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ANALYZING THE RELATIONSHIP BETWEEN THE QUALITY OF LIFE
AND RACE OF LUNG CANCER SURVIVORS

by

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Health Sciences (Pre-Clinical Track) Major

A thesis submitted in partial fulfillment of the requirements
for the Honors Undergraduate Thesis Program in Health Sciences
in the College of Health Professions and Sciences
and in the Burnett Honors College
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ABSTRACT

Purpose: The relationship between racial disparities and the health-related quality of life (HRQoL) of lung cancer patients is not well understood. The purpose of this study was to quantify the overall HRQoL of lung cancer patients and compare differences in HRQoL among racial groups in the United States.

Methods: We analyzed data from the Behavioral Risk Factors Surveillance System (BRFSS), a population-based national cross-sectional study conducted by the Centers for Disease Control and Prevention. The BRFSS is conducted annually in all 50 states and collects information on demographics, health behaviors, health-related experiences, health conditions, use of medications, and use of preventive services. Three HRQoL scores (unhealthy days per month, frequent mental distress, fair/poor health) were generated using the four Healthy Days Measures questions that have been validated as HRQoL measures by previous research.

Results: We found that the HRQoL measures of the Non-Hispanic Black group were not statistically different from those of the Non-Hispanic White group for any of the three measures examined. However, the Hispanic group (OR = 3.14, 95% CI=1.40 – 7.02) and Other races (OR = 1.85, 95% CI=1.04-3.27) had significantly higher odds of frequent mental distress when compared to the Non-Hispanic White group.

Conclusions: Quality of life among lung cancer patients is a heavily under-researched area of the cancer survivorship experience. Rarer, is data examining specifically how racial disparities affect the quality of life of lung cancer survivors. More research is needed to examine this important topic to create a foundation for more beneficial lung cancer interventions in the future.

DEDICATION

I dedicate this project to my family, friends, mentor, and anyone else both affiliated and non-affiliated with the University of Central Florida who helped me find my path in life. I thank all of you for allowing me to find my passion for medicine and giving me the confidence to embark on higher-level academic endeavors such as this project.

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LIST OF ABBREVIATIONS

HRQOL/HRQoL	Health Related Quality of Life
BRFSS	Behavioral Risk Factor Surveillance System
LC	Lung Cancer
BC	Breast Cancer

INTRODUCTION

The following research seeks to determine the relationship between lung cancer (LC) patients' race and their quality of life (QoL) within the state of Florida. This study was inspired by the lack of knowledge on the subject despite LC being a very prevalent and burdening disease for patients.

Lung cancer (LC) is a detrimental disease that causes patients to experience horrible symptoms that proceed to worsen throughout the course of the disease, negatively impacting the patient's quality of life (QoL).¹ LC is the leading cause of cancer death on a global scale and, although LC incidence rates are decreasing, it is still the second most prevalent cancer found in the United States population.^{2,3} Knowing this, it is truly alarming how under-researched the relationships between QoL and race are in regards to LC.^{4,5} These factors need to be explored more as Black patients with LC continue to experience worse comorbidity and higher mortality rates.⁶ Not only is there a lack of research into the connections between these topics, but the research that has been done on these topics proceed to contradict one another. Some studies identify a connection between them while others completely oppose said results.

The correlation between race, QoL, and either colorectal cancer (CRC) or breast cancer (BC) has been explored in previous studies with results that better align with one another compared to that of LC.

Studies have found that there are racial disparities that affect BC outcomes in patients, including their QoL.^{7,8} This may be caused in part by the fact that there is a lower chance that Black patients will undergo the recommended care.⁹ The same can be found with CRC, as studies have detailed how socioeconomic status (SES) may lead to variations in QoL, thereby affecting the survival rates among Black patients.¹⁰ Other studies discovered that Black patients have the poorest survival rate among patients with CRC.^{11,12} These factors may be linked to the fact that a lack of access to insurance has been shown to coincide with lower CRC outcomes.¹¹ Further research would greatly benefit the LC community in the future since

QoL, despite its importance in the healthcare field, is still overlooked in LC patients; including those from the Black population.⁴

LITERATURE REVIEW

Method of Literature Search

Employing Google Scholar, we searched multiple science journal databases (PubMed, Science Direct, National Library of Medicine, etc.) simultaneously using a combination of the keywords “quality of life”, “lung cancer”, “cancer”, “disparities”, and “race”. This search was conducted on October 4th and the search results were narrowed down utilizing the specifications “human subjects only” and “English only”. All considered articles were screened for relevance by reviewing the full text. Our goal was to identify studies that looked at how racial disparities, QoL, or both played a factor in the experiences of cancer (mostly LC) patients. To make the data more relevant to the present-day, any articles published before 2010 were not included in this literature review.

Utilizing a data spreadsheet, we separated and organized data from each eligible study to identify any similarities or differences between them. Articles that explored various aspects of QoL, such as possible determinants of QoL, the quality of QoL assessment in research, and the overall importance of QoL in the medical field, were classified as “QOL articles”. Articles that studied how one’s race may play a factor in the outcomes of cancer patients were classified as “Racial Disparities articles”. Articles that did not fit into either of these two categories but were still considered essential for painting the entire picture of the experiences of LC patients, were classified as “Other articles”.

