ASSOCIATION OF PHYSICAL ACTIVITY, LIFE SATISFACTION AND EMOTIONAL SUPPORT TO HEALTH-RELATED QUALITY OF LIFE IN HODGKIN LYMPHOMA SURVIVORS (BRFSS 2009)

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by

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Association of Physical Activity, Life Satisfaction and Emotional Support to
Health-Related Quality of Life in Hodgkin Lymphoma Survivors

(BRFSS 2009)

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DEDICATION

I dedicate this thesis to Hodgkin Lymphoma survivors everywhere, as well as the Health and Wellness Department at the University of California, Santa Barbara without whom I never would have considered researching positive psychology and pursuing Epidemiology.
ABSTRACT OF THE THESIS

Association of Physical Activity, Life Satisfaction and Emotional Support to Health-Related Quality of Life in Hodgkin Lymphoma Survivors (BRFSS 2009)
by
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Master of Public Health with a Concentration in Epidemiology
San Diego State University, 2013

About 85% of persons with Hodgkin Lymphoma are alive five years after diagnosis and many live well past 40 years. This lengthy survival time may allow late effects of treatment to develop including depression, fatigue, physical complications and anxiety, all of which can influence health-related quality of life. This cross-sectional study assessed the associations of physical activity, life satisfaction, and emotional support to health-related quality of life in Hodgkin Lymphoma survivors. The sample of 365 Hodgkin Lymphoma survivors was gathered from the 2009 Behavioral Risk Factor Surveillance System. Health-related quality of life was measured using frequent activity limitation, frequent mental and physical distress and frequent unhealthy days. Controlling for income, demographics, and co-morbidities, a weighted multivariable logistic regression model showed that life satisfaction was most strongly associated with health-related quality of life. Those survivors who reported being dissatisfied or very dissatisfied with life were more likely to experience frequent activity limitation (Odds Ratio [OR] 36.5, 95% Confidence Interval [CI] 5.4-245.3), frequent physical distress (OR 16.5, 95% CI 3.9-68.9), frequent mental distress (OR 18.2, 95% CI 5.3-62.1), and frequent unhealthy days (OR 39.9, 95% CI 9.8-254.4) compared to those who reported being very satisfied with life. Physical activity was also significantly associated with frequent physical distress and frequent activity limitation. Compared to physically active survivors, those who reported being physically inactive were more likely to experience frequent activity limitation (OR 10.1, 95% CI 2.3-44.2) and frequent physical distress (OR 4.4, 95% CI 1.5-12.5). Emotional support was not associated with health-related quality of life. In sum, life dissatisfaction and physical inactivity were associated with poorer health-related quality of life in this population of Hodgkin Lymphoma survivors. These results may suggest the need for long-term comprehensive survivorship plans that focus primarily on improving life satisfaction and physical activity.
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CHAPTER 1

INTRODUCTION

The Wellness Triangle (Figure 1) represents three aspect of health that contribute to a healthy and balanced life. This triangle consists of mental, physical and social well-being. When all of these facets of health are in balance one is thought to be achieving optimal health (Bronson, 2007). Encompassing this idea, a specific population that may be lacking a “balance” is Hodgkin Lymphoma (HL) survivors. In 2012, 70,130 people were diagnosed with lymphoma. Of those, 9,060 were cases of HL (American Cancer Society [ACS], 2012). HL begins with an abnormal change in a lymphocyte causing it to become a lymphoma cell, which can grow and spread throughout the lymphatic system. If untreated, these cancerous cells can crowd out normal white blood cells causing the immune system to become defective (Surveillance Epidemiology and End Results [SEER], 2012). Fortunately, only an estimated 1,190 deaths will occur due to HL in 2013, as it is one of the most treatable forms of cancer (ACS, 2012). Due to this long survival time it is important that patients receive continued medical care as many adverse late effects arise from treatment. Commonly, HL survivors can suffer from physical deformities and limitations, depression, anxiety, stress, sexual dysfunction, social distancing, and relationship problems, among others (Barrera, Teall, Barr, 2012; Hall et al., 2012; Zebrack, Foley, Wittmann, & Leonard, 2010). Therefore, it is important to consider patients holistically during survivorship follow-up, as many HL survivors may be at increased risk for physical, social and mental complications from treatment.

