followed by a few studies that thoroughly investigated the relationship between the concepts of HL, QoL, breast cancer survivors, and various health disparities related to race/ethnicity and HL.

Theoretical Foundation

The theoretical foundation used for this study will be the HLS framework. Squiers et al. (2012) proposed an HLS framework that hypothesizes the relationship between HL and health-associated outcomes and exemplifies how HL functions at the individual level can be influenced by external factors to the individual organized using four main components: (a) societal factors that affect the advancement of HLS and the influences of health behaviors and outcomes (i.e., race and ethnicity, income, and gender); (b) health-related stimuli (ability to process health information and decision making); (c) HLS needs to acquire, process, identify, and verbalize health information and execute a task; and (d) mediators between HL and health outcomes (e.g., QoL). For example, mediators are variables used to explain why (i.e., methods or route) specific outcomes or effects occur. Squiers et al, noted that moderators show the orientation of strength or relationship between the independent and dependent variables. The emphasis of this study was on the role of the societal-level moderator (i.e., race/ethnicity) and the association between HL and HRQoL among breast cancer survivors.

Squiers et al. (2012) indicated that the HLS conceptual framework described factors that can affect one's development of HLS, a clear understanding of HLS, and how knowledge affects agents such as the community and family factors connected with health-associated outcomes. To develop the HLS framework, researchers reviewed and built upon three existing HL frameworks. Squiers et al. examined the frameworks of Baker (2006), Manganello (2008), and Paasche-Orlow and Wolf (2007) to create a thorough illustration of the constructs related to HL and the application of HLS. The HLS conceptual framework compiles operational variables from prior frameworks to incorporate the socioecological perspective of HL and external factors that influence one's capacity to comprehend health-related information and explore mediators between comprehension and health behaviors. The authors. created the conceptual framework to guide future research and advance the operationalization of the constructs, as there has been limited or no research conducted to date. The HLS framework could guide the progress of interventions to improve HL and QoL in breast cancer survivors**.** Hence, HLS is the best conceptual framework that can assess the causal pathways between HRQoL, social support, and HL among breast cancer survivors.

Health Literacy

HL definitions have undergone significant changes, with no clear definition in the literature. HL has been well-defined as "the degree to which individuals can obtain, process, and understand health information and services needed to make healthy decisions" (Simmons et al., 2017, p. 1). Researchers explored HL when it first emerged in the 1970s as an individual competency to promote health or maintain health within society (Liu et al., 2020; Muhanga & Malungo, 2017). HL was first recognized as functional HL, interactive HL, and critical HL. The HL concept relates to one's capability to acquire information as well as the knowledge to support health actions (Liu et al., 2020). Over the past several years, the concept of health literacy has evolved to encompass cultural and conceptual understanding, listening, speaking, mathematical, literature, and comprehension skills (Kindig et al., 2004; Nutbeam, 2020; Zarcadoolas et al., 2005). The complexity of measurements of HL and the evolution of years are related to several factors that systematically affect HL. Liu et al. (2020) and Papadakos et al. (2018) found the measurements of HL but also noted that the concept differed from those suggested by Kindig et al. (2004), Nutbeam (2020), and Zarcadoolas et al. (2005). These factors further expand the concept of HL, including self-efficacy, self-management, patient–healthcare provider interactions, and social support as considered elements of HL. Holden et al. (2021) expanded the meaning of HL to one's compacity to communicate, assert, and act on decisions. This definition was further refined by Simmons et al. (2017) and Xia et al. (2019) to focus on the asset approach, which builds on an individual's literacy skills to develop more advanced communication and social skills in those with low health literacy (LHL).

Simmons et al. (2017) and Xia et al. (2019) discovered that poor or LHL was associated with contributing factors, including poor health status, adverse health outcomes, increased mortality rates, limited physician engagement, and among one of the social determinants related to cancer disparities. Researchers suggest that the relationship between health outcomes and HL remains important in making an informed shared decision to effectively communicate with a healthcare provider (Holden et al., 2021). Actively participating in healthcare decisions involves ample HL (Shen et al., 2019). While many definitions of HL exist, evidence suggests the evolution of the concept is due to HL demands within health care or the media and the need to define processes and outcomes of measurement and application (Muhanga & Malungo, 2017). Breast cancer patients are expected to have detailed knowledge concerning their diagnosis and management and can make many healthcare decisions (Shen et al., 2019). Currently, the definition of HL is unclear. A valid and reliable measurement is needed to support strategies to improve HL, which is vital among breast cancer survivors.

A systematic literature review by Muhanga and Malungo (2017) yielded two core construct definitions. The first core definition of HL clearly defines one being able to acquire, manage, and comprehend necessary health information to make proper health choices. The authors further expanded upon the definition but also noted thinking and societal competencies for individuals to be motivated and then access and recognize health information to promote and maintain proper health. The authors found that the concept of HL has now evolved into a simple depiction of how one can achieve health-related tasks and cognitively process and comprehend health information towards making decisions.

This study uses the definition adopted by the National Academy of Medicine, formerly the Institute of Medicine (IOM, 2004), which states that “HL is the degree to which individuals can obtain, process, and understand the basic health information and services they need to make informed and appropriate health decisions” (Muhanga & Malungo, 2017; p.109).

In the United States, the IOM report records developed measurement tools for health literacy and screening resources for clinicians, obtained from the Rapid Estimate of Adult Literacy in Medicine (REALM) or the Test of Functional Health Literacy in Adults (TOFHLA). The report also describes HL associated with health systems and outcomes, emphasizing efficient management of chronic diseases, medication adherence, and health and screening programs (Nutbeam, 2000).

It has been estimated that HL costs between $106–$238 billion annually and accounts for 7-17% of individual healthcare expenditures. Healthcare practices now prioritize measuring HL to evaluate patients' abilities to make medical decisions, develop patient-focused interventions, and increase patient equality within the healthcare setting to obtain assistance (Housten et al., 2018; Muhanga & Malungo, 2017). Schillinger (2020) reported that in the United States, nearly one-third to one-half of the populace has LHL, affecting vulnerable populations such as those disabled, elderly, and those with limited education across all sociodemographic groups by the IOM. HL concepts have gained a tremendous amount of attention, and there is a need to understand the benefits to the individual and better understand what needs to be improved within the HL society (Liu et al., 2020). Due to the overwhelming occurrences of limited or decreased HL and the social-economic influence, addressing HL is a public health priority.

Health Literacy in Breast Cancer Survivors

Findings have shown that patients face many challenges once diagnosed with cancer, and the need to understand their diagnosis and treatment options regarding their care is essential (Holden et al., 2021; Mora-Pinzon et al., 2019). For example, research has found that those with lower HL experience challenges processing information and lower QoL than those with increased HL who can manage their health (Holden et al., 2021). In fact, a systematic review by Holden et al. in the United States found decreased HL among those with breast, head, and neck cancers with increased fear of recurrence and progression. However, they noted that the ability to process information was found more commonly among those with lower HL, leading to the risk of breast cancer recurrence amongst those newly diagnosed with cancer. Further, Holden et al. noted barriers to HL, such as higher HL, increased patients' ability to recall information, and increased shared decision-making regarding breast cancer recurrence risk testing.

On the other hand, Shen et al. (2019) suggested that shared decision-making includes making a collaborative decision between a patient and clinician based on a patient's preferences and choices. To this end, the authors asserted that HL could influence one's ability to engage and make a shared decision among cancer patients compared to those with higher HL (Shen et al.,2019). The results showed that although HL can improve decision-making processes, it may ultimately lead to better cancer care.

In contrast, Mora-Pinzon et al. (2019) likewise found detailed situations in which perceived care coordination is deficient regarding HL among breast cancer patients with levels of LHL. By way of a cross-sectional study, the authors analyzed the associations between HL and the insights of care management reported amongst breast cancer patients. The authors noted that HL levels among patients range from low (24%) to medium (34%) and high (42%). The results also showed that among the LHL group, LHL and no coordination of care scores (mean 76.7, 95% CI 72.7–80.8) were lower (17.1%) compared to women with LHL and care coordination (*N* = 187, mean 89.8, 95% CI 88.3–91.2). The authors found that patients had higher perceived care coordination scores (6.9% and 6.2%, individually) among the medium or high-level HL groups. The results showed that although individuals with LHL have challenges understanding, obtaining, and processing health information, leading to underutilization of preventative health services and increased usage of emergency services, hospitalization mortality decreased physical and mental health. HL may also impact racial disparities among breast cancer patients and health outcomes post-diagnosis (Mora-Pinzon et al., 2019).

Schillinger (2020) further examined the limitations of HL and components that impact racial/ethnic health differences. Schillinger found that racial/ethnic inequalities in Black/White differences affect HL and health outcomes; however, a small number of researchers have evaluated other racial or ethnic variations. More research may be needed to address these shortcomings as there is insufficient information using a population-based sample.

In contrast, Fleary and Ettienne (2019) found disparities in HL by quantifying differences in HL based on self-reported sociodemographic characteristics, including household income, race/ethnicity, and education. The authors noted significant variations among groups for all attributes except sex. When measuring health inequalities ratios, the results indicated, using the Extended Gastwirth Index, the need to meliorate HL among participants with income-specific differences. Income (13%) and education (16%) were the highest contributors to overall disparities in HL. The authors found that participants who earned between $50,000 and $74,999 had the greatest income-specific disparity ratio (0.1295, or 13%). Individuals who obtained a high school diploma had a higher education-specific disparity ratio (0.1583 or 16%), indicating that 16% of participants were unable to complete a post-baccalaureate degree and a need to improve HL education-specific inequalities. Similarly, age and race (~6%) collectively contributed to disparities in HL. Race-specific disparities among non-White participants (0.0624 or 6.24%) compared to overall disparities (0.0853 or 8.53%) and a need to improve HL among race/ethnicity. Participants between the ages of 35 and 49 had the most age-specific disparity ratio (0.0621 or 6.21%), suggesting a 6.21% need to address HL age-specific disparities (Fleary & Ettienne, 2019).

Fleary and Ettienne (2019) found the study's limitations included The Extended Gastwirth Index, which cannot account for multiple disparity risk groups when assessing group disparities. As a result, researchers suggested that examining disparities among racial groups with a populous sample may assess all aspects of HL, as a small sample size was used among minority groups in this study, which may lead to misinterpretation of results surrounding HL (Fleary & Ettienne, 2019). This was important to my study as researchers have investigated this issue. Further research may be essential to address these limitations and validate the research findings using a population-based HL tool to better understand HL and race/ethnicity in today’s context of health disparities.

Fleary and Ettienne (2019) and Schillinger (2020) studies provide insight into the importance of HL and health disparities. Fleary and Ettienne found that further examination of health disparities across race/ethnicity (of all major ethnic subgroups) is needed to improve HL and reduce health disparities. Researchers indicate that racial and ethnic differences remain unexplored. Women with breast cancer and associated risk factors, along with social and racial disparities, still exist (Fleary and Ettienne, 2019; Schillinger, 2020).

A large amount of research has examined the African American group, but limited research has been conducted to explore other ethnic groups (Yedjou et al., 2019). Although research has previously measured the association between HL and race/ethnicity, most studies have focused on Black/White disparities in health outcomes. Limited research studies are addressing HL among other race/ethnic groups.

Measurements of Health Literacy

Based on recent literature, the most used measures to investigate HL and its relationship with health outcomes include the TOFHLA, which focuses on reading comprehension, and the REALM, which examines one’s reading ability (Muhanga & Malungo, 2017). According to Muhanga and Malungo (2017) and Nutbeam (2000), when comparing TOFHLA and REALM to other HL measures, such as the Health Activities Literacy Scale (HALS), TOFHLA uses numeracy items compared to REALM, which offers a version that is shortened for convenience. HALS assesses activities surrounding traditional health settings, including hospitals, clinics, at home, or one’s place of work. HALS is a comprehension test that examines health competencies across the five domains “health promotion, health protection, disease prevention, health care, and maintenance, and systems navigation” (Rudd,2007) and takes approximately 1 hour to administer with 191 questions (Muhanga & Malungo, 2017). If this HL measure is more commonly used, an abbreviated version will need to be asked, as there are too many questions that may be cumbersome to use in most research. Therefore, the need persists to identify an HL instrument that could be administered economically in conjunction with a population-based public health survey. For this study, the BRFSS/HL instrument was used and developed by the Centers for Disease Control and Prevention (CDC; Rubin, 2016) and the Office of the Associate Director for Communication to measure population HL compiled from a variation of sources, including the following:

- California Health Interview Survey (NHIS) 2007-2009
- Commonwealth Fund Health Care Quality Survey 2006
- Consumer Assessment of Healthcare Providers and Systems (CAHPS)
- Health Information National Trends Survey (HINTS)
- National Assessment of Adult Literacy (NAAL)
- Program for the International Assessment of Adult Competencies (PIAAC)
- State BRFSS pilot studies (e.g., Kansas, Nebraska, Georgia, Hawaii)
- Veterans’ Health Administration (VHA) electronic health records

A population-centered HL screening instrument adapted from the BRFSS/HL instrument includes three survey items to strengthen HL as a contributing factor to increased public health and increased LHL risk (Rubin, 2016). Coughlin et al. (2020) conducted a secondary analysis using the BRFSS HL instrument to examine the prevalence of HL among cancer survivors. Three HL questions were examined: (a) "How difficult is it for you to get advice or information about health or medical topics if you need it?"; (b) "How difficult is it for you to understand information that doctors, nurses, and other health professionals tell you?" and (c) "You can find written information about health on the Internet, in newspapers and magazines, and brochures in the doctor's office and clinic." Multiple logistic regression was used to estimate the adjusted odds of LHL across demographic groups, including age, race, sex, socioeconomic groups, income, employment status, marital status, and self-reported health status and health insurance among cancer survivors. The adjusted odds of participants having LHL compared to White participants were Black (1.4) and Hispanic (2.5). Those with less than a high school had an adjusted odds of 3.7 times higher having LHL than participants with a college degree. Those who indicated poor health status had an adjusted odds of LHL of 5–9 times compared to participants with good health status (Coughlin et al., 2022).

Participants who did not obtain a high school diploma (27.5%) reported a greater occurrence ($p<.001$) of LHL in comparison to participants who obtained a college degree. Similarly, LHL prevalence was reported to be significantly higher ($p<.001$) among Black and Hispanic cancer survivors than among White participants and those unemployed and without insurance coverage. In contrast, participants with higher household incomes were associated with a lower prevalence of LHL. This study showed that inadequate HL can negatively impact HRQoL in cancer survivors' ability to self-manage their disease (Coughlin et al., 2022).

Approximately one-third (36%) of adults demonstrated HL difficulties, indicating that nearly 80 million adults in the United States whose HL level was either basic or below the basic level of HL (Housten et al., 2018; Muhanga & Malungo, 2017). Results suggest that individuals with lower HL seek fewer preventative services, such as cancer screening, and are more prone to partake in behaviors leading to decreased health outcomes and increased hospitalizations. Due to limited HL, the social and economic implications on the population are a top public health priority. Healthy People 2020 set forth objectives using the National Action Plan to Improve Health Literacy, which calls for increasing research development practices to evaluate interventions to improve HL. Therefore, there is a public health need to incorporate HLS, including HL measures, when conducting population research (Bann et al., 2012).

Quality of Life

QoL has been studied widely among cancer patients and is described as a multifaceted construct that has evolved and includes various physical, operational, emotional, spiritual, economic, and social domains. Although not many studies have been shown to examine QoL among breast cancer patients, racial and cultural differences in QoL have not been adequately explored (Levine et al., 2017). Shen et al. (2020) suggested that QoL among breast cancer patients is crucial in making medical choices, managing their condition and treatments, evaluating outcomes, and developing interventions. Increasing QoL has been linked to sustained survival among cancer patients. In addition, mediating factors, including marital status, level of education, social support, income, and self-efficacy, have also been interconnected with QoL among breast cancer survivors.

Health-Related Quality of Life and Breast Cancer Survivors

In the United States, research has shown that the breast cancer population of women continues to climb, with well over 2.8 million breast cancer survivors (Siegel et al., 2017). Although survival rates continue to improve, survivors continue to face various physical, psychological, and social impacts of treatment that affect overall health and QoL (Culbertson et al., 2020; Keesing et al., 2019). Study findings (e.g., Culbertson et al., 2020; Keesing et al., 2019) have indicated that breast cancer survivors' physical, psychological, and emotional needs can play a role in survivorship. Keesing et al. (2019) explored the needs of women and one's partners and health services during survivorship using a mixed methods approach who lived in Perth, Western Australia. The researchers aimed to explore: (a) the physical, psychological, and emotive needs of breast cancer survivors and their partners; (b) types of social support from the viewpoints of healthcare associates; and (c) evaluate existing support services and achievement between the woman and partners. The researchers analyzed interviews conducted among breast cancer survivors ages 35 to 70 and their partners between June and December 2014. Women and partners of breast cancer survivors also completed questionnaires to evaluate providers' services in breast cancer survivorship support and support services such as psychological, emotional, and relationships between women and their partners. The authors found a significant correlation between physical, psychological, and emotional needs and the relationship between women and their partners focusing on breast cancer treatment and survivorship. Partners of breast cancer survivors felt detached as well as unknowing how to support their spouses and were unable to access support for themselves. Questionnaires indicated that while support services are available, there are unmet needs to address women and partners as health providers. The results indicated several barriers to accessing available support services and the need to increase awareness of support services, improve efforts to increase care coordination and prepare for survivorship among breast cancer survivors (Keesing et al., 2019).