Method of Literature Selection

Figure 1 details how the articles used throughout this Literature Review were discovered and assessed accordingly. A total of 19 articles were found during the preliminary phase of searching multiple research databases utilizing the specifications listed in the “Methods” section of this review. After exploring the reference lists of the articles initially found, 23 articles were added into the screening process for a total of 42 screened articles. Following this process, 17 articles were determined to no longer be relevant and were excluded from further assessment; thus only 25 full-text articles passed the initial assessment and were to undergo further assessment. Full-text reviews of the remaining articles led to the exclusion of 9 articles that were determined to no longer be fit for the Literature Review. Consequently, following both a preliminary and full-text screening, only 16 articles were decidedly fit to be included in the final literature review.

Part 1: Quality of Life (QoL): Importance and Role in Cancer Management

Our search found nine articles that pertained to the QoL of LC patients. The articles and studies included not only detail the importance of QoL and how it may be measured, but also how it can be utilized in the future of LC management to better help patients.

Bouazza et al.¹³ et al. reviewed the impact of patient-reported outcome measures (PROMs) on the management of LC patients. The study determined that the EORTC QLQ-C30 and QLQ-LC13 are the most frequently used PROMs when it comes to LC management. PROMs like these can aid in the understanding of the effectiveness of treatments and help healthcare workers determine the impacts of the disease and its treatments. Both of which are important in

improving the QoL of patients. The researchers also found that the evidence advocating for the routine use of PROMs in clinical practice only continues to grow. PROMs have the potential to improve quality of care and are necessary to truly understand the patient experience from their perspective. The routine collection of PROMs seems to not only enhance physician awareness but also shifts the focus more to the needs of the individual patient. Thus, leading to improved overall symptom control which undoubtedly improves the patient's QoL.

Ediebah et al.¹⁴ analyzed data from 391 advanced NSCLC patients. The patient's HRQoL was assessed after each cycle of chemotherapy using the EORTC QLQ-C30 and QLQ-LC13 questionnaires. The prognostic significance of HRQoL and participant's subsequent changes over time were assessed using Cox regression. The results show that HRQoL scores are significant prognostic factors for survival. This shows the ability that QoL has in the role of predicting the survival rates of LC patients, pointing to an emphasis on its use in the future of clinical practice.

Nicklasson et al.¹⁵ studied the impact of individual health related quality of life (HRQoL) evaluation on the attention of symptom control and psychosocial function in patients with advanced LC or pleural mesothelioma. The EORTC QLQ-30 assessment questionnaire was used to assess study participants. They found that such QoL assessment increases the attention towards the psychosocial function of the patient; both in terms of conversation focus and clinical decisions (such as diagnostic and therapeutic measures to help the patient).

Pierzynski et al.¹⁶ explored the socio-demographic, clinical, and genetic determinants of QoL in LC patients. Utilizing data collected from 2000–2010 at the University of Texas's MD Cancer

Care Center, data from 6,420 patients was analyzed by the researchers in pursuit of finding the factors that are linked to QoL. Of the 6,420 study participants, 5,268 patients were White and 460 were Black. The researchers detailed how QoL has started to become more recognized as an important factor in the treatment of cancer as better patient-reported QoL is linked to improved cancer survival overall. Agreeing with these findings, the study conducted by the researchers found that poor physical component summary (PCS) and mental component summary (MCS) QoL scores were associated with an increased risk of death and poor survival. Also, regarding race-based differences, it was found that Black patients were more likely to have a lower PCS QoL score compared to Whites. However, the study fails to provide more insight as to why this may be so.

Regarding the overall usage of QoL in LC research, Reale and Luca et al.⁵ systematically reviewed the true quality of QoL assessment in phase III trials evaluating LC patients. 122 primary publications were factored into the analysis, and it was found that the proportion of trials that did not include QoL results only increased over time. This includes trials from the metastatic and advanced disease care settings, where patients may be dealing with life-threatening stages of LC and thus an impacted QoL. The researchers determined that QoL is a factor of patient health that goes terribly under-reported, even though LC patients may consider QoL and symptom control more important than life prolongation themselves. The researchers determined that QoL deserves to play a larger role in the care of LC patients, as its analyses could play a crucial role in the shared decision-making process between physicians and their respective LC patients.

Reale and Maio et al.⁴ further expanded on how QoL has been overlooked when it comes to LC patients. Despite the availability of several QoL instruments, QoL has not been previously

regarded as important in the care of LC patients as it should be; especially when LC patients can experience very rapid symptom changes. During this study, the researchers analyzed data taken from 195 patients (during two separate points in time) from the EORTC QLQ-LC29 questionnaire. When authors asked patients approximately 2 – 4 weeks after the first questionnaire if their respective situation was worsening, improving, or stable, less than half (42%) reported that they were stable. Showing not only how fast LC symptoms can fluctuate/progress but also why QoL should play such an important role in the care of LC patients.