In order to improve or prevent these complications it is necessary for doctors to target specific aspects of the Wellness Triangle. In the Behavioral Risk Factor Surveillance System (BRFSS) 2009 dataset, a cross-sectional telephone-based survey conducted annually by state health departments and coordinated by the Centers for Disease Control and Prevention (CDC), three variables correspond to each side of the triangle: physical activity (physical), life satisfaction (mental), and emotional support (social). Increased physical activity improves immune functioning, survival time, emotional states, physiological health, self-
esteem and prevents both future activity limitation and the development of secondary malignancies (Centers for Disease Control and Prevention [CDC], 2011e). Since, HL survivors are at an increased risk of physical disability it is important to focus on maintaining a physically active lifestyle to prevent future complications (Hall et al., 2012; Oerlemans, Mols, Nijziel, Lybeert, & van de Poll-Franse, 2011). In terms of cancer treatment, life satisfaction is an important assessment of an individual’s happiness with his/her life. Generally, lower life satisfaction is associated with more depression and anxiety as well as unemployment. It is also linked to more somatic late effects of cancer treatment such as psychological sequelae (Strine, Chapman, Balluz, Moriarty, & Mokdad, 2008). Similarly, emotional support during survivorship enables survivors to connect with others who understand their arduous experience.

One way to assess physical activity, life satisfaction and emotional support’s influence on a patient’s health is to study their health-related quality of life (HRQoL). HRQoL is used by the CDC to give health professionals a holistic view of the patient. HRQoL varies from quality of life in several important ways. Quality of life takes into consideration both the negative and positive aspects of a life, yet it is challenging to measure due to the variety of ways in which it has been defined and the vast amount of domains it touches—school, jobs, neighborhoods, cultural values, etc. HRQoL, on the other hand, gives researchers a narrower idea of an individual’s health by encompassing most aspects of overall quality of life that have a clear relationship to either physical or mental health. On an individual level this includes various health risks and conditions, social support needs,
socioeconomic status and functionality (CDC, 2011a). In the BRFSS 2009 dataset HRQoL is broken down into four sections: activity limitation, physical distress, mental distress and combined mentally and physically unhealthy days. In this study HRQoL will be described as frequent distress or activity limitation as follows:

1. **Frequent Activity Limitation:** ≥ 14 days, during the past 30 days, in which poor physical or mental health kept the participant from doing usual activities

2. **Frequent Physical Distress:** ≥ 14 days, during the past 30 days, in which physical health, including physical illness and injury was not good

3. **Frequent Mental Distress:** ≥ 14 days, during the past 30 days, in which the respondent reported experiencing stress, depression and/or problems with emotions

4. **Frequent Unhealthy Days:** ≥ 14 days, during the past 30 days, in which mental and/or physical health was not good. Calculated as sum of physically and mentally unhealthy days

All of these factors, in conjunction with HRQoL, can be affected by co-morbidities and sociodemographic factors including income, race/ethnicity, gender, age and age at diagnosis. People with lower income generally are diagnosed at a later stage and with more co-morbidities leading to a lower overall HRQoL (Feuerstein, 2007). These are known confounders and will be controlled for in the study. By considering the association of physical activity, life satisfaction and emotional support to HRQoL, health professionals can develop comprehensive long-term treatment plans that take into consideration important aspects of survivors’ lives. This study will determine which of the three variables (physical activity, life satisfaction and emotional support) is most associated with HRQoL (Figure 2). The results will help to develop targeted interventions based on the most strongly associated factor.

**STATEMENT OF THE PROBLEM**

Separately physical activity, life satisfaction and emotional support have each been shown to decrease frequent distress and activity limitation in other cancer survivor populations but there is a lack of research considering how these variables simultaneously influence HRQoL in HL survivors (Barrera et al., 2012; Bellizzi et al., 2009; Casillas, Zebrack, & Zeltzer, 2006; Hall et al., 2012; Kazak et al., 2004; Oerlemans et al., 2011; Paxton, Jones, & Rosoff, 2010; Strine et al., 2008; Zebrack & Chesler, 2002). Due to treatment advances, HL survivors are living longer yet developing physical and mental
complications as well as secondary cancers. Many of these outcomes may be attributed to low levels of physical activity, low life satisfaction or a lack of emotional support. Currently, post-remission medical treatment does not focus on these aspects of health, especially for HL survivors (Armitage, 2010). Additionally, previous research has shown that increased levels of life satisfaction are inversely related to mean number of days in the past 30 days of mental distress, physical distress and activity limitation (Strine et al., 2008). But currently not much is known for this association among HL survivors.

