

FACTORS INFLUENCING NON-HODGKIN LYMPHOMA SURVIVORS'  
QUALITY OF LIFE

Ashley Nicole Leak

A dissertation submitted to the faculty of the University of North Carolina at Chapel Hill in  
partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of  
Nursing

Chapel Hill  
2011

Approved by:

Deborah Mayer, PhD

Sophia Smith, PhD

Coretta Jenerette, PhD

Donald Bailey, PhD

Jamie Crandell, PhD

Sheryl Zimmerman, PhD

## **ABSTRACT**

Ashley Leak: Factors Influencing non-Hodgkin Lymphoma Survivors' Quality of Life  
(Under the direction of Deborah Mayer, PhD)

Non-Hodgkin lymphoma (NHL) is the most common hematologic malignancy. Survivors of NHL are living longer, and their adaptation to the disease long-term is a needed research area. Therefore, this retrospective, cross-sectional analysis using a preexisting data set (1) explored demographic and disease characteristics associated with quality of life (QOL) for NHL survivors, (2) tested a conceptual model to determine if adaptation to NHL mediated the relationship between the demographic and disease characteristics of that QOL, and (3) determined whether age moderated demographic and disease characteristics and examined their relationships with QOL. The model framework was adapted from the cancer survivor adaptation model (Naus, Ishler, Parrott, & Kovacs, 2009). It was proposed and tested to determine statistically significant relationships among the three components of cancer survivorship: personal characteristics, adaptation, and outcomes. The NHL survivors were predominantly Caucasian, married/living with a partner, 62 years old on average, and 10 years past diagnosis on average. The second aim used a SEM model and provided adequate goodness-of-fit indices with direct effects from personal characteristics on QOL: current age, income, total comorbidity score, and years since diagnosis. The other three effects were partially mediated by either negative adaptation (comorbidity, years since diagnosis) or both negative adaptation and positive adaptation (current age). The remaining personal characteristics had no direct effects on QOL, but they had fully mediated effects

through negative adaptation (bone marrow transplant), positive adaptation (gender), or both (education and current treatment status). A moderation model was used to determine how personal characteristics impacted QOL using age as a moderator for the third aim. The analyses included a comparison of younger ( $< 65$  years of age) and older ( $\geq 65$  years of age) participants and differences in interaction effects on them. Younger age was associated with a greater likelihood of being female, earning less than \$30,000 annually, and poorer QOL outcomes. Income was most strongly correlated with age and was negatively associated with QOL for younger survivors. This study's results suggest that both positive and negative perceptions mediate relationships between demographic and disease characteristics and QOL for NHL survivors.

## **DEDICATION**

This work is dedicated to the special people in my life who have taught me priceless lessons about living with illnesses and thriving. You showed me humility through your cancer experiences. Some of you are still here, and others have died. I want you all to know I think about you often. This work and my future work are dedicated to you. I love you.

James Leak (father), James Lewis Leak (grandfather), Dorothy Leak Cason (grandmother), Milas Cason (grandfather), Josephine Liles (grandmother), Ella Sue Thickpen (great aunt), Ruby Pegues (cousin), Maggie Charles (aunt), Suzanne Carroll, Perry Wiles, Carl Doby, Tanzia Carver, Mr. Satterfield, Mrs. Caberra, and Frank Aversa.

## ACKNOWLEDGMENTS

Countless people have supported me through my educational journey, leading to this accomplishment. Thanks to my Heavenly Father, who has always been right beside me even when I did not trust Him and the process. I also express my sincere gratitude to the many people who helped make this dissertation possible.

I must thank my dissertation chair, Dr. Deborah Mayer, who believed in and encouraged me during this intellectual process. Thank you for always being a support, for listening, and for taking me under your wings to mentor me. Dr. Sophia Smith, you generously offered your data set to me so I could ask questions from it for my research. Your kind words and spirit have never gone unnoticed. Dr. Coretta Jenerette, thank you for listening to and always laughing with me even when I did not think I could make it. To Dr. Donald Bailey, I appreciate your sincere guidance as I have matured in this journey and your expertise in caring for older cancer survivors. Thank you for encouraging me to apply for the John A. Hartford Building Academic Geriatric Nursing Capacity Scholarship Program. To Dr. Jamie Crandell and Dr. Cathy Zimmer, thank you for your tireless support in clarifying theoretical frameworks. Your unrelenting commitment to my statistical analysis work was immeasurable. Thank you to Dr. Sheryl Zimmerman for giving me encouragement while challenging me to perform at my highest effort throughout this process.

Special thanks to all of my dissertation committee members who assisted me in achieving this ultimate goal: Dr. Mayer, Dr. Sophia Smith, Dr. Coretta Jenerette, Dr. Donald

“Chip” Bailey, and Dr. Jamie Crandell. Thank you for your guidance, suggestions, and feedback.

To Michelle Johnson and Theresa Maitland, who have provided countless hours of emotional support and coaching as I progressed through the doctoral program, I do not think I would have completed this without your constant presence and uplifting comments.

I especially want to thank my classmates and friends: Britt Pados, Carolyn Jones, Dr. Melissa Aselage, Cherie Smith Miller, Dr. Leslie Davis, Ken Onori, Dr. Jamie Rogers, Dr. Angelo Moore, Dr. Lisa Lindley, Kobi Lieper, Jinhee Park, Nancy Havill, Cheryl Brewer, Brandy Mechling, and Deborah “Hutch” Allen.

Thanks also to the special friends in my life who called or e-mailed to see how school was coming along: Amy Williams, Natalee Calais, Ann Marie Walton, Heather Mackey, Megan Manuel, Jennifer Howard, Suzanne Carroll, Shaun Michaels, Ellen D. Davis, Angela Spruill, Barbara Riff, Dr. Yolanda Wall, Dr. Brigit Carter, Dr. Terry Ward, and Dr. Tracey Gosselin. Thanks to my colleagues at Wake Forest University Baptist Medical Center, Duke, and the University of North Carolina at Chapel Hill, who supported me wholeheartedly during my educational journey. To my colleagues at the Duke University School of Nursing and on the 9100 unit at Duke University Medical Center who supported me and encouraged me through the process, thank you. I give my gratitude also to the Triangle North Carolina Nurses Association (NCNA) and my NCNA colleagues, to my Central Carolina Black Nurses Council support, and to the 4 Oncology and Bone Marrow Transplant teams at UNC Hospitals.

Lastly, I give my thanks to my parents, James and Patricia Leak, and sister, Alisha Leak, who have always loved me no matter what. They encouraged me to stay focused and

listened patiently day after day. Thanks also to my aunts, uncles, cousins, and grandparents who love me unconditionally. To Owen Bryant, III, and Kayla Bryant, thanks for your humor, laughs, and support during this time. The delicious meals in the evenings and games we played will always be cherished memories for me.

I also want to acknowledge my funding sources for my doctoral studies. Without their financial support, it would have been more difficult to complete this study. My sincere gratitude is given to the T32 Predoctoral Fellow Institutional National Research Service Award for the Interventions to Prevent and Manage Chronic Illness, the John A. Hartford Building Academic Geriatric Nursing Capacity Scholarship for 2009–2011, the Nurse Educators for Tomorrow Gordon H. DeFrieze Career Development in Aging Research Award, the Pauline W. Brown Diversity Scholarship Award, the Triangle Region NCNA Scholarship, the Dr. Hattie Bessent Scholarship, the NC League for Nursing Academic Scholarship, the Nurses Educational Funds, Inc., and the Mary Lewis Wyche Doctoral Fellowship.

## TABLE OF CONTENTS

List of Tables .....	xii
List of Figures .....	xiii
Chapter 1: Introduction .....	1
Statement of the Problem .....	1
Purpose .....	2
Conceptual Framework .....	3
Summary .....	5
References .....	7
Chapter 2: Quality of Life Domains Among NHL Survivors: An Integrative Literature Review .....	9
Introduction .....	9
Methods .....	11
Results of the Literature Review .....	12
General Characteristics .....	12
Quality of Life Measures .....	28
Physical Well-Being .....	31
Psychological Well-Being .....	32
Social Well-Being .....	33
Functional Well-Being .....	34
Spiritual and Existential Well-Being .....	35



Treatment Effects on Quality of Life.....	36
Older Adults with NHL .....	37
Design and Framework.....	38
Discussion.....	39
Implications for Future Research.....	40
References.....	42
Chapter 3: An Exploratory Mediation Model of the Relationships Between Positive and Negative Adaptation to Cancer and NHL Survivors’ Quality of Life.....	47
Introduction.....	47
Conceptual Framework.....	49
Method .....	50
Study Design.....	50
Participants and Procedures .....	51
Measures .....	51
Demographic and disease characteristics.....	51
Adaptation.....	52
Quality of life outcomes.....	52
Data Analyses .....	53
Results.....	55
Sample.....	55
Demographic and Disease Characteristics’ Relationships with Quality of Life.....	56
Results.....	56
Goodness-of-fit results.....	58

Partial and full mediation results. ....	59
Discussion.....	61
Limitations .....	63
Strengths .....	64
Conclusion .....	66
References.....	67
Chapter 4: The Influence of Age on Non-Hodgkin Lymphoma Survivors’ Quality of Life.....	70
Introduction.....	70
Conceptual Framework.....	72
Method .....	72
Study Design.....	72
Participants and Procedures .....	73
Measures .....	73
Demographic and disease characteristics.....	73
Quality of life outcome .....	74
Data Analyses .....	74
Results.....	75
Sample.....	75
Discussion.....	80
Conclusion .....	83
References.....	84
Chapter 5: Findings and Implications.....	86
Conceptual Framework.....	87

Sample.....	88
Aim 1 .....	89
Aim 2 .....	91
Aim 3 .....	92
Strengths and Limitations .....	93
Implications for Research .....	94
Implications for Practice.....	95
Conclusion .....	97
References.....	98

## LIST OF TABLES

Table 1.1 Key Terms and Definitions of Cancer Adaptation Model and of Study .....	4
Table 2.1 General Characteristics of Reviewed Studies.....	13
Table 2.2 QOL-Related Measures Used in NHL Survivorship Studies ( $n = 6$ ) .....	29
Table 3.1 Demographic Characteristics of the Sample.....	54
Table 3.2 Mediation Model of Direct and Indirect Effects of Significant Characteristics on QOL with Standardized Coefficients .....	56
Table 4.1 Demographics of the Sample.....	76
Table 4.2 Age as a Moderator of the Demographic and Disease Factor Relationships with Quality of Life.....	79

## LIST OF FIGURES

Figure 1.1 The cancer survivor adaptation model illustrating the three components and three variables that affect positive and negative adaptations of survivors to their cancer diagnoses and treatments.....	4
Figure 3.1 The cancer survivor adaptation model illustrating the three components and three variables that affect the positive and negative adaptations of survivors to their cancer diagnoses and treatments.....	50
Figure 3.2 Final model of cancer survivorship adaptation and quality of life with standardized paths. Estimates ( $N = 771$ ).....	65
Figure 4.1 Final age moderation model .....	80
Figure 5.1 The cancer survivor adaptation model illustrating the three components and three variables that affect the positive and negative adaptations of survivors to their cancer diagnoses and treatments.....	88
Figure 5.2 Final regression model with all significant variables ( $p < .05$ ).....	90

# CHAPTER 1

## INTRODUCTION

### Statement of the Problem

Non-Hodgkin lymphoma (NHL) is the sixth most common cancer in the United States (US) with more than 65, 540 new diagnoses expected in 2010. An estimated 20, 210 deaths will occur due to NHL this year (Surveillance and Epidemiology and End Results, 2010). The 5-year survival rate for all individuals diagnosed with NHL is 68%. This number will increase because survivors are living longer due to medical and pharmaceutical treatment advancements (National Cancer Institute [NCI], 2010). As survivorship numbers increase, so does the percentage of older adults managing both late- and long-term effects caused by their disease and treatment (Ganz, 2001). The increase in survivorship numbers has generated interest not only in exploring late- and long-term quality of life (QOL) issues, but also in characteristics that influence adaptation to living with the disease.

Non-Hodgkin lymphoma is the most common hematologic malignancy found in people diagnosed with cancer. The median age at time of diagnosis is 67, making advancing age the risk factor most associated with developing NHL (American Cancer Society, 2010). Lymphomas are not a single disease, but rather, a group of diseases that affect white cells of the lymphatic system. They can be slow growing (*indolent*) or fast growing (*aggressive*) and can be chronic illnesses with fluctuating remissions, exacerbations, and symptoms including

fevers, fatigue, weight loss, night sweats, and pain (NCI, 2010). There are two types of lymphoma: Hodgkin and non-Hodgkin. Approximately 80% of affected individuals are diagnosed with NHL (NCI, 2010). Treatment options for those diagnosed with NHL include chemotherapy, radiation, biotherapy (e.g., immunotherapy), hematopoietic transplantation, active surveillance, or a combination of those treatments. The most common first-line treatment of NHL is rituximab combined with cyclophosphamide, doxorubicin, vincristine, and prednisone (R-CHOP), which has improved the long-term outcomes of relapsed, untreated aggressive, or indolent NHLs (Czuczman, Weaver, Alkuzweny, Berlfein, & Grillo-Lopez, 2004; Schulz et al., 2007).

The physiological and psychological changes that occur during the NHL survivorship journey can be stressful, potentially resulting in negative effects on health-related outcomes. Survivors often experience coexisting illnesses or comorbidities, a decline in physical functioning, psychological distress, or a combination of all those factors. They are all associated with improved or decreased QOL (Ganz, 2001), a widely accepted, patient-reported outcome. Although there are different models of QOL, its common domains include physical, psychological, social, spiritual, and functional well-being (Cella et al., 1993; Ferrell, Hassey Dow, & Grant, 1995; Ferrell, Hassey Dow, Leigh, Ly, & Gulasekaram, 1995). An NHL diagnosis and its treatment may have effects on QOL domains, which may differ according to each survivor's individual characteristics. Survivors, specifically those who are elderly, represent a population for which adaptation to the disease remains understudied.

## **Purpose**

Given that the incidence of NHL has increased in the past decade, especially among the older adult population, there is a need to understand NHL survivors' adaptation process to living with their disease. Little literature to date examines the associations of personal characteristics with the adaptation to living with cancer among NHL survivors. This dissertation's aims are to (1) explore demographic and disease characteristics associated with QOL for NHL survivors, (2) test a conceptual model to determine if adaptation to a cancer diagnosis mediates the relationship between the demographic and disease characteristics and QOL, and (3) determine whether age moderates demographic and disease characteristics' effects on QOL and to examine their relationships with QOL.

## **Conceptual Framework**

The framework for this study is based on the cancer survivor adaptation model (CSA), derived from Naus, Ishler, Parrott, and Kovacs's (2009) research. It has three components: personal characteristics, adaptation, and outcomes. The three variables that depict relationships between those components are represented in the CSA model: personal characteristics, adaptation during the illness, and cancer specific QOL outcomes (Figure 1.1). *Personal characteristics* include the biological, psychological, social, and spiritual factors that impact the cancer experience. *Adaptation* is the fundamental component of this model and is an ongoing, cognitive process involving continuous appraisal of the situation by the survivor (Naus et al., 2009). It is reflected as the positive and negative impact of cancer. *Quality of life* is the outcome of the model. The terms of this model and other terms in this dissertation are described in Table 1.1.



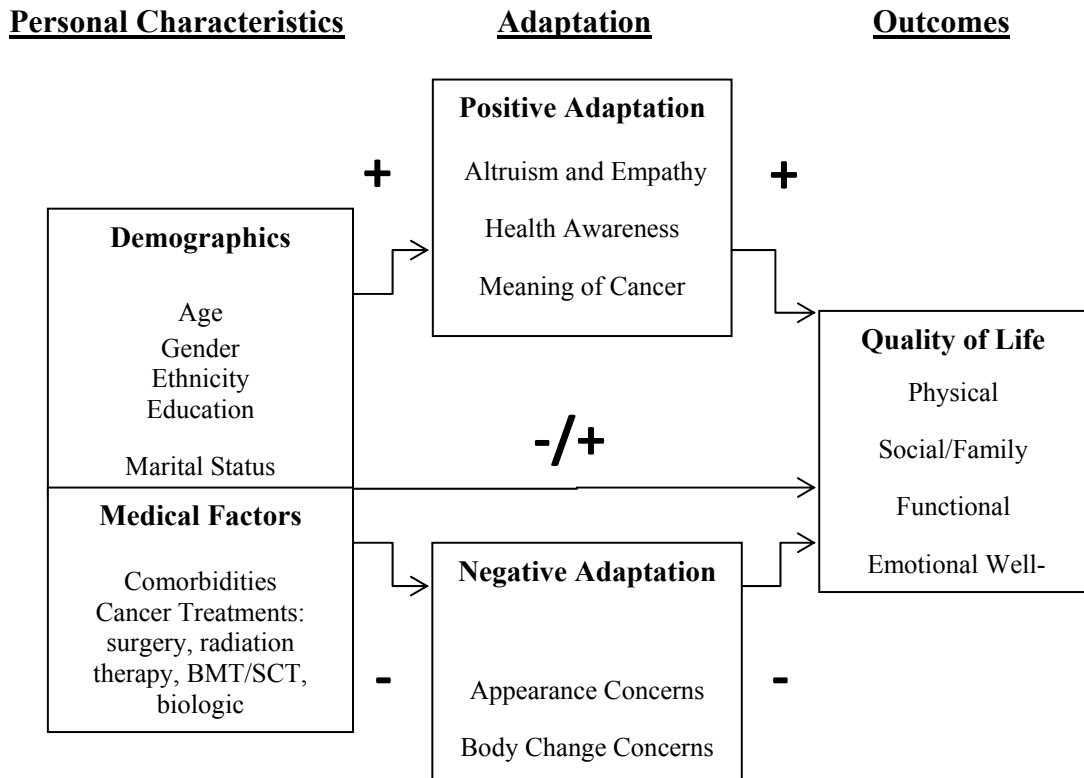


Figure 1.1. The cancer survivor adaptation model illustrating the three components and three variables that affect positive and negative adaptations of survivors to their cancer diagnoses and treatments. *Source:* Adapted from Naus, Ishler, Parrott, and Kovacs, 2009. BMT/SCT = bone marrow transplantation/stem cell transplantation.

All of these variables can influence survivors' adaptations to cancer, and understanding their relationships will help to better address the multifaceted health needs of NHL survivors.

Table 1.1.

*Key Terms and Definitions of Cancer Adaptation Model and of Study*

<b>Key Term</b>	<b>Definition</b>
Adaptation	The appraisal of the situation as positive or negative coping with the cancer experience (Naus, Ishler, Parrott, & Kovacs, 2009).

Impact of Cancer	The assessment of health-related quality of life to more fully understand the burden of cancer and the evaluative effects of cancer treatments (Zebrack, 2000).
Non-Hodgkin Lymphoma	Cancer consisting of malignant lymphocytes (National Cancer Institute [NCI], 2010).
Older Adult	Individuals aged 65 years and older in the United States who have reached retirement age per government regulations (World Health Organization, 2010).
Personal Characteristics	Inter- and intra-personal characteristics that include the biological, psychological, social, and spiritual factors that impact the cancer experience (Naus et al., 2009).
Quality of Life	A subjective, multidimensional construct that includes both positive and negative aspects of life. Its domains include physical, functional, social and familial, and emotional well-being (Cella et al., 1993; Cella, Webster, & Cashy, 2005; Ware & Sherbourne, 1992).
Survivor	A survivor is an individual from the time of cancer diagnosis through the balance of his or her life (National Coalition for Cancer Survivorship, n.d.).
Survivorship	Survivorship is the physical, psychosocial, and economic issues of cancer from diagnosis until the end of life. It focuses on the health and life of an individual with cancer beyond the diagnosis and treatment phases. Survivorship includes issues related to the ability to get health care and follow-up treatment, late effects of treatment, second cancers, and quality of life (NCI, 2010).

---

### **Summary**

Chapters 2, 3, and 4 are three manuscripts that correspond to each specified aim of the study. Chapter 2, Manuscript 1, “Quality of Life Domains among NHL Survivors: An Integrative Literature Review,” is a review of NHL survivorship and QOL with an emphasis on older survivors. A comprehensive synthesis of the literature is provided. Chapter 3, Manuscript 2, “An Exploratory Mediation Model of the Relationships between Positive and

Negative Adaptation on QOL of NHL Survivors,” examines how adapting to cancer mediates the relationship between demographic and disease characteristics and the QOL of NHL survivors. Structural equation modeling (SEM) was used to test a CSA model based on cognitive appraisal theories (Naus et al., 2009). Chapter 4, Manuscript 3, “The Influence of Age on the QOL of NHL Survivors,” examines the effects of age on NHL survivors’ adaptation and QOL. A multiple regression analysis was used to determine the moderating effects of age on survivors’ QOL. Chapter 5 is a synthesis of the three manuscripts’ results with a focus on implications for future research and practice implementations.