Sloan et al.¹⁷ set out to determine the true level of correlation between a LC patient's self-reported QoL and their overall survival (OS) rate. A total of 2,442 patients with NSCLC were observed between the years of 1997 and 2007 and completed a single-item measure of overall QoL within the first six months of receiving a LC diagnosis. The researchers found that QoL deficits at the time of LC diagnosis were significantly associated with their OS. These results prove the usefulness of QoL as an independent prognostic factor for survival in LC patients, further proving how it should be emphasized in healthcare.

Sterzi et al.¹⁸ evaluated the clinical, surgical, and pulmonary function characteristics in over 60 long term cancer survivors who had surgery. This was done with the hopes of better understanding the clinical determinants that can predict the QoL in these patients. Their QoL was evaluated five years after each of the 67 patients had surgery. This analysis was conducted using the Europeans Organization for Research and Treatment of Cancer (EORTC) QOL Core Questionnaire. It was found that several preoperative features, particularly those reflecting pulmonary function, were moderately associated with QOL in long-term LC survivors. This may

be useful in addressing future therapeutic strategies to help LC patients after surgery and therefore improve their overall QoL.

Zikos et al.¹⁹ discovered that although the level of health-related QoL reporting was acceptable in randomized NSCLC trials, improvements are necessary in order to best optimize the information in order to help patients. The researchers state that the presentation of patient-reported state deserves to follow the same rigorous guidelines as do other clinical trial data. To drive clinical decision-making, medical consensus requires as much knowledge as possible; therefore, incomplete, or inaccurate reporting of HRQoL measures can seriously affect the reliability of the data.

Part 2: Racial Disparities: Existence and Possible Causes

Our search found six articles that addressed the racial disparities found in the LC community. These article not only point to the existence of these disparities, but they also attempt to explain why these disparities may be present in the first place; some articles even do so by exploring the culture differences that may play a role in their formation over time.

Hardy et al.²⁰ sought to determine if there was a large gap in the receipt of treatment for NSCLC between Blacks and Whites. Researchers also wished to determine if the size of the gap or disparity had changed over time. The study population consisted of 83,101 patients (90.4% White and 9.6% Black) who were at least 65 years old. For stages 1-2 combined, Blacks were 37% less likely to receive surgery and 42% less likely to receive chemotherapy. For stages 3-4 combined, Blacks were 57% less likely to receive chemotherapy compared to their White counterparts. Also, the disparity gap did not appear to narrow during the 12 years analyzed (1991

to 2002). Overall, researchers believe these results allude to the fact that more effort should be allocated to providing quality treatment and educating Black LC patients on the benefits of having these treatments to reduce these disparities.

Japuntich et al.²¹ looked at Lung Cancer Screening (LCS) utilization and racial disparities in LCS among patients for whom it is clinically indicated. 200 patients were randomly selected who were likely to meet USPSTF guidelines for LCS. They were all mailed a survey to assess their LCS eligibility and uptake. The results of this study show that LCS utilization is low despite coverage provided through the Affordable Care Act. Black patients are less likely to quality for screening and disproportionately less likely to be screened for LC compared to non-Black patients. This is in part because lower screening rates may lead patients to be diagnosed during later cancer stages, when the prognosis and overall survival rates are statistically worse.

Tanner et al.⁶ proved how one's access to proper medical care can lead to differences in LC outcomes. Data collected from the National Lung Screening Trial (NSLT) was used in this study's analysis. Of the 53,452 participants in the NSLT, 47,902 were White and 2,361 were Black. Data from these two groups was used to identify the presence of racial disparities in LC treatment. They found that Black individuals screened with low dose computed tomography (LDCT) had decreased LC mortality rates. The demographics associated with improved LC survival such as educational level, smoking status, and the number of comorbidities they presented with were less likely to be found in Black individuals overall. Also, LC mortality risk was found to be two times higher in current Black smokers than their White counterparts. Overall, all-cause mortality was 1.35 times higher in Black individuals than White individuals. However, Black individuals screened with LDCT had a larger reduction in all-cause mortality

compared to their White counterparts. The researchers suggested that LDCT improves patient's access to medical care to better disease treatment and prospective outcomes. The largest take away from this study is the fact that it points to the existence of racial disparities when it comes to LC treatment and subsequent outcomes as Black individuals proceeded to benefit the most from the additional screening.

Shusted et al.²² examined differences in PLCOm2012 LC risk among Prevention Taskforce (USPSTF) eligible lung cancer screening (LCS) individuals. Utilizing Jefferson LCS registry data, collected from an urban academic medical center, the researchers generated risk qualities of African American and White patients and analyzed the differences between the two. They found that the LC risk scores generated did not align with LC diagnoses in African American patients. These findings lead to the conclusion that when it comes to applying risk models to diverse populations, caution should be used; due to the overall lack of understanding when it comes to LC risk. Many other factors, such as health determinants, should be taken into consideration when analyzing LC risk in underserved populations.

Lin et al.²³ explored the reasoning as to why minority patients with LC are less likely to receive the recommended, stage-appropriate treatment. With cultural factors such as patient's LC beliefs, fatalism, and medical mistrust in mind, the researchers set out to determine the cultural factors that are associated with disparities in LC treatment. From 2008 to 2011, patients with newly diagnosed LC were recruited from four medical centers located in New York City. Participants were then surveyed about their beliefs and multiple regression analyses were used to assess whether cultural factors are associated with disparities in LC care. Results show that negative surgical beliefs, fatalism, and mistrust are not only more prevalent among minorities, but they

also appear to explain almost one-third of the observed disparities in LC treatment among Black patients.