Considering HRQoL in HL survivors is particularly beneficial when dealing with the mental, physical and social late effects of treatment, as it is considered a valid indicator of service needs and current disability. Understanding the HRQoL of a population can break barriers between disciplines by connecting community organizations with psychologists and other medical professionals to make change in a community or an underserved population (CDC, 2011a). For the field of survivorship, as it is in its infancy, understanding the association of physical activity, life satisfaction and emotional support with HRQoL may potentially lead to the development of treatments, interventions and programs that could eventually manage, if not prevent, many late effects of treatment. From National Health Interview Survey data beginning in 1992, it is clear that even though access to programs and services is improving, only a small percentage of survivors are receiving the medical and mental care they require (Feuerstein, 2012). There is a need for comprehensive long-term

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**Figure 2. Model of research plan.**

- **Population:** Hodgkin Lymphoma Survivors
- **Health Factors:**
  1. Physical Activity
  2. Life Satisfaction
  3. Emotional Support
- **Outcome:** HRQoL
survivorship treatment plans that consider all aspects of a person, including medical history as well as sociodemographic factors. Furthermore, there is a dearth of guidelines to develop these comprehensive treatment plans, specifically for HL survivors. Many late effects are under-recognized and under-treated, with many not currently being screened for during medical follow-up (Feuerstein, 2012). Considering these health factors during long-term follow-up may provide a means to prevent future distress and activity limitation.

**PURPOSE OF STUDY**

This study aims to assess the association of physical activity, life satisfaction and emotional support to HRQoL in HL survivors. Past research suggests that HL survivors are at risk for more frequent physical distress when compared to a healthy sample (Hall et al., 2012; Oerlemans et al., 2011). Improving physical activity has been shown to prevent future disability associated with cancer treatment as well as decrease additional side effects such as depression and anxiety. Furthermore, in other cancer survivor populations, levels of distress have been shown to decrease when there is an increase in life satisfaction and emotional support (Krull et al., 2010; Seeman, McEwen, Singer, Albert, & Rowe, 1997; Seitz et al., 2011; Zebrack & Chesler, 2002). Thus, investigating the independent and comparative relationships of these three variables to HRQoL may help inform intervention and prevention efforts aimed at improving HRQoL in HL survivors.

**THEORETICAL BASIS**

Compared to a healthy population, HL survivors commonly experience more physical distress and functional limitations (Hall et al., 2012; Oerlemans et al., 2011). Past research indicates improving physical activity in other cancer survivor populations has resulted in a decrease in physical complications and depression (Bélanger, Plotnikoff, Clark, & Courneya, 2011). Furthermore, physical activity can reduce many late effects of cancer treatment by helping to maintain a healthy weight, increasing self-esteem and improving immunity (Fairey et al., 2005). Therefore, a significant association between physical activity and HRQoL is expected to emerge in this sample of HL survivors as it has in other cancer survivor populations. Additionally, life satisfaction and emotional support have shown in other cancer survivor populations to contribute to improvement in both mental and physical health. Higher life satisfaction and emotional support have been linked with improved HRQoL in several
other cancer survivor populations (Ashing-Giwa & Lim, 2009; Barrera et al., 2012; Casillas et al., 2006; Ford, Moriarty, Zack, Mokdad, & Chapman, 2001; Hall et al., 2012; Kazak et al., 2004; SEER, 2012; Zebrack et al., 2010). A similar association is expected in this sample of HL survivors.

**HYPOTHESES**

Controlling for sociodemographic variables and co-morbidities, it is hypothesized that physical activity, life satisfaction and emotional support will all be significantly positively associated with HRQoL. Specifically, it is hypothesized that physically inactivity will be associated with higher amounts of frequent activity limitation, frequent physical and mental distress and frequent unhealthy days. It is hypothesized that dissatisfaction with life and less emotional support will be associated with more frequent mental distress and frequent unhealthy days.