Researchers have also explored psychosocial factors and QoL. Culbertson et al. (2020) systematically analyzed the relationship between psychosocial contributing factors and QoL in breast cancer survivors using the Medical Outcomes Survey (MOS) Social Support Survey. Psychosocial assessments among breast cancer survivors have been used to examine areas such as depression and/or social support, focusing on the QoL measured by FACT-B and EORTC QLQ-C30 questionnaires (Culbertson et al., 2020). Researchers found an overall reliability in the relationships between various psychosocial variables and QoL. Methods used for this study provide a transparent illustration of the influences of one's psychosocial elements of social support and depression on QoL in breast cancer survivors. The authors found that decreased social support leads to decreased OoL, whereas increased levels of QoL are higher among those with social support. The results indicate that the absence of social support was related to low QoL in breast cancer survivors. In contrast, the study findings showed that as depression increases, QoL decreases, and as QoL increases, depression decreases. Understanding psychosocial factors related to QoL and breast cancer survivors can enable targeted interventions to improve QoL in breast cancer survivorship (Culbertson et al., 2020).

Social Support

Social support is defined as the presence of loved ones or people who show value or respect in one's life through either formal (e.g., healthcare practitioners) or informal network channels (e.g., friends and families) (Shen et al., 2020). Social support amongst breast cancer survivors has been significantly associated with the well-being of breast cancer survivors (Hurtado-de-Mendoza et al., 2021; Lee & Park, 2020; Shen et al., 2020). Shen et al. (2020) examined QoL and the role of social support, hope, and self-efficacy in a cross-sectional study with 121 participants with triple-negative breast cancer in Tianjin, China, between March 2019 and June 2019. Results from multiple linear regression showed a positive association ($p< 0.001$) in social support, hope, and higher self-efficacy scores. The results further indicated that 56.2% of respondents showed a positive association in income, hope, cancer stage, social support, self-efficacy, and QoL ($p < 0.001$). Shen et al. noted that the outcomes suggest that with greater self-efficacy and social support, QoL increases among TNBC survivors. Although the study results demonstrated a positive correlation between multiple variables and QoL, further examination is needed to determine how each of these variables relates to different concepts, such as social support, in future research.

Lee and Park (2020) further explored relationships among illnesses, social support, and HRQoL in breast cancer survivors. The authors examined the mediation role of social support in an association between illness (i.e., the presence of disease) and QoL in female cancer survivors. Multiple regression analysis showed the influences of social support and QoL, suggesting there is uncertainty if the illness can lead to reduced social support and QoL and whether increased social support leads to a better QoL among female cancer survivors. The authors indicated that social support has many avenues that influence illness as a predictive value and affect the QoL as an outcome variable. Social support is a multidimensional concept that can mutually benefit social, psychological, and social support via networks and plays a vital role in providing social relationships, including family, friends, and persons important to one's well-being. There is a necessity for social support; however, there is uncertainty about the roles social support plays in managing and maintaining the QoL, prognosis, and survival once treatment ends. A broad but growing body of research has examined how social support can mediate the association between QoL and illness among female cancer survivors, but the relationship remains unclear.

Race and Ethnicity

Several studies have examined racial-ethnic differences in the QoL over time among breast cancer. Miller et al. (2017) examined breast cancer survival over five years among Black and White women in the United States who participated in the CONCORD-2 study. Data was taken from 37 statewide registries. Participants were grouped into two calendar periods (2001–2003 and 2004–2009) by year of diagnosis. The study showed that 5-year breast cancer survival rates were remarkably above average (88.2%) between 2001 and 2009. In 2001–2003 and 2004–2009, survival among White females was higher (89.1%, 89.6%) than among Black women (76.9%, 78.4%). This study provides precise, helpful data acquired from central cancer registries in the United States among Black and White breast cancer patients and the incidence and survival but lacks examination of other races/ethnicities (Miller et al., 2017).

Hurtado-de-Mendoza et al. (2021) evaluated African American and White breast cancer survivors and the association between HL, QoL, and social support. A large sample of women ≥21 years or older (*N* = 545) self-identified as either Black/African or White race completed questionnaires to evaluate six types of well-being using the Functional Assessment of Cancer Therapy-General (FACT-G) and MOS measures. The researcher examined two types of social support using a 5-point Likert scale, evaluated from none of the time to all the time. Hurtado-de-Mendoza et al. concluded that the linear regression showed that most respondents (71%) White and (29%) African American showed a statistically significant association between race and social support ($p > 0.05$). Additionally, there were positive association between emotional/informational social support, emotional ($\beta = .08$, $p = 0.005$), social ($\beta = 0.36$, $p < 0.001$) and functional well-being ($\beta = .22$, $p < .001$), breast cancer apprehensions ($\beta = .16$, $p = 0.002$), and HRQoL ($\beta = .83$, $p < .001$ (Hurtado-de-Mendoza et al., 2021). The Functional Assessment of Cancer Therapy (FACT-B) scale showed no statistical significance in differences but reported lower overall HRQoL when comparing African American women (total FACT-B = 110.8) to White women (total FACT-B = 117.2) for overall HRQoL across any HRQoL realms when controlling for social and demographic factors**,** health-related, and psychosocial factors associated with HRQoL (Hurtado-de-Mendoza et al., 2021). Pearson correlations were used to assess bivariate relationships between social support and well-being. The results showed no variations in emotional/informational support, physical support, or emotional well-being between African American and White women. However, African Americans showed lower scores on physical (t (516) = 2.44, $p = 0.02$)

and functional (t (512) = 5.05, $p < 0.001$) well-being compared to White women. Given the connection between HRQoL and social support, race may also affect HRQOL. The authors determined that interventions designed to enhance HRQoL amongst all breast cancer survivors may help reduce related race/ethnicity differences in HRQoL (Hurtado-de-Mendoza et al., 2021).

Levine et al. (2017) noted two areas that have not been effectively studied, QoL over time, including (a) spiritual and (b) racial/cultural differences among breast cancer survivors. The researchers examined QoL and the influences of ethnicity and spirituality on breast cancer survivors progressively using a multiethnic sample. The authors concluded that social support over time showed that social interaction was positively correlated with social/family well-being ($F = 34.18$, $p < .001$). QoL did not statistically vary by race/ethnicity except for faith as well as assurance. Similarly, age did not differ by race/ethnicity. Racial/ethnic variations in QoL have not been adequately explored in cancer patients, especially racial differences and disparities in breast cancer survival in the United States (Hurtado-de-Mendoza et al., 2017; Levine et al., 2017; Miller et al., 2017).

Doctor-Patient Relationships

Doctor-patient relationships and shared decision-making can impact QoL among breast cancer survivors. Kugbey et al. (2019b) conducted a cross-sectional survey to examine the direct and indirect interactions of shared decision-making on QoL through doctor-patient relationships among 205 breast cancer survivors in Ghana. The authors suggested that effective communication is a vital part of the doctor-patient relationship, as numerous studies have found communication correlated with positive health findings among cancer patients. The results suggest a statistically noteworthy indirect outcome of shared decision-making on patients' overall QoL and a significant positive mediating result on the doctor-patient association among the patients (*b*=7.633, *t*=6.762, *p*<.05) when controlling for variables including education, duration, and treatment. However, there was no direct influence on shared decision-making on QoL (*b*=2.720, *t*=0.51, *p*=.611). The inferred impacts of shared decision-making were assessed on different QoL components. There was a significant indirect impact on emotional well-being (*b* =1.198) and breast cancer added concerns (*b*=1.456). However, through doctor-patient relationship and shared decision-making (*b* =1.198), there was no evidence of direct effects among patients of either dimension (Kugbey et al., 2019b). Overall, the mediation analysis showed a statistically significant association with doctor-patient relationships, suggesting that shared decision-making and doctor-patient relationships are associated with improved QoL.

Measurements of Quality of Life

Patient-reported outcomes (PROs) have been described as measuring one's health status conveyed clearly by the patient. Patient-reported outcomes show the influence of disease and treatment from a patient's perspective. One type of PRO is HRQoL, which examines a patient's emotional, physical, and social response to an illness or treatment. PROs supply information to make treatment decisions or manage medication side effects through health monitoring (Salas et al., 2022).

Pergolotti et al. (2017) studied data gathered through a hospital-based observational cohort registry named the Health Registry/Cancer Survivorship Cohort. The registry comprises of data self-reported by patients, biologic samples, and tumor tissue samples for adults with cancer. The registry of contributors was selected and enrolled through outpatient clinics between 2010–2014 located at the North Carolina Cancer Hospital. Participants aged 65 and older were included in the registry for this study. Three standardized measures at baseline were used to measure HRQoL demographics and comorbidities to address questions associated with their current condition limiting regular activities, type of cancer, date of diagnosis, and activities/or functions. The subsequent HRQoL measures included the FACT-G and the National Institutes of Health's (NIH) Patient-Reported Outcomes Measurement Information System® (PROMIS®). Global Health short form comprises of both physical and mental health subscales. The PROMIS® Global Health short-form version 1 includes a 10-item measurement that assesses global health beliefs through physical capabilities, fatigue, pain, emotional anguish, and societal health (Pergolotti et al., 2017). HRQoL was measured using the FACT-G. The FACT-G is an instrument for cancer patients included in the Function Assessment of Chronic Illness Therapy measurement system. The FACT-G is recommended in oncology research as the most dependable and highly used HRQoL measure. The FACT-G contains 21 questions that focus on physical, societal/family, emotive, and functional well-being throughout the past week using an ordinal response scale between (0) being not at all to (4) very much. The total score for the FACT-G ranges from 0 to 108, with greater scores revealing improved HRQoL (Pergolotti et al., 2017). When measuring the significance between groups of cancer survivors, the results show that the significant difference was only cancer type. Additionally, a significant association between comorbidities and lower HRQoL was consistent with the literature examined by Wei et al. (2021). Among Black participants, more than one comorbidity ($p < .05$) and a decreased level of activity and function were independently correlated with poor HRQoL ($p < .001$).

Health Literacy and Quality of Life of Breast Cancer Survivors

Adverse health outcomes have been associated with low HL in older adults, leading to poor use of healthcare facilities and misinterpretation of health information (Buffart et al., 2015; Lee, 2012; Pishkar et al., 2015). Researchers suggest that higher scores of QoL have shown a significant correlation with increased levels of HL, health behavior, and self-efficacy promotion among older adults (Buffart et al., 2015; Lee, 2012; Pishkar et al., 2015). Lee & Oh (2020) reported findings consistent with the results of studies by Buffart et al. (2015), Lee (2012), and Pishkar et al. (2015). The study showed that when evaluating the association between the two constructs and self-efficacy, social support, and health promotion, these factors of QoL are influenced by social support and are considered essential factors with significant effects among older adults. A positive relationship between HL and HRQoL showed a strong effect on social support, an increase in HRQoL in older adults, and self-efficacy as a predictor of HRQoL, consistent with previous research conducted in older adults. This suggests that factors of QoL supply social support that can include many influential persons such as family, health care providers, and friends. All of which may encourage interventional programs to improve QoL (Lee & Oh, 2020).

Although Lee and Oh (2020) found a direct relationship between individuals' HLS and health outcomes, several considerations may mediate the relationship, including health status, motivation, and self-efficacy, exacerbated by environmental influences such as social support. Baik et al. (2020) differed from those suggested by Lee & Oh (2020) and suggested that without understanding these factors may be difficult to change without understanding the determinants of HRQoL, such as self-efficacy and one's ability to perform a specific behavior to generate an anticipated result (Baik et al., 2020). Likewise, Bandura (2004) found that increasing knowledge surrounding health risks while comparing the benefits can lead to one's ability to change and is vital to personal efficacy but also noted that change is based on one's desire to believe they can change, producing the desired effect when facing challenges without incentive differed from those suggested by Baik et al. (2020. This suggests that further examination is essential to identify factors connected with HL and QoL among females with breast cancer.

While Lee & Oh (2020) observed a direct correlation between HL and HRQoL and a strong influence on social support, Kugbey et al. (2019a) recommended a different approach to assess the direct and indirect effects of HL and QoL among females living with breast cancer because of depression and anxiety. Kugbey et al. conducted a cross-sectional study to examine the direct and indirect causes of HL and the approach to health information on the QoL among women living with breast cancer due to depression and anxiety. Mediation analysis showed HL had an indirect impact on the QoL between both depression and anxiety after controlling for access to information, increased depression (*b* = -3.581, *t* =-9.929, $p < .001$) and levels of anxiety (*b* =-1.155, *t* =-3.887, $p < .001$) with an anticipated decreased QoL. The findings suggest that health information access and HL indirectly affect the QoL through depression and anxiety. In contrast, access to health information had no direct effect on the QoL.

Halverson et al. (2015) reported outcomes consistent with the findings of Lee & Oh (2020) but also noted that the effects of HL on QoL differed from those suggested by Kugbey et al. (2019a). Halverson et al. showed a secondary analysis to analyze the association between HL and HRQoL among a populous sample of cancer diagnosed with lung, prostate, breast, and colorectal cancer. The population-based sample included information on cancer support, patient satisfaction, comorbidities, and HRQoL among Wisconsin cancer patients. The results suggest that HL was positively correlated and significantly ($p <.0001$) associated with each HRQoL variable and each subscale of physical well-being (*M*=0.3 (SE=0.04), emotional well-being (*M*=0.31 (SE=0.03), and functional well-being (*M*=0.43 (SE=0.05). This shows that cancer survivors' HL level was positively correlated with overall QoL, irrespective of whether HL was considered a continuous or categorical variable (Halverson et al.,2015). Wei et al. (2021) expanded on the results of Halverson et al. by examining a cross-sectional study using convenience sampling among breast cancer survivors in North Taiwan. Using the SF-12 questionnaire, QoL was measured to investigate HL and the predictors of QoL. For the survey, the physical part summary (PCS) and mental component summary (MCS) where scores can be attained. Improved HL was positively associated with MCS-related QoL (Wei et al., 2021). Likewise, Wei et al. (2021) found the relationship between HL and HRQoL consistent with Halverson et al. findings. The results suggest that age and comorbidities showed a negative association with PCS-related QoL than HL (r= 0.223, *p*= 0.039) and a positive association with MCS-related QoL. The results further show that HL was significantly associated with QoL in breast cancer survivors overall. Despite these findings, it is currently unclear whether the association between HL and HRQoL is also present among a nationwide sample of breast cancer survivors in the United States and if the association differs by race/ethnicity.

Summary and Conclusions

HL influences health effects such as physical and emotional functioning, utilization of health support, and care management among patients. Several researchers showed inconsistent findings about the direct and indirect impacts on HL and QoL by race/ethnicity in the United States (Halverson et al., 2015; Wei et al., 2021; Xia et al., 2019). While researchers have shown a relationship between HL and HRQoL among breast cancer survivors in other countries, it is unknown whether the association between HL and HRQoL among breast cancer survivors differs by race/ethnicity. HRQoL is associated with cancer outcomes. Even though there is a growing body of literature examining self-efficacy as well as social support amongst QoL and HL among breast cancer survivors (Hurtado-de-Mendoza et al., 2021; Lee & Park, 2020; Shen et al., 2020), the association between QoL and social support among women with breast cancer is still unclear (Baik et al., 2020). Few research studies have examined HL and its influences on cancer patients’ HRQoL. The results of these studies have been inconclusive; therefore, more investigation is warranted.

To fill that gap in the literature, I examined the association between HL and HRQoL and the mediating impacts of social support among a nationwide sample of breast cancer survivors in the United States and if the association differs in race/ethnicity. Although minimal or no research was conducted using the HLS framework, Squiers et al. (2012) supplied a theoretical base where I explored the concepts of HLS on health-related outcomes to show a theoretical linkage between HL and HRQoL and race/ethnicity and provided a causal pathway that can be empirically evaluated. In Chapter 3, I will discuss the research design, instrumentation, and ethical considerations for participants of this study.

Chapter 3: Research Method

Introduction

The objective of this quantitative study was to assess whether the association between HL and HRQoL amongst breast cancer survivors is moderated by race/ethnicity and if social support mediates the association between HL and HRQoL. Additionally, I explored the association between HL and HRQoL among breast cancer survivors. Although researchers have investigated this issue, the topic has not been explored by examining race/ethnicity as a moderator of the association between HL and HRQoL among a nationwide sample of breast cancer survivors in the United States and if the association is mediated by social support. This chapter provides a summary of the studies research design and rationale, methodology, data analysis plan, ethical considerations, and threats to validity.

Research Design and Rationale

For this study, I used a quantitative method to address the research questions and explore the apparent hypothesized connection using the following linear regression analyses: HL (IV) and HRQoL (DV) among breast cancer survivors. A mediation analysis (Warner, 2013) was conducted to assess social support's direct and indirect influences on HL and HRQoL among breast cancer survivors. Lastly, a moderation analysis (Warner, 2013) was conducted to test if race/ethnicity moderates the association between HL and HRQoL when controlling for education, healthcare access, marital status, income, and age.