Meza et al.³ looked at LC incidence trends in the United States with an emphasis on gender and racial differences. Data from the SEER cancer registry dating from 1973-2010 was used in the analysis. Using joint point regression, the researchers evaluated five major histological types of LC by gender and race. This study showed that squamous, large, and small cell carcinoma rates are continuing to decrease, while adenocarcinoma rates have remained the same for males and increased for females. When it comes to race, Black males were shown to be disproportionately affected by squamous LCs, and Black individuals continue to be diagnosed with more advanced cancers than Whites. Overall, this study shows how LC incidence rates by histology continue to change over time, and it is important for future studies to focus on identifying racial disparities and how to reduce them.

Part 3: Lung Cancer: The Patient Perspective

Lehto et al.² showed that those with LC not only experience the effects of the disease itself but also the added burden of having an illness that is perceived negatively in the public eye. Utilizing a confidential list of those who were treated for non-small cell lung cancer (NSCLC) in a participating community hospital, the prospective participants were contacted via telephone. The authors interviewed a total of 11 Caucasian participants who were treated for NSCLC in a rural, Midwestern part of the United States. The participants were separated into a total of four focus groups where they were asked a multitude of questions surrounding their personal experience with NSCLC and the social stigma surrounding said disease. Researchers found that questions

surrounding themes related to smoking, social stigma, and lung cancer prompted intense discussion among the focus group participants. These themes included societal attitudes, institutional practices and experiences, negative thoughts and emotions, smoking cessation, and causal attributions. Overall, the study emphasized that all LC patients deserve respect and consideration when undergoing treatment. The culmination of both negative societal views and possible feelings of personal anger and guilt can further exacerbate an already difficult situation for the patient.

THEORY/HYPOTHESIS

Based on the literature studied thus far on this topic, we believe that lung cancer patients who identify as “Black” or “African-American” will have a lower quality of life when compared to their White counterparts. We will use a quantitative approach to analyze secondary cross-sectional data to examine if this racial disparity is present in survivors of lung cancer located in the United States.

METHODOLOGY

Data Source

We used data from the most recent five years of the Behavioral Risk Factors Surveillance System (BRFSS) available at the time of our analysis, collected from 2017 - 2021. The BRFSS is a national survey of adult non-institutionalized residents in all 50 states, Washington DC, and US territories.²⁴ The survey is conducted annually by the Centers for Disease Control and Prevention through telephone interviews.²⁴ The survey covers a variety of health-related questions including health behaviors, access to healthcare, use of healthcare services, and diagnoses of health conditions.²⁴ Individual responses are weighted to represent the overall population within each state and collectively, the entire United States population.

Inclusion Criteria

To be eligible for the current study, participants needed to have indicated a prior diagnosis of lung cancer in the survey, and provided responses to survey questions regarding their race, ethnicity, and items related to HRQoL. This study's main goal is to determine how race factors into the quality of life of lung cancer survivors. To accomplish this the data analyzed needs to be from those who have had or currently have lung cancer. This study's main exposure is the respondent's self-identified race or ethnicity. The race or ethnicity that an individual belongs to may be subjective to that individual. In this study the respondents were split into four racial/ethnicity categories prior to analyzing the data: Non-Hispanic White, Non-Hispanic Black, Hispanic, and all other races.

Demographic Variables

We assessed demographic factors of participants including age, race/ethnicity, income, highest education level, sex, census region, age at diagnosis, and marital status. The main exposure of interest in this study was the race/ethnicity of the lung cancer patients.

Health-Related Quality of Life Outcome Measures

To be eligible for the current study, respondents needed to have provided responses to four HRQoL questions known as the Health Days Measures. These questions quantify how the patient's physical and mental health for the past 30 days and a rating of their own health on a scale from excellent to poor. The questions are listed below as follows:

1. Would you say that in general your health is excellent, good, fair, or poor?
2. 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?
3. 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?
4. 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?

The set of four Health Days Measures questions were used to calculate three HRQoL scores by race/ethnic group: Total Unhealthy Days, Frequent Mental Distress, and Fair/Poor Health. These

measures of HRQoL have been previously verified as both a valid and reliable measure of quality of life.²⁸

Unhealthy Days: Summary Index of Unhealthy Days

Unhealthy Days are an estimate of the overall numbers of days during the past 30 days when the respondent felt that their physical or mental health was not good. Responses to Healthy Days Measures questions 2 and 3 are combined to calculate the summary index of the overall unhealthy days of the respondent per month.

Frequent Mental Distress

This HRQoL measure for frequent mental distress is taken from question 3 and is defined as a dichotomous variable. Those categorized as experiencing frequent mental distress reported 14 or more days during the previous 30 days when mental health was not good. Those who reported less than 14 days when mental health was not good were categorized as not experiencing frequent mental distress.

Estimates for Fair/Poor Health

This HRQoL measure utilizes responses to Healthy Days Measures question 1 for its calculation. This score compared the total participants who rated they were in fair/poor health (lower end of the health scale provided). Those who reported their own health as good, very good, or excellent were not included in this score.