**BASIC ASSUMPTIONS**

The responses to the telephone-based BRFSS survey from 2009 are all self-reported. It is assumed that all participants accurately and correctly answered all questions. Additionally, it is assumed that the data collected by the BRFSS staff are valid and precise. Considering the large sample size and weighted measures it is assumed that the sample is representative of the general HL survivor population.
CHAPTER 2

LITERATURE REVIEW

This chapter reviews existing literature on the Wellness Triangle, diagnosis of HL, survivorship and HRQoL. It also expands on the importance of physical activity, life satisfaction and emotional support to HRQoL. This chapter will also review the influence of adjustment variables, including age at diagnosis, sociodemographic variables and co-morbidities, on HRQoL.

WELLNESS TRIANGLE

The concept of a multidimensional model to health, as described by the World Health Organization (WHO, 1946), is a “state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity” (para. 2). The Wellness Triangle encompasses this concept from the WHO. It is a tool used to help understand the body’s efficiency and an individual’s overall well-being (Bronson, 2007). The triangle consists of three sides: physical, social and mental health, which all play a crucial role in creating a balanced life. Physical health captures the body’s functional ability and incorporates many components namely exercise, nutrition, sleep, the consumption of alcohol and drugs and weight management. Of the three sides of the triangle, physical health is arguably the most well understood and will be discussed further in the “Physical Health: Physical Activity” section of this paper.

The mental health side of the triangle is broadly defined as psychological well-being. It consists of communication skills, learning ability, self-esteem and resilience (Bronson, 2007). Corey Keyes, an American psychologist and sociologist with expertise in positive psychology, draws a distinction between mental health and mental illness saying that the two are on different continuums and should be studied separately (Figure 3). He defines mental health as a separate dimension of “positive feelings and functioning” as compared to mental illness (Horwitz, 2002, p. 604). Mental health consists of flourishing and languishing. Flourishing is a psychological concept consisting of happiness, fulfillment, and purpose,
where as languishing defines individuals exhibiting few, if any, aspects of flourishing (Horwitz, 2002). Keyes argues that people with and without a mental illness can utilize the concepts of mental health and flourishing. For this study mental health will be defined in terms of life satisfaction. Lastly, social health involves how individuals interact with others. This could include the environment, family, friends and peers (Bronson, 2007). Higher amounts of social health have shown to positively influence individuals’ overall well-being (Fredrickson & Losada, 2005). In this study social health will be measured using emotional support. Overall, developing a balance between all three sides is associated with optimal well-being. Improving just one side of the triangle may help to bolster the others as well. For instance, increasing physical activity can lead to an improved mental state, such as an increase in flourishing behaviors. In turn this may help to advance one’s social well-being (CDC, 2011a).
Similar to the dimensions of the Wellness Triangle, the late effects of cancer arguably can fit into the same three dimensions: mental, physical and social. The long-term effects of cancer have wide ramifications and may also be intertwined; as those with constant fatigue and pain may also experience increased depression, weight gain or social distancing. Additionally, as survivors increase in age it is questionable whether these negative effects are due to cancer treatment or the aging process itself. Studies show that aside from the observed physical change, the mental and social issues experienced by survivors appear to be linked directly with cancer not the aging process (Feuerstein, 2007; Nayfield, Ganz, Monipour, Cella, & Hailey, 1992; Victorson, Cella, Wagner, Kramer, & Smith, 2007). Additionally, findings from a sample of 28 brain cancer survivors compared to age and sex matched non-cancer survivors, indicated that survivors consistently report more emotional, social and physical problems (Barrera et al., 2012). Therefore, when developing a treatment plan considering specific behaviors that are associated with each side of the Wellness Triangle can help to create targeted interventions to improve overall health.

**HODGKIN LYMPHOMA**

One particular population that may lack a balance between their mental, physical and social health are Hodgkin Lymphoma (HL) survivors. HL is a type of blood cancer which affects the white blood cells of the lymphatic system. According to the Leukemia and Lymphoma Society, it is currently one of the most curable forms of cancer in the United States and about 12% of all lymphomas diagnosed are HL. Surveillance Epidemiology and End Results (SEER) data illustrates that the incidence rate is 3.2 per 100,000 men and 2.5 per 100,000 women with the highest incidence in white men at 3.3 per 100,000 men. The age adjusted incidence rate from 2005-2009 SEER data is 2.8 per 100,000 men and women with a median age at diagnosis of 38 years and the largest percentage of people diagnosed between the ages of 20 and 34. HL is more prevalent in males than females (SEER, 2012). Additionally, age-adjusted death rates from 2005-2009 SEER data are 0.4 per 100,00 men and women per year with the highest death rate in white men at 0.5 per 100,000 men per year.