A cross-sectional research design was chosen to determine the association between variables by exploring a populace sample at a set point in time rather than longitudinally. I accessed the publicly available de-identified data from BRFSS collected between January and June 2016 from adults ≥ 18 years old who completed health-associated phone surveys in the United States (CDC, 2016). The BRFSS was a rational choice for this study as the sample includes breast cancer survivors and data related to my variables of interest: HL, HRQoL, social support, and race/ethnicity.

Research Questions and Hypotheses

The research questions and hypotheses follow:

RQ1: What is the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age?

> $H_0$1: There is no statistically significant association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age.
>
> H_A1: There is a statistically significant association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age.

RQ2: To what extent does race/ethnicity moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age?

$H_0$2: Race/ethnicity does not moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age.

H_A2: Race/ethnicity does moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

RQ3: Does social support mediate the relationship between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age?

$H_0$3: Social support does not mediate the relationship between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

H_A3: Social support does mediate the relationship between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

Methodology

Population

The populace for this study was adult women who are breast cancer survivors who reside in the United States. The sample was obtained from the BRFSS in the United States (CDC, 2016)**.** The 2016 BRFSS is a national phone survey of United States adults designed to collect data related to “health-related risk behaviors, chronic health conditions, and use of preventive services” among adult residents living in the United

States (CDC, 2016). The populace of interest for this study is respondents to the BRFSS survey, which was used to obtain the study sample.

Sampling and Sampling Procedures

The BRFSS was designed to obtain information on a population of interest of adults residing in different states in the United States. The sampling strategy for the 2016 BRFSS uses a telephone sampling frame and disproportionate stratified sample (DSS) to attain a population-based likelihood for their landline samples from the 50 states and US territories (CDC, 2018). Stratification and data weighting were completed for this study in compliance with a cooperative agreement with states that conduct the BRFSS, as recommended by the CDC (Nelson, 2021). This procedure allowed for the adjustment of survey measures in analysis to explain geographic and phone number stratification and weighting (Luo et al., 2020). The adjustment of sampling weights reflects the probability of selecting participants and adjusts for non-response bias and non-coverage errors (CDC, 2018). The BRFSS contains randomly selected phone numbers used to identify individuals to contact for the telephone survey. Therefore, participating states must meet the telephone sampling design and the ability to justify sample records in the homes of states where the BRFSS is used (CDC, 2016).

Sample Size Calculation. *G*Power* 3.1.9.7 was used to substantiate the sample size (Warner, 2013). A Pearson correlation coefficient and linear regression were used to evaluate the significance. The a priori sample size calculation was computed using a 2-tailed Correlation Point Biserial model with an effect size of 0.30, a power level (1β) of 95%, and a p-value of <.05. The results indicated that a minimum sample of 134 participants was needed to assess the research questions for this study. Additional outputs showed Noncentrality parameters of 3.6404323, Critical t of 1.9780988, and actual power of 0.9509217.

Spearman’s correlation coefficient will be calculated amongst the demographic variables, the dependent variable of HRQoL, and the independent variable of HL by race and ethnicity. Demographic variables found to be significantly related to HRQoL and HL ($p < .05$) were included as covariates in the statistical analyses for hypothesis examination (Warner, 2013).

G Power* was used to calculate the sample size for linear regression using the F test setting for multiple linear regression. A fixed model, R^2 deviation from zero, was selected using a power level (1β) of 95% with a significance level of p-value <.05. An effect size of 0.15 and 7 as the predictors indicated a required minimum sample size of 153. Additional outputs showed that Noncentrality parameters were critical F of 2.073280, numerator degrees of freedom as 7, and a denominator degree of freedom as 145. The actual power was calculated as 0.9503254. Based on the *G*Power* calculations, the sample size required for this study is 153, as this is the larger sample size of the two outputs.

Procedures for Recruitment, Participation, and Data Collection

The core questions of the BRFSS were administered to participants from all fifty states; however, optional modules were administered to participants from selected states. HRQoL questions were included in the core component, and HL, cancer survivorship, and social support questions were included in optional modules. HRQoL questions were administered to all participants from all 50 states and territories (CDC, 2016). Participants in 14 states and territories (Alabama, Alaska, Georgia, Illinois, Iowa, Louisiana, Maryland, Mississippi, Minnesota, North Carolina, Nebraska, Pennsylvania, Virginia, and Washington, DC) was provided the HL module. The cancer survivorship module will be used to determine cancer history and was administered in eight states (Idaho, Indiana, Louisiana, Michigan, Missouri, South Dakota, Virgin Islands, and Wisconsin). Those who indicated they were cancer survivors were asked, "With your most recent diagnosis of cancer, what type of cancer was it?" Respondents who answered (1) Breast cancer were included in the current study (CDC, 2016). All other cancer types were excluded. The emotional and social support modules were administered in four states (Louisiana, Minnesota, Rhode Island, and Tennessee).

Although the HL, cancer survivorship, and emotional support modules are optional, these modules are to be used without modification per CDC standards. Eight states (Alabama, Alaska, Illinois, Iowa, Louisiana, Mississippi, Nebraska, and Virginia), the District of Columbia, and Puerto Rico contributed to the HL and emotional support modules, with only Louisiana participating in all three optional modules (CDC, 2016). Therefore, for the current study, only female breast cancer survivors aged ≥ 18 years from the state of Louisiana were included as participants, and they are the only respondents who completed the core survey and participated in all three optional modules.

I accessed the publicly available preexisting/secondary data from BRFSS (CDC, 2016). The data for this study has been de-identified. Once IRB approval was granted, I downloaded the publicly available de-identified data from the CDC website.

Instrumentation and Operationalization of Constructs

Instrumentation

The BRFSS/HL was the best choice for this study, as it is devised to measure health literacy using a population-based public health survey. The BRFSS/HL instrument was developed adopting a previous instrument from the V.A. to include a three-item HL screening tool for use in a populace-created public health survey based on the following criteria: (1) HL research; (2) defined as a state and populace-created questionnaire related to chronic ailments and health differences; (3) received approximately 80% of funding from states and territories to be an accepted BRFSS module; and (4) relationship to public health interest and events (Rubin, 2016).

Several questions have been derived from various references, including but not limited to the NHIS, CAHPS, and NAAL were included. Using the above criteria, seven candidate questions were chosen for the cognitive testing evaluation of the HL questions. The interviews were administered in English; however, if another language were preferred, interviews/questions would be conducted in another language. Respondents were asked: “Who did you think of when the question asked about health professionals?” Lastly, cognitive analysis evaluated the pros of a number of questions for readability, for example, asking how easy compared to how hard or how difficult. As an end result of the cognitive analysis, the question of “how difficult” was incorporated into all questions, and all seven candidate items seemed to be fairly understood and nonproblematic (Rubin, 2016).

BRFSS/HL Validity and Reliability

This three-question instrument using the optional model was approved for inclusion in the BRFSS**.** The BRFSS/HL instrument was adopted from a clinical health literacy screener for low health literacy used for Veterans Health Administration patients. Researchers considered the three self-report questions well-validated and suitable for large-scale administration that could be administered economically as a conventional public survey of public health (Rubin, 2016). Analysis of responses to the 2016 BRFSS/HL module indicated respondents had no challenges completing the questions, a response rate of 60% with overall internal consistency reliability of a= .733 (Rubin, 2016).

HRQOL Instrument

HRQoL is a frequently used concept created to assess the effects of health status on QoL. HRQoL includes the significance of physical and mental health and population health progress through initiatives such as Healthy People 2020 (HP2020). The CDC created four survey questions to measure HRQoL at both the state and nationwide levels (CDC HRQoL-4). Individual measurement of these four core questions may not encompass a comprehensive depiction of overall HRQoL (Barile et al., 2016); however, these four survey items have shown good retest reliability, validity, and responsiveness using the (BRFSS) in all 50 states since 1993. Prior studies have found a robust association among the CDC HRQoL-4 measures, indicating these questions are appropriate for analysis (Hennessy et al., 1994). Additionally, Toet et al. (2006) found good quality internal consistency in the four items (*a*= 0.77) and more than acceptable consistency (*a*= 0.70) for the three unhealthy day questions. Conversely, Horner-Johnson et al. (2009) found that when removing the question, Cronbach's alpha increases slightly (i.e., 0.001), indicating a concern for consistency but not enough to challenge the internal consistency of using the mentally unhealthy day question in conjunction with other HRQoL questions.

Operationalization of Constructs

HL (Independent Variable)

The CDC created a three-question health literacy scale from seven candidate questions (Rubin, 2016) adopted for the 2016 BRFSS/HL optional module. HL was operationally defined using three HL questions: (a) "How difficult is it for you to get advice or information about health or medical topics if you need it?" (b) In general, "How difficult is it for you to understand written health information?" (c) "How difficult is it for you to understand information that doctors, nurses, and other health professionals tell you?" (CDC, 2016).

For this study, HL was calculated using a five-point Likert scale, with the total scores ranging between zero and twelve. Participant responses included:1=Very easy, 2=Somewhat easy, 3=Somewhat difficult, 4=Very difficult. For getting advice or information, (5)I don't look for health information. For written information, (6) I don't pay attention to written health information, 7= Don't know/Not Sure, 9= Refused (CDC, 2016).

HRQoL (Dependent Variable)

The Healthy Days principal questions (CDC HRQoL– 4) have been widely used as a standard HRQoL measure since 1993 by the BRFSS. Between 2000 and 2012, the CDC HRQoL– 4 questions were administered to those older than 12 years of age in the National Health and Nutrition Examination Survey (NHANES) and further measured in the Medicare Health Outcome Survey (HOS) found within the National Commission for Quality Assurance's (NCQA) Healthcare Effectiveness Data and Information Set (CDC, 2000; Yin et al. 2016).

The CDC uses several questions obtained from the "Healthy Days Measures," as listed below (CDC, 2000).

- "Would you say that in general your health is excellent, very good, good, fair or poor?"
- "Now thinking about your physical health, which includes physical illness and injury, how many days during the past 30 days was your physical health not good?"
- "Now thinking about your mental health, which includes stress, depression, and problems with emotions, how many days during the past 30 days was your mental health not good?"
- "During the past 30 days, approximately how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?"

For my study, I used the four CDC “Healthy Day Measures” (CDC, 2000) that related to general self-reported health, recent periods of physical and mental health, and activity restrictions (CDC, 2000). The first measure included General Health Status, which describes the participant's overall self-related health status based on a Likert scale (1-9) from poor to excellent. An average score was calculated centered around participant's responses to determine participants' overall self-rated health status.

The remaining questions assessed overall healthy and unhealthy days for the past 30 days based on the response to the following three questions: (a) Number of Days Physical Health Not Good, (b) Number of Day Mental Health Not Good, (c) Poor Physical or Mental Health (CDC, 2016). Participants were asked: (1) “Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?” (2) “Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?” (3) “During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?” (CDC, 2016). The responses were captured using the following measurement categories: (1) (1 – 30) =Number of days, (2) 88=None, (3) 77= Don't know/Not sure, (9) 99=Refused. The following responses: (77) Don't know/Not Sure, and (99) refused was treated as missing. (CDC, 2016).

For this study, overall unhealthy days was measured based on the health of respondents who reported “not good” for both physical health (physically unhealthy days) and mental health (mentally unhealthy days). Estimated overall unhealthy days was obtained by way of adding the sum of unhealthy days during the past 30 days. For instance, for one who reports six physically unhealthy days and one mentally unhealthy day, the number 7 is assigned for the amount of unhealthy days. Based on previous research, this method provided an estimate of unhealthy days based on the pattern of survey responses related to specific questions (CDC, 2001). An estimate of overall healthy days was calculated based on the respondents' number of days an individual's physical and mental health was excellent or good health by deducting the number of unhealthy days from 30 days. Summary measures were used as standard practice in public health by social science researchers, policymakers, and physicians to assess overall mental and physical health over time and help identify potential unmet health needs within a population or group (CDC, 2001).

Emotional Support and Social Support (mediator variable): For this study, Social Support was operationally defined by responding to the following question: “How often do you get the social and emotional support you need?”. Emotional Support and Social Support were operationally coded as binary outcomes by combining the responses where 1= “Always,” “2= Usually”, and 3= “Sometimes” into 1 category— having support(yes)—and by combining “4=Rarely” and 5= “Never” into 1 category—not having support (no). The remaining responses, 7= “Don’t know/Not Sure” and 9= “Refused” was treated as missing (CDC, 2016).

Race/Ethnicity (moderating variable). The moderating variable of Race/ethnicity was assessed using a five-level race/ethnicity category measured by a nominal variable and coded as follows: 1=White only, Non-Hispanic, 2= Black only, Non-Hispanic, 3= Other race only, Non-Hispanic, 4=Multiracial, Non-Hispanic, 5= Hispanic, (9) Don't know/Not sure/Refuse) (CDC, 2016). The responses of 9= "Don't know/Not Sure" and "Refused" was treated as missing.

Covariates

Covariates was included in the statistical analysis for assessment for this study. Education level, age, income, marital status, and healthcare access were selected based on identified literature to reduce threats to validity and bias. Studies have concluded that elements such as age, level of education, and income had significant relationships with HL, while persons with higher HL reported increased QoL (Ferguson et al., 2011; Nelson,2021; Tung et al., 2014). Additionally, the authors included socioeconomic variables, including household income, employment status, and marital status, to investigate the inadequacies of HL and the effects of HRQoL among breast cancer survivors (Coughlin et al., 2022).

Covariate: Age. Age was measured via one question reported in years, "What is your age?". Responses 7= "Don't know/Not Sure" and 9= "Refused" was treated as missing (CDC, 2016).

Covariate: **Health Care Access.** Health Care Access was measured via the question, ' Have you delayed getting needed medical care for any of the following reasons in the past 12 months?" 1= You couldn't get through on the telephone, 2= You couldn't get an appointment soon enough, 3= Once you got there, you had to wait too long to see the doctor, 4= The (clinic/doctor's) office wasn't open when you got there,5=You didn't have transportation, 6= Other, 7= Don't know/Not Sure, 8= No, I did not delay getting medical care/did not need medical care, 9= Refused.

Covariate: Education Level. The highest level of education was assessed by one question, "What is your highest level of education?" The responses are coded where 1 = Never attended school or only kindergarten, 2 = Grades 1 through 8 (Elementary), 3 = Grades 9 through 11 (Some high school), 4 = Grade 12 or GED (High school graduate), 5 = College 1 year to 3 years (Some college or technical school), 6 = College 4 years or more (College graduate), 9 = Refused. The response 9= "Refused" was treated as missing (CDC, 2016).

Covariate: Income. Income was measured by one question reported by income level**:** Is your annual household income from all sources? Responses 1=Less than $10,000, 2 =Less than $15,000, 3= Less than $20,000, 4= Less than $25,000, 5= Less than $35,000, 6= Less than $50,000, 7= Less than $75,000, 8= 75,000 or more. Responses 7= "Don't know/Not Sure" and 9= "Refused" was treated as missing (CDC, 2016).

Covariate: Marital Status. Marital status was measured through one question, "Are you: marital status?" The responses are coded where 1 = Married, 2 = Divorced, 3 = Widowed, 4 = Separated, 5 = Never married, 6 = A member of an unmarried couple, and 9 = Refused. The response 9= "Refused" was treated as missing (CDC, 2016).

Data Analysis Plan

The Statistical Package for Social Sciences (SPSS 28.0) was employed for data analysis. Missing data values were excluded. The study sample was described using descriptive statistics, including means and standard deviations. The univariate analysis was conducted to determine the independent associations between the covariates and HRQoL and HL. The regression models included variables discovered to be significantly associated with HL and HRQoL.

To address research question #1, what is the association between HL and HRQoL among breast cancer survivors in the United States when controlling for age, income, marital status, and healthcare access? Multiple regression analysis was used to examine the direct effects of HRQoL and HL among breast cancer survivors (Warner, 2013). To address research question #2, to what extent does race/ethnicity moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for age, income, marital status, and healthcare access? A moderation analysis was conducted to evaluate the interaction effects of the moderating variable, race/ethnicity, on the relationship between the two variables, HL and HRQoL**,** among breast cancer survivors (Warner, 2013).

To address research question #3**,** does social support mediate the relationship between HL and HRQOL among breast cancer survivors in the United States when controlling for education, age, and income? The recommended Baron and Kenny was used as a causal relationship approach to conducting a mediation analysis to assess the direct and indirect effects of social support on HL and HRQoL among breast cancer survivors**.** The Sobel test was used to assess the magnitude of the mediating impacts of social support (Warner, 2013). Table 1 summarizes the relationship between the independent, dependent, mediating, moderating, and covariate variables. The table aligns the research questions to provide information regarding the relationships.