Statistical Analyses

We calculated frequencies for demographic and outcome variables. We used chi-square tests to compare HRQoL differences between race/ethnicity categories of each variable. We then produced odds ratios to quantify relationships between race and ethnicity with HRQoL, using the Non-Hispanic White group as the reference category. We compared the odds of the Non-Hispanic Black, Hispanic, and all other races groups reporting that they were experiencing Frequent Mental Distress compared to the Non-Hispanic White group. Odds ratios greater than 1.0 would indicate that the racial group had elevated odds of reporting that they were experiencing frequent mental distress compared to the Non-Hispanic White group. Odds ratios less than 1.0 would indicate that the racial group had lower odds of reporting that they were experiencing frequent mental distress compared to the Non-Hispanic White group. Odds ratios equal to 1.0 would indicate that no difference is present between the two racial groups when it came to their odds of reporting frequent mental distress. We also calculated odds ratios of fair/poor health. Odds ratios greater than 1.0 would indicate that the racial group had elevated odds of reporting that they were in fair/poor health compared to the Non-Hispanic White group. Odds ratios less than 1.0 would indicate that the racial group had lower odds of reporting that they were in fair/poor health compared to the Non-Hispanic White group. Odds ratios equal to 1.0 would indicate that no difference is present between the two racial groups when it comes to their odds of reporting that they were in fair/poor health.

RESULTS

Sample Characteristics

Demographic characteristics of the sample are shown in Table 1. The majority of patients included in the sample identified as Non-Hispanic White (82.17%), female (58.80%), were 65 or older (75.11%), without a romantic partner (divorced/widowed/separated/never married) (55.11%), former smokers (62.72%), have only one type of cancer (62.07%), and retired (63%). The largest portion of patients were diagnosed with LC at 65 years of age or older (48.70%), had an educational background in high school or less (47.39%), made less than \$25,000 a year (30.11%), and were located in the Midwest (45.98%).

Race and Ethnicity. Of the total 920 participants, 756 were Non-Hispanic White (82.17%), 66 were Non-Hispanic Black (7.17%), 27 were Hispanic (2.93%), and 71 (7.72%) were from all other races.

Education. Across all race/ethnicity categories, the majority of the study sample had an educational background of high school or less (Non-Hispanic White = 46.96%, Non-Hispanic Black = 56.06%, Hispanic = 59.26%, and Other = 39.44%, $p = 0.7364$). Less than a quarter of the study sample had obtained a bachelor's degree or higher at the time of taking the survey (22%).

Marital Status. Most Non-Hispanic White, Non-Hispanic Black, and Hispanic participants were not married or in a relationship with a romantic partner at the time of taking the survey (Non-Hispanic White = 53.17%, Non-Hispanic Black = 80.3%, and Hispanic = 74.07%, $p < 0.0001$)

and identified as either divorced, widowed, separated, or never married. Those who did not identify as any of these races/ethnicities were mainly married or they had a romantic partner (Other = 52.11%).

Employment Status. Across all categories, most of the study sample were retired when it came to their employment status (Non-Hispanic White = 64.81%, Non-Hispanic Black = 53.03%, Hispanic = 55.56%, and Other = 57.75%, $p < 0.0001$). Only a small portion of the study sample were employed and currently working at the time of taking the survey (15%).

Age. The majority of the study sample were 65 and older individuals for all race/ethnicity categories (Non-Hispanic White = 76.59%, Non-Hispanic Black = 63.64%, Hispanic = 70.37%, and Other = 71.83%, $p = 0.0017$).

Sex. Most of the Non-Hispanic White, Non-Hispanic Black, and Hispanic respondents were Female (Non-Hispanic White = 60.32%, Non-Hispanic Black = 57.58%, Hispanic = 59.26%, $p = .1021$). Most of those who did not identify with any of these racial categories were male (Other = 56.34%).

Smoking Status. Across all racial categories, most of the study sample were former smokers (Non-Hispanic White = 64.42%, Non-Hispanic Black = 57.58%, Hispanic = 55.56%, Other = 52.11%, $p = 0.1639$). Respondents who identified as Hispanic or other races have higher portions of current smokers when compared to Non-Hispanic White and Non-Hispanic Black categories (Hispanic = 25.92%, Other = 25.36%). The Non-Hispanic Black racial category had the highest portion of those who never smoked (Non-Hispanic Black = 22.73%).

How many different types of cancer have you had? Across all racial categories, most respondents only had one type of cancer in their lifetime (Non-Hispanic White = 59.39%, Non-Hispanic Black = 83.33%, Hispanic = 62.96%, Other = 70.42%, $p = 0.0040$). The Hispanic category had the highest portion of those with two types of cancer (Hispanic = 33.33%).

Age at Diagnosis. Across all racial categories, most respondents were age 65 and older when they were first diagnosed with lung cancer (Non-Hispanic White = 49.34%, Non-Hispanic Black = 43.94%, Hispanic = 44.44%, Other = 47.89%). The Hispanic category had the highest portion of those who were diagnosed with lung cancer before the age of 41 (0 - 40). (Hispanic = 14.81%). The Non-Hispanic Black category contained the largest portion of those who were diagnosed with lung cancer between the ages of 41-54 (Non-Hispanic Black = 18.18%).