Fortunately, HL has a relative five-year survival rate of 84.7% (SEER, 2012). Due to the great advances in cancer treatment, survivors are able to live well past 40 years after
diagnosis and treatment, and death rates for both male and female patients have decreased in the past four decades (Armitage, 2010). Unlike other forms of cancer, The ACS found that HL has high incidence in adolescences and young adults (age 15-39) as well as in individuals over 55 years, although the risk of developing HL is highest in adolescences and young adults. Risk factors for developing HL vary depending on age at diagnosis, but are most commonly linked to a family history of lymphoma, genetic variations, and exposure to certain occupational and environmental chemicals such as asbestos and radon. Varying by stage at diagnosis, treatments for HL include radiation, chemotherapy or a combination of the two. If an individual’s HL is unresponsive to either form of treatment, bone marrow or stem cell transplants are also an option (ACS, 2012).

SURVIVORSHIP

According to the National Coalition for Cancer Survivorship (2013) individuals are considered survivors from the time of diagnosis throughout the remainder of his or her life. As treatment does not end once a survivor is in remission survivors enter into a new spectrum of medical follow-ups in which they no longer need active treatment yet still require further medical attention to monitor the disease, reduce the risk of cancer recurrence and decrease the likelihood of developing secondary malignancies and/or co-morbidities. During this transitional period some survivors gain a higher sense and acceptance of self, whereas others enter into a depressive state filled with anxiety about their future health. Regardless of their outlook, survivors require continued medical and psychological screening (Schwartz, Hobbie, Constine, & Ruccione, 2007).

There are many late effects that could result from the treatment of HL. Medical and chronic conditions can develop in all organ systems, varying by the type of treatment the patient received and age at diagnosis. These late effects range from hearing loss to neuropathy to fertility concerns (Abrahamsen, Loge, & Hannisdal, 1998; Bloom, Fobair, & Gritz, 1993; Fobair et al., 1986). It is also common for survivors to have psychosocial, physical and financial concerns post-treatment. Specifically for HL survivors, usual self-reported late effects include poor physical functioning, infertility concerns, fatigue, low cognitive functioning and financial difficulties (Fobair et al., 1986; Joly, Henry-Amar, & Arveux, 1996; Loge, Abrahamsen, Ekeberg, & Kaasa, 1999; van Tulder, Aaronson, &
Bruning, 1994; Wettergren & Björkholm, 2004). Therefore, it is recommended that survivors of HL get regular blood tests and screenings for heart disease and other secondary malignancies. Survivors should also receive regular mammograms, lung cancer screenings, and checks of thyroid functionality. All of these screenings should be encompassed in a comprehensive, long-term survivorship treatment plan. With the increase in medical advancements, an increasing number of individuals will survivor HL, leading to more long-term impacts on a survivors’ well-being and health (Atherton, Evans, Dibben, Woods, & Hubbard, 2012).

**Health-Related Quality of Life**

HRQoL is a subjective, multidimensional term including physical, psychological, emotional and social concepts. The CDC defines HRQoL as a, “broad multidimensional concept that includes self-reported measures of physical and mental health” (CDC, 2011a, para. 4). Additionally, HRQoL is an indicator of both self-reported chronic disease and the risk factors associated with it (CDC, 2011a). In this study HRQoL will be measured in terms of frequent distress or activity limitation, which will help to highlight the chronic disease burden and current disability of this population. Yet in some other studies HRQoL is defined as a more positive measurement, assessing an individual’s physical and mental well-being, or healthy days. For all intents and purposes, throughout the remainder of this literature review HRQoL will be defined as an individual’s mental and physical well-being, unless otherwise noted.