Table 1

Variables of Interest in Racial/Ethnic Differences in the Association Between Health Literacy and Quality of Life Among Breast Cancer Survivors

Variable Type	Variable	Measurement	Data Analysis
Dependent	HRQoL	Continuous	Linear Regression
Independent	HL	Continuous	Linear Regression
Moderator	Race/Ethnicity	Categorical	Moderation Analysis
Mediator	Social Support	Categorical	Mediation Analysis
Covariates	Education	Categorical	Linear Regression
	Health Care Access	Categorical	
	Marital Status	Categorical	
	Income	Categorical	
	Age	Categorical	

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Threats to Validity

Barriers and challenges exist when completing secondary analysis using existing data collected that does not explicitly address a specific research question or specific hypothesis. A significant limitation to analysis exists based on how the data are collected (Cheng & Phillips, 2014). For example, limitations to the BRFSS exist, such as self-reported HL data leading to subject bias and measurement errors (Luo et al., 2020). For instance, since the BRFSS survey is self-reported, results can lead to evoke bias and misclassification due to interviewer or recording errors (Stoney et al., 2022). Respondents to the BRFSS survey who responded “I don’t look for health information” in Question 1 and “I don’t pay attention to written health information” in Question 3 were excluded. This may suggest that respondents may have decreased HL (Luo et al., 2020). Secondly, a 3-item HL survey was given as an optional module, limiting the generalizability of results to additional states and regions beyond those who participated in the optional module (Luo et al., 2020). During the collection process, several individuals are involved, which can lead to misinterpretation of variables or missing essential details within the data set when conducting large-scale surveys supplied by government agencies. Robust documentation is crucial for data validity, and the examination of relevant documents can mitigate problems by the user (Cheng & Phillips, 2014).

Ethical Procedures

All procedures performed in human participants' studies were per the institution's ethical standards and the 1964 Helsinki Declaration. For this study, the BRFSS data set is de-identified and does not involve human subjects for analysis (Kim & Han, 2019). Once

IRB approval has been granted, I will download the publicly available de-identified data from the CDC website. Confidentiality and protection of the rights of participants will be ensured through coding data numerically and the exclusion of information that can identify the participants. All raw and analyzed data will be stored on an external hard drive in a locked cabinet in my office, password-protected and encrypted.

Summary

This quantitative study aimed to examine whether the association of HL and HRQOL among breast cancer survivors was moderated by race/ethnicity and if social support mediates the effects between HL and HRQOL. Additionally, I sought to explore the association between HL and HRQOL among breast cancer survivors. In Chapter 3, I described the research design and rationale, research questions and hypotheses, methodology, sampling and sampling procedures, recruitment, participation, data collection, instrumentation and operationalization of constructs, and data analysis plan. In addition, the ethical reflections, confidentiality, and protection of the rights of participants were addressed. In Chapter 4, I will present the results of the statistical analyses of the study.

Chapter 4: Results

Introduction

In the United States, breast cancer affects women of all racial backgrounds; however, the causes of racial/ethnic differences remain unclear. Approximately 30% of women newly diagnosed with cancer have shown the highest incidence rates of breast cancer compared to other cancers in the United States (Siegel et al., 2019). This growing population of survivors faces numerous physical, psychological, and social effects of treatment that impact overall health, and QoL remains uncertain for women when transitioning to survivorship (Culbertson et al., 2020; Keesing et al., 2019).

Researchers have shown that health behaviors are influenced by HRQoL and was associated with HL amongst cancer survivors in other countries but has not been sufficiently explored in the United States. It is still unclear whether the observed association diverges by race/ethnicity (Halverson et al., 2015; Lee & Park., 2020; Wei et al., 2021; Xia et al., 2019).

A growing body of literature suggests that social support contributes to the role of QoL. However, there is uncertainty when managing and maintaining QoL and HL self-efficacy among breast cancer survivors once treatment ends (Hurtado-de-Mendoza et al., 2021; Lee & Park, 2020; Shen et al., 2020).

In this study, I explored the association between HL and HRQoL among breast cancer survivors by race and ethnicity. I analyzed the mediation of social support between HL HRQoL among breast cancer survivors. Additionally, I assessed whether the association between HL and HRQoL amongst breast cancer survivors is moderated by race/ethnicity. To examine these associations, the following research questions and hypotheses were examined:

RQ1: What is the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age?

$H_0$1: There is no statistically significant association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age.

H_A1: There is a statistically significant association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age.

RQ2: To what extent does race/ethnicity moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age?

$H_0$2: Race/ethnicity does not moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, healthcare access, marital status, income, and age.

H_A2: Race/ethnicity does moderate the association between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

RQ3: Does social support mediate the relationship between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age?

> $H_0$3: Social support does not mediate the relationship between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.
>
> H_A3: Social support does mediate the relationship between HL and HRQoL among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

In this chapter, I will provide information about the data collection process and present the results acquired from statistical analysis based on the presented research questions. I used Pearson's correlation coefficient and linear regression to examine the variables and determine if a relationship occurs between the independent variable, HL, and the dependent variable, HRQoL, mediating and moderating variable, social support, and the confounding variables.

Data Collection

I used the 2016 BRFSS for data analysis with a total sample of 117 participants in the sample after data cleaning was completed. Data cleaning included removing participants who were males and those who "refused" or did not provide a response. The final sample included females with breast aged $\geq$ 18 years from Louisiana.

Upon data analysis, age was changed to a nominal categorical measure for the measurement levels. Stratification of the variables was as follows: six age categories where responses: 1 age 18 to 24 years, 2= Age 25 to 34 years, 3= Age 35 to 44 years, 4= Age 45 to 54 years, 5= Age 55 to 64 years, and 6 =Age 65 or older.

Emotional Support and Social Support were recorded by combining the responses where 1= “Always,” “2= Usually”, and 3= “Sometimes” in the category— (0) having support (yes)—and by combining “4=Rarely” and 5= “Never” into one category— (1) not having support (no). Income was measured by one question reported by income level**:** Is your annual household income from all sources? Responses 1=Less than $10,000, 2 =Less than $15,000, 3= Less than $20,000, 4= Less than $25,000, 5= Less than $35,000, 6= Less than $50,000, 7= Less than $75,000, 8= 75,000 or more. The following responses (7) Don't know/Not Sure, and (9) refused were updated to (77) Don't know/Not Sure, and (99) refused will be treated as missing (CDC, 2016).

HL was measured using three questions: “How difficult is it for you to get advice or information about health or medical topics if you need it?” (MEDADVIC), In general, “How difficult is it for you to understand written health information?” (WRITTEN), “How difficult is it for you to understand information that doctors, nurses, and other health professionals tell you?” (UNDRSTND). Consistent with previous research, HL responses were changed from a nominal categorical and measured continuously to calculate the total scores: (1) Very easy (score=4) ; (2) Somewhat easy (score=3) ;(3) Somewhat difficult (score=2); (4) Very difficult (score=1); (5) For getting advice or information, “I don't look for health information” (score=0) was added to the variable (MEDADVIC) and For written information, “I don't pay attention to written health information”(score=0) was added to the variable (WRITTEN), (7) Don't know/Not Sure and (9) "Refused" will remain as previously answered. In 2015, the BRFSS/HL module was adopted and approved by over 80% of the states and territories, making it fitting to be included as an optional module starting with the 2016 BRFSS used for this study (Rubin, 2016). Table 2 presents the responses for HL recoded to a continuous score variable to calculate total scores. The table aligns the research questions HL to provide information regarding the relationships of the nominal responses for HL recoded to a continuous score variable.

Table 2

Relationship of the Responses for HL Recoded to a Continuous Score Variable

Responses for HL recorded as a nominal variable		Responses for HL re-coded to score variable	
Very easy	Response of (1)	Very easy	Re-coded to a score of (4)
Somewhat easy	Response of (2)	Somewhat easy	Re-coded to a score of (3)
Somewhat difficult	Response of (3)	Somewhat difficult	Re-coded to score of (2)
Very difficult	Response of (4)	Very difficult	Re-coded to a score of (1)
For getting advice or information, "I don't look for health information" (MEDADVIC), and For written information, "I don't pay attention to written health information"(WRITTEN)	Response of (5)		Re-coded to a score of (0)

Health-Related Quality of Life responses: Number of Days Physical Health Not Good (PHYSHLTH), Number of Days Mental Health Not Good (MENTHLTH), and Poor Physical or Mental Health (POORHLTH). These three questions were obtained from the CDC "Healthy Days Measures" that include the following measures as followed: (1) (1 – 30) =Number of days, (2) 88=None, (3) 77= Don't know/Not sure, (4) 99=Refused. The following responses: (77) Don't know/Not Sure, (99) refused will be treated as missing, and 88-None re-coded as "0" for 0 number of days (CDC, 2016).

Study Sample

Most studies have used large, geographically dispersed, randomly selected samples representative of the general population. In contrast, the data set used for this study was a subsample of the larger data set targeted specifically to females with breast cancer and excluded all other cancers. Although a large data set was used, threats to external validity may exist as the target population maybe disproportionately represented due to the small sample size, missing data, and inclusion/exclusion of participants from one state based on variables of interest.

Descriptive statistics, assessment of statistical assumptions, and variable analyses using Pearson's correlation coefficient and linear regression concerning the research questions are discussed next.

I calculated descriptive statistics for nominal and ordinal variables using frequency (n) and percentages, as shown in Table 3. The sample consisted of 117 females with breast cancer, representing the population of interest from Louisiana. These variables included (a) race/ethnicity, (b) marital status, (c) education level, (d) income level, (e) health care access/delayed med care, and (f) do you get the emotional support needed. The most frequently observed categories for the nominal and ordinal variables were (a) race of *White* (76.1%); (b) marital status as *married* (44.4%); (c) an education level of college 1 to 3 years (38.5%); (d) an income level of > $35,000 (17.1%); (e) health care access/delayed med care as *no* (88%); (f) Do you get the emotional support needed as *yes* (90.6%); and (g) age as 65 or older (67.5%).

Table 3

Descriptive Statistics for Nominal and Ordinal Variables

Variable	*n*	%
Race/ethnicity		
White only, Non-Hispanic	89	76.1%
Black only, Non-Hispanic	23	19.7%
Other race only, Non-Hispanic	1	0.9%
Multiracial, Non-Hispanic	1	0.9%
Hispanic	2	1.7%
Missing	1	0.9%
Marital status		
Married	52	44.4%
Divorced	15	12.8%
Widowed	42	35.9%
Never married	7	6.0%
A member of an unmarried couple	1	0.9%
Education level		
Never attended school or only kindergarten	1	0.9%
Grades 1 through 8 (Elementary)	2	1.7%
Grades 9 through 11 (Some high school)	10	8.5%
Grade 12 or GED (High school graduate)	31	26.5%
College 1 year to 3 years (Some college or technical school)	45	38.5%

Variable	*n*	%
College 4 years or more (College graduate)	28	23.9%
Income level		
Less than $10,000	3	2.6%
Less than $15,000 ($10,000 ≥ $15,000)	9	7.7%
Less than $20,000 ($15,000 ≥ $20,000)	7	6.0%
Less than $25,000 ($20,000 ≥ $25,000)	11	9.4%
Less than $35,000 ($25,000 ≥ $35,000)	20	17.1%
Less than $50,000 ($35,000 ≥ $50,000)	13	11.1%
Less than $75,000 ($50,000 ≥$75,000)	16	13.7%
$75,000 ≥	15	12.8%
Missing	23	19.7%
Health care access/delayed med care		
You couldn't get through on the telephone	1	0.9%
You couldn't get an appointment soon enough	3	2.6%
Once you got there, you had to wait too long to see the doctor	3	2.6%
The (clinic/doctor's) office wasn't open when you got there.	1	0.9%
You didn't have transportation	2	1.7%
Other	4	3.4%
No, I did not delay getting medical care/did not need medical care	103	88.0%
Do you get the emotional support needed		
Yes	106	90.6%
No	9	7.7%
Missing	2	1.7%
Age		

Variable	*n*	%
Age 35 to 44	1	0.9%
Age 45 to 54	12	10.3%
Age 55 to 64	25	21.4%
Age 65 or older	79	67.5%

I calculated the first measure that included the General Health Status based on a Likert scale (1-9) of participants and the overall self-related health status. The general health average score was 3.10 on a scale of 1 to 5, where 1 equals very good and 5 equals poor (SD = 1.19), indicating an overall "good" self-rated health status for 37 participants (31.6%). Further results are shown in Table 4 below.

Table 4

Average General Health Score

	N	%	*M*	*SD*
			3.10	1.185
Excellent	8	6.8%		
Very Good	31	26.5%		
Good	37	31.6%		
Fair	25	21.4%		
Poor	15	12.8%		
Don't Know/Not Sure	1	0.9%		

Table 5

Descriptive Statistics for Interval and Ratio Variables

Variable	*n*	*M*	*SD*	Minimum	Maximum
Number of Poor Physical Health Days (PHYSHLTH)	111	6.29	10.115	0	30
Number of Poor Mental Health Days (MENTHLTH)	113	2.58	6.653	0	30
Number of Poor Physical or Mental Health Days (POORHLTH)	68	7.56	10.994	0	30
Difficulty in getting advice or information about health or medical topics if you need it (MEDADVIC2)	117	3.41	1.281	0	7
Difficulty in understanding information that doctors, nurses, and other health professionals tell you (UNDRSTND2)	117	3.63	.638	2	7
How difficult is it for you to understand written health information (WRITTEN2)	117	3.41	1.084	0	4

The observations were as follows for HRQoL: (a) frequency of participants that reported poor physical health in the past month had an average of 6.29 (SD = 10.12); (b) number of days respondents reported poor mental health had an average of 2.58 (SD = 0.83,); (c) number of days respondents reported poor mental and physical health in the past month had an average of 7.56, where the minimum represented “no days” and the maximum represented 30 days.

Summary measures were calculated using the overall unhealthy days based on respondents' health who reported “not good” for physical and mental health, as shown in Table 5. An estimate of the participants' overall healthy days was calculated based on how many days an individual had poor physical and mental health. To determine the estimates of healthy days an individual's poor physical and mental health was good, I deducted the number of unhealthy days by subtracting the number of unhealthy from 30 days. Responses to two questions (1), in the past 30 days, no. of days respondents reported poor mental and physical health, and (2), in the past 30 days, no. of poor mental health days were combined to calculate a summary of the overall unhealthy days, with a maximum of 30 unhealthy days.

The observations showed that most participants reported different numbers of poor physical health days versus poor mental health days overall. However, similar observations were reported for 6.0% of 111 participants who reported two days of poor physical health (Table 5) versus 6.0% of 113 participants who reported two days of poor mental health) assigned the value, four unhealthy days out of 30 or 26 good days. Additional evidence indicates that other reported days, including recent activity limitation due to both poor physical and mental health, 1.7 % of the 111 participants who reported both ten poor physical health days and ten poor mental health days (1.7 % of the 113) participants also reported more than ten days of recent activity limitation due to poor physical and mental health. This suggest that out of 30 days, ten days participants poor physical and mental health was good.

In summary, participants reported healthy days estimate of more “good” days where their physical health was good; 49% of the 111 participants' physical health was good compared to 71% of the 113 participants' mental health was good, and 27% of the 68 participants who reported no limitations to activity due to both physical and mental health. Evaluation of the statistical assumptions and results for Pearson’s correlation coefficient are presented next.

Results

When conducting linear regression, there are four assumptions associated with a linear regression model: (a) normality of residuals, (b) homoscedasticity of residuals, (c) absence of multicollinearity, and (d) the lack of outliers was analyzed (Flatt & Jacobs, 2019). The Q-Q scatterplot was used to assess the normality of residuals based on normal distribution. Using a normal distribution model, a normal Q-Q plot represents a correlation between the data and quantiles. Therefore, if the data is found to have a normal distribution, then the data should have a high positive correlation with normal distribution and plot points that fall relatively on a straight line (Yang & Berdine, 2021).

Assumption Analysis for Linear Regression

The Q-Q scatterplot regarding RQ1 indicated nonnormality and was positively skewed, deviating in the end. The Q-Q scatterplot showed that the majority of study participants reported about 15 days for the frequency of poor physical health. The Q-Q scatterplot showed that most study participants reported about ten days for the frequency of poor mental health days, and the Q-Q scatterplot showed about 15 days of poor mental and physical days. The Q-Q scatterplot for RQ2, the moderating variable of race/ethnicity coded (0= White, 1= Non-White), showed minimal skewness and followed the assumption for normality of residuals, with White participants being the most reported race. Lastly, in reference to RQ3, the Q-Q scatterplot showed minimal skewness and followed the assumption for normality of residuals, with participants reporting "yes" to having social support coded (0=yes, 1=no). Owning a small sample size, the violation of normality has negligible influence on the statistical analysis.

The following assumption tested was the homoscedasticity of residuals, where linear regression models are associated with assumptions regarding the distribution. A violation of the assumption surrounding a linear model is reflected within these residuals. The definition of assumptions is normally obtained by calculating a difference between an observed value and the predicted value fitted within the model (Jemna et al., 2020). Homoscedasticity determines the differences between the predicted and observed values plotted on a graph where the dependent variable corresponds to the X axis and the residuals to be predicted along the Y axis. If homoscedasticity is achieved, scatter plots of residuals will not indicate a pattern such as thickening or funnel-shape behavior, providing evidence of violating this assumption (Hickey et al., 2019).

The homoscedasticity of the scatterplot of the residuals for the RQ1 showed no funnel shape behavior and had diagonal lines due to the categorical variables indicating the scatterplot showed discreetness, as shown in Figures 1, 2, and 3.