## REFERENCES

- American Cancer Society. (2010). *Cancer Facts & Figures*. Retrieved from [http://www.cancer.org/downloads/STT/Cancer\\_Fact\\_and\\_Figures\\_2010.pdf](http://www.cancer.org/downloads/STT/Cancer_Fact_and_Figures_2010.pdf).
- Cella, D., Webster, K., & Cashy J. (2005). Development of a measure of health-related quality of life for non-Hodgkin's lymphoma clinical research: The Functional Assessment of Cancer Therapy-Lymphoma (FACT-Lym) [Abstract]. *Blood*, *106*, 222A.
- Cella, D., Tulsky, D., Gray, G., Sarafian, B., Linn, E., & Bonomi, A. (1993). The Functional Assessment of Cancer Therapy Scale: Development and validation of the general measure. *Journal of Clinical Oncology*, *11*(3), 570–579.
- Czuczman, M., Weaver, R., Alkuzweny, B., Berlfein, J., & Grillo-López, A. (2004). Prolonged clinical and molecular remission in patients with low-grade or follicular non-Hodgkin's lymphoma treated with rituximab plus CHOP chemotherapy: 9-year follow-up. *Journal of Clinical Oncology*, *22*(23), 4711–4716.
- Ferrell, B., Dow K., Leigh, S., Ly, J., & Gulasekaram P. (1995). Quality of life in long-term cancer survivors. *Oncology Nursing Forum*, *22*, 915–922.
- Ferrell, B., Dow, K., & Grant, M. (1995). Measurement of the quality of life in cancer survivors. *Qualitative Life Research*, *4*, 523–531.
- Ganz, P. A. (2001). Late effects of cancer and its treatment. *Seminars in Oncology Nursing*, *17*(4), 241–248.
- National Coalition for Cancer Survivorship. (n.d.) *The organization*. Retrieved from <http://www.canceradvocacy.org/about/org/>
- National Cancer Institute. (2010). *Non-Hodgkin Lymphoma*. Retrieved from <http://www.cancer.gov/cancertopics/types/non-hodgkin>
- Naus, M., Ishler, M., Parrott, C., & Kovacs, S. (2009). Cancer survivor adaptation model: Conceptualizing cancer as a chronic illness. *Journal of Clinical Psychology*, *65*(12), 1350–1359.
- Schulz, H., Bohilus, J., Telle, S., Skoetz, N., Reiser, M., Kober, T., . . . Engert, A. (2007). Immunotherapy with Rituximab and overall survival in patients with indolent or mantle cell lymphoma: a systematic review and meta-analysis. *Journal of National Cancer Institute*, *99*, 706-714.
- Surveillance and Epidemiology End Results [SEER]. (2010). *SEER State Fact Sheets: Non Hodgkin Lymphoma*. Retrieved from the National Cancer Institute: <http://seer.cancer.gov/statfacts/html/nhl.html>

Ware, J., & Sherbourne, C. (1992). The MOS 36 item short-form health survey (SF-36). Conceptual framework and item selection. *Medical Care*, 30, 473–483.

World Health Organization. (2010). The World Health Report. Accessed August 1, 2010 from [http://www.who.int/whr/1998/media\\_centre/50facts/en/](http://www.who.int/whr/1998/media_centre/50facts/en/)

Zebrack, B. (2000). Cancer survivors and quality of life: A critical review of the literature. *Oncology Nursing Forum*, 27(9), 1395–1401.

## CHAPTER 2

### QUALITY OF LIFE DOMAINS AMONG NHL SURVIVORS: AN INTEGRATIVE LITERATURE REVIEW

#### Introduction

Non-Hodgkin lymphoma (NHL) is the sixth most common cancer in the United States (US), with more than 65,540 new NHL diagnoses and 20,210 deaths expected in 2010 (American Cancer Society, 2010). Incidence and prevalence rates increase with age, and more than 70% of NHLs are diagnosed after the survivor is 55 years of age (American Cancer Society, 2010). The overall, 5-year survival rate is 68% (Horner, Ries, & Krapcho, 2009). Belonging to a group of hematologic cancers, NHL affects the white cells within the lymphatic system. Lymphomas can be slow growing (*indolent*) or aggressive (*fast-growing*). Individuals with HIV-associated NHL are more likely to have high-grade histology and respond poorly to treatment (Cote et al., 1997). In addition, NHL is a chronic illness with fluctuating remissions and exacerbations with varying symptoms: fevers, fatigue, weight loss, night sweats, and even localized pain dependent on the involvement of the tumors (National Cancer Institute, 2010). In fact, many survivors live with the disease for years and are often diagnosed during routine examinations (Hamblin, 2011).

In general, cancer is no longer synonymous with a death sentence; some types are viewed as manageable, chronic conditions, which is frequently the case with NHL. This is reflected in the change of terminology associated with cancer care. For example, individuals

with cancer are no longer perceived as *victims* but instead as *survivors* who live for years following a cancer diagnosis (Aziz & Rowland, 2003; Bloom, 2002). Although survivorship is often celebrated, cancer has a significant impact on survivors in terms of long-term health and psychosocial sequelae (Aziz & Rowland, 2003; Brown et al, 2003; Centers for Disease Control and Prevention, 2004; Ganz, 2001; Jemal et al., 2004). For example, cancer survivors are at increased risk for developing secondary malignancies and other diseases (e.g., cardiovascular disease, diabetes, osteoporosis; (Brown, et al., 2003; Centers for Disease Control and Prevention, 2004; Jemal et al., 2004, Bolin, 2008). In addition, Hewitt, Rowland, and Yancik (2003) reported that cancer survivors have almost a twofold greater likelihood of having at least one functional limitation than those without cancer.

The presence of one or more coexisting conditions or ailments in addition to a primary disease such as cancer is known as a *comorbidity* (Yancik, Ganz, Varicchio & Conley, 2001; Yancik, Havlik, & Wesley, 1996). When a survivor has another comorbid condition, they may experience a decline in functional status that can negatively influence their QOL. These comorbid conditions become more prevalent as people age, complicating the illness trajectory of NHL. However, the psychosocial and QOL needs of older adults with NHL remain understudied (National Cancer Institute, 2010). Because little data exist on older NHL survivors and the effects of various treatments on their QOL, it is important to understand their QOL domains to better address their needs. The purpose of this paper is to provide an integrative review that reports the science that has been used for determining QOL among older NHL survivors. The review was focused on QOL measures and treatment effects in the identified studies.

## Methods

Articles were retrieved for review via a combination of computer and manual searches of selected QOL and cancer-related publications. A comprehensive, online database search of Medline, Cumulative Index to Nursing and Allied Health Literature (CINAHL), PsycINFO, and the Cochrane Library was conducted for NHL research articles published between January 2000 and April 2010. The following search terms were used alone and in combination: *non-Hodgkin lymphoma*, *health-related quality of life*, *quality of life*, and *impact of cancer*.

Because there is a paucity of data regarding the QOL of older NHL survivors, studies that included younger NHL survivors and those with subsamples of NHL survivors were used in this analysis. However, there was a lack of clarity in age delineation in several studies, but it is assumed for this paper that individuals 65 years of age and older are *older adults* as per Medicare requirements, unless explicitly stated otherwise (Mols, Coebergh, & van de Poll-Franse, 2007). Except for Mols, Coebergh, and van der Poll-Franse (2007), no studies delineated age in their analyses.

Articles focused on central nervous system and T-cell cutaneous lymphomas were excluded because their treatment and clinical courses differ from other NHL subtypes (National Comprehensive Cancer Network, 2010). Additionally, publications lacking a standardized QOL-related outcome measure were excluded. Articles were retrieved in the English language, and publication types were limited to primary research reports and systematic reviews. Editorials, opinions, and case studies were excluded.

Articles were initially reviewed by abstracts and titles, yielding 42 abstracts from Medline, 143 abstracts from CINAHL, 12 abstracts from PsycINFO, and no abstracts from



the Cochrane Library. Duplicate articles were excluded as were abstracts that did not meet the inclusion criteria. The full texts of the remaining 98 articles were read. Eighteen articles met the inclusion criteria and were selected for review. Each article was critiqued and appraised for the quality of the research evidence in relation to the QOL of NHL survivors.

## **Results of the Literature Review**

### **General Characteristics**

The full list of reviewed studies and general characteristics are presented on Table 2.1. The majority ( $n = 15$ ) of the selected studies were published within the past 5 years. Twelve of the studies were based in the US, which has a larger cancer database and registry than those in the countries of the remaining studies: Netherlands ( $n = 2$ ), Canada ( $n = 1$ ), Israel ( $n = 1$ ), and the United Kingdom ( $n = 1$ ). Seventeen of the studies were descriptive, used a cross-sectional design with varying age ranges, and reported on the number of years postdiagnosis. Sociodemographic characteristics were homogeneous across all the studies.

Table 2.1

*General Characteristics of Reviewed Studies*

<b>Authors</b>	<b>Design</b>	<b>Purpose</b>	<b>Sample Characteristics</b>	<b>QOL-Related Measures</b>	<b>Findings</b>	<b>Strengths and Limitations</b>
Ahles et al. (2005)	Cross-sectional; New Hampshire, US	Compare QOL of breast and lymphoma svrs. treated with standard-dose, systemic CT or local surgery/RT	$N = 103$ NHL svrs, mean age = 55.8 years ( $SD = 13.5$ ). Chemotherapy, $n = 66$ , mean age = 50.4 years ( $SD = 12.8$ ); local therapy, $n = 37$ )	QOL-CS	Svrs. treated with systemic CT ( $n = 66$ ) scored significantly lower on overall QOL compared with svrs. treated with surgery and/or RT ( $p = .04$ , $n = 37$ ), Lymphoma svrs. treated with chemotherapy scored worse on the physical subscale than those treated with surgery and/or RT ( $p = .01$ )	Strengths: Appropriate instruments used to capture long-term effects  Limitations: Recruitment from 1 site, little diversity in sample, small number of lymphoma svrs., not randomly assigned to treatments, no conceptual framework

<b>Authors</b>	<b>Design</b>	<b>Purpose</b>	<b>Sample Characteristics</b>	<b>QOL-Related Measures</b>	<b>Findings</b>	<b>Strengths and Limitations</b>
Arden-Close, Pacey, & Eiser (2010)	Systematic review	<ol style="list-style-type: none"> <li>1. Identify and evaluate commonly used HRQOL measures</li> <li>2. Compare HRQOL in svrs. with NHL with general population</li> <li>3. Assess association between HRQOL &amp; different treatments, demographics, medical &amp; psychological variables</li> </ol>	18 identified eligible studies	SF-36, EORTC QLQ C-30, FACT-An, CARES, QOL-CS	18 studies included adult svrs. with lymphoma with histological diagnoses from various countries and various ages postdiagnosis	Strengths: 9 studies were longitudinal or case controlled, focus on lymphoma svrs.  Limitations: Cross-sectional designs, lack of demographic reporting of means and standard deviations, small samples, no conceptual framework

<b>Authors</b>	<b>Design</b>	<b>Purpose</b>	<b>Sample Characteristics</b>	<b>QOL-Related Measures</b>	<b>Findings</b>	<b>Strengths and Limitations</b>
Arora et al (2007)	Cross-sectional, Los Angeles SEER registry	Address conducting population-based survivorship research using cancer registries	N = 408 NHL svrs., mean age = 59.7 years SD = 15), 2-5 years posttreatment. Treatments: CT: 50.2%, CT + RT: 33.3%, BMT/SCT: 9.6%	SF-36	Older adults (65+; 19.9%) less likely to be lost to follow-up than younger adults 20-44 years old (37.6%), $p < .01$	Strengths: SEER registry for largest cohort of multiple cancers, use of Andersen's Behavioral Model for Health Services Utilization & Wilson & Cleary's HRQOL Model conceptual framework  Limitations: Cross-sectional, subject burden with 52-page questionnaire

Authors	Design	Purpose	Sample Characteristics	QOL-Related Measures	Findings	Strengths and Limitations
Bellizzi, Miller, Arora, & Rowland (2007)	Cross-sectional, Los Angeles County Cancer Surveillance Program	Examine positive and negative life changes of NHL svrs. and effects on physical and mental function	N = 308 NHL svrs, median age = 59.8 years (SD = 14.9), 3.5 years posttreatment. 94.2% had CT as part of treatment	SF-36, Life Impact Scale that identifies positive and negative changes, Life Orientation Test-Revised	Positive life change increased with physical functioning when examining overall change ( $p = .01$ ) and health behaviors ( $p = .01$ ); NHL had positive change on relationships, but a negative change on finances	Strengths: First to examine positive and negative life changes  Limitations: Cross-sectional, psychometrics of Life Impact Scale, lack of diverse sample demographically & in disease-related characteristics; no conceptual framework
Bellizzi et al., (2009)	Cross-sectional, California	Examine correlates of physical activity and QOL in NHL svrs.	N = 319 NHL svrs., mean age 59.8 years (SD = 14.8), 2–6 years posttreatment. CT: 48.9%, CT + RT: 33.9%, BMT/SCT: 10.7%	SF-36	25% svrs. met 150 mins.+ goal of exercise per week, 53% reported some activity, 20% reported no activity; NHL svrs. who engaged in some form of physical activity had better mental and physical health, improved QOL, $p < 0.001$	Strengths: First to describe exercise behavior in NHL svrs.  Limitations: Cross-sectional, self-report of physical activity, no conceptual framework

Authors	Design	Purpose	Sample Characteristics	QOL-Related Measures	Findings	Strengths and Limitations
Crespi, Smith, Petersen, Zimmerman, & Ganz (2010)	Cross-sectional, NC registry-based sample	1. Examine reliability and validity of the IOC v2 scales' measurement comparing breast and NHL svrs. 2. Compare results between survivor groups and evaluate generalizability of the IOC v2	N = 652 NHL svrs. mean age = 51.9 SD (14.2), 2-44 years postdiagnosis. Treatments not discussed	IOC, FACT-Lym, SF-36	Reliability and validity support associations of the scale; breast and NHL svrs. have similar IOC domains; scale may be generalizable to long-term svrs. but needs to be tested with other cancer svrs.	Strengths: Use of 47-item IOC vs. 81-item instrument, large NHL sample  Limitations: Cross-sectional, less diverse sample, no conceptual framework
Diamond, Taylor, & Anton-Culver (2010)	Cross-sectional; Orange and San Diego counties, California	Compare QOL characteristics and survival of svrs. with NHL with and without HIV infection	N = 50 NHL svrs. without HIV, median age = 45 years for entire sample (range = 17-70 years old), 1 year postdiagnosis. CT: 84%	FACT-G, FAHI	HIV+ NHL svrs. had worse overall QOL and survival than HIV- NHL svrs., $p < .0001$ , emotional well-being did not statistically differ between HIV+ and HIV- NHL svrs.	Strengths: NHL subgroups with and without HIV for comparison  Limitations: Cross-sectional, small NHL sample, few women, no conceptual framework

<b>Authors</b>	<b>Design</b>	<b>Purpose</b>	<b>Sample Characteristics</b>	<b>QOL-Related Measures</b>	<b>Findings</b>	<b>Strengths and Limitations</b>
Geffen, Blaustein, Amir, & Cohen (2003)	Cross-sectional, Israel	Explore relationship between PTSD and HRQOL	N = 44 cancer svrs., n = 36 NHL svrs. median age 51 years (range = 27–80), 2 years posttreatment. CT: 54%, RT: 14%, CT + RT: 32%	SF-36, PTSD Inventory	Lymphoma svrs. had lower physical HRQOL than controls, $p < .05$ ; intrusion scale and avoidance scale ( $p < .01$ ) associated with intense symptoms at early disease onset	Strengths: Comparison group, PTSD and HRQOL correlation  Limitations: Cross-sectional, small NHL sample, no conceptual framework

<b>Authors</b>	<b>Design</b>	<b>Purpose</b>	<b>Sample Characteristics</b>	<b>QOL-Related Measures</b>	<b>Findings</b>	<b>Strengths and Limitations</b>
Mols et al. (2007)	Cross-sectional survey; Eindhoven Cancer Registry, Netherlands	Explore long-term effects of NHL and treatment on HRQOL	N = 221 NHL svrs. mean age at survey 55.3 years. CT: 37%, RT: 15%, CT + RT: 26%, Surgery + RT + CT: 13%, Watchful waiting: 9%, 5–15 years postdiagnosis	SF-36, QOL-CS	NHL svrs. who had CT experienced worse psychological and social well-being than those who did not have CT; chronic conditions associated with poorer physical functioning, more pain; those employed reported more vitality and better mental well-being scores	Strengths: Diverse population treated throughout the Netherlands, large sample, initial response rate 80%  Limitations: Cross-sectional, follow-up was difficult due to low response rate (unverifiable addresses), no conceptual framework



Authors	Design	Purpose	Sample Characteristics	QOL-Related Measures	Findings	Strengths and Limitations
Mols, Coebergh, & van de Poll-Franse (2007)	Cross-sectional; Eindhoven Cancer Registry, Netherlands	Compared HRQOL and health care utilization of long-term cancer svrs. using population-based study comparing svrs. over and under 70 years of age	N = 294 NHL svrs. median age = 53 years for NHL svrs. < 70, median age = 76 years for NHL svrs. > 70, 5–15 years postdiagnosis. Surgery: n = 28, RT: n = 102, CT: n = 160, Watchful waiting: n = 16	SF-36	NHL svrs. had lower scores for general health perception and vitality compared to the normative population ( $p < .001$ ). Older age, $\geq 1$ comorbid disease, lower educational level, and current occupation had poorer HRQOL ( $p < .01$ ). > 70-years-old NHL svrs. visited their oncologist more than their PCP when compared to < 70 years, $p < 0.01$	Strengths: Work changes/patterns exist in long-term svrs.; work change correlated with HRQOL Limitations: Cross-sectional, limited follow-up, no conceptual framework
Pettengell, Donatti, & Hoskin (2008)	Cross-sectional, United Kingdom	Explore relationship between disease activity and health functioning on HRQOL	N = 222 follicular lymphoma, median age 60.4 years ( $SD = 10.6$ )	FACT-Lym	Svrs. who relapsed had worse QOL and physical and mental functioning compared to newly diagnosed, in partial or complete remission, or disease-free svrs.	Strengths: Health outcomes reported at different cancer stages, large sample Limitations: Subgroups were small, cross-sectional, no conceptual framework

<b>Authors</b>	<b>Design</b>	<b>Purpose</b>	<b>Sample Characteristics</b>	<b>QOL-Related Measures</b>	<b>Findings</b>	<b>Strengths and Limitations</b>
Reeve et al. (2009)	Cross-sectional; SEER data and MHOS, 1998–2003	Quantify extent of HRQOL changes before and after cancer diagnosis	N = 1,432 prostate, breast, colorectal, lung, bladder, endometrial, kidney, melanoma, and NHL svrs.; mean age 73.86 <i>SD</i> = 5.85; mean time from diagnosis to follow-up MHOS was 12.4 months. Treatments not discussed	SF-36	NHL svrs. ( <i>n</i> = 53) had the greatest decline in physical health compared to other cancers; NHL svrs. had lowered vitality and decrease in social function	Strengths: Large, focused older adult sample; svrs. survey data linked with SEER data; evaluated HRQOL before and after cancer diagnosis  Limitations: Medicare managed-plan svrs., sample size was small for NHL svrs., unable to conduct HRQOL follow-up survey (deaths, unenrolled from plan), no conceptual framework

Authors	Design	Purpose	Sample Characteristics	QOL-Related Measures	Findings	Strengths and Limitations
Smith, Crespi, Petersen, Zimmerman & Ganz (2010)	Cross-sectional, NC Cancer Registry	Examine the association between the IOC v2 scales and outcomes in a large sample of adult NHL svrs.	N = 652 NHL svrs., median age at study enrollment = 62.7 years, mean age at diagnosis = 51.9 years ( <i>SD</i> = 14.2), mean time from diagnosis to study enrollment = 10.8 years, ( <i>SD</i> = 7.5). RT: 48%, CT: 82%	IOC, SF-36, FACT-G	Svrs. who were non-Caucasian, without a college degree, unemployed, younger at study enrollment, had comorbid conditions or less social support had worse QOL when controlled for other variables; svrs. with comorbidities and negative appraisal reported worse physical and mental health ( $p < .05$ )	Strengths: Validation of IOC v2; health status, functioning, and QOL in large sample of NHL svrs.; broad demographic profile; high response rate (74%)  Limitations: Cross-sectional, 2 NC Comprehensive Cancer Centers, no conceptual framework