Research from The Institute of Medicine and the National Action Plan for Childhood Cancer featured HRQoL as an essential treatment outcome, specifically in childhood cancer survivors (Arceci et al., 2002; Hewitt, Weiner, & Simone, 2003). Furthermore, findings report the use of HRQoL as a prognostic factor. Research from Earlam, Glover, Fordy, Burke, and Allen-Mersh (1996) found HRQoL scores to be a stronger indicator of survival than predicted tumor size in colorectal cancer survivors. From interviews with 50 colorectal cancer survivors, researchers found that those with a higher HRQoL score survived longer than those with a lower HRQoL score. From studies such as these, HRQoL assessments can be used to develop supportive interventions to decrease the late effects of cancer treatment and possibly extend survival time.
Little research has been conducted on the HRQoL in HL survivors specifically, as many live well over 40 years post-treatment. Data from these sparse studies present mixed findings, with a few purporting poorer HRQoL, or more frequent distress and activity limitation, for HL survivors compared to healthy populations or other cancer survivors (Brandt et al., 2010; Hjermstad et al., 2012; Joly et al., 1996; Loge et al., 1999; van Tulder et al., 1994) and others indicating no variance in HRQoL (Gil-Fernandez et al., 2003; Goodman et al., 2008; Mols et al., 2006). These dissimilarities may arise due to differences in study designs, as well as a variety of sample sizes ranging from 46 (Brandt et al., 2010) to 459 (Loge et al., 1999), and varying means of measuring HRQoL. Yet, survivorship research studies have consistently linked a lack of social support, insufficient physical activity, and lower life satisfaction to more frequent distress and activity limitation (Barrera et al., 2012; Bellizzi et al., 2009; Casillas et al., 2006; Hall et al., 2012; Kazak et al., 2004; Paxton et al., 2010; Strine et al., 2008; Zebrack & Chesler, 2002).

**Physical Health: Physical Activity**

Physical activity is known to have numerous health benefits including improved mental and physical health, decreased risk of developing cardiovascular disease, diabetes, hypertension, and even some cancers. Furthermore, physical activity can extend survival time and prevent future physical limitations (CDC, 2011e). Cancer survivors are at a two-fold greater risk for developing at least one functional limitation, emphasizing the importance of physical activity in a survivorship treatment plan (Leak, Mayer, & Smith, 2011). HL survivors tend to have lower physical functioning scores and more physical shortcomings when compared to a healthy population (Hall et al., 2012; Oerlemans et al., 2011). Physical activity has also been shown to be safe and well tolerated among cancer survivors. The CDC (2011b) recommends that adults should partake in at least 150 minutes of moderate-intensity or 75 minutes of vigorous physical activity every week, with muscle strengthening exercises on two or more days a week. Similarly, children and adolescents should engage in at least an hour of moderate or vigorous physical activity daily along with muscle and tone strengthening at least three days a week (CDC, 2011c). The ACS recommends that cancer survivors should aim to do moderate exercise at least 150 minutes per week, or meet the
CDC’s guidelines for moderate physical activity. It is also suggested that survivors should limit their sedentary behaviors and engage in more intentional physical activity (ACS, 2012).

Physical activity can help to improve HRQoL by maintaining a healthy body weight, increasing self-esteem and bolstering immunity. Body fat increases cancer risk by secreting cytokines that promote inflammation. Decreasing inflammation is important, as it is associated with increased cancer risk and the development of tumors. Too much body fat will trigger insulin resistance, raising levels of insulin and growth factors that promote cancer, which may increase the risk of developing a secondary malignancy (Gilbert & Slinglander, 2012). In immunosuppressed cancer patients it is also important to note that increased body fat may impair immunity. To further illustrate this point a randomized controlled trial studied 52 breast cancer survivors in a 15-week aerobic exercise intervention. Those in this intervention group had an increase in natural killer cells and unstimulated thymidine uptake by peripheral lymphocytes (Fairey et al., 2005). Studies such as these suggest positive relationships between cancer recurrence and natural killer cell function, which can be improved by maintaining a physically active lifestyle.