Income. Across all racial categories, the largest portion of respondents made less than \$25,000 a year (Non-Hispanic White = 27.65%, Non-Hispanic Black = 45.45%, Hispanic = 59.26%, Other = 30.99%, $p < 0.0001$). Those who did not identify with any of the presented racial categories had the highest portion of those who made \$50,000 or more a year (Other = 30.99%).

Census Regions (Location of Respondents' Residence). Most Non-Hispanic White respondents were in the Midwest (Non-Hispanic White = 49.21%). Most of the Non-Hispanic Black respondents were in the South (Non-Hispanic Black = 45.45%). Most Hispanic respondents and those from all other racial categories were located in the West (Hispanic = 44.44%, Other = 52.11%, $p < 0.0001$).

Table 1. Characteristics of Lung Cancer Survivors by Race, BRFSS 2017-2021

	NH White	NH Black	Hispanic	Other	
Variables	n (%)	n (%)	n (%)	n (%)	p-values
All	756 (100)	66 (100)	27 (100)	71 (100)	
Education					p = 0.7364
High school or less	355 (46.96)	37 (56.06)	16 (59.26)	28 (39.44)	
Some college and tech school	228 (30.16)	15 (22.73)	7 (25.93)	25 (35.21)	
Four-year college graduate or higher	172 (22.75)	14 (21.21)	4 (14.81)	18 (25.35)	
Refused to answer	1 (0.13)	0 (0)	0 (0)	0 (0)	
Marital Status					p < 0.0001*
Married or has a partner	350 (46.3)	13 (19.7)	7 (25.93)	37 (52.11)	
Divorced/Widowed/Separated/Never Married	402 (53.17)	53 (80.3)	20 (74.07)	32 (45.07)	
Refused to answer	4 (0.53)	0 (0)	0 (0)	2 (2.82)	
Employment Status					p < 0.0001*
Employed	120 (15.87)	5 (7.58)	5 (18.52)	13 (18.31)	
Unemployed	17 (2.25)	5 (7.58)	0 (0)	9 (12.68)	
Homemaker/Student/Unable to work	128 (16.93)	21 (31.82)	7 (25.93)	7 (9.86)	
Retired	490 (64.81)	35 (53.03)	15 (55.56)	41 (57.75)	
Refused to answer	1 (0.13)	0 (0)	0 (0)	1 (1.41)	
Age					p = 0.0017*
18 – 54	47 (6.21)	12 (18.19)	3 (7.41)	9 (12.68)	
55 – 64	130 (17.2)	12 (18.18)	5 (18.52)	11 (15.49)	
65 and older	579 (76.59)	42 (63.64)	19 (70.37)	51 (71.83)	
Sex					p = 0.1021
Male	300 (39.68)	28 (42.42)	11 (40.74)	40 (56.34)	
Female	456 (60.32)	38 (57.58)	16 (59.26)	31 (43.66)	
Smoking Status					p = 0.1639
Current	148 (19.58)	13 (19.7)	7 (25.92)	18 (25.36)	
Former	487 (64.42)	38 (57.58)	15 (55.56)	37 (52.11)	
Never	116 (15.34)	15 (22.73)	4 (14.81)	16 (22.54)	
How many different types of cancer have you had?					p = 0.0040*
Only one	449 (59.39)	55 (83.33)	17 (62.96)	50 (70.42)	
Two	238 (31.48)	8 (12.12)	9 (33.33)	13 (18.31)	
Three or more	69 (9.13)	3 (4.55)	1 (3.7)	8 (11.27)	
Age at Diagnosis					p = 0.9677
Age 0 - 40	71 (9.39)	6 (9.09)	4 (14.81)	7 (9.86)	
Age 41 - 54	104 (13.76)	12 (18.18)	3 (11.11)	11 (15.49)	
Age 55 - 64	208 (27.51)	19 (28.79)	8 (29.63)	19 (26.76)	
Age 65 and older	373 (49.34)	29 (43.94)	12 (44.44)	34 (47.89)	
Income					p < 0.0001*
Less than \$25,000	209 (27.65)	30 (45.45)	16 (59.26)	22 (30.99)	

\$25,000 - \$49,000	198 (26.19)	14 (21.21)	5 (18.52)	18 (25.35)	
\$50,000 or more	199 (26.32)	12 (18.18)	3 (11.11)	22 (30.99)	
Refused to answer	150 (19.84)	10 (15.15)	3 (11.11)	9 (12.68)	
Census Regions (Location of Respondents' Residence)					p < 0.0001*
Midwest	372 (49.21)	28 (42.42)	4 (14.81)	19 (26.76)	
Northeast	130 (17.2)	7 (10.61)	4 (14.81)	6 (8.45)	
South (includes Puerto Rico)	130 (17.2)	30 (45.45)	7 (25.93)	9 (12.68)	
West (includes Guam)	124 (16.4)	1 (1.52)	12 (44.44)	37 (52.11)	

* $p < 0.05$ indicates statistical significance

Health-Related Quality of Life by Race

The mean unhealthy days per month for each race/ethnicity is reported in Table 2. Compared to the Non-Hispanic White group (13.41 days), the Hispanic group was found to have reported the highest average of unhealthy days per month in this study (17.56 days). Other races were found to have the next highest average of unhealthy days compared to the Non-Hispanic White group with 16.25 days per month. The Non-Hispanic Black group was found to have the lowest average unhealthy days with an average of 11.52 days per month. However, due to p-values greater than 0.05, none of these results were found to be statistically significant.