Figure 1

Residuals Scatterplot Testing Homoscedasticity for the Predictor Frequency of Poor Physical Health Days

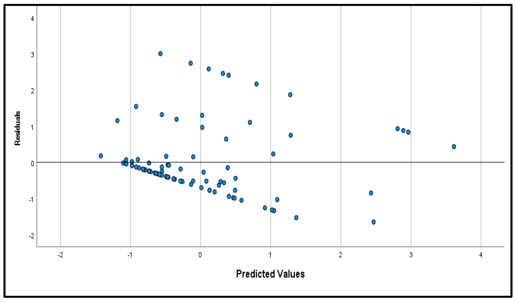


Figure 2

Residuals Scatterplot Testing Homoscedasticity for the Predictor Frequency of Poor *Mental Health Days*

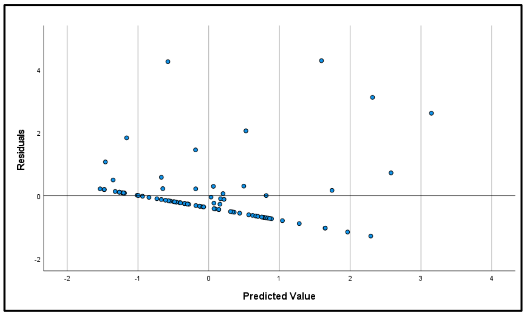
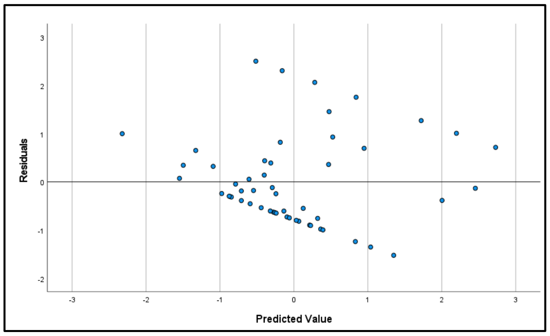


Figure 3

Residuals Scatterplot Testing Homoscedasticity for the Predictor Frequency of Poor *Physical and Mental Health Days*



For the RQ2, shown in Figures 4, 5, and 6, the scatterplot showed discreetness due to the binary values of predictor race/ethnicity coded as (0= White, 1= Non-White)

Figure 4

Residuals Scatterplot Testing Homoscedasticity for the Predictor of Race/Ethnicity on Poor Physical Health Days

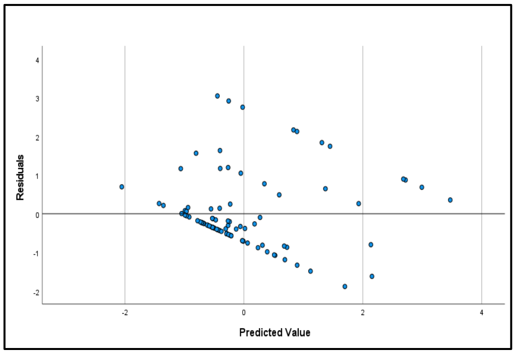


Figure 5

Residuals Scatterplot Testing Homoscedasticity for the Predictor of Race/Ethnicity on Poor Mental Health Days

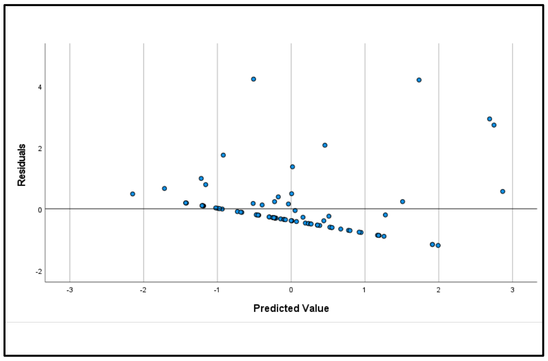
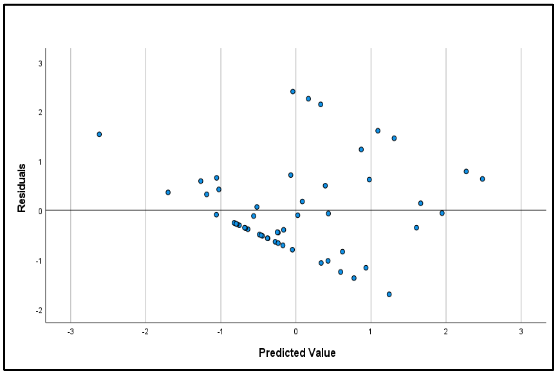


Figure 6

Residuals Scatterplot Testing Homoscedasticity for the Predictor of Race/Ethnicity on Poor Physical and Mental Health Days



For the last research question, Q3, the scatterplot showed discreetness similar to RQ2 with social support (0= yes, 1= no) of the predictor, social support, as shown in Figures 7, 8, and 9. Overall, the data met the assumption for homoscedasticity of residuals.

Figure 7

Residuals Scatterplot Testing Homoscedasticity for the Predictor of Social Support on Poor Physical Health Days

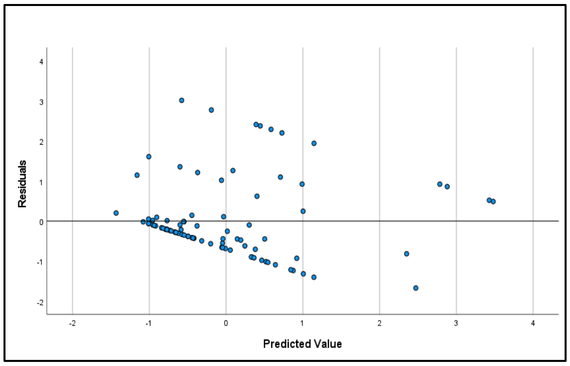


Figure 8

Residuals Scatterplot Testing Homoscedasticity for the Predictor of Social Support on Poor Mental Health Days

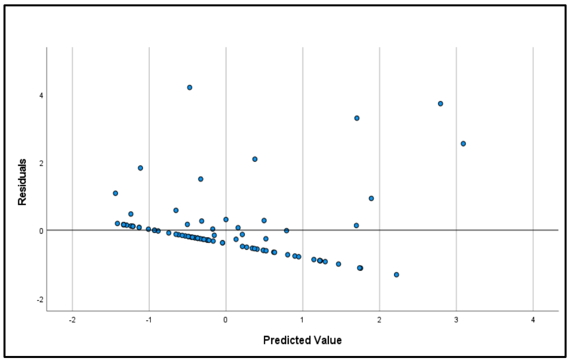
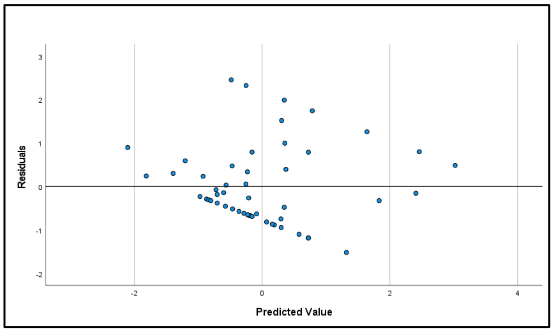


Figure 9

Residuals Scatterplot Testing Homoscedasticity for the Predictor of Social Support on Poor Physical and Mental Health Days



The absence of multicollinearity between predictors was examined using variance inflation factors (VIF). The plausible way to determine multicollinearity is by calculating the variance inflation factors (VIFs) of the independent, mediating, and moderating variables. A value between 1 and 5 indicates a moderate correlation between a given predictor variable and other predictor variables in the model. A VIF greater than 5 but equal to 10 indicates multicollinearity may be present, and a problem may exist within the model (Lee, 2022). When analyzing the absence of multicollinearity, all VIFs were less than 2, representing that the assumption was met.

The assumption for linear regression, lack of outliers, was assessed by calculating Studentized residuals with absolute values plotted against the observed number of days to detect any outliers that exist within data. A studentized residual greater than 3 was considered an outlier in a regression model and may impact the results. A standardized residual value of 2 or 3 is suggested for outlier detection (Fitrianto & Xin, 2022).

To calculate studentized residuals, the model residuals were divided by the residuals and estimated residual standard deviation (Hata et al., 2021). The studentized residual plots showed a random scatter of the points (independence) with a constant spread (constant variance) with values outside the suggested reference value ±2 for participants of RQ1 and RQ2, the moderating variable race/ethnicity who reported poor physical and mental health in the past month, and RQ3, the mediating variable, social support indicates in the regression model outliers exist. Acknowledging the study's small sample size, the outliers pose no concern to the validity of the statistical analysis for linear regression. The assumptions for linear regression also showed minimal threats to validity and were cause for some concern due to the small sample size. The linear regression results for each research question are discussed below.

Pearson’s Correlation Coefficient

Pearson’s correlation coefficient was computed to assess the linear relationship between HL and HRQoL. A bivariate analysis included three HL independent variables, where participants reported difficulty getting advice or information about health or medical topics if needed, difficulty understanding information that doctors, nurses, and other health professionals tell you, and how difficult it is for you to understand written health information. The dependent HRQoL variables included were the number of poor physical health days, poor mental health days, and poor physical or mental health variables in the past month. Social support was included as the mediating variable, race/ethnicity as the moderating variable, and covariates included education, health care access, marital status, income, and age.

For this study, demographic variables found to be significantly related to HRQoL and HL ($p < .05$) were included as covariates in the statistical analyses (Warner, 2013). Pearson’s correlation coefficient (rp) was used to determine the need for covariate analysis of RQ1, the first independent variable for HL, participants who reported difficulty in getting advice or information about health or medical topics if needed, by examining its relationship to the first dependent variable, the number of physical health days related to HRQoL. A significant negative correlation was observed when examining the frequency of physical health days and participants who answered difficulty in getting advice or information about health or medical topics if needed (*r*p = −.08, p < .405).

Similar results were found when analyzing the second independent HL variable, where participants reported difficulty understanding information from doctors, nurses, and other health professionals when told, and the third independent HL variable, how difficult it is to understand written health information between the dependent variable, number of poor physical health days. There was a negative correlation between the two variables, the number of poor physical health days and participants who reported difficulty understanding information from doctors, nurses, and other health professionals when told (*r*p = -.1.74, p < .067) as well as poor physical health days and where participants reported difficulty in understanding written health information (*r*p = -.180, p < .059).

Amid the three HL independent variables, the first independent variable for HL, where participants reported getting advice or information about health or medical topics if needed, showed a statistically significant positive association (p < .05) among covariates, education level (*r*p = .258, p < .005) and income level (*r*p = .210, p < .042). The frequency of the number of poor mental health days and difficulty getting advice or information about health or medical topics if needed showed a negative correlation between the two variables (*r*p = -0.84, p < .3.75). In addition, a negative correlation was found on the number of poor mental health days amongst the second HL variable, where participants reported difficulty understanding information from doctors, nurses, and other health professionals when told (rp = -.1.02, p < .281) and the third HL variable, where participants reported difficulty in understanding written health information (rp = -.99, p < .295).

There was no statistical correlation between the variables of the number of poor physical and mental health days and getting advice or information about health or medical topics if needed (rp = .000, p < .998). The number of poor physical and mental health days and participants who reported where participants reported difficulty understanding information from doctors, nurses, and other health professionals when told (rp = -.91, p < .462), as well as the number of poor physical and mental health days where participants reported difficulty in understanding written health information (rp = -.170, p < .166) showed a negative correlation and no statistical significance between the variables.

Similarly, the interaction between the independent variables for RQ2, the HL variables, where participants reported difficulty in getting advice or information about health or medical topics if needed, difficulty understanding information from doctors, nurses, and other health professionals when told, and difficulty understanding written health information, the study found similar results with negative moderating effect between the moderator variable, race/ethnicity, and the dependent variables, number of poor physical health days, number of poor mental health days, and poor physical and mental health days. These results identify race/ethnicity as a non-moderator with no statistical significance between the independent and dependent variables. Specifically, in reference to answering RQ2, *To what extent does race/ethnicity moderate the association between HL and HRQoL among breast cancer survivors in the U.S. when controlling for education, health care access, marital status, income, and age*?

The final analysis was conducted using Pearson's correlation coefficient to analyze RQ3, the relationship between the mediating variable, social support, and the dependent variables of HRQoL, number of poor physical health days, number of poor mental health days, and poor physical and mental health days.

The results for Pearson's correlation showed a low *r*p with negative correlation and no statistical significance between the dependent variables and the mediating variable, social support when examining the frequency of the HL independent variables, where participants reported getting advice or information about health or medical topics if needed, where participants reported difficulty understanding information from doctors, nurses, and other health professionals when told, and difficulty in understanding written health information. A significant negative correlation was observed (*r*p = −.194, p <. 038) when using Pearson's correlation coefficient on social support and the HL independent variable, where participants reported difficulty in getting advice or information about health or medical topics if needed.

When examining the covariates to determine significance among the variables related to HRQoL and HL, only the HL variable, where participants who reported difficulty in getting advice or information about health or medical topics if needed, was found to show a significant negative correlation (*r*p = −.227, p < .015) between social support and education level, in addition to social support and income level (rp = −.226, p < .030). No other significance was found amongst the HRQoL variables or remaining HL variables.

Although small effect sizes were present for all tests, differences were seen for social support, confirming the use of covariates, income, and education, for the independent variable, difficulty in getting advice or information about health or medical topics if needed. A limitation of Pearson's correlation is that it cannot determine the impact of confounding variables on the independent, dependent, moderating, and mediating variables concurrently. For this reason, linear regression was performed as the next statistical test used for this study. Unstandardized regression coefficients were reported unless otherwise indicated (Warner, 2013).

A summary of the results for Pearson's correlation coefficient is shown in Table 6.

Table 6

Summary of Results for Pearson's Correlation Coefficient

Variables	r_p	P
RQ1		
PHYSHLTH	1	
MEDADVIC2	-.08	.405
UNDRSTND2	-1.74	.067
WRITTEN2	.180	.059
MENTHLTH	1	
MEDADVIC2	-0.84	3.75
UNDRSTND2	-1.02	.281
WRITTEN2	-.99	.295
POORHLTH	1	
Variables	r_p	P

MEDADVIC2	.000	.998
UNDRSTND2	-.91	.462
WRITTEN2	-.170	.166
RQ2		
PHYSHLTH	1	
Moderate_Race	0.23	.807
MENTHLTH	1	
Moderate_Race	0.44	.645
POORHLTH	1	
Moderate_Race	-.138	.263
RQ3		
PHYSHLTH	1	
EMTSUPRT2	.108	.261
MENTHLTH	1	
EMTSUPRT2	.101	.294
POORHLTH	1	
EMTSUPRT2	.026	.836

RQ1: Health Literacy and Health-Related Quality of Life

Linear regression was computed to assess the linear relationship between HL independent variables participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information that doctors, nurses, and other health professionals told to you, difficulty in understanding written health information and HRQoL dependent variable, the number of poor physical health days and covariates. The analysis indicated a significant effect, *F* (8,82) = 340.81 $p < .001$, R^2 =. 292, where 29% of the variance in frequency of poor physical health was explainable by education, healthcare access, marital status, income, and age. Table 7 summarizes the results for linear regression evaluating the relationship between participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty understanding information from doctors, nurses, and other health professionals when told, and difficulty in understanding written health information and frequency of the number of poor physical health days, when controlling for confounding variables.

The first independent variable, participants who reported difficulty in getting advice or information about health or medical topics if needed, did not significantly predict the frequency of the number of poor physical health days, *B* = .923, t (340.808) = .987, p = .326. The second independent variable, where participants reported how difficult it is to understand information from doctors, nurses, and other health professionals when told, did not significantly predict the frequency of the number of poor physical health days *B* =-.464, t (340.808) = -.292, p = .771. Lastly, participants reported difficulty understanding written health information and did not significantly predict the frequency of poor physical health days, *B* = -1.567, t (340.808) = -1.471, p = .145.

Table 7

Results for Linear Regression with MEDADVIC2, UNDRSTND2, WRITTEN2, and Confounding Variables Predicting Frequency of PHYSHLTH

	B	*SE*	β	*T*	*p*	95% CI	
(Intercept)	53.434	10.948		4.881	<.001	31.655	75.213
Independent							
MEDADVIC2	.923	.934	.108	.987	.326	-.936	2.782
UNDRSTND2	-.464	1.587	-.030	-.292	.771	-3.620	2.693
WRITTEN2	-1.567	1.066	-.171	-1.471	.145	-3.688	.553
Confounding							
MARITAL	-.344	.841	-.043	-.409	.683	-2.018	1.329
EDUCA	-.459	1.045	-.047	-.440	.661	-2.537	1.619

Confounding	B	*SE*	β	*T*	*p*	95% CI	
INCOME2	-1.011	.608	-.200	-1.662	.100	-2.221	.199
DELAYMED	-3.012	.742	-.400	-4.061	<.001	-4.488	-1.536
@_AGE_G	-2.224	1.332	-.167	-1.669	.099	-4.875	.426

Note. F (8,82) = 340.808 $p < .001$, $R^2 = .292$.