Engaging in physical activity can also help to reduce a major deterrent of HRQoL: fatigue (Hall et al., 2012). Cancer-related fatigue is one of the most difficult late effects to treat and it is also one of the most common. After receiving treatment patients are told to relax and rest, which has been overemphasized to the point where survivors are very sedentary in their lifestyles, leading to many unfavorable health outcomes such as increased weight and higher levels of activity limitation. In a meta-analysis study of breast cancer patients physical activity not only led to improved HRQoL, but it also decreased fatigue and pain in all of the studies assessed (Courneya & Friedenreich, 1999). From this research it is evident that there is a strong connection between HRQoL and physical activity. A study piloted by Bellizzi et al. (2009) evaluated the benefits of physical activity on HRQoL in 319 non-HL survivors. The study assessed whether the survivors met or did not meet the physical activity guidelines and the relation of this on their overall HRQoL. Results indicated that over half of the population surveyed did not meet the physical activity recommendations set forth by the CDC and these individuals reported lower HRQoL compared to those who did meet the recommendations. Furthermore, a study conducted in Canada studied HRQoL and physical activity in adolescent and young adult (AYA) survivors. The researchers were
interested in the amount of physical activity and the dose-response relationship with HRQoL. A random sample of 2,000 AYA cancer survivors were pulled from the Canadian Cancer Registry and were mailed a survey regarding leisure time physical activity, medical outcomes and psychosocial challenges. Similar to other studies, the results found that over half the individuals were not meeting the recommended physical activity guidelines. Additionally, those that were more physically active had lower rates of depression and stress, as well as higher HRQoL. This study indicated differences in stress and depression even between those who were completely sedentary to insufficiently meeting the recommendations suggesting that any amount of physical activity may be beneficial to overall health (Bélanger et al., 2011). Similarly designed studies of leukemia, lymphoma and brain cancer patients conducted at the University of Texas denoted that exercise at any level improves social and cognitive functioning, body image, and stress (Paxton et al., 2010).

Overall, it is evident that physical activity is strongly associated with a decrease in frequent distress, such as depression, and activity limitations. Since HL is a disease that most people will end up living with and not dying from, it is important that physical activity is included in a survivorship treatment plan.

**Mental Health: Life Satisfaction**

The WHO (2013) defines mental health as a, “state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community” (para. 1). Corey Keyes elaborates on this concept further by describing mental health as a syndrome of positive feelings and functioning in life. Whereas those who are mentally healthy are described as flourishing and the absence of mental health is considered languishing. An individual who is flourishing exhibits life satisfaction, is filled with positive emotions and functions well psychosocially (Horwitz, 2002).

Currently, in the medical field there is much skepticism towards these ideas behind positive psychological. Particularly, that mental states improve physical well-being. A study conducted in the Department of Psychology at the University of Miami in Florida provides evidence that optimism, or positive mental health, is strongly predictive of future health and recovery. The researchers hypothesized that people with a positive outlook cope better and
tend to live longer. They studied 59 breast cancer patients at the time of their diagnosis and asked them to rate their overall optimism about life. This questions was then asked of the women one day pre-surgery, 10 days post-surgery, and at 3-, 6-, and 12-month follow-ups (Carver, 1993). Researchers predicted that coping techniques, such as humor, used by the women would lead to lower distress and more happiness in their lives. While observing these coping techniques the researchers simultaneously looked at the ways in which optimistic and pessimistic thought processes influenced the women’s coping abilities.

The results showed that optimistic women compared to their less optimistic counterparts exhibited the ability to accept their situation and handle the consequences, poor or favorable. By choosing to consciously pursue the things that brought them joy, the optimistic women presented improved immune functionality leading to a decrease in the development and spread of cancerous cells. When the University of Miami researchers looked at how optimism related to coping methods they found that active coping methods were linked to optimistic outlooks (Carver, 1993). The optimists remained engaged in their lives and pursued activities that were pleasurable to them. These optimistic thinking styles were also associated with enhanced coping styles, such as the use of humor in their everyday lives. The ability to bring humor into the situation allowed the women to create a balance between the seriousness of their illness and their capability to control the situation. Therefore, exhibiting positive mental health improved the physical health of these breast cancer survivors.