Table 2. Mean Unhealthy Days by Race, BRFSS 2017-2021

Race/Ethnicity	Mean Unhealthy Days	p-value
NH White	13.41	Reference
NH Black	11.52	0.70
Hispanic	17.56	0.36
Other	16.25	0.32

Odds ratios comparing the odds of frequent mental distress are reported in Table 3. Compared to the Non-Hispanic White Group, the Hispanic group was found to have 3.14 times the odds of reporting frequent mental distress (OR = 3.14, 95% CI=1.40 – 7.02). With 95% confidence limits

greater than 1.0, this result was found to be statistically significant. The Non-Hispanic Black group was found to have less than 1.0 the odds of reporting frequent mental distress when compared to the Non-Hispanic White group (OR = 0.86, 95%CI=0.41-1.78). Receiving a 95% confidence limit less than 1.0, this result was not found to be statistically significant. Other races were found to have 1.85 times the odds of reporting frequent mental distress compared to the Non-Hispanic White group (OR = 1.85, 95%CI=1.04-3.27). With 95% Confidence Limits greater than 1.0, this result was found to be statistically significant.

Table 3. Odds Ratio Estimates Comparing Frequent Mental Distress by Race, BRFSS 2017-2021

Effect	Odds Ratio	95% Confidence Limits
NH Black vs NH White	0.86	0.41 – 1.78
Hispanic vs NH White	3.14	1.40 – 7.02*
Other vs NH White	1.85	1.04 – 3.27*

* Statistically significant

Odds ratios of fair/poor health by race/ethnicity are reported in Table 3. Compared to the Non-Hispanic White Group, the Non-Hispanic Black group was found to have 1.39 times the odds of reporting fair/poor health (OR = 1.39, 95%CI=0.84-2.32). The Hispanic group was found to have less than 2.29 times the odds of reporting fair/poor health when compared to the Non-Hispanic White group (OR = 2.29, 95%CI=0.99-5.29). All other races were found to have 1.57 times the odds of reporting fair/poor health compared to the Non-Hispanic White group (OR= 1.57, 95%CI=0.95-2.59). Receiving 95% confidence limits less than 1.0, none of these results were found to be statistically significant.

Table 4. Odds Ratio Estimates Comparing Reports of Fair/Poor Health by Race, BRFSS 2017-2021

Effect	Odds Ratio	95% Confidence Limits
NH Black vs NH White	1.39	0.84 – 2.32

Hispanic vs NH White	2.29	0.99 – 5.29
Other vs NH White	1.57	0.95 – 2.59

DISCUSSION

The purpose of this study was to examine the relationship between racial categories and quality of life in lung cancer survivors utilizing 2017-2021 BRFSS data. It was hypothesized that non-Hispanic Black lung cancer survivors would have the lowest reported HRQoL. We expected the Non-Hispanic Black sample used in this study to have lower HRQoL scores overall. Contrary to our hypothesis, the Non-Hispanic Black survivors did not have statistically different HRQoL scores when compared to the Non-Hispanic White survivors for any of the three measures we examined (mean unhealthy days, frequent mental distress, report of fair/poor health).

Interestingly, our findings indicated that Hispanic survivors reported experiencing greater levels of mental distress among the racial categories. When compared to the Non-Hispanic White group, the Hispanic odds of reporting frequent mental distress were 3.14 times higher. The Hispanic population also had a higher average of unhealthy days (though not statistically different from Non-Hispanic White) and had highest odds of fair/poor health. For these reasons, we consider the Hispanic sample to have the lowest HRQoL in this study. Although these results were unexpected, prior research has provided similar findings of poor HRQoL reported in Hispanic cancer survivors (ref).

Comparison to the Literature

Previous studies (Bouazza et al.¹³, Ediebah et al.¹⁴, Nicklasson et al.¹⁵, Pierzynski et al.¹⁶, Reale and Luca et al.⁵, Reale and Maio et al.⁴, Sloan et al.¹⁷, Sterzi et al.¹⁸, and Zikos et al.¹⁹) have reported on the importance and role of quality of life when it comes to LC management and how

it has been previously under-reported until recent years. While our results were unexpected, it does not minimize the importance of HRQoL as a form of measurement within future LC studies. Quality of life has been linked to important consequences of those with the LC such as mortality and survival rates^{14,16,17}.

Additional HRQoL work by Hardy et al.²⁰, Japunitch et al.²¹, Tanner et al.⁶, Shusted et al.²², Lin et al.²³, and Meza et al.³ examined the presence of racial disparities in lung cancer community and possible reasons for their existence specifically between the Black and White racial groups. While our results comparing the HRQoL scores between Non-Hispanic White and Non-Hispanic Black racial groups were found to be statistically insignificant, it is important to remember that the Black population has the worst survival rate out of any of the groups analyzed within this study²⁵; thereby, possibly affecting the results.