A second linear regression was computed to assess the linear relationship between the HL independent variable, participants who reported difficulty getting advice or information about health or medical topics if needed, and the HRQoL dependent variable, number of poor mental health days and covariates. The analysis did not significantly predict, F (8,81) = 54.864 $p < .110$, R^2 =. 144, where 14% of the variance in frequency of the number of poor mental health days was explainable by education level, healthcare access, marital status, income level, and age. The first independent variable, where participants reported difficulty in getting advice or information about health or medical topics if needed, did not significantly predict the frequency of the number of poor mental health days, B = -.281, t (54.864) = -.888, p =.611. The second independent variable, participants who reported difficulty understanding information from doctors, nurses, and other health professionals when told, did not significantly predict the frequency of the number of poor mental health days, B =-.180, t (54.864) = .179, p = .858. Lastly, where participants reported difficulty understanding written health information, did not significantly predict the frequency of the number of poor mental health days, B = -.972, t (54.864) = -1.545, p = .126. Table 8 summarizes the results when evaluating the relationship between difficulty in getting advice or information about health or medical topics if needed, difficulty understanding information from doctors, nurses, and other health professionals when told, and difficulty in understanding written health information and frequency of the number of poor mental health days, when controlling for confounding variables.

Table 8

Results for Linear Regression with MEDADVIC2, UNDRSTND2, WRITTEN2, and Confounding Variables Predicting Frequency of MENTHLTH

	B	*SE*	β	*t*	*p*	95% CI	
(Intercept)	18.439	7.132		2.586	.012	4.249	32.629
Independent							
MEDADVIC2	-.281	.550	-.058	-.511	.611	-1.375	.813
UNDRSTND2	.180	1.007	.020	.179	.858	-1.824	2.184
WRITTEN2	-.972	.629	-.185	-1.545	.126	-2.224	.280
Confounding							
MARITAL	1.089	.529	.239	2.058	.043	.036	2.142
EDUCA	-.601	.662	-.108	-.908	.367	-1.918	.716
INCOME2	.128	.387	.044	.332	.741	-.641	.898
DELAYMED	-.654	.469	-.152	-1.395	.167	-1.587	.279
@_AGE_G	-1.417	.880	-.179	-1.611	.111	-3.168	.333

Note. F (8,81) = 54.864 $p < .110$, R^2 =. 144.

The final linear regression was computed to assess the linear relationship between the HL independent variable, where participants reported difficulty in getting advice or information about health or medical topics if needed, and the HRQoL dependent variable, the number of poor physical and mental health days and covariates. The analysis did not significantly predict, F (8,44) = 197.55 $p < .073$, R^2 =.264, where 26% of the variance in frequency of the number of poor physical and mental health days was explainable by education, healthcare access, marital status, income, and age. Table 9 summarizes the results for linear regression evaluating the relationship between participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information from doctors, nurses, and other health professionals when told, and difficulty in understanding written health information and frequency of the number of poor physical and mental health days when controlling for confounding variables.

All independent HL variables, participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information from doctors, nurses, and other health professionals when told, and difficulty in understanding written health information did not show a significant relationship to the dependent variables, the number of poor physical health days, the number of poor mental health days, and the number of poor physical and mental health days after controlling for the confounding variables.

No confounding variables showed significance other than marital status and healthcare access. Marital status significantly predicted the frequency of the number of poor mental health days $B = 1.089$, t (54.864) = 2.058, p < .043, which suggests female breast cancer survivors who are unmarried have an increased number of poor mental health days by an average of 1.089 days per 30- day period.

Similar to the dependent and independent variables, healthcare access in the first linear regression also significantly predicted the frequency of poor physical and mental health days. Healthcare access significantly predicted the frequency of the number of poor physical health days, $B = -3.012$, t (340.808) = -4.061, p < .001, which suggests female breast cancer survivors with delayed or no healthcare access reduced the number of poor physical health days by an average of 3.012 days per 30- day period. Health care access also significantly predicted the frequency of the number of poor physical and mental health days, *B* = -2.429, t (197.55) = -2.783, p <. 008, which suggests female breast cancer survivors with health care access will decrease in the frequency of number of poor physical or mental health days by an average of 2.429 days per 30- day period.

Table 9

Results for Linear Regression with MEDADVIC2, UNDRSTND2, WRITTEN2, and Confounding Variables Predicting Frequency of POORHLTH

	B	*SE*	β	*t*	*p*	95% CI	
(Intercept)	36.820	14.697		2.505	.016	7.199	66.441
Independent							
MEDADVIC2	.647	1.221	.078	.530	.599	-1.814	3.107
UNDRSTND2	.929	2.196	.059	.423	.674	-3.498	5.356
WRITTEN2	-1.127	1.286	-.132	-.877	.385	-3.719	1.464
Confounding							
MARITAL	-1.987	1.256	-.228	-1.582	.121	-4.517	.544
EDUCA	-.907	1.740	-.084	-.521	.605	-4.414	2.599
INCOME2	-.831	.844	-.161	-.985	.330	-2.532	.870
DELAYMED	-2.429	.873	-.386	-2.783	.008	-4.189	-.670
@_AGE_G	-.105	1.840	-.008	-.057	.955	-3.812	3.602

Note. F (8,44) = 197.55 *p* < .073, R^2 = .264.

Therefore, we fail to reject the null hypothesis for RQ1: *What is the association between HL and HRQoL among breast cancer survivors in the U.S. when controlling for education, healthcare access, marital status, income, and age?* based on the results from linear regression, summarized in Table 7, as there is no statistically significant association between HL and HRQoL among breast cancer survivors when controlling for education, healthcare access, marital status, income, and age.

RQ2: Race/Ethnicity as Moderator

A moderation analysis was conducted to assess whether the HL independent variables of participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information from doctors, nurses and other health professionals when told, difficulty in understanding written health information interact with race/ethnicity coded (0=White, 1=non-White) to predict the dependent variable, the number of poor physical health days controlling for education, healthcare access, marital status, income, and age. The overall regression was statistically significant, $F\ (9,81) = 322.386\ p < .001,\ R_2 = .311$, where 31% of the interaction of the number of poor physical health days was explainable controlling for education, healthcare access, marital status, income, and age.

Table 10 summarizes the results for linear regression evaluating the interaction term between race/ethnicity and the relationship between participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information from doctors, nurses, and other health professionals when told, and difficulty in understanding written health information and frequency of the number of poor physical health days when controlling for confounding variables.

Table 10

Regression Coefficient to predict PHYSHLTH (DV1) From Medavice 2 (IV1),

Understand 2(IV2), Written2 (IV3) and the Moderating Variable Moderate_Race
Controlling for Martial, EDUCA, Income2, DelayMed, and Age[a]

	B	*SE*	B	*t*	*p*	95% CI	
(Intercept)	53.224	11.038		4.822	<.001	31.262	75.187
Moderate_Race	-5.348	10.365	-.230	-.516	.607	-25.971	15.276
Independent							
Medadvic2_x_race	.104	1.659	.016	.063	.950	-3.196	3.404
Understand2_x_race	-1.085	3.380	-.166	-.321	.749	-7.810	5.639
WRITTEN2_x_race	1.240	1.640	.178	.756	.452	-2.023	4.502
Confounding							
MARITAL	-.780	.806	-.098	-.968	.336	-2.383	.823
EDUCA	.126	1.047	.013	.120	.904	-1.958	2.210
INCOME2	-1.837	.613	-.363	-2.999	.004	-3.056	-.618
DELAYMED	-2.556	.758	-.339	-3.371	.001	-4.064	-1.047
@_AGE_G	-2.819	1.357	-.212	-2.077	.041	-5.519	-.119

Note. F (9,81) = 322.386 *p* < .001, R^2 = .311

The regression for race/ethnicity was not statistically significant, *B*= -5.348, t (*322.386*) = -.516, *p* <.607. The interaction term of MEDADVIC2 x race was not statistically significant, *B*= .104, t (*322.386*) = .063, *p* <.950, and the interaction term Understand2 x race *B*= -1.085, t (*322.386*) = -.321, *p* .749. WRITTEN2 x race interaction term showed a negative interaction, *B*= 1.240, t (*322.386*) = -.756, *p* <.452. Because the interaction terms were not statistically significant, the interaction was not retained in the model.

When evaluating participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information from doctors, nurses, and other health professionals when told, difficulty in understanding written health information and HRQoL dependent variables on the number of poor mental health days and race/ethnicity as a moderator, the overall analysis was not statistically significant, F (9,80) = 373.790 < .281, R2 = .123., where 12% of the interaction of the number of poor mental health days was explainable by education, healthcare access, marital status, income, and age. The effect for race was not statistically significant, *B*= -.110, t (373.790) = -.016, *p* <.987. Table 11 summarizes the results for linear regression evaluating the relationship between participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information from doctors, nurses, and other health professionals when told, and difficulty in understanding written health information and frequency of poor mental health days when controlling for confounding variables.

Table 11

Regression Coefficient to predict MENTHLTH *(DV2) From Medavice 2 (IV1), Understand 2(IV2), Written2 (IV3) and the Moderating Variable* Moderate_Race *Controlling for Martial, EDUCA, Income2, DelayMed, and Age*[a]

	B	*SE*	β	*t*	*p*	95% CI	
(Intercept)	16.959	7.378		2.298	.024	2.276	31.643
Moderate_Race	-.110	6.862	-.008	-.016	.987	-13.765	13.546
Independent							
medadvic2_x_race	.311	1.174	.085	.265	.791	-2.025	2.647
understand2_x_race	-1.076	2.265	-.284	-.475	.636	-5.582	3.431
WRITTEN2_x_race	.430	1.177	.108	.365	.716	-1.912	2.772
Confounding							
MARITAL	.839	.523	.184	1.604	.113	-.202	1.881
EDUCA	-.432	.673	-.078	-.642	.523	-1.772	.908
INCOME2	-.296	.398	-.102	-.744	.459	-1.089	.496
DELAYMED	-.463	.491	-.108	-.943	.348	-1.441	.514
@_AGE_G	-1.648	.948	-.207	-1.738	.086	-3.534	.239

Note. F (9,80) = 373.790 < .281, R^2 = .123

The final linear regression was computed to assess the linear relationship between three HL independent variables: participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information from doctors, nurses, and other health professionals when told, difficulty in understanding written health information and HRQoL dependent variable, the number of poor physical and mental health days and covariates. The effect for race/ethnicity was not statistically significant, *B*= -4.025, t (2129.328) = -.217 *p* <.829. This indicates race/ethnicity did not significantly predict *F* (9,43) = 2129.328 *p* < .016, R^2 = .355., where 36% of the interaction of the number of poor physical and mental health days was explainable controlling for education, healthcare access, marital status, income, and age. Table 12 summarizes the results for linear regression evaluating the relationship between participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information from doctors, nurses, and other health professionals when told, and difficulty in understanding written health information and frequency of the number of poor physical and mental health days when controlling for confounding variables.

Table 12

Regression Coefficient to predict POORHLTH (DV1) From Medavice 2 (IV1), Understand 2(IV2), Written2 (IV3) and the Moderating Variable Moderate_Race Controlling for Martial, EDUCA, Income2, DelayMed, and Age^a

	B	*SE*	B	*t*	*p*	95% CI	
(Intercept)	38.581	13.616		2.834	.007	11.122	66.039
Moderate_Race	-4.025	18.509	-.170	-.217	.829	-41.353	33.302
Independent							
medadvic2_x_race	-.834	3.148	-.133	-.265	.792	-7.183	5.515
understand2_x_race	-1.836	6.001	-.283	-.306	.761	-13.937	10.266
WRITTEN2_x_race	1.752	2.444	.256	.717	.478	-3.178	6.681
Confounding							
MARITAL	-2.436	1.210	-.280	-2.012	.050	-4.877	.005
EDUCA	-.043	1.676	-.004	-.026	.980	-3.423	3.337
INCOME2	-1.718	.848	-.333	-2.025	.049	-3.428	-.007
DELAYMED	-1.634	.861	-.260	-1.899	.064	-3.370	.101
@_AGE_G	-.485	1.770	-.038	-.274	.785	-4.054	3.085

Note. F (9,43) = 2129.328 $p < .016$, $R^2 = .355$.

Similarly to the previous analyses for RQ1, all independent HL variables, participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty in understanding information from doctors, nurses, and other health professionals when told, and difficulty in understanding written health information did not show a significant association between to the dependent variables, the number of poor physical health days, the number of poor mental health days, the number of poor physical and mental health days, after controlling for the confounding variables. The results suggest that the effect of race/ethnicity did not show a significant interaction with the dependent variables after controlling for the confounding variables. Therefore, there is no interaction between the independent HL variables of participants who reported difficulty in getting advice or information about health or medical topics if needed, difficulty understanding information from doctors, nurses, and other health professionals when told, and difficulty understanding written health information.

Because the interaction term was not statistically significant, the interaction was not retained in the model.

The majority of the confounding variables were statistically significant predictors of the number of poor physical health days. There was a significant adverse interaction found by income level on the number of poor physical health days, *B*= -1.837, t (*322.386*) = -2.999, *p* <.004, healthcare access on the number of poor physical health days, *b*= -2.556, t (*322.386*) = -3.371, *p* <.001, as well as age on the number of poor physical health days, *B*= -2.819, t (*322.386*) = -2.077, *p* <.041. This indicates that income level, healthcare access, and age were statistically significant predictors of poor physical health among breast cancer survivors.

There was also a significant interaction found by marital status on the number of poor physical and mental health days, *B* = -2.436, t (2129.328) = -2.012, p < .050 and also the number of poor physical and mental health days on income level, *B*= -1.718, t (2129.328) = -2.025, p < .049 indicating marital status and income as predictors of poor physical or mental health among breast cancer survivors.

Therefore, we fail to reject the null hypothesis based on the results from the moderation analysis for RQ2, *To what extent does race/ethnicity moderate the association between HL and HRQoL among breast cancer survivors in the U.S. when controlling for education, health care access, marital status, income, and age?* summarized in Table 10, as race/ethnicity does not moderate the association between HL and HRQoL among breast cancer survivors when controlling for education, healthcare access, marital status, income, and age.

RQ3: Social Support as Mediation

Structural equation modeling was not needed to test the direct and indirect effects of social support on HL and HRQoL among breast cancer survivors for RQ3, based on the recommended Baron and Kenny approach to assessing mediation (Warner, 2013). Linear regression was included in the analysis, examining the relationship between the independent and dependent variables and mediating variables. The analysis showed that social support does not mediate a relationship between HL and HRQoL among breast cancer survivors in the United States (Table 13, 14, and 15) when controlling for education, healthcare access, marital status, income, and age. Due to these conditions not being met between the independent and dependent variables, mediation was not examined. This indicates there was no indication of sustenance for mediation or a need to assess the impact of the Sobel test; therefore, we fail to reject the null hypothesis for RQ3, *Does social support mediate the relationship between HL and HRQoL among breast cancer survivors in the U.S. when controlling for education, health care access, marital status, income, and age?*

Table 13

Regression Coefficient to predict PHYSHLTH (DV1) From Medavice 2 (IV1), Understand 2(IV2), Written2 (IV3) and the Mediating Variable EMTSUPRT2 (MV1) Controlling for Martial, EDUCA, Income2, DelayMed, and Age^{a}

	B	*SE*	β	*t*	*p*	95% CI	
(Intercept)	53.173	10.951		4.855	<.001	31.384	74.963
Independent							
MEDADVIC2	1.130	.957	.133	1.180	.241	-.775	3.034
UNDRSTND2	-.446	1.587	-.028	-.281	.780	-3.603	2.712
WRITTEN2	-1.516	1.067	-.165	-1.420	.159	-3.639	.608

	B	*SE*	β	*t*	*p*	95% CI	
Mediating							
EMTSUPRT2	4.588	4.595	.103	.999	.321	-4.554	13.730
Confounding							
MARITAL	-.418	.844	-.053	-.495	.622	-2.098	1.262
EDUCA	-.297	1.057	-.030	-.281	.779	-2.401	1.806
INCOME2	-.942	.612	-.186	-1.538	.128	-2.160	.276
DELAYMED	-3.024	.742	-.401	-4.077	<.001	-4.500	-1.548
@_AGE_G	-2.556	1.373	-.192	-1.861	.066	-5.289	.176

a. Dependent Variable: PHYSHLTH

Table 14

Regression Coefficient to predict MENTHLTH (DV2) From Medavice 2 (IV1), Understand 2(IV2), Written2 (IV3) and the Mediating Variable EMTSUPRT2 (MV1) Controlling for Martial, EDUCA, Income2, DelayMed, and Age[a]

	B	*SE*	β	*t*	*P*	95% CI	
(Intercept)	18.033	7.150		2.522	.014	3.801	32.265
Independent							
MEDADVIC2	.052	.617	.010	.084	.933	-1.176	1.280
UNDRSTND2	.153	1.011	.017	.151	.880	-1.858	2.164
WRITTEN2	-1.140	.697	-.205	-1.636	.106	-2.528	.247
Mediating							
EMTSUPRT2	3.159	2.926	.124	1.079	.284	-2.666	8.983
Confounding							
MARITAL	1.091	.537	.239	2.031	.046	.022	2.160
EDUCA	-.476	.672	-.085	-.709	.481	-1.813	.861
INCOME2	.192	.390	.066	.491	.625	-.586	.969
DELAYMED	-.646	.470	-.150	-1.375	.173	-1.582	.290
@_AGE_G	-1.634	.906	-.206	-1.804	.075	-3.438	.169

a. Dependent Variable: MENTHLTH

Table 15

Regression Coefficient to predict POORHLTH (DV2) From Medavice 2 (IV1), *Understand 2(IV2), Written2 (IV3) and the Mediating Variable EMTSUPRT2 (MV1) Controlling for Martial, EDUCA, Income2, DelayMed, and Age*[a]

	B	*SE*	β	*t*	*p*	95% CI	
(Intercept)	35.020	15.028		2.330	.025	4.692	65.348
Independent							
MEDADVIC2	1.220	1.480	.137	.825	.414	-1.766	4.207
UNDRSTND2	1.071	2.254	.067	.475	.637	-3.477	5.619
WRITTEN2	-1.640	1.611	-.179	-1.018	.315	-4.892	1.612
Mediating							
EMTSUPRT2	4.998	8.108	.090	.616	.541	-11.364	21.360
Confounding							
MARITAL	-1.824	1.335	-.209	-1.367	.179	-4.518	.869
EDUCA	-.574	1.800	-.052	-.319	.752	-4.207	3.059
INCOME2	-.760	.858	-.147	-.886	.381	-2.492	.971
DELAYMED	-2.370	.886	-.377	-2.676	.011	-4.158	-.582
@_AGE_G	-.436	1.905	-.034	-.229	.820	-4.280	3.408

a. Dependent Variable: POORHLTH

Results of Post-Hoc Analyses of Statistical Tests

A Post hoc analysis was used to compute the actual achieved power using the total sample size of 117 participants for the study. The analysis indicated the study was powered at a power level (1β) of 86%, with an effect size of 0.15, numerator degrees of freedom as 7, and a p-value of <.05, compared to a sample size of 153 previously computed with a power level (1β) of 95%.