<b>Authors</b>	<b>Design</b>	<b>Purpose</b>	<b>Sample Characteristics</b>	<b>QOL-Related Measures</b>	<b>Findings</b>	<b>Strengths and Limitations</b>
Smith, Zimmerman, Williams, Preisser, & Clipp (2008)	Cross-sectional, NC Cancer Registry	Estimate prevalence of PTSD symptoms in svrs. of adult NHL who are at least 2 years postdiagnosis and identify risk factors associated with PTSD symptoms	N = 886 NHL svrs, median age = 52.6 years (range = 25–92), 2–44 years postdiagnosis. No treatment: 5%, Surgery: 28%, RT: 47%, CT: 78%, BMT/SCT: 14.9%, biologic therapy: 29.5%	PCL-C, Medical Outcomes Study-Social Support Survey	8% of svrs. met PTSD diagnostic criteria and 39% had PTSD symptoms; the impact of a cancer diagnosis and treatment persists for years for many svrs; positive association between social support and QOL, $p < .001$	Strengths: Examined PTSD well-being of long-term NHL svrs, large sample with age range of 25–92, use of Lazarus & Folkman (1984) PTSD conceptual framework  Limitations: No comparison group; cross-sectional; svrs. treated at 2 large, comprehensive cancer centers in Southeastern region

Authors	Design	Purpose	Sample Characteristics	QOL-Related Measures	Findings	Strengths and Limitations
Smith, Zimmerman, Williams, & Zebrack (2009)	Cross-sectional, NC Cancer Registry	Compare QOL status of those with active NHL to that of those who are disease-free, both short-term (2-4 years) and long-term ( $\geq 5$ years) postdiagnosis	N = 761 NHL svrs, Median age = 62.7 years (range = 25-92), 2-44 years postdiagnosis. Surgery: 30.5%, RT: 47.8%, CT: 81.1%, BMT/SCT: 15.6%, Biologic therapy: 28.3%	SF-36, FACT-Lym, IOC	Svrs. with active disease had worse physical and mental health functioning, worse QOL, and less positive and more negative IOCs compared with disease-free svrs., $p < .001$	Strengths: Large sample, large older adult population, use of Lazarus & Folkman (1984) and cancer survivorship based on coping theories conceptual framework  Limitations: Cross-sectional, 2 large comprehensive cancer centers

Authors	Design	Purpose	Sample Characteristics	QOL-Related Measures	Findings	Strengths and Limitations
Vallance, Courneya, Jones, & Reiman (2005)	Cross-sectional; retrospective survey; Canada	1. Examine differences in QOL between NHL svrs. who meet/do not meet exercise guidelines 2. Examine exercise behavior changes across treatment	N = 438 NHL svrs., mean age 61.1 years (SD = 13.1). CT: 64.6%, RT: 10.7%, CT + RT: 15.5%, Surgery: 3.6%, Immunotherapy: 0.9%, BMT: 25.2%, Watchful waiting: 17.1%	FACT-An	NHL svrs. (n = 23) who met the public health exercise guidelines had better physical functioning (less fatigue), fewer anemia related symptoms, better mental functioning than those that did not meet the guidelines (n = 332)	Strengths: Large population base of NHL svrs, use of well-established measures Limitations: Selection bias, recall bias related to length of long-term survivorship, self-report of exercise, observational study, no conceptual framework
Zeback (2000)	Cross-sectional, face-to-face semistructured interviews, California	Examine QOL of leukemia and lymphoma long-term svrs	N = 53 long-term svrs, n = 25 lymphoma svrs., median age at diagnosis: 17, average years postdiagnosis: 18, treatments not discussed	QOL-CS	Lymphoma svrs reported positive experiences from their cancer, uncertainties about the future were associated with decreased QOL, spiritual/existential QOL domain reflected that having a purpose in life is critical in survival	Strengths: Qualitative description of quality of life, mixed methods approach Limitations: Cross-sectional, no comparison group, selection bias, no

Authors	Design	Purpose	Sample Characteristics	QOL-Related Measures	Findings	Strengths and Limitations
Zeback, Yi, Petersen, & Ganz (2008)	Cross-sectional, California	Examine breast, prostate, colorectal, and lymphoma impact on QOL of long-term svrs.	N = 193 cancer svrs, n = 49 lymphoma svrs, (Hodgkin's and NHL) Mean age at study 61.5 years (SD = 14.3) 5-10 years postdiagnosis. Treatments not discussed	SF-36, IOC, QOL-CS	Older svrs. reported better overall QOL ( $p = .004$ ) and mental health ( $p < .001$ ), but worse physical health ( $p = .04$ ); svrs reporting low income ( $p = .02$ ) and comorbidities ( $p = .003$ ) indicated worse physical functioning; higher negative IOC score was associated with worse physical functioning ( $p < .0001$ ), worse mental health ( $p < .0001$ ), and lower overall QOL ( $p < .0001$ ); higher positive IOC score was associated with better mental health ( $p = .0004$ ) and better overall QOL ( $p = .005$ )	Strengths: IOC instrument as potential tool; long-term svrs. of breast, prostate, colorectal, and lymphoma  Limitations: Cross-sectional, younger age at enrollment, younger age at diagnosis, high levels of education and income, sociodemographic variables were limited; no conceptual framework

*Note.* BMT/SCT = bone marrow transplant/stem cell transplant, CARES = Cancer Rehabilitation Evaluation System, CT = chemotherapy, EORTC = European Organization for Research into the Treatment of Cancer, FACT-An = Functional Assessment of Cancer Therapies-Anemia, FACT-G = Functional Assessment of Cancer Therapies-General, FACT-Lym = Functional Assessment of Cancer Therapies-Lymphoma, FAHI=Functional Assessment of HIV Infection, HIV- = negative for human immunodeficiency virus, HIV+ = positive for human immunodeficiency virus, HR = health-related; IOC = impact of cancer, IOC v2 = Impact of Cancer scale version 2, lym. = lymphoma, MHOS: Medical Health Outcomes Survey, NC = North Carolina, PCL-C = Post-Traumatic Stress Disorder Checklist-Civilian Version, PCP = primary care physician, PTSD = post-traumatic

stress disorder, QLQ C-30 = Quality of Life Questionnaire Cancer-30, QOL = quality of life, QOL-CS = Quality of Life-Cancer Survivors' Tool, RT= radiation therapy, SD = standard deviation, SEER = Surveillance and Epidemiology End Results, SF-36 = short form, svrs.= survivors.



## **Quality of Life Measures**

It is generally agreed that QOL is a subjective, multidimensional construct with both positive and negative aspects (Cella, Tulsky et al., 1993). The domains typically measured are physical, psychological, social, functional, and spiritual/existential. Each will be addressed in this paper. Instruments used to measure the domains vary, with the physical domain being included most often. No QOL instrument is accepted consistently as a gold standard for measurement (Donnelly, 2000). As shown in Table 2.2, half of the studies ( $n = 9$ ) used more than one QOL outcome measure. Additional instruments not included in Table 2.2 included the Functional Assessment of HIV Infection (Diamond, Taylor, & Anton-Culver, 2010), the Medical Outcomes Study-Social Support (Sherbourne & Stewart, 1991), Life Impact (Bellizzi, Miller, Arora, & Rowland, 2007), the Post-traumatic Stress Disorder (PTSD) Inventory (Geffen, Blaustein, Amir, & Cohen, 2003), and the PTSD Checklist-Civilian Version (Smith, Zimmerman, Williams, Preisser, & Clipp, 2008).

Table 2.2

*QOL-Related Measures Used in NHL Survivorship Studies (n = 6)*

<b>QOL Measure</b>	<b>Number of Items</b>	<b>Content or Subscales</b>	<b>Reliability</b>	<b>Validity</b>
SF-36 (Ware & Sherbourne, 1992)	36	Generic measure of QOL	Test-retest, $\alpha > 0.70$	Observed physical outcomes correlate with scale
FACT-G (Cella, Tulskey, Gray, Sarafian, Linn, & Bonomi, 1993)	33	Cancer specific; physical, functional, social/familial, and emotional well-being	Test-retest, $\alpha > 0.70$	Discriminates on medical variables
FACT-Lym (Cella, Webster, & Cashy, 2005)	22	Cancer specific; physical, functional, social/familial, and emotional well-being focused on NHL	Test-retest, $\alpha > 0.70$	Discriminates on medical variables
FACT-An (Cella, 1997)	20	Cancer specific; physical, functional, emotional, and social well-being; anemia symptoms	Test-retest, $\alpha > 0.70$	Discriminates on medical variables
The City of Hope QOL-Cancer Survivors (Ferrell, Dow, Leigh, Ly, & Gulasekaram, 1995; Ferrell, Dow, & Grant, 1995)	41	Cancer specific; physical, psychological, social, and spiritual well-being	Test-retest, $\alpha > 0.70$	Discriminates on medical and demographic variables
Impact of Cancer (version 2) (Crespi, Ganz, Peterson, Castillo, et al., 2008)	50	Cancer specific; Positive Impact Scale (altruism and empathy, health awareness meaning of cancer, positive self-evaluation); Negative Impact Scale (appearance concerns, body change	Test-retest, $\alpha > 0.70$	Discriminates on medical and demographic variables

<b>QOL Measure</b>	<b>Number of Items</b>	<b>Content or Subscales</b>	<b>Reliability</b>	<b>Validity</b>
		concerns, life interferences, worry); employment concerns; relationship concerns (partnered); relationship concerns (not partnered)		

*Note.* FACT-An = Functional Assessment of Cancer Therapy-Anemia; FACT-G = Functional Assessment of Cancer Therapy-General; FACT-Lym = Functional Assessment of Cancer Therapy-Lymphoma; NHL = non-Hodgkin lymphoma; QOL = quality of life; SF-36 = Short Form-36.

## **Physical Well-Being**

Multiple chronic conditions can affect functional abilities and decrease a person's ability to maintain a healthy lifestyle. Using the Impact of Cancer (IOC) scale, Zebrack, Yi, Petersen, and Ganz (2008) measured QOL in a sample of individuals with cancer, including 49 lymphoma survivors, who were 5 to 10 years postdiagnosis ( $n = 193$ ). They found that older adults reported better overall QOL ( $p = .004$ ) but worse physical health ( $p = .04$ ) than their younger counterparts. Lower income ( $p = .02$ ) and comorbidities ( $p = .003$ ) were associated with worse physical functioning. A higher negative impact summary score was associated with worse physical functioning ( $p < .0001$ ), worse mental health ( $p < .0001$ ), and lower overall QOL ( $p < .0001$ ).

These findings are consistent with Smith, Zimmerman, Williams, Preisser, and Clipp's (2008) results. They measured NHL survivors' ( $n = 652$ ) QOL and found that survivors who were non-Caucasian, without a college degree, unemployed, younger at study enrollment, or who had comorbid conditions or less social support also had lower QOL. In a related study, survivors with active NHL disease were found to have worse physical functioning and QOL than disease-free survivors (Smith, Zimmerman, Williams, & Zebrack, 2009).

Although cancer-related detriments to physical functioning are common, it has been shown that healthy behaviors such as physical activity can improve QOL and reduce symptoms such as fatigue in cancer survivors (Pinto, Rabin, Abdow, & Papandonatos, 2008). In a cross-sectional study of 438 NHL survivors, differences in overall QOL were found between NHL survivors who met and did not meet recommended public-health exercise guidelines of at least 150 minutes per week of moderate to strenuous activity (Vallance,

Corneya, Jones, & Reiman, 2005). The NHL survivors who met these guidelines reported higher QOL than those who did not meet them, suggesting that individuals who exercise at least 150 minutes per week receive physical and mental health benefits (Pate et al, 1995). Bellizzi et al (2009) also explored physical activity as it related to QOL and found that survivors who engaged in some form of physical activity reported better physical and mental health ( $p < .001$ ). Furthermore, Reeve et al. (2009) examined QOL among older adults using the Surveillance, Epidemiology, and End Results-Medicare Health Outcomes Survey in a longitudinal, population-based study. Changes in QOL from before and after the cancer diagnoses were reported for nine cancer types including NHL. The NHL survivors ( $n = 53$ ) had one of the highest declines in physical health.

In summary, these studies highlight that older adult cancer survivors and those with comorbid illnesses experience more physical health problems and worse physical QOL compared to their younger counterparts and healthy controls. However, physical activity can provide some protective effects and improve QOL for these individuals.

### **Psychological Well-Being**

Psychological changes occur during the survivorship trajectory and can be stressful on the mind and body, resulting in negative health outcomes for the survivor. How an individual appraises his or her diagnosis or the perceived threat of the cancer can affect clinical and psychological outcomes (Tedeschi, Park, & Calhoun, 1998). In addition, the *Diagnostic and Statistical Manual of Mental Disorders, 4th edition* recognizes that a cancer diagnosis meets the criteria of a traumatic stressor (American Psychiatric Association, 2000). For example, survivors of NHL may develop symptoms of post-traumatic stress disorder (PTSD) that are also reported in individuals who experience a non-cancer-related traumatic

event (e.g., motor vehicle accident, sexual assault, military combat; Geffen et al., 2003; Smith et al., 2008) .

In a cross-sectional study of 886 NHL survivors, 8% met the criteria for a full PTSD diagnosis (compared to an estimated 2.4% prevalence in the general adult population), 9.1% met partial criteria, and 39.0% of the total sample had PTSD symptoms in at least one of the three domains used for diagnosis (Smith et al., 2008). In addition, Geffen, Blaustein, Amir, and Cohen (2003) found that NHL survivors who had more PTSD symptoms also experienced lower physical QOL.

In other studies, lymphoma survivors were found to have mental health functioning comparable to the general population (Bellizzi et al., 2009). However, survivors with active NHL disease had worse mental health functioning than those individuals in remission. In addition, younger NHL survivors (25–34 and 45–55 years of age) had lower mental summary scores than the general population (Smith et al., 2009). In summary, it has been shown that a cancer diagnosis affects an individual's psychological well-being and their ability to cope during a time of uncertainty.

### **Social Well-Being**

Social well-being encompasses the interpersonal relationships that may have been changed by the cancer experience as the survivor reintegrates into the social environment. Aside from receiving the diagnosis, the treatment for NHL can have a negative effect on various QOL domains, including changes in social relationship. Social functioning after a cancer diagnosis may be a long-term adjustment for many survivors.

In one study, Bellizzi et al. (2009) reported that NHL had a positive effect on relationships but a negative effect on a survivor's current financial situation. The social

impact of financial and relationship changes led survivors to other sources of social support. Social support was a significant positive psychosocial variable with a mean of 83.1 (*SD* 16.4) on a 20–100 scale. This number indicates that NHL survivors have supportive resources or individuals that are important to them during a time of unpredictability (Smith et al., 2009). These financial and relationship changes led survivors to individuals who were important to them during a time of unpredictability and change (Smith et al., 2009). Employment, financial, and insurance issues are also ongoing concerns of survivors and will be addressed in the functional well-being section.

### **Functional Well-Being**

The Functional Assessment of Cancer Therapy-General (FACT-G) measure includes functional well-being as one of its QOL domains. Six of the studies used the FACT-G instrument with consistent findings that one or more health problems coupled with NHL can lead to a decline in functional well-being. Chronic conditions can impede a survivors' ability to maintain healthy behaviors and lifestyles, further contributing to a decline in function. Hewitt et al. (2003) reported that cancer survivors, including those of NHL, have almost a twofold likelier chance of having at least one functional limitation than the average populace. When an additional chronic condition is combined with cancer, functional limitation increases. In addition, Diamond, Taylor, and Anton-Culver (2010) reported that HIV-infected survivors with NHL have worse overall QOL and survival rates than uninfected survivors with NHL, indicating that having more than one life-limiting illness had a detrimental effect on the overall health and survival of their study participants.

Smith, Zimmerman, Williams, and Zebrack (2009) reported that 60% of NHL survivors were either unemployed or retired due to cancer-related issues. In addition, how

NHL survivors perceive their illness can influence their functional and physical abilities, which can impede their QOL (Smith, Crespi, Petersen, Zimmerman, & Ganz, 2010).

Functional change at any juncture of the survivorship journey may require a change in living arrangements and the amount of support needed. This QOL domain continues to gain more interest as the population ages and that has related impacts on daily living.

In one study, survivors who maintained their work status reported higher physical QOL compared to those who reduced their work hours or stopped working completely (Mols, Thong, Vreugdenhil & van de Poll-Franse, 2009).

. Forty-one percent of the participants in the same study reported a change in work status and related QOL decline due to their cancer, along with problems obtaining insurance or a mortgage.

Not only do NHL survivors experience physiological effects with risks of disability and poor functioning, but they also have psychological stresses on their QOL associated with healthcare expenditures. In addition, individuals with chronic health conditions, including cancer survivors, account for the majority of U.S. healthcare expenses. The assessment of QOL may direct interventions that reduce healthcare costs and, ultimately, improve QOL (Baker, Haffer, & Denniston, 2003).

### **Spiritual and Existential Well-Being**

Cancer survivors' experiences parallel those individuals who have experienced other traumatic stressors involving acute, unpredictable events that threaten an individual's life. However, few studies have assessed the positive psychological changes or benefits from the illness (Bellizzi et al., 2009; Tomich & Helgeson, 2004). In one of these studies, the majority of cancer survivors reported that experiencing a traumatic event, such as the diagnosis of a



life-threatening illness, led to positive personal changes, a greater ability to cope with life stressors, and a sense of personal strength (Tedeschi et al., 1998). Post-traumatic growth is an interrelated concept that has been linked with the spiritual and existential QOL domain, or a “perceived positive psychological change experienced as a result of the struggle with highly challenging life circumstances” (Stanton, Bower, & Low, 2006). Exploration of the role of spirituality has increased in recent years but is typically not addressed or described in research studies.

In addition, having cancer often prompts individuals to revisit their outlook on life. Zebrack’s (2000) study used a qualitative approach with face-to-face, semistructured interviews to explore four QOL domains (physical, psychological, social, and spiritual/existential). The spiritual/existential QOL domain was reflected in finding purpose and meaning in life, which were critical components in the survivorship trajectory. Zebrack (2000) found that having a purpose in life and hopefulness were highly scored spiritual subscale items, leading to a conclusion that survivors who were hopeful had better QOL.

#### **Treatment Effects on Quality of Life**

Watch-and-wait or active surveillance approaches for indolent types of NHL are the most conservative management strategies. Surveillance involves monitoring through blood tests and physical examinations until the symptoms progress or the cancer interferes with the survivor’s QOL (Bailey, Mishel, & Belyea, 2004). Individuals with fast-growing or aggressive NHL often present with symptoms such as fatigue, weight loss, night sweats, or complaint of sore lymph nodes (Elphee, 2008). Aggressive NHL is commonly treated with targeted biologic therapies such as rituximab.

Most NHL survivors included in these studies received chemotherapy, radiation therapy, rituximab, or some combination of them for their treatment. The NHL survivors

treated with chemotherapy or with active disease reported significantly worse psychological and social well-being and health-related QOL than those who had not received chemotherapy (Diamond et al., 2010; Stanton et al., 2006). The survivors who reported significantly less vitality and worse general health compared with the general population (Reeve et al., 2009; Mols et al., 2007), and those treated with either radiation therapy or watchful waiting did not report a worse QOL compared with the general population (Bailey et al., 2004). Survivors who relapsed had worse QOL and physical and mental functioning compared to newly diagnosed NHL survivors (Pettengell, Donatti, & Hoskin, 2008).

Persson and Hallberg (2004) explored the experience of receiving lymphoma and leukemia treatment using a phenomenological design. Three themes emerged from their research about what survivors experienced while undergoing treatment: *belief in life* (they fought for it and came through stronger); *life went on* (they adapted and found a balance in the new life); or *life was over* (they felt out of control and lost belief in life). The impact of the disease varied depending on the survivors' illness trajectory and their ability to cope with the disease's unpredictability. This study supplied meaning to the experiences felt by lymphoma and leukemia survivors and allowed them to retell their stories of living with their disease.

### **Older Adults with NHL**

Age-related issues that impact QOL for NHL survivors were examined in less than ten studies. For those that did, older age was associated with worse physical QOL but better mental health compared with younger NHL adults (Mols, Coebergh et al., 2007; Smith et al., 2009; Reeve et al., 2009, Zebrack, 2000; Mols, Aaronson et al., 2007; Arora et al., 2007; Kouroukis, Meyer, Benger, Marcellus, Foley, & Browman, 2004).

Most of the survivors studied received chemotherapy in combination with radiation therapy, surgery, bone marrow transplant, stem cell transplant, or biological therapies. Additionally, older survivors who received chemotherapy had poorer psychological and social well-being compared to those who did not receive chemotherapy (Mols, Coebergh et al., 2007; Mols et al., 2009).