The article by Lehto et al.² utilized interviews with 11 LC patients to determine how the stigmatization surrounding LC adds another burden to their experience with the disease; especially regarding how the smoking status of the patient plays into the diagnosis of LC. While this study was unable to explore qualitative methods of assessing the lung cancer patient experience, it is important to realize that 16.41% of our study sample identified as never having smoked before. Roughly 25% of those diagnosed with LC have never smoked² and, at such a devastating point of their lives, the need for social support and negative societal views may play a role in quality of life, specifically frequent mental distress.

Survivorship Bias

We believe survivorship bias may be present in the sample, impacting the observed results for the Non-Hispanic Black survivors reporting higher HRQoL scores than expected. Lung cancer has an overall five-year survival of only around 19%.²⁵ Therefore, lung cancer survivors, as represented in this sample, may be healthier than their counterparts that did not survive the disease. Previous research also shows that the Non-Hispanic Black population has the highest lung cancer mortality than any other racial group.²⁵ The people that survived lung cancer and answered the BRFSS questionnaire used in this study were an older, higher educated, and possibly healthier subset of the non-Hispanic Black population of cancer patients. This may be playing into the better HRQoL scores observed for the non-Hispanic Black population. Additionally, Hispanic women have the best mortality rate when it comes to LC²⁵, and approximately 59% of the Hispanic sample used in this study were women. Previous analyses have reported a survival advantage among Hispanic women. They have the lowest cancer mortality of any racial/ethnic group. However, our results show that even though they may be surviving their quality of life may be suffering. Survival does not necessarily translate into one's quality of life. Further research into factors surrounding quality of life in Hispanic lung cancer survivors is necessary.

We examined the demographic variables of our sample and the characteristics that were found to be statistically significant when compared by race were marital status, employment status, age, the number of cancers the respondent had, income, and the census region of the respondents'

residence. The sample of non-Hispanic Black survivors also had a higher percentage of never smokers than the non-Hispanic White and Hispanic survivors. Lung cancer associated with a smoking history is often more aggressive than lung cancer in never smokers, potentially impacting quality of life.²⁶

Limitations

Even after combing five years of BRFSS data, this study still utilized a relatively small sample size of 920 LC patients in the data analysis and even smaller totals once respondents were divided into groups by their race/ethnicity. Compared to other racial disparities studies of this nature that obtained statistically significant results such as those conducted by Hardy et al.²⁰ and Tanner et al.⁶ we had a much smaller sample size. With our data being from a national-cross sectional study and over 235,000 people being diagnosed with the disease every year in the United States,²⁵ a larger sample size should be obtained moving forward. Our results contained wide confidence intervals, likely a result of the small sample size, which may have underpowered our ability to detect statistical significance. Another possible limitation is that the stage at which the respondents were diagnosed with LC could not be assessed. The BRFSS does not collect data regarding the LC's stage of diagnosis. The stage at which LC is diagnosed greatly impacts the survival rate of individuals and possible treatment approaches recommended by healthcare professionals.²⁵ Specifically, it was found in Meza et al.³ that Black patients continue to get diagnosed with LC at later stages of the disease and Hardy et al.²⁰ discovered that Black LC patients diagnosed at later stages are also 57% less likely to receive the recommended chemotherapy treatment. It is assumable that those who were diagnosed at a later stage may

experience a lower quality of life. Lower HRQoL scores have been linked to lower survival rates which have been linked to late-stage LC diagnoses.^{14,16,17}

Implications for Future Research

Future research needs to heavily consider the poor survival rates of those with LC and push for data collection that occurs within one year of diagnosis to prevent low survival rates from interfering with the validity of the data. Knowing that the Non-Hispanic Black/African American population is more likely to die from this disease when compared across racial groups, they may be less likely to be able to be represented in studies like this. This study also identifies a potential need for culturally appropriate interventions and treatment for Hispanics who have lower quality of life to determine why they are experiencing elevated levels of frequent mental distress. It has been found that various psychosocial treatments such as exercise and navigational interventions benefit this population.²⁷ Although, the HRQoL scores calculated are from self-reported data, there is a lack of qualitative data within the field overall. LC not only affects a large number of people, but 81% percent of those individuals diagnosed with LC are not expected to survive five years with the disease.²⁵ This creates an environment where it is difficult to access LC patients for research to understand their experience with the disease, especially for minority groups with limited access to the same levels of care and lower survival rates compared to their White counterparts. To better bridge the gap between the HRQoL quantitative scores that we see and racial groups' true experience with the LC, qualitative data is a necessity. Patient interviews will allow us to obtain such data and push toward recognizing if a disparity is truly present between the Non-Hispanic Black and White populations.

Conclusion

To our knowledge, this project was the first of its kind to utilize BRFSS cross-sectional data on LC survivors and examine the connection between their quality of life and race/ethnicity.

Although we obtained unexpected results, with the Hispanic group having the lowest HRQoL scores, our results still demonstrate the need for further research in this field. Future studies should consider mixed methods designs to examine patients currently experiencing the disease to better assess LC patient HRQoL scores between racial groups.

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