Summary

In Chapter 4, descriptive statistics were computed, as well as the results for Pearson's correlation coefficient and linear regression about answering the three research questions with a total sample size of 117 female breast cancer survivors from Louisiana.

We fail to reject the null hypothesis for RQ1, as no statistically significant association was found between HL and HRQoL among breast cancer survivors considering the confounding variables education, healthcare access, marital status, income, and age. We fail to reject the null hypothesis for RQ2, as race/ethnicity did not moderate the association between HL and HRQoL, and for RQ3, the mediating variable, social support, did not mediate the association between HL and HRQol among breast cancer survivors in the United States when controlling for education, health care access, marital status, income, and age.

Analysis for RQ3 showed a lack of association, which precludes the need to assess mediation between the independent variable and the mediating variable, whereby the mediating variable independent variable can account for the independent variable. Due to these conditions not being met between the independent and dependent variables, mediation was not examined. We fail to reject the null hypothesis for RQ3, which indicates that social support does not mediate a relationship between HL and HRQoL among breast cancer survivors when controlling for education, healthcare access, marital status, income, and age.

Chapter 5 presents the interpretation of the results related to the literature reviewed and the conceptual framework. Limitations to the study will be discussed, as well as recommendations for future researchers and practitioners considering potential implications for social change.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

I conducted this study to provide additional information about the role of HL and HRQoL among breast cancer survivors in the United States. The specific purpose of this quantitative**,** cross-sectional study was to examine whether the association between HL and HRQoL among breast cancer survivors is moderated by race/ethnicity, with consideration of the mediation influences of social support between HL and HRQoL among breast cancer survivors in the United States. I used the HLS conceptual framework for this research, which allowed me to examine how HL functions at the personal level, affects health-related outcomes, and influences externally at the societal level. The societal-level moderator, race/ethnicity, was examined, including the association between HL and HRQoL (Squiers et al., 2012). The 2016 BRFSS data set was used with optional modules for cancer survivorship and social support questions with a total sample size of 117 female breast cancer survivors from Louisiana.

The literature review provided support for more extensive analysis using linear regression due to the need to consider the confounding variables of education, healthcare access, marital status, income, and age. A significant relationship was not found between the independent variable HL and HRQoL among breast cancer survivors.

A mediation analysis was conducted to test the hypothesis to understand the underlying effects of the independent variable on the dependent variable or outcome of social support (Hayes & Rockwood, 2017). For RQ3, for mediation to exist, the following conditions must be met. First, there must be a significant relationship between the independent variable and the mediating variable, whereby the mediating variable and independent variable can account for the independent variable. This step establishes that there is an effect that may be mediated. Secondly, there must be a relationship between the independent variable and the dependent variable before and after adjustment for the mediator. The method tests whether a third variable, here a mediator, significantly changes the relationship between two variables. Due to these conditions not being met between the independent and dependent variables, mediation was not examined. This indicates that confounding bias may have severely limited the mediator's influence and can obscure the relationship between the variables of interest (MacKinnon & Pirlott, 2015).

A moderation analysis assessed the moderation of race/ethnicity and whether an interaction exists between the independent and dependent variables. The interaction was not statistically significant, as race/ethnicity did not influence a significant relationship between the independent and dependent variables.

Interpretation of the Findings

This study provides several noteworthy findings supported in the literature and yielded new information. Analysis of RQ1 revealed there is no statistically significant association between HL and HRQoL among breast cancer survivors when controlling for education, healthcare access, marital status, income, and age. Poor physical and mental health status was shown to lead to delayed healthcare access among breast cancer survivors. These themes aligned with findings from Simmons et al. (2017) and Xia et al. (2019), where poor or LHL as a social determinant was found to be a contributing factor to poor health status, adverse health outcomes, increased mortality, and limited physician interaction associated with cancer disparities. In contrast, by way of a cross-sectional study, Mora-Pinzon et al. (2019) found HL was associated with overall care management that led to delayed healthcare access that may impact racial disparities and health outcomes post-diagnosis amongst breast cancer survivors. The results indicated that LHL led to challenges in understanding, obtaining, and processing health information, including decreased preventative health services, increased use of emergency services, hospitalization, mortality, and decreased physical and mental health.

A moderation analysis was conducted to evaluate the interaction effects of the moderating variable, race, and ethnicity, on the relationship between the two variables, HL and HRQoL**,** among breast cancer survivors (Warner, 2013). The results showed that for RQ2, the effect of race/ethnicity did not show a significant interaction between the two variables, HL and HRQoL**,** among breast cancer survivors. Although a relationship did not exist, findings showed income, healthcare access, and age were significantly associated with decreased poor physical health among breast cancer survivors. In addition, decreased poor health among breast cancer survivors was found to be associated with marital status and income level. Findings for RQ1 and RQ2 directly aligned with the findings for health care access and income level, where decreased poor physical health status was associated with access to health care among breast cancer survivors. These findings confirm many of the common themes found in the literature review. Healthcare disparities play a leading role in socioeconomic differences and can contribute to the increase of racial and ethnic disparities in mortality among women with breast cancer

(Singh & Jemal, 2017). Women who are of minority and low-income status and living in disadvantaged areas face many economic challenges related to primary care treatment, diagnosis, and follow-up care that can decrease cancer survival (Miller et al., 2017; Singh & Jemal, 2017; Yedjou et al., 2019). These social and economic inequalities can lead to disparities among women with breast cancer, including medical coverage and income. (Singh & Jemal, 2017; Yedjou et al., 2019). Specifically, women of low income have significantly been affected by decreased breast cancer screenings, leading to increased chances of being diagnosed at a later stage of breast cancer, leading to higher mortality and the likelihood of poor differentiating treatment (Miller et al., 2017; Singh & Jemal, 2017; Yedjou et al., 2019). The continuing growth in cancer mortality disparities amongst Black and White women indicates there is a gap in current approaches to address racial and ethnic disparities across population groups of low-income status. Black women are more likely to be uninsured and rely on public insurance compared to White women (Yedjou et al., 2019). Women of lower socioeconomic status are more likely to have limited or insufficient medical insurance coverage, leading to breast cancer disparities, access to care, and higher rates of latent stage cancer among women (Singh & Jemal, 2017; Yedjou et al., 2019). Studies suggest HRQoL and HL are significant factors in making appropriate health decisions to increase positive health outcomes among disadvantaged populations (Singh & Jemal, 2017; Xia et al., 2019).

Healthcare providers often provide care to those in disadvantaged communities and cannot adequately provide the appropriate treatment or supply targeted information for the population they serve due to the lack of infrastructure where they practice (Singh

& Jemal, 2017; Yedjou et al., 2019). Cancer-related patterns associated with racial and ethnic disparities have led to incidents of mortality that suggest cancer-related inequalities affect those from the least to most advantaged social groups and would benefit from targeted interventions (Singh & Jemal, 2017).

Social support is a critical component of cancer survivorship, with a minimal exploration of the QoL, HL, and racial differences. The mediation analysis of RQ3 showed that social support did not mediate a relationship between HL and HRQoL among breast cancer survivors as the conditions for mediation were not met, and mediation was not examined. Although a relationship did not exist, the analysis showed that social support was significantly associated with income as well as education and participants seeking medical advice or information among breast cancer survivors. Similar to my findings, when measuring health inequalities, education level and income proved to be the significant variables associated with HL, with the highest contributors to overall disparities in HL (Fleary & Ettienne, 2019). Fleary and Ettienne (2019) examined HL differences based on self-reported sociodemographic characteristics, including household income, race/ethnicity, and education. Similar to my findings, the authors noted that many participants' earnings were between $50,000 and $74,999, earning a high school diploma but less than a post-baccalaureate degree. The study results indicate a need to improve HL education-specific inequalities confirmed in the literature by Fleary& Ettienne, 2019. Although my study results demonstrated a positive association between education and social support, further examination is needed to determine how each variable relates to different concepts in future research.

Limitations of the Study

This study had several limitations. First, potential misrepresentation exists across social and socioeconomic groups when investigating the differences in HL and the effects of HRQoL among breast cancer survivors (Coughlin et al., 2022). Although the 2016 BRFSS was designed using well-validated questions and data analysis to test data consistency, threats to validity exist. Admitting to my examination, disparities among racial groups appeared to be misrepresented. The inconsistencies were likely due to the percentage of female participants of White race versus non-White included for analysis. Race/ethnicity seemed skewed toward primarily White women as the majority due to the small sample size and the inclusion of participants from only the state of Louisiana who completed the core survey and participated in all three optional modules (CDC, 2016).

The use of self-reported information is also a potential limitation. Measures of self-reported HL data can lead to subject bias measurement errors and misclassification due to interviewer or recording errors (Stoney et al., 2022). Self-report scales have apparent advantages for administration as a BRFSS module, but because of the social desirability bias may inevitably result in respondents over-estimating their HL capacity and reliability of the validated survey (Luo et al., 2020; Rubin, 2016; Rutan et al., 2021). The insertion of confounding variables based on the literature review influencing HL was included to reduce data analysis bias.

Limitations to the mediation analysis include the significant relationship between the predictor and mediation outcome (Fairchild & McDaniel, 2017). Based on the analysis, the independent variable did not significantly predict the dependent variable, but the independent variable significantly relates to the mediator, creating evidence of a causal chain. This suggests inconsistencies in the mediation model, and the direct and indirect effects can potentially nullify the overall effect (Ohrnberger et al., 2017). Specifically, the third variable explains the plausible relationship between an independent and dependent variable. In addition, confounders can incorrectly complicate or heighten a relationship between two factors of interest when this relationship is decreased based on the third variable, removing the falsehood based on the confounding variable (MacKinnon et al., 2000). MacKinnon et al. noted that statistical removal of the mediational or confounding effect can, in turn, increase the magnitude of the relationship between the independent and dependent variables, known as suppression.

The HLS conceptual framework allows for hypothesizing how demographic attributes (e.g., age, income, and gender) directly and indirectly influence societal factors such as race/ethnicity to determine the strength of the relationship between HL and QoL among breast cancer survivors (Squiers et al., 2012). Squiers et al. created the conceptual framework to guide future research and advance the operationalization of the constructs, as there has been limited or no research conducted to date. In addition, the HLS conceptual framework was created to examine the external factors mediating the comprehension of health behaviors and the socioecological perspective of HL. This study intended to analyze variables associated with societal influences and external factors of the HLS using a national data set to clarify the association between HL and the mediating role of social support to improve health behaviors and outcomes (Squiers et al., 2012). Based on the analysis and limited research, further examination of the conceptual framework is needed to explore mediators between comprehension and health to improve HL and QoL in breast cancer survivors**.**

With respect to limitations, the results may not be generalizable to breast cancer survivors in the United States because of the low response rate, as the results of my study can best be argued as applicable to Louisiana and less so to the rest of the country. In addition, only 14 states implemented the HL module, eight participated in the cancer survivorship module, and the emotional and social support modules were administered in four states.

Recommendations

A meditation analysis is a popular statistical method that provides a framework and potential pathways to measure the effects to understand the outcomes used in applied research (Lachowicz et al., 2018). The concept of mediation provided a unique perspective in variable analysis and could be used statistically to analyze other public health programs aiming to close the gap in health disparities. Specifically, social support and healthcare access have been shown to decrease poor and mental health outcomes and could be included in additional analyses of female breast cancer survivors. These findings will provide a better understanding of the significant impact of HL, QoL and the mediating role of social support in improving HRQoL among diverse breast cancer survivors.

Upon moderation of race/ethnicity and poor physical health, a secondary finding showed poor physical health to be statistically significant and a predictor of income level, healthcare access, and age among breast cancer survivors. Further examination using a moderation analysis on poor physical health, income level, health care access, and age would be another recommendation for future studies to examine the strength of the relationship among female breast cancer survivors.

Further recommendations should focus on creating alternative HL measures that are not subject to bias and can assure the reliability and validity of the measures across population subgroups. NAAL HL scale uses a secondary measurement data tool and is the most well-accepted population-based measure of health literacy (Rubin, 2016). The 2003 NAAL has been more commonly used to identify significant disparities across different race/ethnic groups. In the United States, the NAAL comprehensively assesses various HL skills across various social groups. The comprehensive assessment directly measures HL and a variation of HL skill by race and ethnicity, educational attainment, income, and different social groups among those aged 16 and older in the United States (Housten et al., 2018; Muhanga & Malungo, 2017; Schillinger, 2020). Specifically, education level and income level proved to be contributing factors in seeking medical advice among female breast cancer survivors and could be included in the analysis when examining breast cancer survivorship. Further analysis on examining HL and LHL by race and ethnicity among female breast cancer survivors in the United States would be another recommendation for future studies. Further research may be essential to address these limitations and validate the findings using a population-based HL tool to better understand HL and race/ethnicity in today’s context of health disparities.

Implications

Positive social change implications include understanding the relationship between complex variables associated with HL and HRQoL. Shaping positive social change by illustrating possible differences in HL by race/ethnicity and improving HRQoL should be the primary focus for cancer centers and healthcare providers in developing programs and interventions to improve this population's QoL and social support (Hulett et al., 2015; Lee & Oh, 2020; Miller et al., 2017). Application of the HLS conceptual framework in this study examined the societal-level moderator, race/ethnicity, including the association between HL and HRQoL and the influences of health behaviors and outcomes (i.e., race and ethnicity, income, and gender); (b) health-related stimuli (ability to process health information and decision making).

For this study, the small sample size may not have been sufficient for detecting the effects between HL and HRQoL. This may lead to misinterpretation of the study results when examining racial-ethnic differences in the QoL and HL in breast cancer as one is unable to determine the disparities between other races (Fleary & Ettienne, 2019). Further examination is warranted to examine the differences in HL by race/ethnicity and improve HRQoL among various groups of breast cancer survivors using a populous sample.

The mediation analysis showed that social support did not mediate a relationship between HL and HRQoL among breast cancer survivors as the conditions for mediation were not met, and mediation was not examined. Although a relationship did not exist, the implications of this study showed the correlation of social support on many confounding variables associated with HL. Specifically, when measuring health inequalities, education level and income were the significant variables associated with HL, with the highest contributors to overall disparities in HL (Fleary& Ettienne, 2019).

Healthcare practices now prioritize measuring HL to evaluate patients' abilities to make medical decisions, develop patient-focused interventions, and increase patient equality within the healthcare setting to obtain assistance (Housten et al., 2018; Muhanga & Malungo, 2017). Authors suggested interventions to enhance HRQoL amongst all breast cancer survivors may help reduce related race/ethnicity differences in HRQoL (Hurtado-de-Mendoza et al., 2021). Understanding psychosocial factors related to QoL and breast cancer survivors can enable targeted interventions to improve QoL in breast cancer survivorship (Culbertson et al., 2020).

Current programs using patient-focused interventions and evidence-based approaches are most relevant in promoting positive social change. In addition, patient-reported outcomes (PROs) have been used to assess patients with breast cancer. For example, patient-reported outcomes (PROs) effectively measure HRQoL physical and mental health subscales but also measure areas of physical function, fatigue, pain, emotional distress, and social health (Pergolotti et al., 2017). Patient-reported outcomes allow patients to indicate the impact of disease and treatment from a patient's perspective. PROMs questionnaires are reliable and valid patient assessments used to capture patients' perceptions and responses in a structured manner based on participants' responses (Salas et al., 2022). FACT-B is also a widely used HRQoL-validated instrument for breast cancer that measures psychosocial elements such as depression and/or social support once cancer treatment ends and has entered breast cancer survivorship (Culbertson et al., 2020).