It is not uncommon that older adults have one or more coexisting illnesses coupled with cancer (Yancik et al., 1996), so that is a finding that needs to be explored. Further research within this population will provide new insights into how older NHL survivors manage their multiple comorbidities and their impacts on their QOL.

### **Design and Framework**

The design and framework of a study impacts the quality of the data and how it relates to other areas of research. The methods used in the reviewed studies (Table 2.1) had both negative and positive effects on the ability to use the data as an accurate measurement of the QOL in NHL survivors. Large, cross-sectional studies are generally less costly than longitudinal studies but are limited to describing only associations within the sample. For example, cross-sectional designs do not answer cause and effect questions but provide useful information in the exploration of relationships among QOL domains and the effects of cancer treatments.

The lack of a conceptual or theoretical model can be problematic when QOL is used to guide the study's design or is viewed as the outcome variable. While theoretically driven studies allow relationships to be tested in the model, only three reviewed studies identified conceptual or theoretical perspectives (Smith et al., 2008; Smith et al., 2009; Arora et al., 2007). Inclusion of a model addressing the multidimensionality of QOL and its

interrelationships or factors among QOL domains allows for hypotheses and relationships to be tested (Aaronson, Meyerowitz, & Bard, 1991). Using theoretically based models of QOL increases applicability of the concept and contributes to the ongoing development of cancer survivorship models. Ultimately, intervention studies to improve QOL in NHL survivors could be developed based on these models.

### **Discussion**

This paper provides an integrative review of the NHL survivorship literature relevant to older NHL survivors with a focus on the QOL measures and treatment methods used. While a limited number of studies examining QOL factors of older NHL survivors were found, the literature reflected growing interest in understanding the QOL among NHL survivors as a group. This is evidenced by recently published research (within the last decade) from around the world. Limitations of this literature review include underrepresentation of minority NHL survivors, lack of longitudinal studies and theoretical or conceptual frameworks, limited findings specific to older adults, and lack of literature regarding long-term survivors. In other cancer groups, racial, ethnic, or both types of differences in QOL have been reported; therefore, future NHL studies with increased minority representation may find similar disparities (Chlebowski et al., 2005). Also, qualitative studies are needed to enhance the understanding of the impact that NHL has on QOL for survivors, particularly in minority and older populations. Finally, mixed-methods studies that complement quantitative findings and explore the experiences of NHL survivors, such as Zebrack et al.'s (2008) study in which survivors shared their experiences of receiving their cancer diagnoses and their uncertainties about the future associated with decreased

QOL, would be beneficial. It is one example of how quantitative and qualitative methods inform each other, at least in the spiritual and existential domain of QOL.

Although QOL was measured objectively in all the studies, it is important to understand the subjective nature of QOL's multidimensionality that allows survivors to express their experiences more thoroughly. Using qualitative methods to complement standardized QOL-related instruments would more adequately capture the totality of a survivor's experience compared to using one measure.

### **Implications for Future Research**

Cancer survivors are at increased risk for QOL-related concerns due to their exposure to disease and treatment-related effects (e.g., recurrences, secondary malignancies, cardiotoxicities, social and financial issues) compared to the general population (Ganz, 2001). Lack of understanding of the QOL outcomes (i.e., physical, psychological, social, functional, and spiritual and existential outcomes) of older adults with cancer is a growing health concern due to the aging U.S. population. For survivors of all ages, there is increasing information on intermediate (2–5 years postdiagnosis) and longer term (> 5 years postdiagnosis) adjustment to NHL. Increasing sociodemographic diversity in the sample could also enhance generalizability of the findings.

As the growing population of older NHL survivors increases, research focused on QOL-related outcomes is needed. Future studies are needed to build on descriptive, cross-sectional designs and provide a more comprehensive understanding of the survivorship journey. Longitudinal designs in cancer survivorship research can help specify under what circumstances the process of cancer survivorship adaptation is best described (Aziz & Rowland, 2003). From these longitudinal findings, interventions tailored specifically to NHL

survivors will determine who responds to the intervention and the sustainable effect of the intervention. Study findings could be generalized also to a larger, long-term, survivor population.

## REFERENCES

- Aaronson, N., Meyerowitz, B., & Bard, M. (1991). Quality of life research in oncology. Past achievements and future priorities. *Cancer, 67*, 839–843.
- Ahles, T., Saykin, A., Furstenberg, C., Cole, B., Mott, L., Titus-Ernstoff, L., . . . Silberfarb, P. (2005). Quality of life of long-term survivors of breast cancer and lymphoma treated with standard-dose chemotherapy or local therapy. *Journal of Clinical Oncology, 23*, 4399–4405.
- American Cancer Society. (2010). *Cancer facts & figures*. Retrieved from [http://www.cancer.org/downloads/STT/Cancer\\_Fact\\_and\\_Figures\\_2010.pdf](http://www.cancer.org/downloads/STT/Cancer_Fact_and_Figures_2010.pdf)
- American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.
- Arden-Close, E., Pacey, A., Eiser, C. (2010). Health related quality of life in survivors of lymphoma: A systematic review and methodological critique. *Leukemia & Lymphoma, 51*, 628–640.
- Arora, N., Hamilton, A., Potosky, A., Rowland, J., Aziz, N., Bellizzi, K., . . . Stevens, J. (2007). Population-based survivorship research using cancer registries: A study of non-Hodgkin's lymphoma survivors. *Journal of Cancer Survivorship, 1*, 49–63.
- Aziz, N., & Rowland, J. (2003). Trends and advances in cancer survivorship research: Challenge and opportunity. *Seminars in Radiation Oncology, 13*, 248–266.
- Bailey, D., Mishel, M., & Belyea, M. (2004). Uncertainty intervention for watchful waiting in prostate cancer. *Cancer Nursing, 27*, 339–346.
- Baker, F., Haffer, S., & Denniston, M. (2003). Health-related quality of life of cancer and noncancer patients in Medicare managed care. *Cancer, 97*, 674–681.
- Bellizzi, K., Miller, M., Arora, N., & Rowland, J. (2007). Positive and negative life changes experienced by survivors of non-Hodgkin's lymphoma. *Annals of Behavioral Medicine, 34*, 188–199.
- Bellizzi, K., Rowland, J., Arora, N., Hamilton, A., Miller, M., & Aziz, N. (2009). Physical activity and quality of life in adult survivors of non-Hodgkin's lymphoma. *Journal of Clinical Oncology, 27*, 960–966.
- Bloom, J. (2002). Surviving and thriving? *Psycho-Oncology, 11*, 89–92.
- Bolin, K. (2008). Health among long-term survivors of breast cancer: An analysis of 5-year survivors based on the Swedish surveys of living conditions 1979–1995 and the Swedish Cancer Registry 2000. *Psycho-Oncology, 17*, 1–8.
- Brown, J., Byers, T., Doyle, C., Courneya, K., Denmark-Wahnefried, W., Kushi, L., . . . McTiernan, A. (2003). Nutrition and physical activity during and after cancer treatment: An

American Cancer Society guide for informed choices. *CA: A Cancer Journal for Clinicians*, 53, 268–291.

Chlebowski, R., Chen, Z., Anderson, G., Rohan, T., Aragaki, A., Lane, D., . . . Prentice, R. (2005). Ethnicity and breast cancer: Factors influencing differences in incidence and outcome. *Journal of the National Cancer Institute*, 97, 439–448.

Cella, D. (1997). The Functional Assessment of Cancer Therapy-Anemia (FACT-An) Scale: A new tool for the assessment of outcomes in cancer anemia and fatigue. *Seminars in Hematology*, 34(3 Suppl. 2), 13–19.

Cella, D., Tulsky, D., Gray, G., Sarafian, B., Lloyd, S., Linn, E., . . . Harris, J. (1993). The Functional Assessment of Cancer Therapy Scale: Development and validation of the general measure. *Journal of Clinical Oncology*, 11, 570–579.

Cella, D., Webster, K., Cashy, J. (2005). Development of a measure of health-related quality of life for non-Hodgkin's lymphoma clinical research: The Functional Assessment of Cancer Therapy-Lymphoma (FACT-Lym) [Abstract]. *Blood*, 106, 222A.

Centers for Disease Control and Prevention. (2004). Cancer survivorship—United States, 1971–2001. *Morbidity and Mortality Weekly Report*, 53, 526–529.

Cote, T., Biggar, R., Rosenberg, P., Devesa, S., Percy, C., Yellin, F., . . . Blattner, W. (1997). Non-Hodgkin's lymphoma among people with AIDS: Incidence, presentation, and public health burden. *International Journal of Cancer*, 73, 645–50.

Crespi, C., Ganz, P., Petersen, L., Castillo, A., & Caan, B. (2008). Refinement and psychometric evaluation of the Impact of Cancer Scale. *Journal of the National Cancer Institute*, 100, 1530–1541.

Crespi, C., Smith, S., Petersen, L., Zimmerman, S., & Ganz, P. (2010). Measuring the impact of cancer: A comparison of non-Hodgkin lymphoma and breast cancer survivors. *Journal of Cancer Survivorship*, 4, 45–58.

Diamond, C., Taylor, T., & Anton-Culver, H. (2010). Quality of life, characteristics, and survival of patients with HIV and lymphoma. *Quality of Life Research*, 19, 149–155.

Donnelly, S. (2000). Quality-of-life assessment in advanced cancer. *Current Oncology Reports*, 2, 338–342.

Elphee, E. (2008). Understanding the concept of uncertainty in survivors with indolent lymphoma. *Oncology Nursing Forum*, 35, 449–454.

Ferrell, B., Dow, K., & Grant, M. (1995). Measurement of the quality of life in cancer survivors. *Quality of Life Research*, 4, 523–531.



Ferrell, B., Dow, K., Leigh, S., Ly, J., & Gulasekaram, P. (1995). Quality of life in long-term cancer survivors. *Oncology Nursing Forum*, *22*, 915–922.

Ganz, P. (2001). Late effects of cancer and its treatment. *Seminars in Oncology Nursing*, *17*, 241–248.

Geffen, D., Blaustein, A., Amir, M., & Cohen, Y. (2003). Post-traumatic stress disorder and quality of life in long-term survivors of Hodgkin's disease and non-Hodgkin's lymphoma in Israel. *Leukemia & Lymphoma*, *44*, 1925–1929.

Hamblin, T. (2001). Achieving optimal outcomes in chronic lymphocytic leukemia. *Drugs*, *61*, 593–611.

Hewitt, M., Rowland, J., & Yancik, R. (2003). Cancer survivors in the United States: Age, health, and disability. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *58*, 82–91.

Horner, M., Ries, L., Krapcho, M. (Eds.). (2009). *SEER cancer statistics review, 1975–2006*. Retrieved from the National Cancer Institute: [http://seer.cancer.gov/csr/1975\\_2006](http://seer.cancer.gov/csr/1975_2006).

Jemal, A., Clegg, L., Ward, E., Ries, L., Wu, X., Jamison, P., . . . Edwards, B. (2004). Annual report to the nation on the status of cancer, 1975–2001, with a special feature regarding survival. *Cancer*, *101*, 3–27.

Kouroukis, T., Meyer, R., Bengner, A., Marcellus, D., Foley, R., & Browman, G. (2004). An evaluation of age-related differences in quality of life preferences in patients with non-Hodgkin's lymphoma. *Leukemia & Lymphoma*, *45*, 2471–2476.

Mols, F., Aaronson, N., Vingerhoets, A., Coebergh, J. W., Vreugdenhil, G., Lybeert, M. L., . . . van de Poll-Franse, L. (2007). Quality of life among long-term non-Hodgkin lymphoma survivors. *Cancer*, *109*, 1659–1667.

Mols, F., Coebergh, J., & van de Poll-Franse, L. (2007). Health-related quality of life and health care utilization among older long-term cancer survivors: A population-based study. *European Journal of Cancer*, *43*, 2211–2221.

Mols, F., Thong, M., Vreugdenhil, G., & van de Poll-Franse, L. (2009). Long-term cancer survivors experience work changes after diagnosis: Results of a population-based study. *Psycho-Oncology*, *18*, 1252–1260.

National Cancer Institute. (2010). *Non-Hodgkin lymphoma*. Retrieved from <http://www.cancer.gov/cancertopics/types/non-hodgkin>.

National Comprehensive Cancer Network. (2010). *Non-Hodgkin's lymphoma overview*. Retrieved from <http://www.nccn.com/treatment-summaries/non-hodgkins-lymphoma.html>

- Pate, R., Pratt, M., Blair, S., Haskell, W., Macer, C., Bouchard, C., . . . Wilmore, J. (1995). Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *Journal of the American Medical Association, 273*, 402–407.
- Persson, L., & Hallberg, I. (2004). Lived experience of survivors of leukemia or malignant lymphoma. *Cancer Nursing, 27*, 303–313.
- Pettengell, R., Donatti, C., & Hoskin, P. (2008). The impact of follicular lymphoma on health-related quality of life. *Annals of Oncology, 19*, 570–576.
- Pinto, B., Rabin, C., Abdow, S., & Papandonatos, G. (2008). A pilot study on disseminating physical activity promotion among cancer survivors: A brief report. *Psycho-Oncology, 17*, 517–521.
- Reeve, B., Potosky, A., Smith, A., Kan, P., Hays, R., Davis, W., . . . Clauser, S. (2009). Impact of cancer on health-related quality of life of older Americans. *Journal of the National Cancer Institute, 101*, 860–868.
- Sherbourne, C., & Stewart, A. (1991). The MOS Social Support Survey. *Social Science & Medicine, 32*, 705–714.
- Smith, S., Crespi, C., Petersen, L., Zimmerman, S., & Ganz, P. (2010). The impact of cancer and quality of life for posttreatment non-Hodgkin lymphoma survivors. *Psycho-oncology, 19*, 1259-1267.
- Smith, S., Zimmerman, S., Williams, C., & Zebrack, B. (2009). Health status and quality of life among non-Hodgkin lymphoma survivors. *Cancer, 115*, 3312–3323.
- Smith, S., Zimmerman, S., Williams, C., Preisser, X., & Clipp, X. (2008). Posttraumatic stress outcomes in non-Hodgkin's lymphoma survivors. *Journal of Clinical Oncology, 26*, 934–941.
- Stanton, A., Bower, J., & Low, C. (2006). Post-traumatic growth after cancer. In L. Calhoun & R. Tedeschi (Eds.), *Handbook of post-traumatic growth: Research and practice*, (pp. 138-175). Mahwah, NJ: Erlbaum.
- Tedeschi, R., Park, C., & Calhoun, L. (1998). Post-traumatic growth: Conceptual issues. In R. Tedeschi, C. Park., & L. Calhoun (Eds.), *Post-traumatic growth: Positive changes in the aftermath of crisis*, (pp. 1–22). Mahwah, NJ: Erlbaum.
- Tomich, P., & Helgeson, V. (2004). Is finding something good in the bad always good? Benefit finding among women with breast cancer. *Health Psychology, 23*, 16–23.

Vallance, J., Courneya, K., Jones, L., & Reiman, T. (2005). Differences in quality of life between non-Hodgkin's lymphoma survivors meeting and not meeting public health exercise guidelines. *Psycho-oncology*, *14*, 979–991.

Ware, J., & Sherbourne, C. (1992). The MOS 36-item short-form health survey (SF-36). Conceptual framework and item selection. *Medical Care*, *30*, 473–483.

Yancik, R., Ganz, P., Varricchio, C., & Conley, B. (2001). Perspectives on comorbidity and cancer in older patients: Approaches to expand the knowledge base. *Journal of Clinical Oncology*, *19*, 1147–1151.

Yancik, R., Havlik, R., Wesley, M., Ries, L., Long, S., Rossi, W., . . . Edwards B. (1996). Cancer and comorbidity in older patients: A descriptive profile. *Annals of Epidemiology*, *6*, 399–412.

Zebrack, B. (2000). Cancer survivors and quality of life: A critical review of the literature. *Oncology Nursing Forum*, *27*, 1395–1401.

Zebrack, B., Yi, J., Petersen, L., & Ganz, P. (2008). The impact of cancer and quality of life for long-term survivors. *Psycho-oncology*, *17*, 891–900.

## CHAPTER 3

### AN EXPLORATORY MEDIATION MODEL OF THE RELATIONSHIPS BETWEEN POSITIVE AND NEGATIVE ADAPTATION TO CANCER AND NHL SURVIVORS' QUALITY OF LIFE

#### Introduction

The Institute of Medicine (2006) and the National Cancer Institute (NCI) have redefined *cancer survivorship* to include the multifaceted and interrelated “physical, psychosocial, and economic issues of cancer from diagnosis until the end of life” (NCI, 2008). However, this new definition does not account for the varied and unique experiences of each person that culminate in their non-Hodgkin lymphoma (NHL) survivorship trajectories. The increase in survivorship numbers has generated interest not only in exploring their long-term impact on quality of life (QOL), but also on factors that influence survivors’ adaptation to living with the disease.

There is accumulating evidence indicating that NHL survivors’ QOL varies; some report positive outcomes from their diagnoses and treatments, and others experience negative outcomes including poor health and poor QOL (Arden-Close, Pacey, & Eiser, 2010; Bellizzi, Miller, Arora, & Rowland, 2007; Mols et al., 2007; Reeve et al., 2009). Researchers have suggested that the psychosocial domains of survivorship—such as affect, mood, and QOL including spiritual, social, and emotional well-being—are among the most important outcomes for NHL survivors, if we are to extend our understanding of survivorship to

include QOL for NHL survivors (Cella et al., 1993; Ferrell, Dow, Leigh, Ly, & Gulasekaram, 1995; Ferrell, Dow, & Grant, 1995).

The literature has found that negative psychosocial well-being has an effect on QOL, but few studies have considered the positive psychological changes and possible benefits of adaptation to the illness (Bellizzi et al., 2007; Tomich & Helgeson, 2004). Interestingly, the majority of cancer survivors in one study reported that experiencing a traumatic event, such as a diagnosis of a life-threatening illness, led to positive personal changes in their lives, a greater ability to cope with life stressors, and a sense of personal strength (Tedeschi, Park, & Calhoun, 1998). Cancer survivorship represents a turning point for many individuals and not one that is always negative to their overall QOL.

There is a growing body of NHL literature and additional studies are needed to explore how cancer survivors adapt to the disease. Physical functioning has been the primary QOL outcome measured in NHL survivors, and less focus has been given to psychosocial and emotional health (Leak, Mayer, & Smith, 2011). Understanding the positive and negative relationships that cancer and its treatments may have on the long-term health of NHL survivors is an important aspect of survivorship and overall QOL. A cancer diagnosis carries the possibility of disrupting life and can have varied QOL outcome implications. The purpose of this paper is to explore which personal and disease characteristics are associated with QOL and to investigate whether or not adaptation to living with cancer may mediate their effects.

The research questions for this paper are:

1. What demographic and disease characteristics are associated with QOL?
2. How does adaptation to cancer mediate the relationship between demographic and disease characteristics and QOL?

## **Conceptual Framework**

The cancer survivor adaptation (CSA) model of QOL among NHL survivors was developed for this study and adapted from Naus, Ishler, Parrott, and Kovacs' (2009) model. It has three components: personal characteristics, adaptation, and outcomes. *Adaptation*, the fundamental component of this model, is an ongoing, cognitive process involving continuous appraisal of the situation by the survivor (Naus et al., 2009). It is reflected as positive and negative adaptation. Positive adaptation has favorable psychosocial implications such as better coping skills. It encompasses these positive aspects: altruism and empathy, health awareness, understanding the meaning of cancer, and positive self-evaluation. Negative adaptation focuses on appearance concerns, body change concerns, life interferences, and worry. It has unfavorable physical or psychological outcomes (Zebrack, Ganz, Bernaards, Petersen, & Abraham, 2006). The Impact of Cancer (IOC) scale conceptualizes the cancer experience as *perceptions*. In this study we have conceptualized perceptions as adaptation.

The CSA model proposes that *personal characteristics*, which include demographic and disease factors, can have a direct positive or negative association with QOL. Relationships between personal characteristics and QOL outcomes can be mediated through positive or negative adaptation to the illness. Personal characteristics are represented by *individual characteristics* (demographic and disease factors), *positive adaptation* or *negative adaptation*, and outcomes of *cancer-specific QOL* (Figure 3.1).

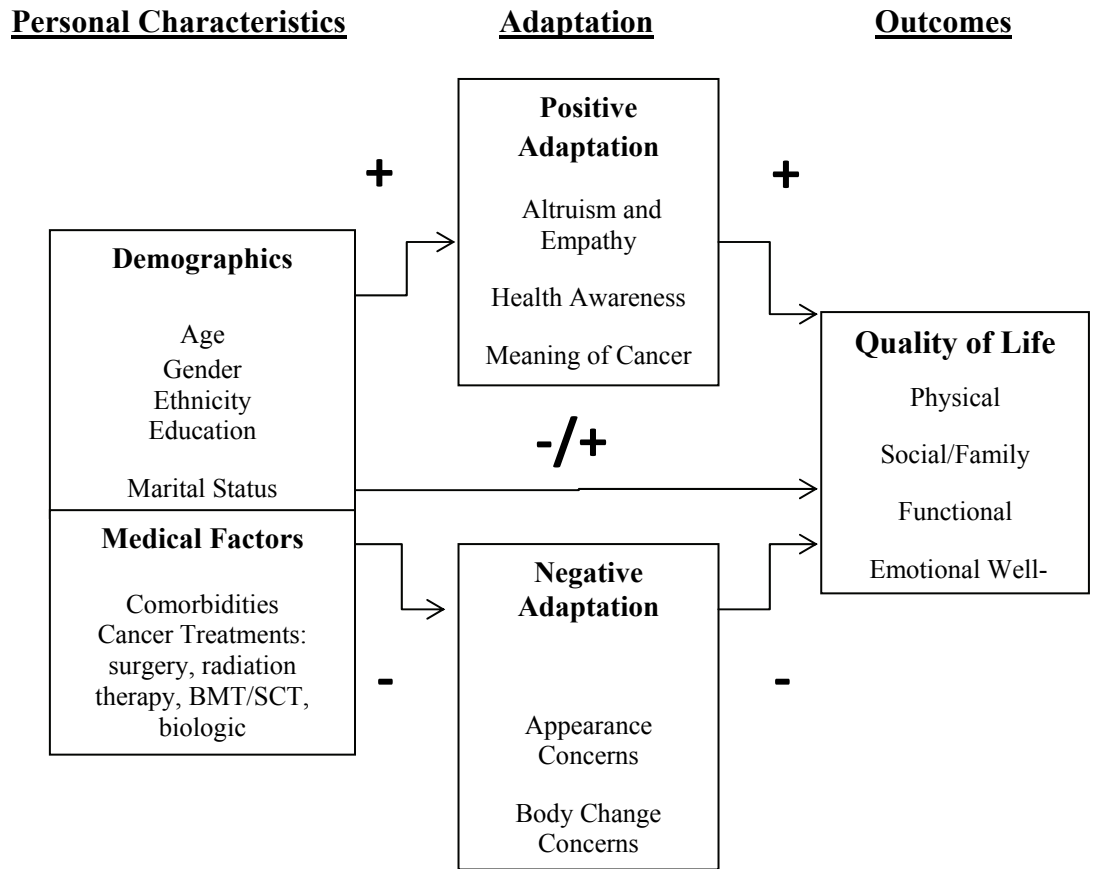


Figure 3.1. The cancer survivor adaptation model illustrating the three components and three variables that affect the positive and negative adaptation of survivors to their cancer diagnoses and treatments. *Source:* Adapted from Naus, Ishler, Parrott, and Kovacs, 2009.

## Method

### Study Design

This research was a secondary analysis of a cross-sectional study of NHL survivors. The primary aim of the initial study was to estimate the prevalence of post-traumatic stress disorder (PTSD) symptoms in survivors of adult NHL who were at least two years post-diagnosis and to identify risk factors associated with PTSD symptoms for the study population (Smith, Zimmerman, Williams, Preisser, & Clipp, 2008).

## **Participants and Procedures**

The data were accrued through mailed surveys. Participants were NHL survivors treated at one of two comprehensive cancer centers in North Carolina: the Duke Cancer Center and the University of North Carolina at Chapel Hill's Lineberger Comprehensive Cancer Center. Eligibility criteria for the parent study included an age of 18 years or older, at least 2 years postdiagnosis, and either currently receiving treatment, in remission, or cured. *Survivors* were defined as individuals postdiagnosis, whether or not they had active disease (National Coalition for Cancer Survivorship, n.d.).

## **Measures**

**Demographic and disease characteristics.** The sociodemographic information collected included current age, gender, income, education level, ethnicity, marital status, and employment status. The disease-related characteristics included total comorbidity score, cancer treatment(s) undergone (i.e., surgery, radiation therapy, chemotherapy, biologic therapy, bone marrow transplantation [BMT] and/or stem cell transplantation [SCT]), remission status, and years since diagnosis. The sociodemographic and disease-related characteristics were self-reported.

The self-administered Sangha comorbidity questionnaire (Sangha, Stucki, Liang, Fossel, & Katz, 2003) was used to assess past and current health conditions. The conditions listed were heart disease, high blood pressure, lung disease, diabetes, ulcer or stomach disease, kidney disease, liver disease, anemia or other blood disease, cancer other than lymphoma or non-melanoma skin cancer, depression, osteoarthritis, degenerative arthritis, back pain, and rheumatoid arthritis. There were also two open-ended spaces for conditions that could be specified by the participant. The comorbidity score consisted of the sum of the



answers to three questions for each of the ten conditions: 1) whether the participant had ever been seen for the listed condition, 2) whether they were currently receiving treatment for the condition, and 3) whether their function was limited by the identified condition. A binary answer (*yes-1* or *no-0*) was supplied for each question. The total comorbidity score ranged from 0 to 30 with higher scores indicating a greater comorbidity burden and lower scores indicating a lower burden.

**Adaptation.** The Impact of Cancer (IOC) Scale, version 2 (Zebrack, Ganz, Bernaards, Petersen, & Abraham, 2006), is a 37-item scale used to measure perceptions of positive and negative aspects of one's life as they relate to cancer. For this study, the IOC was used to measure adaptation to living with cancer. The four positive subscales were altruism and empathy, health awareness, understanding of the meaning of cancer, and positive self-evaluation. The negative subscales were appearance concerns, body change concerns, life interferences, and worry. Higher scores overall on the positive subscales indicate a more positive adaptation, and higher scores on the negative subscale indicate a more negative adaptation. The reliabilities for all subscales are 0.90.

**Quality of life outcomes.** The 27-item Functional Assessment of Cancer Therapy-General, version 4 (FACT-G; Cella et al., 1993), was used to measure general cancer-related QOL outcomes in physical, social and familial, emotional, and functional domains. The total FACT-G was used as the QOL outcome. Satisfactory reliability and validity for the FACT-G has been reported in initial psychometric studies (Cella et al., 1993; Cella, Webster, & Cashy, 2005). The reliability of the FACT-G subscales and total score ranged from 0.77 to 0.93 in the initial study (Smith et al., 2008).

## Data Analyses

Descriptive statistics were computed for the secondary study using the Statistical Package for the Social Sciences, version 14. Multiple regressions and SEM analyses were conducted using MPlus, version 4.2, to test the proposed model of demographic and disease characteristics, positive and negative adaptation, and QOL outcomes. Most variables had less than 5% missing data, but one variable was noted to have a higher percentage of missing data: the disease stage (13%). It was not statistically significant in the regression and SEM analyses and was therefore excluded. The adaptation and QOL variables were latent.

In conducting SEM, it is important to include variables and paths that are both supported mathematically and reflect theoretically meaningful relationships. A number of fit indices were used to assess model fit as suggested by the guidelines for SEM (Baron & Kenny, 1986). We used the goodness-of-fit index (GFI), comparative fit index (CFI), Tucker Lewis Index (TLI), and root mean square error of approximation (RMSEA). An adequate fit is indicated by values of 0.05 or smaller for the RMSEA and 0.90 or greater for the other indices, (Brown & Cudeck, 1993). The model was trimmed to remove non-significant paths, and standardized model coefficients were reported. The units of standardized coefficients for continuous correlates were standard deviations and are presented in Table 3.1.

Table 3.1

*Demographic Characteristics of the Sample*

Variable	All Survivors (N = 771)	
	<i>n</i>	%
<b>Demographics</b>		
<b><i>Gender</i></b>		
Male	384	49.8
Female	387	50.2
<b><i>Race</i></b>		
White	662	85.9
Minority	109	14.1
<b><i>Ethnicity</i></b>		
Hispanic	12	1.5
Non-Hispanic	759	98.5
<b><i>Education</i></b>		
College Graduate	314	59.3
Not a College Graduate	457	40.7
<b><i>Marital Status</i></b>		
Married/Living with Partner	589	76.3
Not Married/Living with Partner	181	23.6
Missing	1	0.1
<b><i>Employment Status</i></b>		
Retired/Unemployed	437	56.7
Employed	322	41.8
Missing	12	1.5
<b><i>Income (\$ annually)</i></b>		
< 30,000	213	27.7
30,000–59,999	236	30.6
60,000–89,999	136	17.6
90,000 or higher	186	24.1
<b>Disease Characteristics</b>		
<b><i>NHL Histology</i></b>		
Indolent	384	49.8
Aggressive	346	44.9
Missing	41	5.3
<b><i>Stage at Diagnosis</i></b>		
I	217	28.1
II	141	18.3
III	126	16.4
IV	189	24.5

Missing	98	12.7
<b><i>Currently in Remission</i></b>		
Yes	602	78.1
No	98	12.7
Don't Know	71	9.2
<b><i>Currently receiving treatment</i></b>		
Yes	107	13.8
No	664	86.2
<b><i>Treatments Received</i></b>		
Chemotherapy	613	79.5
Radiation Therapy	369	47.8
Biologic Therapy	233	30.2
Surgery	231	29.9
Bone Marrow/Stem Cell Transplantation	123	15.9
Other Therapy	93	12.1
Missing Age	20	0.2
Average age	62 (13.5)	Range 24–92

---

*Note.* Numbers given in parenthesis are standard deviations.

## **Results**

### **Sample**

There were 1,312 eligible NHL survivors, and 886 responded to the surveys, with a 68% response rate (Smith et al., 2008). There were 771 survivors with complete data for the IOC and FACT-G. The demographics of this sample are given in Table 3.1. The average age at the time of study was 62.2 (*SD* 13.5, range 25–92). Over half of the participants were either retired or unemployed (53%), and 25% earned less than \$30,000 annually. Fifteen percent were of racial backgrounds other than White. The participants were evenly split between genders, 50% female and 50% male. A majority of the sample reported having had chemotherapy (80%), and 48% had radiation as part of their treatment. More than half of the NHL survivors had never had a recurrence (59%). An even larger proportion of participants were self-reportedly in remission (78%). The mean years since diagnosis were 10.2 (*SD* 7.1).

For the disease characteristics of this sample, 32% of the participants had Stage I cancer and 28% had Stage IV cancer. The mean total comorbidity score was 5.6 (*SD* 4.8; range 0–30) which indicates a high comorbidity burden.

### **Demographic and Disease Characteristics’ Relationships with Quality of Life**

*Research Question 1: What demographic and disease characteristics are associated with QOL?*

**Results.** We conducted a multiple linear regression to model the QOL scores from the FACT-G and to identify the significant independent variables (all at  $p < .05$ ) to address this research question. The bivariate associations between QOL and the independent variables are given in Table 3.2. The significant demographic characteristics in the multiple regression model were age, gender, education (college graduate vs. not a college graduate), annual income (< \$30,000 vs. \$30,000 +), and employment status (employed vs. not employed). Significant disease characteristics were total comorbidity scores, some treatment types (BMT or SCT, biologic therapy), and years since diagnosis.

Table 3.2

*Mediation Model of Direct and Indirect Effects of Significant Characteristics on QOL with Standardized Coefficients*

<b>Characteristics</b>	<b>Regression Model</b>	<b>TDE on QOL with mediators</b>	<b>TDE on positive adaptation</b>	<b>TDE on negative adaptation</b>	<b>TIE on QOL via positive</b>	<b>TIE on QOL via negative</b>	<b>Total Effects</b>
<b>Demographic</b>							
Current age at study	0.185	0.078	-0.114	-0.156	-0.034	0.134	0.178
Female	0.079	-	0.126	-	0.037	-	
< \$30,000 annually	-0.136	-0.123	-	-			-

College graduate	0.086	-	-0.154	-0.152	-0.045	0.131	
Employed	0.090		-	-	-	-	
Minority	-	-	0.217	0.098	0.064	-0.084	
<b>Disease</b>							
Comorbidity score	-0.590	-0.164	-	0.340	-	-0.292	0.456
Remission status	-	-	-	0.068	-		
Currently receiving treatment	-0.110	-	-0.150	0.125	-0.044	-0.107	
BMT/SCT	-0.120	-	-	0.202	-	-0.174	
Biologic	-0.081	-	-		-	-	-
Chemotherapy	-	-	0.196	0.113	0.058	-0.097	-
Years since diagnosis	0.098	-0.066	-	-0.175	-	0.151	0.085

*Note:* Positive adaptation and negative adaptation are the mediators. Variables that were not significant in the model were ethnicity, marital status, age at diagnosis, and certain cancer treatments including surgery and radiation therapy. BMT = bone marrow transplant, QOL = quality of life, SCT = stem cell transplantation, TDE = trimmed direct effects, TIE = trimmed direct effects.  $p < .05$ .

The model indicated that QOL was worse for survivors who were males, younger at the time of the study, had a greater comorbidity burden, had received a BMT or SCT or biologic therapy, or had been diagnosed more recently (all at  $p < .05$ ). These significant variables were included in the final trimmed model and accounted for 34% of the variance in QOL. All coefficients in Table 3.2 were statistically significant.

*Research Question 2: How does adaptation to cancer mediate the relationship between demographic and disease characteristics of QOL?*

**Goodness-of-fit results.** Before the full model was examined, measurement models were assessed to establish relationships among observed variables (indicators) and the three

latent variables (positive adaptation, negative adaptation, and QOL). The results per latent variables were (a) QOL using FACT-G (4 subscales): chi-square value ( $\chi^2$ ) = 59.443,  $df$  = 2, CFI = 0.958, TLI = 0.873, RMSEA=0.181; (b) positive adaptation using IOC (4 subscales):  $\chi^2$  = 14.904,  $df$  = 2, CFI = 0.988, TLI = 0.964, RMSEA = 0.085; and (c) negative adaptation using IOC (4 subscales):  $\chi^2$  = 1.619,  $df$  = 2, CFI = 1.000, TLI = 1.001, RMSEA = 0.000. Higher loadings indicated a stronger relationship between the indicator and latent variables (Kline, 2005; Bollen, 1989).

The full hypothesized model included the observed and latent variables. The results indicated that the fit of the hypothesized model to the data was mixed and inadequate:  $\chi^2$  = 1091.690,  $df$  = 241, CFI = 0.824, TLI = 0.767, RMSEA = 0.069. The model was trimmed to remove extraneous variables and insignificant paths (Baron & Kenny, 1986). To ensure the most parsimonious model and to reduce the number of parameters to be estimated, only significant paths ( $p < .05$ ) were included in the model (Kline, 2005). The paths insignificant to QOL were type of comorbidity problems, remission status, currently receiving treatment, most cancer treatments (surgery, radiation, chemotherapy, BMT or SCT, biologic, or other therapies), gender, ethnicity, employment income, education, race, and marital status. The paths insignificant to positive adaptation were type of comorbidity problems, remission status, most cancer treatments (surgery, radiation, BMT or SCT, biologic, or other therapies), being Hispanic, being employed, income levels, current ages, and marital statuses. The paths insignificant to negative adaptation were type of comorbidity problems, some cancer treatments (surgery, radiation, or other therapies), being female, being Hispanic, being employed, having an income equal to or greater than \$30,000 annually, and marital status.

The trimmed model was refit and then trimmed a second time due to two insignificant paths: gender to negative adaptation and income to negative adaptation. The remaining paths were all significant at the .05 level and were not deleted from the mediation model (Table 3.2). This final mediated model had an adequate fit with the following GFIs:  $\chi^2 = 1393.776$ ,  $df = 188$ , CFI = 0.775, TLI = 0.735, RMSEA = 0.091. An acceptable chi-square to degrees of freedom ratio is less than 3, and our study met this guideline (Byrne, 2001; Kline, 2005).

**Partial and full mediation results.** The mediation models allowed for the examination of potential intervening variables that linked an independent variable to a dependent variable. A direct effect, unmediated, is a path from one of the model variables to the outcome variable of QOL. Positive adaptation had a direct positive effect and negative adaptation had a direct negative effect on QOL. There were direct effects from four personal characteristics on QOL: income, current age, total comorbidity score, and years since diagnosis. Income's direct effect on QOL was the only effect it had, so the relationship between income and QOL was unmediated.

The other three effects were partially mediated by either negative adaptation (comorbidity burden, years since diagnosis) or both negative adaptation and positive adaptation (current age). The remaining personal characteristics had no direct effects on QOL, but they had fully mediated effects through negative adaptation (BMT or SCT), positive adaptation (gender), or both (education and current treatment status).

The effect of current age on QOL was partially mediated by both negative adaptation and positive adaptation. Increased age was directly associated with increased QOL and a decrease in both positive adaptation and negative adaptation. The largest effect was the indirect effect via negative adaptation. The total effect (direct and indirect effects combined)



indicated that a 1-point *SD* increase in age directly predicted a 0.178-point increase in QOL, which was significant.

Total comorbidity scores and years since diagnosis had both direct effects and indirect effects mediated through negative adaptation on QOL. As the comorbidity burden increased, negative adaptation also increased and QOL decreased. For comorbidities' effects on QOL, 36% were direct and 64% were indirect and mediated through negative adaptation. The total effect of a greater comorbidity burden on QOL was 0.456 points. A 1-point standard deviation increase in the total comorbidity score directly predicted a 0.164-point decrease in QOL.

The direct effect on QOL of the number of years since diagnosis was negative. However, this effect was partially mediated, because an increase in years since diagnosis was associated with lower negative adaptation scores, and thus an increase in QOL. The indirect effect was greater, and thus, the total effect on QOL of years post-diagnosis was positive. A 1-point standard deviation increase of years since diagnosis directly predicted a 0.066-point increase in QOL, a significant finding.

The effect of having a BMT or SCT was fully mediated by negative adaptation, which was associated with lower QOL. Gender was mediated through positive adaptation; females were better able to positively adapt and had better QOL than males. Not being white and having received chemotherapy were also fully mediated through positive and negative adaptation. However, the total effects for both indicators were not significant ( $p > .05$ ). The effects of being a college graduate and currently receiving treatment were indirect on positive and negative adaptation and on QOL. Thus, being a college graduate had indirect positive and negative effects with

increased and decreased QOL overlapping. This coexistence was also true for those currently receiving treatment, showing positive and negative indirect effects on QOL.

### **Discussion**

In this study, demographic and disease characteristics associated with the QOL of NHL survivors were explored using multiple regression and SEM techniques. At the bivariate level, several of the demographic and disease characteristics were strongly associated with QOL: current age, being a male, having an annual income of less than \$30,000, having less than a college education, being unemployed or retired, having more of a comorbidity burden, currently receiving treatment, ever having received a BMT, SCT, or biologic therapy, and the number of years post-diagnosis. These findings are consistent with prior studies that reported statistically significant associations of sociodemographic variables with QOL outcomes for breast and lymphoma cancers (Kornblith et al., 2003; Geffen, Blaustein, Amir, & Cohen, 2003; Zebrack et al., 2006; Bellizzi & Blank, 2006). These results indicate that adaptation to positive and negative aspects of cancer can help explain the relationship of these characteristics to QOL.

These findings support and extend the current NHL literature and the CSA model. Bellizzi et al. (2007) found that 78% of NHL survivors reported at least one positive and one negative change in their lives related to their cancer experience. This study's results indicate that positive and negative adaptation was common, but especially negative adaptation. Current age at time of study was a significant indicator and accounted for the only partial mediation. Older adults (> 65 years of age) were less likely to report negative changes compared to younger survivors ( $\leq$  65 years of age), and this is similar to previous findings (Bower et al, 2005; Blank & Bellizzi, 2006). This suggests that older adults have experienced

other significant life events or stressors and have learned how to manage these life changes, unlike younger survivors.

Younger survivors at the time of the study, survivors with a higher comorbidity score, unemployed or retired survivors, and survivors with fewer years passed since the time of their diagnoses had a more difficult time adapting to the cancer experience. Life interferences and worry may also have negative associations with abrupt changes in work and family environments, leading to economic constraints, so it is possible that the demographic factors were interrelated. Positive and negative adaptation co-occurred, which supports the notion that survivors continually appraise their cancer experience and adjust to various factors associated with increased or decreased QOL.