Lastly, the 2003 NAAL was created as a population-based measure to examine whether HL can capture disparities across different race/ethnic groups (Rubin, 2016). The assessment tool provides insight into various examination areas, including race and ethnicity, educational attainment, and income, to directly measure HL (Housten et al., 2018; Muhanga & Malungo, 2017; Schillinger, 2020).

Continuous investigation and building knowledge related to QoL and HL are essential, and the use of validated instruments can comprise programs to support will lead to intervention efforts to address race/ethnicity differences and social support among breast cancer survivors.

Conclusion

Analysis of RQ1 revealed that HL and HRQoL were not significantly associated among breast cancer survivors when controlling for education, healthcare access, marital status, income, and age. The findings of this study show that decreased physical and mental health days can lead to delayed healthcare access among breast cancer survivors. In addition, decreased physical poor health among breast cancer survivors was found to be associated with marital status and income level. The results showed that the effect of race/ethnicity for RQ2 did not show a significant interaction between the two variables, HL and HRQoL, among breast cancer survivors. Although a relationship did not exist, findings showed income, healthcare access, and age were significantly associated with decreased poor physical health among breast cancer survivors. In addition, decreased poor physical health among breast cancer survivors was found to be associated with marital status and income level.

RQ1 and RQ2 directly aligned with the findings for health care access and income level, where decreased poor health status was associated with access to health care among breast cancer survivors. The mediation analysis of RQ3 showed that social support was not a mediator for HL and HRQoL. The findings of this study show that social support was significantly associated with income as well as education and participants seeking medical advice or information among breast cancer survivors. Although a relationship did not exist, the analyses showed that social support was significantly associated with income as well as education and participants seeking medical advice or information among breast cancer survivors. Publication of my results in scholarly peer-reviewed journals would make this information widely available for cancer clinics and healthcare providers. This greater understanding of the complex variables associated with HL and HRQoL among breast cancer survivors could increase awareness and ways to improve interventional programs focused on increasing equity for breast cancer survivors.

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Appendix A: Figures and Tables

Figure A1

Q-Q Scatterplot Testing Normality of Residuals for the Dependent Variable, Frequency of Poor Physical Health, With Positively Skewed Nonnormality

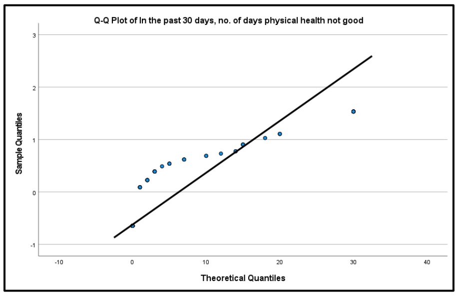

Figure A2

Q-Q Scatterplot Testing Normality of Residuals for the Dependent Variable, Frequency of Poor Mental Health, With Positively Skewed Nonnormality

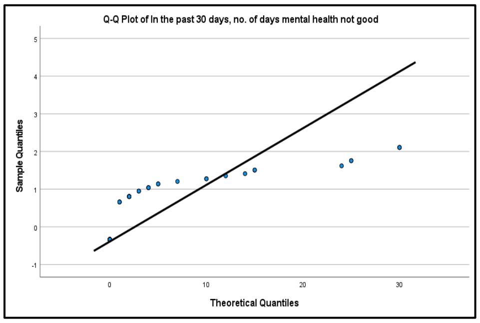

Figure A3

Q-Q Scatterplot Testing Normality of Residuals for the Dependent Variable, Frequency of Poor Physical and Mental Health, with Positively Skewed Nonnormality

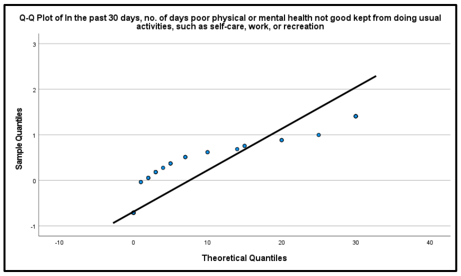

Figure A4

Q-Q Scatterplot Testing Normality of Residuals for the Moderating Variable, Race/Ethnicity (0= White, 1= Non-White), with Minimal Skewness

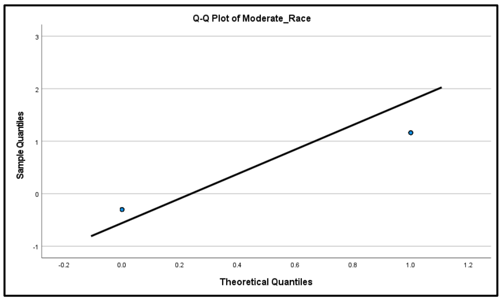

Figure A5

Q-Q Scatterplot Testing Normality of Residuals for the Mediating Variable (0= yes, 1= No), Social Support, with Minimal Skewness

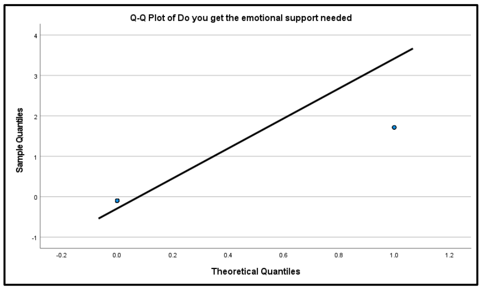

Figure A6

Studentized Residuals Plot for Outlier Detection for the Dependent Variable, Frequency of PHYSHLTH

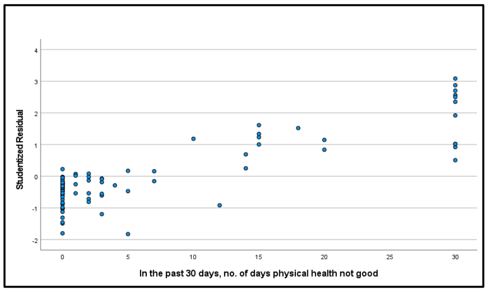

Figure A7

Studentized Residuals Plot for Outlier Detection for the Dependent Variable, Frequency of MENTHLTH

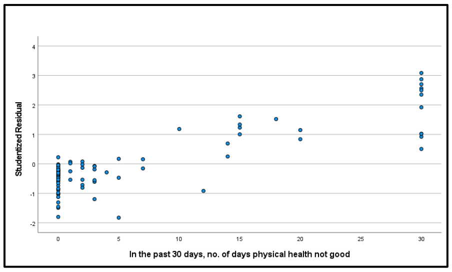

Figure A8

Studentized Residuals Plot for Outlier Detection for the Dependent Variable, Frequency of POORHLTH

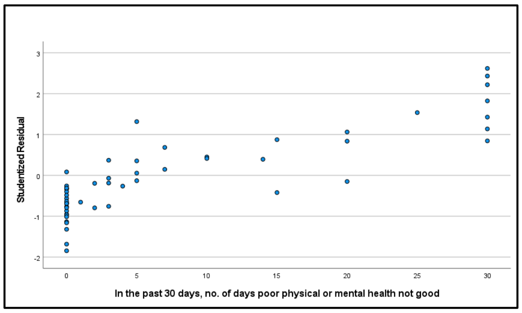

Figure A9

Studentized Residuals Plot for Outlier Detection for the Moderating Variable, Race/ Ethnicity on PHYSHLTH

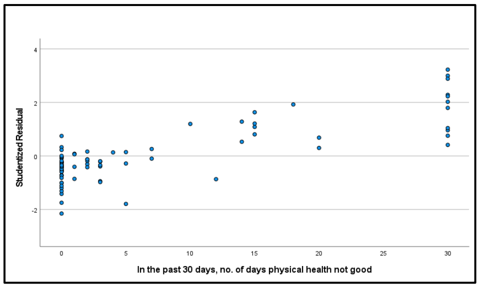

Figure A10

Studentized Residuals Plot for Outlier Detection for the Moderating Variable, Race/ Ethnicity on Poor Mental Health

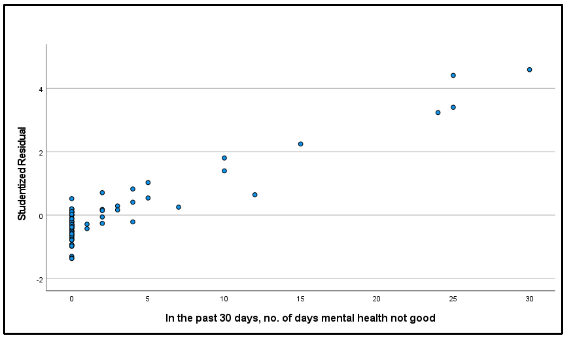

Figure A11

Studentized Residuals Plot for Outlier Detection for the Moderating Variable, Race/ Ethnicity on Poor Mental and Physical Health

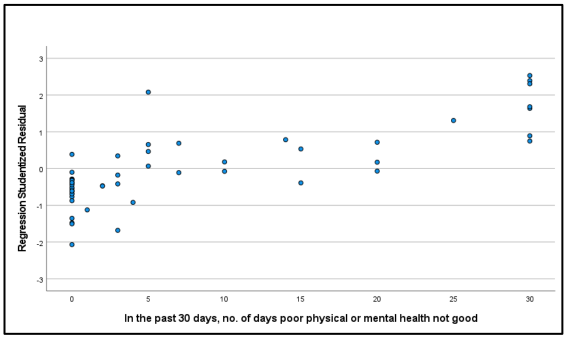

Figure A12

Studentized Residuals Plot for Outlier Detection for the Mediating Variable, Social Support on Poor Physical Health

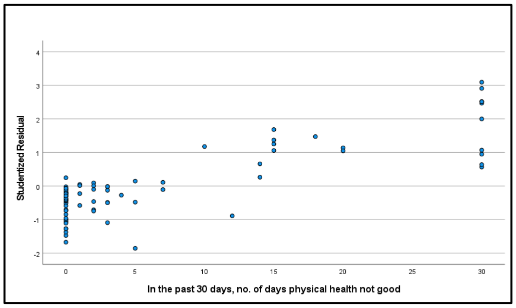

Figure A13

Studentized Residuals Plot for Outlier Detection for the Mediating Variable, Social Support on Poor Mental Health

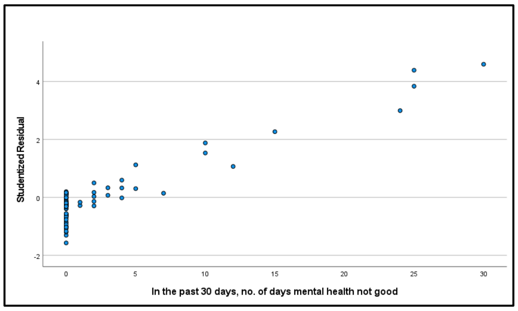

Figure A14

Studentized Residuals Plot for Outlier Detection for the Mediating Variable, Social Support on Poor Mental and Physical Health

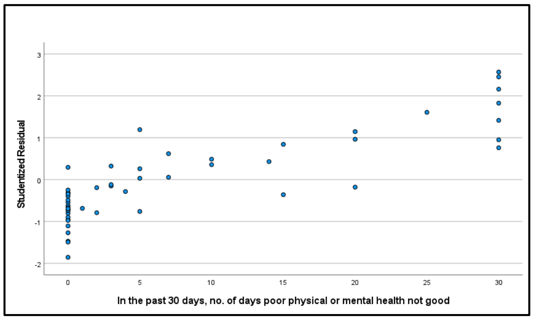

Table A1

Variance Inflation Factors for the Independent and Confounding Variables in Relation to the Dependent Variable Frequency of Poor Physical Health^a

	Collinearity statistics
Variables	VIF
Independent variables	
MEDADVIC2	1.397
UNDRSTND2	1.182
WRITTEN2	1.559
Confounding variable	
MARITAL	1.300
EDUCA	1.316
INCOME2	1.678
DELAYMED	1.122
@_AGE_G	1.164

Table A2

Variance Inflation Factors for the Independent and Confounding Variables in Relation to the Dependent Variable Frequency of Poor Mental Health[a] [a]

	Collinearity statistics
Variables	VIF
Independent variable	
MEDADVIC2	1.204
UNDRSTND2	1.187
WRITTEN2	1.354
Confounding variable	
MARITAL	1.279
EDUCA	1.335
INCOME2	1.694
DELAYMED	1.120
@_AGE_G	1.162

Table A3

Variance Inflation Factors for the Independent and Confounding Variables in Relation to the Dependent Variable Frequency of Poor Physical or Mental Health[a]

Variables	Collinearity statistics
	VIF
Independent variables	
MEDADVIC2	1.294
UNDRSTND2	1.148
WRITTEN2	1.356
Confounding variables	
MARITAL	1.246
EDUCA	1.544
INCOME2	1.595
DELAYMED	1.151
@_AGE_G	1.243

Table A4

Variance Inflation Factors for the Independent and Confounding Variables in Relation to the Dependent Variable Frequency, Moderating Variable Race/Ethnicity of Poor Physical Health[a]

Variables	Collinearity statistics
	VIF
Independent variable	
MEDADVIC2	1.412
UNDRSTND2	1.194
WRITTEN2	1.598
Moderating variable	
Moderate_Race	1.452
Confounding variable	
MARITAL	1.306
EDUCA	1.335
INCOME2	1.886
DELAYMED	1.207
@_AGE_G	1.264

Table A5

Variance Inflation Factors for the Independent and Confounding Variables in Relation to the Dependent Variable Frequency, Moderating Variable Race/Ethnicity of Poor Mental Health[a]

Variables	Collinearity statistics
	VIF
Independent variable	
MEDADVIC2	1.209
UNDRSTND2	1.195
WRITTEN2	1.358
Moderating variable	
Moderate_Race	1.419
Confounding variable	
MARITAL	1.281
EDUCA	1.357
INCOME2	1.950
DELAYMED	1.203
@_AGE_G	1.269

Table A6

Variance Inflation Factors for the Independent and Confounding Variables in Relation to the Dependent Variable Frequency, Moderating Variable Race/Ethnicity of Poor Physical or Mental Health[a]

	Collinearity statistics
Variables	VIF
Independent variable	
MEDADVIC2	1.313
UNDRSTND2	1.148
WRITTEN2	1.373
Moderating variable	
Moderate_Race	1.373
Confounding variable	
MARITAL	1.252
EDUCA	1.558
INCOME2	1.815
DELAYMED	1.262
@_AGE_G	1.326

Table A7

Variance Inflation Factors for the Independent and Confounding Variables in Relation to the Dependent Variable Frequency Mediating Variable, Social Support of Poor Physical Health[a]

Variables	Collinearity statistics
	VIF
Independent variable	
MEDADVIC2	1.466
UNDRSTND2	1.182
WRITTEN2	1.563
Mediating variable	
EMTSUPRT2	1.240
Confounding variable	
MARITAL	1.310
EDUCA	1.347
INCOME2	1.699
DELAYMED	1.123
@_AGE_G	1.237

Table A8

Variance Inflation Factors for the Independent and Confounding Variables in Relation to the Dependent Variable Frequency Mediating Variable, Social Support of Poor Mental Health[a]

Model	Collinearity statistics
	VIF
Independent variable	
MEDADVIC2	1.369
UNDRSTND2	1.176
WRITTEN2	1.478
Mediating variable	
EMTSUPRT2	1.251
Confounding variable	
MARITAL	1.307
EDUCA	1.347
INCOME2	1.720
DELAYMED	1.121
@_AGE_G	1.223

Table A9

Variance Inflation Factors for the Independent and Confounding Variables in Relation to the Dependent Variable Frequency Mediating Variable, Social Support of Poor Physical or Mental Health[a]

Variables	Collinearity statistics
	VIF
Independent variable	
MEDADVIC2	1.597
UNDRSTND2	1.158
WRITTEN2	1.804
Mediating variable	
EMTSUPRT2	1.229
Confounding variable	
MARITAL	1.363
EDUCA	1.558
INCOME2	1.609
DELAYMED	1.153
@_AGE_G	1.288

Appendix B: Glossary Variable Names

Dependent Variable Names

Number of Days Physical Health Not Good [PHYSHLTH]

Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?

Number of Days Mental Health Not Good [MENTHLTH]

Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?

Poor Physical or Mental Health [POORHLTH]

During the past 30 days, for about how many days did poor physical or mental health keep you from doing your usual activities, such as self-care, work, or recreation?

Independent Variable Names

How difficult is it for you to get advice or information about health or medical topics if you need it? (MEDADVIC2)

How difficult is it for you to understand information that doctors, nurses, and other health professionals tell you? (UNDRSTND2)

In general, how difficult is it for you to understand written health information? (WRITTEN2)

Covariate Variables

Age [@AGE]

Reported age in years

Level of Education Completed [EDUCAG]

Computed level of education completed categories

Income Level [INCOME2]

Is your annual household income from all sources…?

Marital Status [MARITAL]

Moderator

Do you get the emotional support needed [EMTSUPRT]

Mediator

Race [_RACE]

Computed race-ethnicity grouping