Survivors with less than a college education experienced both positive and negative changes, a finding supported by previous findings on the relationship between negative life changes and adaptation with lower education (Cordova, Cunningham, Carlson, & Andrykowski, 2001; Sears, Stanton, Danoff-Burg, 2003). Additionally, NHL survivors with a relatively recent diagnosis (2–5 years postdiagnosis) need to be targeted for help adjusting to the ongoing, dynamic process of adaptation. Equipping this population with information and resources early will emphasize not only the positive changes adaptation may bring but give them ways to overcome the negative effects of the cancer experience. Hopefully, with early intervention, their cognitive appraisal processes will change faster as stressors and psychological growth occur, reflecting integration into a new way of life (Conway, 2005; Conway, Meares, & Standart, 2004; Conway & Pleydell-Pearce, 2000). The CSA model shows that QOL changes occur differently in each QOL domain, which may aid newly diagnosed survivors in recognizing that positive and negative coping behaviors are expected

to occur. It is hoped that this understanding will help them reintegrate into their social environments.

The SEM model found that current age, being a male, having less than a college degree, being non-White, currently receiving treatment, and having received chemotherapy had direct associations with positive adaptation and higher levels of reported QOL. Current age, not being a college graduate, being a minority, having a greater comorbidity burden, being in remission, currently receiving treatment, having received a BMT, SCT, or chemotherapy, and years since diagnosis had negative associations with adaptation and lower levels of QOL. Using SEM to test multiple relationships simultaneously offered a more thorough assessment than univariate analyses would. Thus, the model incorporated indirect and direct effects of demographic and disease characteristics, providing a basis for hypothesizing specific relationships among these variables.

### **Limitations**

Although the study gave important insight into the QOL of NHL survivors and their adaptations to cancer, there are some limitations to consider. This study was a cross-sectional, secondary analysis and thus was limited in determining causal processes and relationships among factors. Because it used a secondary data set, items available for analyses were limited. Social support was available in the parent data set, but was not included in the secondary analysis. Inclusion of this variable might potentially increase the GFI for a stronger model fit. Future studies should investigate informal and formal social support sources (e.g., spiritual or existential beliefs, familial support) to investigate their associations with the QOL of NHL survivors. This analysis provided suggestions for causal models, but longitudinal research is needed to delineate the processes that link personal and

disease characteristics, adaptation to cancer, and QOL. Longitudinal research will also allow assessment of varying adaptation patterns over time and of how to intervene at the most critical points of the survivorship trajectory.

The results may not be generalizable to other cancers than NHL or to geographical locations. The data was self-reported with recall bias a concern. Based on the results of the goodness-of-fit indices, the initially hypothesized model had a better fit than the trimmed model. These findings were not expected and further analyses to determine adequate fit is needed. The model could be improved by measuring QOL with measures other than the FACT-G. The social and familial well-being subscale was weakly associated with the indicators when compared with the three other well-being subscales and that may have decreased the goodness of fit. Additionally, the model could be improved by including theorized relationships in the model that might not be significant to determine if the overall fit improves based on the theory, not just statistical analyses.

### **Strengths**

A strength of this study is the development of a conceptual model of indicators that incorporate demographic and disease characteristics, QOL factors, and adaptation. The conceptual CSA model identified theoretically meaningful relationships among the factors, and its final state incorporating the study's results can be seen in Figure 3.2. It is clinically relevant and encourages clinicians to ask NHL survivors about adjusting to living with cancer and the coping process to provide resources to them throughout the survivorship period. Another strength of the study is the large sample size of a cancer-specific population in a diverse state. The observed squared multiple correlations between the latent variables indicates that they accounted for a substantial proportion of the variance in QOL. This study

also supported the idea that negative adaptation to cancer is associated with decreased QOL and potentially negative health outcomes (Bellizzi et al., 2007).

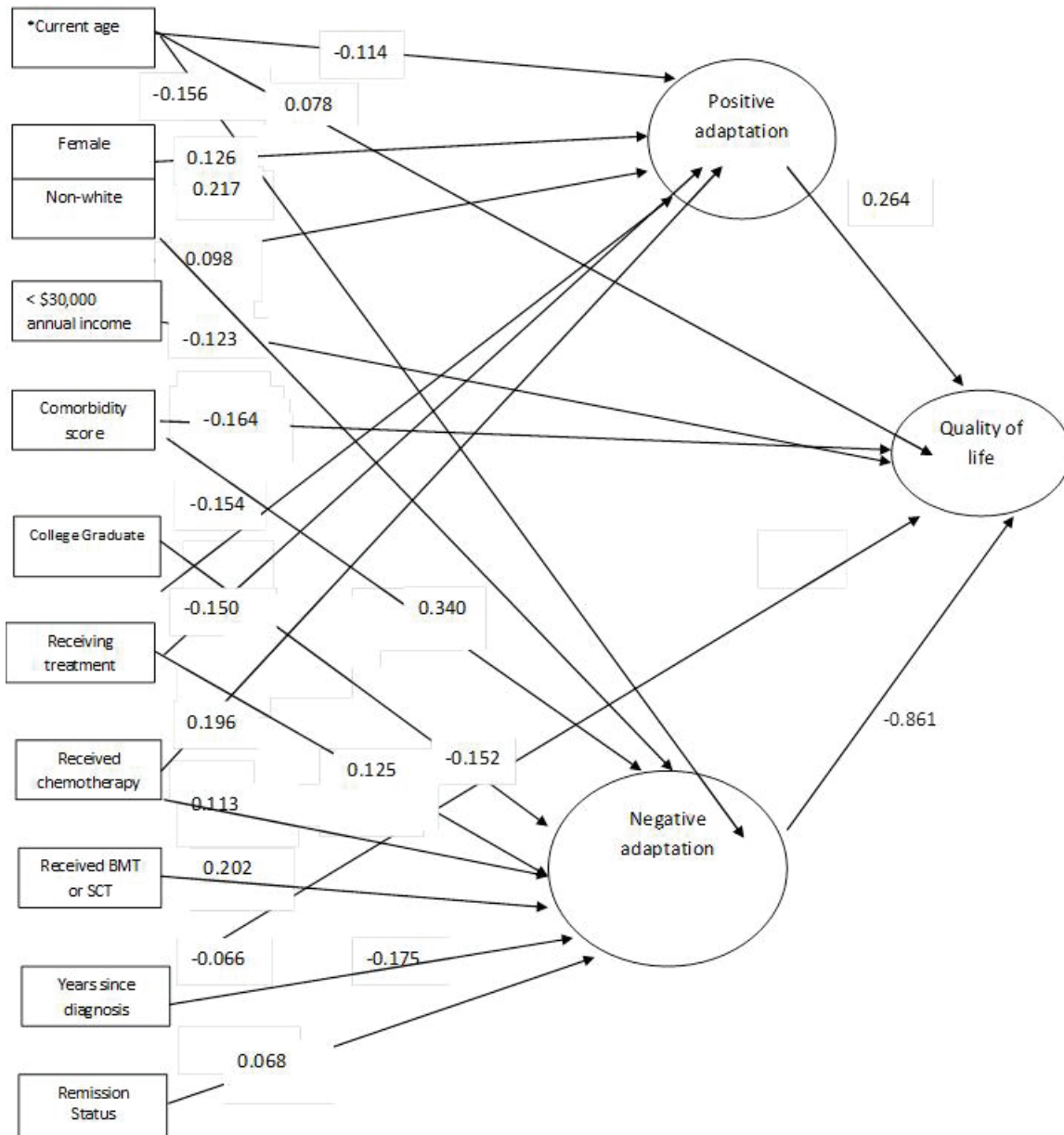


Figure 3.2. Final model of cancer survivorship adaptation and quality of life with standardized paths estimates ( $N = 771$ ).

In summary, both positive and negative adaptation had significant path coefficients that showed mediation of the relationships between demographic and disease characteristics and QOL. These data illustrate the usefulness of the IOC as a general cancer-specific measure of adaptation and shows evidence of the need for intervention work with this population. Given the analysis from the mediation models, a negative perception of cancer is a stronger mediator than positive adaptation. Interventions tailored to assist survivors' in cognitively reframing their experiences may be useful and may result in decreased adverse health outcomes and increased QOL.

### **Conclusion**

The CSA model was tested using SEM. Significant theorized relationships were supported by the data. Positive and negative adaptation mediated some effects of demographic and disease characteristics on QOL. Further research is needed to expand how positive and negative adaptation to cancer can have overlapping effects on the survivor and also on the caregivers and families of survivors. Interventions are needed to target support to NHL survivors postdiagnosis to improve their ability to reduce the negative effects of cancer and to support them in seeing the positive changes and benefits of living with the disease.

## REFERENCES

- Arden-Close, E., Pacey, A., & Eiser, C. (2010). Health-related quality of life in survivors of lymphoma: A systematic review and methodological critique. *Leukemia & Lymphoma, 51*(4), 628–640.
- Baron, R. & Kenny, D. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173–1182.
- Bellizzi, K. & Blank, T. (2006). Predicting post-traumatic growth in breast cancer survivors. *Health Psychology, 25*, 47–56.
- Bellizzi, K. M., Miller, M. F., Arora, N. K., & Rowland, J. H. (2007). Positive and negative life changes experienced by survivors of non-Hodgkin's lymphoma. *Annals of Behavioral Medicine, 34*(2), 188–199.
- Blank, T. & Bellizzi, K. (2006). After prostate cancer: Predictors of well-being among long-term prostate cancer survivors. *Cancer, 106*, 2128–2135.
- Bollen, K. (1989). *Structural equations with latent variables*. New York, NY: John Wiley & Sons.
- Bower, J., Meyerowitz, B., Desmond, K., Bernaards, C., Rowland, J.H., & Ganz, P.A. (2005). Perceptions of vulnerability and growth among cancer survivors: Positive and negative effects of cancer diagnosis. *Annals of Behavioral Medicine, 29*, 236–245.
- Brown, M. & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. Bollen, & J. Long (Eds.), *Testing structural equation models* (pp. 136–162). Beverly Hills, CA: Sage.
- Byrne, B. (2001). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*. Mahwah, NJ: Erlbaum.
- Cella, D. F., Tulsky, D. S., Gray, G., Sarafian, B., Linn, E., Bonomi, A., . . . Brannon, J. (1993). The Functional Assessment of Cancer Therapy Scale: Development and validation of the general measure. *Journal of Clinical Oncology, 11*(3), 570–579.
- Cella, D., Webster, K., & Cashy J. (2005). Development of a measure of health-related quality of life for non-Hodgkin's lymphoma clinical research: The Functional Assessment of Cancer Therapy-Lymphoma (FACT-Lym) [Abstract]. *Blood, 106*, 222A.
- Conway, M. (2005). Memory and the self. *Journal of Memory and Language, 53*, 594–628.
- Conway, M., Meares, K., & Standart, S. (2004). Images and goals. *Memory, 12*, 525–531.
- Conway, M. & Pleydell-Pearce, C. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review, 107*, 261–288.



Cordova, M., Cunningham, L., Carlson, C., & Andrykowski, M. (2001). Post-traumatic growth following breast cancer: A controlled comparison study. *Health Psychology, 20*, 176–185.

Ferrell, B. R., Dow, K. H., & Grant, M. (1995). Measurement of the quality of life in cancer survivors. *Quality of Life Research, 4*, 523–531.

Ferrell, B. R., Dow, K. H., Leigh, S., Ly, J., & Gulasekaram, P. (1995). Quality of life in long-term cancer survivors. *Oncology Nursing Forum, 22*, 915–922.

Geffen, D., Blaustein, A., Amir, M., & Cohen, Y. (2003). Post-traumatic stress disorder and quality of life in long-term survivors of Hodgkin's disease and non-Hodgkin's lymphoma in Israel. *Leukemia & Lymphoma, 44*(11), 1925–1929.

Institute of Medicine. (2006). *Implementing Cancer Survivorship Care planning workshop summary*. Retrieved from <http://www.iom.edu/Reports/2006/Implementing-Cancer-Survivorship-Care-Planning-Workshop-Summary.aspx>

Kline, R. (2005). *Principles and practice of structural equation modeling* (2nd ed.). New York, NY: Guilford.

Kornblith, A., Herndon, J., Weiss, R., Zhang, C., Zuckerman, E., Rosenberg, S., . . . Holland, J. (2003). Long-term adjustment of survivors of early-stage breast carcinoma 20 years after adjuvant chemotherapy. *Cancer, 98*(4), 679–689.

Leak, A., Mayer, D., & Smith, S. (2011). Quality of life domains among non-Hodgkin lymphoma survivors: An integrative literature review. *Leukemia and Lymphoma, 52*, 972–985.

Mols, F., Aaronson, N. K., Vingerhoets, A. J., Coebergh, J. W., Vreugdenhil, G., Lybeert, M. L., . . . van de Poll-Franse, L. (2007). Quality of life among long-term non-Hodgkin lymphoma survivors. *Cancer, 109*(8), 1659–1667.

National Cancer Institute (2008). *Survivorship*. Retrieved from <http://www.cancer.gov/dictionary/?CdrID=445089>

National Coalition for Cancer Survivorship. (n.d.) *The organization*. Retrieved from <http://www.canceradvocacy.org/about/org/>

Naus, M., Ishler, M., Parrott, C., & Kovacs, S. (2009). Cancer survivor adaptation model: Conceptualizing cancer as a chronic illness. *Journal of Clinical Psychology, 65*(12), 1350–1359.

- Reeve, B. B., Potosky, A. L., Smith, A. W., Han, P. K., Hays, R. D., Davis, W. W., . . . Clauser, S. B. (2009). Impact of cancer on health-related quality of life of older Americans. *Journal of the National Cancer Institute, 101*(12), 860–868.
- Sangha, O., Stucki, G., Liang, M., Fossel, A., & Katz, J. (2003). The self-administered comorbidity questionnaire: A new method to assess comorbidity clinical and health services research. *Arthritis Rheumatology, 49*, 156–163.
- Sears, S., Stanton, A., & Danoff-Burg, S., (2003). The yellow brick road and the emerald city: Benefit finding, positive reappraisal coping, and post-traumatic growth in women with early-stage breast cancer. *Health Psychology, 22*, 487–497.
- Smith, S. K., Zimmerman, S., Williams, C. S., Preisser, J. S., & Clipp, E. C. (2008). Post-traumatic stress outcomes in non-Hodgkin's lymphoma survivors. *Journal of Clinical Oncology, 26*(6), 934–941.
- Tedeschi, R., Park, C., & Calhoun, L. (1998). Post-traumatic growth: Conceptual issues. In R. Tedeschi, C. Park., & L. Calhoun (Eds.), *Post-traumatic growth: Positive changes in the aftermath of crisis* (pp. 1–22). Mahwah, NJ: Erlbaum.
- Tomich, P., & Helgeson, V. (2004). Is finding something good in the bad always good? Benefit finding among women with breast cancer. *Health Psychology, 23*, 16–23.
- Zebrack, B., Ganz, P., Bernaards, C., Petersen, C., & Abraham, L. (2006). Assessing the impact of cancer: Development of a new instrument for long-term survivors. *Psychooncology, 15*(5), 407–421.

## CHAPTER 4

### THE INFLUENCE OF AGE ON NON-HODGKIN LYMPHOMA SURVIVORS' QUALITY OF LIFE

#### Introduction

There are nearly 12 million cancer survivors in the United States, and this number rises as older adults live longer with the disease (National Cancer Institute [NCI], 2011). Not only are survivors living longer with the disease, they are managing other health conditions. The Institute of Medicine (IOM) report, *Ensuring Quality Cancer Care*, states that in caring for survivors with cancer, adequate measures should be taken to also address noncancer diseases in concert with the primary disease (Hewitt & Simone, 1999; Ko & Chaudhry, 2002). These noncancer diseases are known as *comorbidities*, the coexistence of various chronic illnesses, which is an increasing health problem due to the rising proportion of older adults. Survivors with comorbidities present a challenge for cancer management. With an aging American population, the needs of older adults with cancer and comorbidities will become a dominant public health concern. Likewise, most cancers occur primarily in older adults (Yancik & Reis, 2000). Age and comorbidities are positively correlated; increasing age is associated with poorer physical health but higher levels of psychological health. Survivors with comorbidities have poorer physical and psychological QOL (Fortin et al., 2006; Karakiewicz et al., 2008; Yancik, Ganz, Varricchio, & Conley, 2001).

Non-Hodgkin lymphoma (NHL) is the sixth most common cancer in the United States with more than 65,540 new diagnoses expected in 2011. As a person ages, their

likelihood of getting cancer increases. The survival rate for NHL survivors has increased, but it remains an illness that elicits concerns related to late- and long-term effects. Previous studies support that age differences affect quality of life (QOL) for breast cancer survivors, and they strongly suggest that younger breast cancer survivors (< 40 years of age) fare worse than their older counterparts in social functioning (Avis, Smith, McGraw, Smith, Petronis, & Carver, 2005; Ganz, Guadagnoli, Landrum, Lash, Rakowski, & Silliman, 2003; Kroenke, Rosner, Chen, Kawachi, Colditz, & Holmes, 2004). This trend has been mixed, however, because younger breast cancer survivors (< 50 years of age) reported significantly lower social functioning than their older counterparts in one study (Abrandt et al., 2004) and no significant age differences were found in another study (Ganz, Rowland, Desmond, Meyerowitz, & Wyatt, 1998). These findings provide a foundation for exploring the role of age in cancer survivors' QOL, specifically in other populations such as NHL survivors.

A review of the literature showed that defining QOL is challenging at best. It is a widely accepted outcome measure that strives to balance the efficacy of possible treatment modalities with potential side effects and benefits to the survivors' well-being. It is a subjective, multidimensional construct of an individual's perception of specific goals, expectations, and values within the domains of physical, social and familial, emotional, and functional well-being (Ferrell, Dow, Leigh, Ly, & Gulasekaram, 1995; Parsons & Mayer, 2004).

Moderators are independent variables that affect the direction of the association between another independent variable and the outcome variable and help to determine when the relationship occurs (Bennett, 2000). They are also described as influencing the strength of the relationship between two other variables. It is important to understand how age is

associated with QOL, and although there is evidence that personal characteristics are important in determining QOL, it is limited in the NHL survivorship literature. Thus, the moderator of age and its relationship with QOL will be explored in this paper. Understanding moderators that may interfere with, enable, reinforce, or facilitate a higher QOL during survivorship is critical for adults diagnosed with NHL. Therefore, the purpose of this study was to answer the following research question:

1. Does age moderate relationships between demographic and disease characteristics and QOL for NHL survivors?

### **Conceptual Framework**

A cancer survivor adaptation (CSA) model of QOL among NHL survivors was used and adapted from Naus, Ishler, Parrott, and Kovacs (2009). It is described in Figure 4.1. It has three components: personal characteristics, a moderator (age), and outcomes. The model proposes that personal characteristics (demographic and disease factors) have a relationship with QOL and that there is potential that age may affect that relationship or its strength. Moderation is an important consideration in this study because the demographic variables and disease factors could potentially change the associations with QOL. The outcome variable for this model is QOL.

### **Method**

#### **Study Design**

This research was a secondary analysis of a cross-sectional study of NHL survivors. The primary aim of the parent study was to estimate the prevalence of post-traumatic stress disorder (PTSD) symptoms in survivors of adult NHL who were at least two years

postdiagnosis and to identify the risk factors associated with PTSD symptoms (Smith, Zimmerman, Williams, Preisser, & Clipp, 2008).

### **Participants and Procedures**

The sample, during 2005 to 2006, was accrued through mailed surveys to individuals who were treated for NHL at one of two comprehensive cancer centers in the southeastern United States: the Duke Cancer Center and the University of North Carolina at Chapel Hill Lineberger Cancer Center. Eligibility included individuals 18 years of age or older, at least two years postdiagnosis, and with active disease. *Survivors* are defined as individuals from the time of diagnosis through the balance of their lives, and in this study, survivors with or without active disease (National Coalition for Cancer Survivorship, n.d.) were eligible. This study was exempted as a secondary data analysis by the University of North Carolina at Chapel Hill's Institutional Review Board.

### **Measures**

**Demographic and disease characteristics.** Sociodemographic information included current age, gender, income, education, ethnicity, and marital status. Disease-related characteristics included NHL histology, cancer treatments such as surgery, radiation therapy, chemotherapy, biologic therapy, and bone marrow or stem cell transplantation. The sociodemographic and disease-related characteristics were self-reported.

The self-administered Sangha comorbidity questionnaire (Sangha, Stucki, Liang, Fossel, & Katz, 2003) was used to assess past and current health conditions. The conditions listed were heart disease, high blood pressure, lung disease, diabetes, ulcer or stomach disease, kidney disease, liver disease, anemia or other blood disease, cancer other than lymphoma or nonmelanoma skin cancer, depression, osteoarthritis, degenerative arthritis,

back pain, and rheumatoid arthritis. There were also two open-ended spaces for conditions that could be specified by the participant. The comorbidity score consisted of the sum of the answers to three questions for each of the ten conditions: 1) whether the participant had ever been seen for the listed condition, 2) whether they were currently receiving treatment for the condition, and 3) whether their function was limited by the identified condition. A binary answer (*yes-1* or *no-0*) was supplied for each question. The total comorbidity score ranged from 0 to 30 with higher scores indicating a greater comorbidity burden and lower scores indicating a lower burden.

**Quality of life outcome.** The 27-item Functional Assessment of Cancer Therapy-General (FACT-G, version 4; Cella et al, 1993, was used to measure cancer-related QOL in physical, social and familial, emotional, and functional domains. In this study, the total score from the FACT-G was used as the QOL outcome. A higher score indicates a higher perception of QOL. Evidence of satisfactory reliability and validity for the FACT-G has been reported in initial psychometric studies (Cella et al, 1993; Cella et al, 2005). The reliability of the FACT-G subscales and total score ranged from 0.77 to 0.93 in the initial study (Smith et al, 2008).

### **Data Analyses**

Descriptive statistics were computed using SPSS. This study used multiple regression to analyze relationships between personal characteristics and QOL. The base model includes demographic and disease characteristics that were found to be statistically significant (all at  $p < .05$ ) in another paper (Leak, Mayer, & Smith, 2011). The regression model was trimmed of all non-significant ( $p > .05$ ) predictors before adding any interactions to test moderation of the effects by age (column 1 for Table 2), then each moderation effect was

tested separately. Interactions that were significant were jointly entered in the model, and the final model retained only those predictors that were significant ( $p < .05$ ). All variables had  $< 5\%$  missing data except for cancer stage (13%) and was therefore excluded from the analyses.

## Results

### Sample

The study sample included 741 NHL survivors who were, on average, 62.3 ( $SD$  13.4) years of age at the time of study (range 25–92). The demographics of the sample can be seen on Table 4.1. More than 40% of the sample were adults over 65 years of age ( $n = 322$ ), and 86% were Caucasian. Over half (58%) were either retired or unemployed, and 28% earned less than \$30,000 annually. The mean time since diagnosis for the sample was 10.2 years ( $SD$  7.1). Disease characteristics for the sample included 28% of survivors in Stage 1 or 24% in Stage 4. A majority of the sample reported having had chemotherapy (80%) and radiation (48%) as part of their treatment. The total comorbidity score was 5.6 ( $SD$  4.8) with a higher number indicating more comorbidity burden (range 0–30). On average, the number of comorbid problems for the entire sample was 2.90 ( $SD$  2.1) but higher for older adults with a mean of 3.54 ( $SD$  2.1). The most commonly reported comorbid problems were heart disease (18.7%), high blood pressure (18.2%), diabetes (14.1%), and lung disease (17.1%). Of the 741 NHL survivors, 11.4% had no comorbidities, 18.7% had 1 comorbidity, 18.2% had 2 comorbidities, and 51.5% had 3 or more comorbidities. The younger survivors were more likely to be of a minority race, college-educated, married or living with a partner, and employed. The younger survivors also had higher annual income than the older survivors.



Table 4.1

*Demographics of the Sample*

<b>Variable</b>	<b>All Survivors (N = 741)</b>	<b>Total %</b>	<b>&lt; 65 years of age (n = 419)</b>	<b>Total %</b>	<b>≥ 65 years of age (n = 322)</b>	<b>Total %</b>	<b>p value</b>
<b>Personal Characteristics</b>							
<b>Gender</b>							
Male	377	50.9	220	52.5	157	48.8	.312
Female	364	49.1	199	47.5	165	51.2	
<b>Race</b>							
White	640	86.4	347	82.8	293	91.0	.013
Minority	101	13.6	72	17.2	29	9.0	
<b>Ethnicity</b>							
Hispanic	12	1.6	10	2.4	2	0.6	.059
Non-Hispanic	729	98.4	409	97.6	320	99.4	
<b>Education</b>							
College Graduate	309	41.7	197	47.0	112	34.8	.000
Not a College Graduate	432	58.3	222	53.0	210	65.2	
<b>Marital Status</b>							
Married/Living with Partner	56	76.7	328	78.3	240	74.5	.000
Not Married/Living with Partner	172	23.2	91	21.7	81	25.2	
Missing	1	0.1					
<b>Employment Status</b>							
Retired/Unemployed	427	57.6	150	35.8	277	86.0	.000
Employed	314	42.4	269	64.2	45	14.0	
<b>Annual Income (US \$)</b>							
< 30,000	202	27.3	93	22.2	109	33.9	.000
30,000–59,999	228	30.8	111	26.5	117	36.3	

60,000–89,999	131	17.7	89	21.2	42	13.0	
≥ 90,000	180	24.3	126	30.1	54	16.8	
<b>Disease Characteristics</b>							
<b>NHL Histology</b>							
Indolent	365	49.3	202	48.2	163	50.6	.244
Aggressive	335	45.2	200	47.7	135	41.9	
Missing	41	5.5	17	4.1	24	7.5	
<b>Stage at Diagnosis</b>							
I	204	27.5	108	25.8	96	29.8	.249
II	137	18.5	78	18.6	59	18.3	
III	125	16.9	79	18.9	46	14.3	
IV	178	24.0	108	25.8	70	21.7	
Missing	97	13.1	46	11.0	51	15.8	
<b>Currently in Remission</b>							
Yes	579	78.1	321	76.6	258	80.1	.415
No	97	13.1	60	14.3	37	11.5	
Don't Know	63	8.5	38	9.1	25	7.8	
Missing	2	0.3	5		2	0.6	
<b>Currently receiving treatment</b>							
Yes	105	14.2	69	16.5	36	11.2	.041
No	636	85.8	350	83.5	286	88.8	
<b>Treatments Received</b>							
Chemotherapy	592	79.9	340	81.1	252	78.3	.331
Radiation therapy	358	48.3	214	51.1	144	44.7	.086
Surgery	223	30.1	133	31.7	90	28.0	.245
Biologic therapy	223	30.1	150	35.8	73	22.7	.000
Bone marrow/stem cell transplantation	116	15.7	95	22.7	21	6.5	.000
Other therapy	87	11.7	54	12.9	33	10.2	.269

Missing surgery variable	18	2.4	11	2.6	7	2.2	
<b>Comorbid Scores</b>							
0	86	11.4	73	7.4	13	4.0	.001
1	141	18.7	97	5.2	44	13.5	
2	137	18.2	80	0.8	57	17.4	
≥ 3	389	51.5	176	23.3	213	28.3	
<b>Total lifetime medical conditions (range 0–30)</b>	5.6 (4.8)		4.6 (4.5)		6.8 (5.1)		
<b>Mean age at time of study (range 21–90)</b>	62.3 (13.4)		53.1 (9.3)		74.4 (6.4)		
<b>Years since diagnosis (range 2–44)</b>	10.2 (7.1)		9.6 (6.3)		11.2 (7.9)		

*Note.* Numbers given in parenthesis are standard deviations.

*Research Question 1: Does age moderate relationships between demographic and disease characteristics and QOL for NHL survivors?*

The demographic characteristics included in the regression model were gender (female), income (< \$30,000 or ≥ \$30,000 annually), education (college graduate or not), and employment status (employed or unemployed or retired). The disease factors were comorbidity scores, currently receiving treatment, types of cancer treatments received (bone marrow transplant, biologic therapies, or both), and years since diagnosis.

Female gender was associated with 1.8 point increase in FACT-G score, college graduates had a 2.4 point increase in FACT-G score, and those who were employed had a 2.7 point increase in FACT-G score over those who were unemployed or retired while earning less than \$30,000 was associated with a 6.0 point decrease in FACT-G score. For every point increase in comorbidity score, the FACT-G score decreased by 1.4 points. Those who were currently receiving treatment had a lower FACT-G score by 4.9 points, those who had

received a BMT had a 4.5 point decrease in FACT-G score, those who had received biologic therapy had a 2.7 point decrease in FACT-G score while longer time since diagnosis was associated with a higher FACT-G score, with a .16 point increase for every year since diagnosis.

There were two demographic characteristics/disease factors whose relationships with QOL were significantly moderated by age: income and gender. Lower income is associated with lower FACT-G score, but this effect was not as strong in older survivors. Younger women had higher FACT-G scores than younger men, but the difference was not as large in older survivors (9.8 points). The moderating effect was not statistically significant in the full model.

Table 4.2

*Age as a Moderator of the Demographic and Disease Factor Relationships with Quality of Life*

Characteristics	Regression Model with moderation		Moderation with Age	
	<i>B (SE)</i>	<i>P value</i>	<i>B (SE)</i>	<i>P value</i>
Gender: Female	1.87	0.08	10.34	0.04
Income: < \$30,000	-6.03	<.0001	-24.1	<.0001
Education: College Graduate	2.47	0.05	2.71	0.03
Employed	2.78	0.03	1.98	0.13
Comorbidity Score	-1.35	<.0001	-1.35	<.0001
Currently Receiving Treatment	-4.84	0.00	-4.92	0.00
Cancer Treatments: Bone Marrow Transplant	-4.58	0.00	-4.86	0.00
Cancer Treatment: Biologic	-2.68	0.03	-2.82	0.02
Years Since Diagnosis	0.155	0.04	0.125	0.10
Female* Age	-		-0.13	0.08
Income *Age	-		0.284	0.00

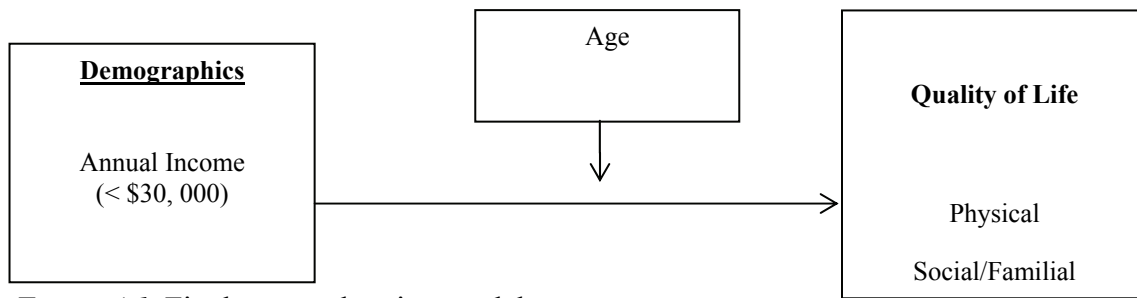


Figure 4.1. Final age moderation model.

## Discussion

The goal of the study was to examine the moderating role of age on the relationship between demographic and disease factors and QOL in NHL survivors. The sample was evenly distributed with numbers of males and females, 50% each. While NHL is more common in older adults than younger adults with an unpredictable illness trajectory, we found that younger survivors had a more difficult time with their cancer diagnosis than older survivors.

This study fills an important gap in the NHL literature about younger survivors and the association that demographic characteristics have on QOL. Breast cancer survivorship literature has explored the impact of cancer in younger survivors more than any other cancer, and this is the first NHL study to explore age and its relationship on QOL, specifically in younger survivors with NHL.

The disease is not gender specific, and its unique characteristics expand across ages. The effect of income on QOL was significantly moderated by age and though the effect of gender was not significantly moderated by age in the full model, there still may be clinical relevance for genders. Being a female, being a college graduate, being employed, and having

a longer time since diagnosis all had positive associations with QOL, whereas, earning less than \$30,000 annually, having higher comorbidity scores, currently receiving treatment, having had a bone marrow transplant, and having had biologic therapy all had negative associations with QOL. These associations support findings from other studies that have explored these demographic and disease characteristics. Those without a college degree may be more likely to terminate their job due to physical demands at their place of employment and less flexibility in hours compared with those who have a college degree (Abrandt et al., 2004; Hartl et al., 2003).

Younger survivors who made less than \$30,000 had poorer QOL than older survivors who earned the same amount. This finding is supported by Bellizzi et al. (2007) who reported that survivors with NHL reported negative economic changes as a result of having a cancer diagnosis. Sixty percent of the current sample were younger survivors, and more than half employed (64%). Another study reported that survivors who maintained their employment status reported higher physical QOL compared to those who reduced their work hours or stopped working completely (Mols, Thong, Vreugdenhil & van de Poll-Franse, 2010).

Forty-one percent of the participants in the same study reported a change in employment status and decline in QOL status due to their cancer, along with problems obtaining insurance or a mortgage. Employment and income are ongoing social and financial concerns faced by survivors and future work that explores their long term impact on QOL is needed. These results suggest that younger women diagnosed with NHL are more likely than their older counterparts to experience psychological distress and poorer QOL related to their disease and its treatment due to financial constraints.

Other studies support that younger breast cancer survivors felt that their diagnosis has limited their family, career, and lifestyle priorities (Stewart et al, 2001; Thewes, Butow, Girgis, & Pendlebury, 2004). This finding has implications for both younger and older survivors, but focused economic implications are greater for younger survivors who have competing demands with career aspirations compared to those who may be retired. Increasing social support systems can increase QOL to favorably impact overall survival in younger breast cancer survivors (Chou, Stewart, Bloom, & Koo, 2003).

There are several plausible explanations for why younger female survivors have lower QOL than their older counterparts. Younger survivors are often diagnosed at a time when they have multiple responsibilities with their family (e.g., primary caregiver for their spouse, parent, or child), working in or outside of the home, and/or maintaining their career aspirations. Additionally, younger survivors usually have fewer coping skills to manage their diagnosis and the thought of an early death may contribute to greater distress and poorer QOL.

This secondary analysis is cross sectional in nature so we cannot establish a cause-effect relationship between demographic and disease characteristics and QOL, however we are able to assess the strength of the associations. A longitudinal study may provide a more convincing answer to the question of whether demographic and disease characteristics impact QOL changes with increasing age. Increasing age does not mean that QOL will be reduced, but future studies are needed to look at age differences across cancer populations with various sociodemographic and disease variables. The strength of this study is the use of an existing large dataset of NHL survivors to answer questions about a unique and understudied cancer population. Data is self-reported. These data provide a source of population-based

information about NHL cancer survivorship in North Carolina. Additionally, the large sample provided age stratification that allows for inferences for the age groups. Future studies could include other moderating effects on QOL such as comorbidities, gender, and income. In addition, studies could stratify younger age groups to assess for QOL differences and intervene appropriately if one age group has poorer QOL.

The strength of this study is the use of an existing, large data set of NHL survivors to answer questions about a unique and understudied cancer population. These data provided a source of population-based information about NHL cancer survivorship in North Carolina. Additionally, the large sample provided age stratification that allowed for inferences among age groups. Future studies could include other moderating effects on QOL such as comorbidities, gender, and income. In addition, studies could stratify younger age groups to assess for QOL differences and intervene appropriately if one age group has poorer QOL.

### **Conclusion**

Age is an important moderator of the effects of QOL. Our findings demonstrate that the association between income and QOL was more prominent in younger survivors. This difference clearly warrants the development of resources and interventions sensitive and specific to age-related issues unique to younger NHL cancer survivors. This difference clearly warrants the development of resources and interventions sensitive and specific to age-related issues unique to younger NHL cancer survivors



## REFERENCES

- Abrandt, T., Martikainen, R., Virtanen, S., Pukkala, E., Hietanen, P., & Lindbohm, M. (2004). The impact of education and occupation on the employment status of cancer survivors. *European Journal of Cancer, 40*, 2488–2493.
- Avis, N., Smith, K., McGraw, S., Smith, R., Petronis, V., & Carver, C. (2005). Assessing quality of life in adult cancer survivors (QLACS). *Quality Life Research, 14*, 1007–1023.
- Bennett, J. (2000). Mediator and moderator variables in nursing research: Conceptual and statistical differences. *Nursing Research, 23*, 415–420.
- Chou, A., Stewart, S., Bloom, J., & Koo, J. (2003). *Survival in young women with breast cancer: The effect of social support*. Unpublished manuscript.
- Fortin, M., Bravo, G., Hudon, C., Lapointe, L., Almirall, J., Dubois, M., & Vanasse, A. (2006). Relationship between multimorbidity and health-related quality of life of patients in primary care. *Quality of Life Research, 15*(1), 83–91.
- Ganz, P., Rowland, J., Desmond, K., Meyerowitz, B., & Wyatt G. (1998). Life after breast cancer: Understanding women's health-related quality of life and sexual functioning. *Journal of Clinical Oncology, 16*, 501–514.
- Ganz, P., Guadagnoli, E., Landrum, M., Lash, T., Rakowski, W. & Silliman, R. (2003). Breast cancer in older women: Quality of life and psychosocial adjustment in the 15 months after diagnosis. *Journal of Clinical Oncology, 21*, 4027–4033.
- Hartl, K., Janni, W., Kastner, R., Sommer, H., Strobl, B., Rack, B., & Stauber, M. (2003). Impact of medical and demographic factors on long-term quality of life and body image of breast cancer patients. *Annals of Oncology, 14*, 1064–1071.
- Hewitt, M., & Simone, J. (1999). *Ensuring quality cancer care*. Washington, DC: National Academy Press.
- Karakiewicz, P. I., Bhojani, N., Neugut, A., Shariat, S. F., Jeldres, C., Graefen, M., . . . Kattan, M. W. (2008). The effect of comorbidity and socioeconomic status on sexual and urinary function and on general health-related quality of life in men treated with radical prostatectomy for localized prostate cancer. *Journal of Sexual Medicine, 5*(4), 919–927.
- Ko, C., & Chaudhry, S. (2002). The need for a multidisciplinary approach to cancer care. *The Journal of Surgical Research, 105*, 53–57.
- Kroenke, C., Rosner, B., Chen, W., Kawachi, I., Colditz, G., & Holmes, M. (2004). *Journal of Clinical Oncology, 22*, 1849–1856.

Mols, F., Thong, M., Vreugdenhil, G. & van de Poll-Franse, L. (2009). Long-term cancer survivors experience work changes after diagnosis: Results of a population-based study. *Psycho-Oncology*, *18*, 1252–1260.

National Cancer Institute. (2011). *US cancer survivors grows to nearly 20 million*. Retrieved from <http://www.cancer.gov/newscenter/pressreleases/2011/survivorshipMMWR2011>

National Coalition for Cancer Survivorship. (n.d.) *The organization*. Retrieved from <http://www.canceradvocacy.org/about/org/>

Naus, M., Ishler, M., Parrott, C., & Kovacs, S. (2009). Cancer survivor adaptation model: Conceptualizing cancer as a chronic illness. *Journal of Clinical Psychology*, *65*(12), 1350–1359.

Parsons, S., & Mayer, D. (2004). Health-related quality of life assessment in hematologic disease. *Hematology/Oncology Clinics of North America*, *18*(6): 1235–48.

Sangha, O., Stucki, G., Liang, M., Fossel, A., & Katz, J. (2003). The self-administered comorbidity questionnaire: A new method to assess comorbidity clinical and health services research. *Arthritis Rheumatology*, *49*, 156–163.

Stewart, A., Mills, K., King, A., Haskell, W., Gillis, D., & Ritter, P. (2001). CHAMPS physical activity questionnaire for older adults: Outcomes for interventions. *Medicine and Science in Sports and Exercise*, *33*, 1126–1141.

Thewes, B., Butow, P., Girgis, A., & Pendlebury, S. (2004). The psychosocial needs of breast cancer survivors: A qualitative study of the shared and unique needs of younger versus older survivors. *Psycho-Oncology*, *13*, 177–189. doi:10.1002/pon.710

Yancik, R., & Ries, L. (2000). Aging in America: Demographic and epidemiologic perspectives. *Hematology Oncology Clinics of North America*, *14*, 17–23.

Yancik, R., Ganz, P., Varricchio, C., & Conley, B. (2001). Perspectives on comorbidity and cancer in older patients: Approaches to expand the knowledge base. *Journal of Clinical Oncology*, *19*, 1147–1151.

## **CHAPTER 5**

### **FINDINGS AND IMPLICATIONS**

There are nearly 12 million cancer survivors in the US, and 438,325 of them are non-Hodgkin lymphoma (NHL) survivors (National Cancer Institute, 2010). As the population ages and increases, survivors will live longer with this disease. Cancer coupled with comorbid illnesses and the long-term effects of both diseases will be issues NHL survivors will face. The impact of cancer usually extends beyond the physical, influencing psychological and social functioning to the point that all aspects of life may be adversely affected. It is therefore reasonable to conclude that cancer can adversely influence survivors' lives in the area of psychological adaptation.

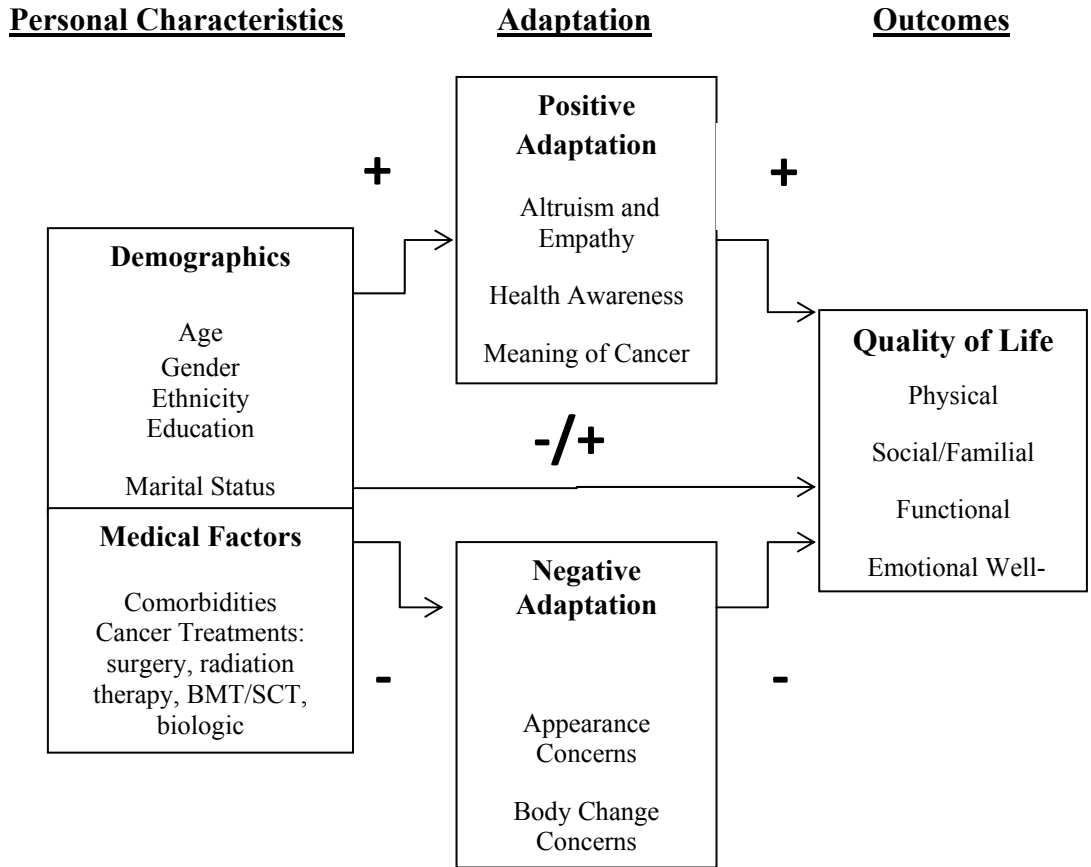
This concept of adaptation to cancer can be seen in the cancer survivor adaptation (CSA) model that encompasses personal and demographic characteristics, positive and negative adaptations to cancer, and the impact of them all on quality of life (QOL) outcomes (Naus, Ishler, Parrott, & Kovacs, 2009). The purpose of this dissertation was to explore the relationships between demographic and disease characteristics and QOL and to examine the impact that a cancer diagnosis has on survivorship, specifically for NHL survivors.

The review of literature findings (Leak, Mayer, & Smith, 2011) on NHL survivors' QOL led me to explore the unique issues of older adults with NHL. The literature findings and clinical perspectives drew me to explore and understand how NHL survivors perceive their disease during a time of uncertainty. As the population of NHL survivors grows,

research focused on QOL-related outcomes for older adults is needed. Thus, this dissertation study was conducted.

### **Conceptual Framework**

The framework for this study was based on the CSA model derived from Naus, Ishler, Parrott, and Kovacs's (2009) research. It has three components: personal characteristics, adaptation, and outcomes. The three variables that depict relationships between those components are represented in the CSA model: personal characteristics, adaptation during the illness, and cancer-specific QOL outcomes (Figure 5.1). Personal characteristics include the biological, psychological, social, and spiritual factors that impact the cancer experience. Adaptation is the fundamental component of this model and is an ongoing, cognitive process involving continuous appraisal of the situation by the survivor (Naus et al., 2009). It is reflected as the positive and negative impacts of cancer. Quality of life is the outcome of the model.



*Figure 5.1.* The cancer survivor adaptation model illustrating the three components and three variables that affect positive and negative adaptations of survivors to their cancer diagnoses and treatments. *Source:* Adapted from Naus, Ishler, Parrott, and Kovacs, 2009. BMT = bone marrow transplant, SCT = stem cell transplant.

All of these variables can influence survivors’ adaptations to cancer, and understanding their relationships will help to address the multifaceted health needs of NHL survivors.

### Sample

This secondary data analysis used cross-sectional data that provided a large geographical sample for exploring relationships between personal characteristics and QOL, mediations between personal characteristics and QOL, and the effect of age on the QOL of NHL survivors. Approval was obtained from the University of North of North Carolina at Chapel Hill Institutional Review Board. Data on the survivors were collected from 2005–

2006 through mailed surveys, supported by a R03-CA-101492 NCI grant for the Quality of Life of Older Long-Term Lymphoma Survivors study (Sophia Smith, Principal Investigator). The cancer survivors were predominately Caucasian and married or living with a partner. The sample was recruited from survivors treated at two comprehensive cancer centers in the southeastern United States: the Duke University Medical Center and the University of North Carolina at Chapel Hill Lineberger Center. More than half were employed or had a college degree. The average age of the survivors was 62.4 (*SD* 13.3), and they were an average of 10.1 (*SD* 7.1) years postdiagnosis.

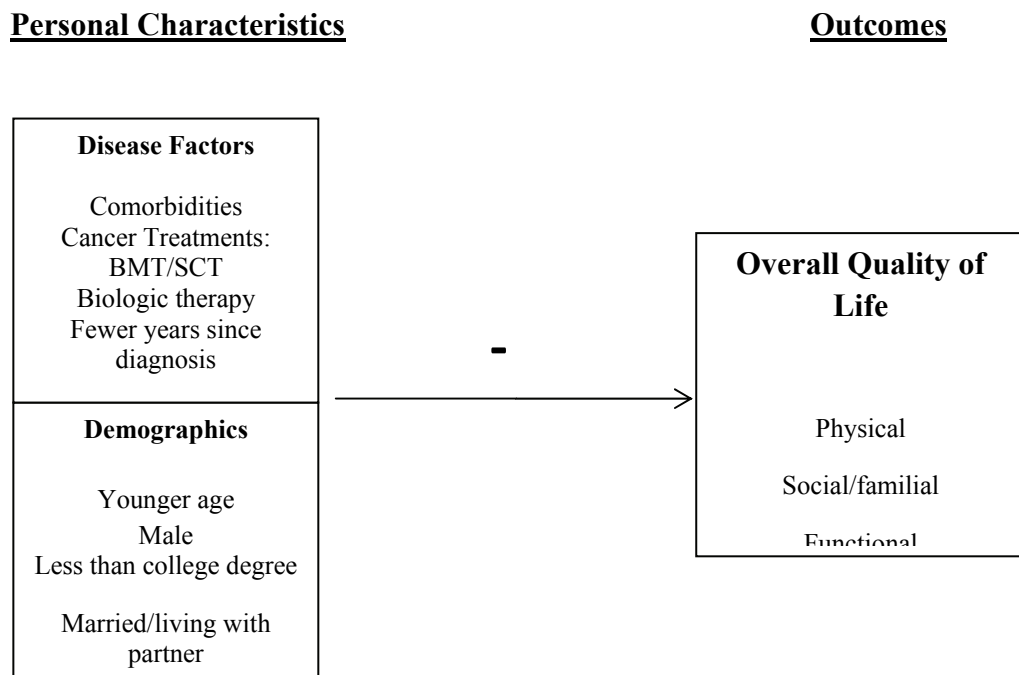
### **Aim 1**

*To explore demographic and disease characteristics associated with quality of life for non-Hodgkin-lymphoma survivors*

The CSA model proposed that personal characteristics, which include demographic and disease factors, can have a direct positive or negative association with QOL. Poorer QOL was seen in those who were male, had less than a college degree, had an annual income of less than \$30,000, and were unemployed or retired. Significant disease characteristics associated with poorer QOL included higher total comorbidity scores, some treatment types (bone marrow transplantation [BMT] or stem cell transplantation [SCT], biologic therapy), and fewer years since diagnosis. The final regression model indicated that QOL was worse for survivors who were males, who were younger at the time of the study, had a greater comorbidity burden, had received a BMT, or SCT, or biologic therapy, or had been diagnosed more recently ( $p < .05$ ).

These findings are similar to other cancer population studies wherein survivors who were younger at the time of the study or diagnosis, had a higher number of comorbidities,

and those who were recently diagnosed had poorer QOL. These associations identify a group of NHL survivors at higher risk for poor QOL who should be targeted for assessment and intervention. These variables accounted for 34% of the variance of QOL, with 66% of the variance remaining unexplained, indicating that other key variables were absent. Other characteristics that might influence QOL and could be included in future studies are social support, spiritual and existential influences, and insurance issues. The significant relationships found in this aim are modeled in Figure 5.2.



*Figure 5.2.* Final regression model with all significant variables ( $p < .05$ ). BMT = bone marrow transplantation, SCT = stem cell transplantation.

## Aim 2

*To test a conceptual model to determine if adaptation to a cancer diagnosis mediated the relationship between demographic and disease characteristics and quality of life*

The CSA model was the guiding model to determine how adaptation to cancer mediated relationships between demographic and disease characteristics and QOL. This adaptation is an ongoing, cognitive process involving continuous appraisal by the survivor and is reflected as positive and negative adaptation (Naus et al., 2009; Zebrack, Ganz, Bernaards, Petersen, & Abraham, 2006). Positive adaptation has favorable psychosocial implications, such as better coping skills, and encompasses these positive aspects: altruism and empathy, health awareness, understanding the meaning of cancer, and positive self-evaluation. Negative adaptation focuses on appearance concerns, body change concerns, life interferences, and worry with unfavorable physical or psychological outcomes (Zebrack et al., 2006). The Impact of Cancer (IOC) scale used in the parent study conceptualizes the cancer experience as perceptions. Relationships between personal characteristics and QOL outcomes can be mediated through positive or negative adaptation to the illness. Personal characteristics are represented by *personal characteristics* (demographic and disease factors), *positive adaptation* or *negative adaptation*, and outcomes of *cancer-specific QOL*. Our findings supported the coexistence of positive and negative perceptions, and negative adaptation to cancer resulted in a stronger mediating effect than positive adaptation to cancer. These findings add to the limited evidence on the presences of both types of adaptation (Bower et al, 2005).

Survivors of NHL may go through an intermittent exacerbation and remission cycle or a downward illness trajectory complicated by the presence of multiple comorbid conditions. Some NHL survivors, dependent on whether the lymphoma is slow growing or aggressive, are more apt to endure a longer treatment process with unknown disease progression or remission and uncertainty. The statistical approach used to clarify the nature



between the independent variables (personal characteristics) and dependent variables (QOL outcomes) was mediation (Baron & Kenny, 2006). Mediation represents processes that could potentially be targeted for interventions to influence QOL outcomes.

Using the CSA model, we identified higher risk groups for poorer QOL. The model suggested that older survivors could be targeted for interventions aimed at the negative mediators (negative perceptions), and survivors without a college degree, with a higher comorbidity score, with a more recent diagnosis, currently receiving treatment, and who are younger might benefit from psychological counseling or cognitive behavioral therapy as a means to improve their QOL. Additionally, survivors who have received a BMT, SCT, or biologic therapy may also benefit from interventions focused on enhancing management of symptoms or late effects from treatment and cancer. Such treatment might reduce negative thoughts and improve QOL. The structural equation modeling (SEM) used in this aim provided support for the concept of postcancer diagnosis experiences being simultaneously shaped by both positive and negative life changes with varying adaptation trends occurring over time.

### **Aim 3**

*To determine whether age moderated the effects of demographic and disease characteristics on quality of life*

Moderators are variables that change the impact of one variable on another (Baron & Kenny, 2006). A moderation model was used for this aim to determine how personal characteristics change the impact of QOL with age as a moderator. Advancing age is the most-associated risk factor for cancer, with a median age of 67 for NHL diagnoses (Surveillance and Epidemiology and End Results, 2010). The analyses included a

comparison of the effects of personal characteristics in younger (< 65 years of age) and older ( $\geq 65$  years of age) survivors. Age was found to be a moderator of the relationships between income and QOL and gender and QOL. The associations between being male or having low income and QOL were stronger in the younger participants than in the older participants.

### **Strengths and Limitations**

In my literature review of 18 studies on NHL survivors and QOL domains (Leak et al., 2011), and in Arden-Close, Pacey, and Eiser's literature review (2010), methodological issues related to small sample sizes, lack of conceptual or theoretical models, and no longitudinal studies for comparing changes over time were raised. As a cross-sectional study, the parent study for this research did not capture information about changes over time; nonetheless, the large sample of survivors provided a unique opportunity to explore the psychological distress of NHL survivors within the CSA theoretical framework. The parent study used a cancer-specific QOL measure, the Functional Assessment Cancer Therapy-General (FACT-G), and was able to capture the QOL of NHL survivors. However, additional QOL measures should be considered that include more diverse QOL domains and cultural representation. One strength of the study was the large database that consisted of 40% older adults ( $\geq 65$  years old), a large enough subsample to allow for comparisons with younger survivors (< 65 years old). However, there was a high percentage of missing data noted in the disease stage category. The NHL sample also had high socioeconomic statuses, and over 50% had a college degree.

The regression and SEM models contributed an adequate fit, but other theoretical models and methods of analysis may yield a better fit and should be considered in future

studies. Replication studies in other geographical areas with other types of cancers are needed to validate the roles of positive and negative adaptation in the QOL of survivors.

### **Implications for Research**

The findings of this study indicate several areas for future scientific inquiry. Although coexisting comorbidities had a significant effect on these survivors' health, the longitudinal relationships between NHL and management of noncancer conditions have not been fully investigated. One recommendation for future studies is to use medical records in addition to self-reports to investigate comorbidities among cancer survivors. Medical records may provide additional information to validate the severity of the comorbidity self-reported. Additionally, future analyses to look at each FACT-G QOL domain may provide a more nuanced appreciation of how mediators affect specific aspects of QOL, providing more in-depth assessments of these associations.

Other research studies could include looking at subsamples of survivors with recurrences or actively on treatment and comparing their ability to adapt to the disease with survivors in remission not receiving treatment. Additional analyses could include racial and ethnic minority groups' adaptation to NHL as compared to Caucasians to determine if there is a difference in QOL. Also, there is no matched control study for comparing psychosocial adaptation and QOL to determine if these survivors have a better or worse status than a similar group who never had cancer.

Further studies could include mixed-methods studies that explore the experiences of NHL survivors. Research supports spirituality's important effect on health and QOL; however, what extent it has on health remains an area for further investigation (Efficace & Marrone, 2002; Powell, Shahabi, & Thoresen, 2003). Many studies involving religious and

spiritual well-being are cross-sectional, which makes it difficult to prospectively understand the relationships. As a result, future studies should be prospective, including variables that might mediate the relationship between spirituality and the physical and emotional domains of QOL.

Two of the noted limitations of the NHL survivorship literature (Leak et al., 2011) are the lacks of longitudinal studies following survivors over time and the underrepresentation of minorities. Given that this study was cross-sectional, it provided insight for prospective studies in the development of longitudinal and intervention studies. Future studies to include survivors' abilities to adapt to cancer changes over time would be beneficial in determining how and when to intervene. To address the question on how survivors adapt differently throughout their illness trajectory, Dr. Sophia Smith has collected 5-year follow-up data on NHL survivors. These data will be compared to baseline data (2004–2005) to retest the CSA model and evaluate QOL domain outcome changes. Interventions may be identified, developed, and implemented. From this study, positive and negative perceptions have been identified as potential areas for interventions to improve the QOL of NHL survivors, with negative adaptation having a stronger mediating effect on QOL.

### **Implications for Practice**

These findings are consistent with previous studies that found that while most survivors adjust to living with NHL, there remain subsamples of survivors who suffer from psychosocial distress from their cancer diagnosis (Tedeschi, Park, & Calhoun, 1998). Only the survivor living the life can describe his or her QOL and the impact it has on daily living. Subsequently, QOL should not be judged by others but needs to be understood from the perspective of the person living as a cancer survivor (Parse, 1998). Both social and functional

QOL domains remain areas that affect interpersonal relationships, employment, finances, abilities to obtain insurance, and reintegration into the social environment. Although income cannot easily be augmented, it is suggested that continued efforts to increase access to affordable health insurance and care remain important for long-term recovery. How survivors perceive their illness can influence their functional and physical abilities, which can impede or enhance their QOL.

In the CSA model, fewer years since diagnosis was correlated with poorer QOL, indicating that survivorship issues occur throughout the illness trajectory but may be more intense closer to the diagnosis and initial treatment. The negative psychosocial problems faced by survivors may not always be recognized by healthcare providers, but ongoing screening and assessments is recommended. Thus, healthcare providers must provide information about healthy behaviors, such as physical activity and exercise, to guide the survivor throughout the illness trajectory. Vallance, Courneya, and Jones (2006) found that 150 minutes per week of physical activity was associated with improved QOL, and ultimately, favorable physical and psychological well-being for NHL survivors. Some survivors have positive and negative experiences from their health behaviors, but additional work is needed to determine the relationship between those experiences. Nevertheless, some survivors still experience poorer functioning than others, and nurses should inquire about lifestyle behaviors to provide management or counseling for them.

### **Conclusion**

Several characteristics were identified that were significantly related to adaptation to NHL and poorer QOL. The results of this study suggest that both positive and negative adaptation mediate the relationships between demographic and disease characteristics and the

QOL of NHL survivors. Thus, it would be reasonable to hypothesize that cognitive reframing (Mishel, 1990) to promote better QOL could be an effective, tested cognitive method for cancer survivors. The CSA model supported the importance of exploring the role of adaptation in QOL outcomes.

## REFERENCES

- Arden-Close, E. Pacey, A., & Eiser C. (2010). Health-related quality of life in survivors of lymphoma: A systematic review and methodological critique. *Leukemia & Lymphoma*, *51*, 628–640.
- Baron, R., & Kenny, D. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182.
- Bower, J., Meyerowitz, B., Desmond, K., Bernaards, C., Rowland, J.H., & Ganz, P.A. (2005). Perceptions of vulnerability and growth among cancer survivors: Positive and negative effects of cancer diagnosis. *Annals of Behavioral Medicine*, *29*, 236–245.
- Efficace, F., & Marrone, R. (2002). Spiritual issues and quality of life assessment in cancer care. *Death Studies*, *26*, 743–756.
- Leak, A., Mayer, D., & Smith, S. (2011). Quality of life domains among non-Hodgkin lymphoma survivors: An integrative literature review. *Leukemia & Lymphoma*, *52*, 972–985.
- Mishel, M. (1990). Reconceptualization of the uncertainty in illness theory. *The Journal of Nursing Scholarship*, *22*, 256–262.
- National Cancer Institute. (2010). *Non-Hodgkin Lymphoma*. Retrieved from <http://www.cancer.gov/cancertopics/types/non-hodgkin>
- Naus, M., Ishler, M., Parrott, C., & Kovacs, S. (2009). Cancer survivor adaptation model: Conceptualizing cancer as a chronic illness. *Journal of Clinical Psychology*, *65*(12), 1350–1359.
- Parse R. R. (1998). *The human becoming school of thought: A perspective for nurses and other health professionals*. Thousand Oaks, CA: Sage.
- Powell, L. H., Shahabi, L., & Thoresen, C. E. (2003). Religion and spirituality: Linkages to physical health. *American Psychologist*, *58*, 36–52.
- Surveillance and Epidemiology End Results. (2010). *SEER state fact sheets: non-Hodgkin lymphoma*. Retrieved from the National Cancer Institute: <http://seer.cancer.gov/statfacts/html/nhl.html>
- Tedeschi, R., Park, C., & Calhoun, L. (1998). Post-traumatic growth: Conceptual issues. In R. Tedeschi, C. Park., & L. Calhoun (Eds.), *Post-traumatic growth: Positive changes in the aftermath of crisis* (pp.1–22). Mahwah, NJ: Erlbaum.
- Vallance, J., Courneya, K., & Jones, L. (2005). Differences in quality of life between non-Hodgkin’s lymphoma survivors meeting and not meeting public health exercise

guidelines. *Psycho-oncology*, 14, 979–991.

Zebrack, B., Ganz, P., Bernards, C., Petersen, C., & Abraham, L. (2006). Assessing the impact of cancer: Development of a new instrument for long-term survivors. *Psychooncology*, 15(5), 407–421.