An aspect of positive mental health is life satisfaction. Life satisfaction is the mental evaluation of an individual’s life and may be influenced by a variety of factors including socioeconomic status, race, education and social inclusion. Higher life satisfaction is linked with lower all-cause disease and mortality, as well as positive health behaviors and favorable social support (Zebrack & Chesler, 2002). Life satisfaction has shown to be a predictor of longevity and psychiatric morbidity with a dose-response relationship evident between life dissatisfaction and injury, physical distress, mental distress and activity limitation (Strine et al., 2008). In terms of cancer treatment, life satisfaction takes into account an individual’s perception of the effects of cancer and treatment on their overall happiness (Bradlyn, Ritchey, & Harris, 1996). Past research of cancer survivors indicates that the awareness of positive changes due to cancer and a sense of a meaningful life are related to a positive
influence on HRQoL (Zebrack & Chesler, 2002). Additional research of the general population has shown a strong relationship between life satisfaction and HRQoL. For instance, those with higher levels of life satisfaction have shown greater levels of immunity (Lemonick, 2005), as well as reduced risk of cardiovascular disease, hypertension, diabetes and upper-respiratory infections (Segerstrom, 2006), all of which are potential threats to the fragile health of immunosuppressed cancer survivors. This interconnectivity illustrates the concepts supported by the Wellness Triangle and Keyes’ concept of flourishing by showing how life satisfaction, as an aspect of mental health, is linked to both social and physical health.

In cancer survivors, several variables are associated with life satisfaction. Generally, lower life satisfaction indicates higher amounts of depression and anxiety as well as unemployment. It is also associated with more somatic late effects of cancer treatment such as psychological sequelae (Strine et al., 2008). Research conducted by Seitz et al. (2011), studied life satisfaction of 820 survivors of a variety of cancers using the Questions on Life Satisfaction (FLZM) scale. These survivors were then compared to an age and sex matched community sample. The results indicated that survivors were significantly less satisfied with their life compared to their healthy counterparts. Furthermore, they found that lower life satisfaction was associated with more mental distress. Overall a clear relationship is evidenced between life satisfaction and HRQoL. The results from this research of HL survivors may provide insight into the connection between mental states and physical health in HL survivors.

**SOCIAL HEALTH: EMOTIONAL SUPPORT**

Cancer is a social experience, which requires support from family and friends. Therefore, it is not uncommon for a survivor to feel withdrawn. Past research shows that receiving emotional support is associated with less depression, more self-esteem, lower levels of cortisol, less mental and physical illness, improved morality and benefits for immune and cardiovascular health (Achat et al., 1998; Berkman, 1995; Blazer, 1982; Bloom, 1990; Broadhead et al., 1983; Callaghan & Morriessy, 1993; Cohen, 1988; Hale, Hannum, & Espelage, 2005; Lin, Simeone, Ensel, & Kuo, 1979; Seeman, 1996; Seeman et al., 1997; Uchino, 2006). But if the psychosocial problems go untreated, there is an increased risk of
worsening health status and poor health behavior outcomes (Hall et al., 2012). To further illustrate this, a study conducted by Krull et al. (2010) at St. Jude Children’s Research Hospital in Tennessee longitudinally studied 1,652 adolescent survivors of childhood cancer and 406 siblings of cancer survivors to assess for an association between adolescent psychological problems following treatment and poor health habits such as physical inactivity and smoking. After seven years of follow-up, this study concluded that survivors had higher mental distress, more emotional concerns, and an increased likelihood of social withdrawal compared to their siblings. Furthermore, social withdrawal was found to be associated with obesity and physical inactivity.

Therefore, emotional support is an important tool to mediate health complications and improve HRQoL. In other populations, emotional support has shown to be predictive of frequent activity limitation such as research by Shy, Tang, Tsai, Liang, and Chen (2006), which studied HRQoL in elderly Taiwanese people with hip fractures. This prospective study considered the influences of emotional support on HRQoL in 126 elderly Taiwanese individuals by interviewing them 1-, 3- and 6-months post-discharge from surgery. The results showed that those with greater levels of emotional support had less activity limitation and saw a faster recovery. Similar findings were noted in Bloor, Sandler, Martin, Uchino, and Kinney’s (2006) population study among 851 individuals living in North Carolina. The results indicated that emotional support was associated directly with enhanced HRQoL in these individuals, even after controlling for age, self-reported health status and martial status.

Establishing emotional support allows survivors to share coping mechanisms and their fears about the uncertain future. Support groups and care from family members increases HRQoL, particularly psychological well-being (Maurice-Stam, Oort, Last, & Grootenhuis, 2009). A cross-sectional study conducted in Amsterdam by Maurice-Stam et al. (2009), looked at 353 young adult cancer survivors. The researchers mailed the participants questionnaires regarding their current state of health, coping styles and social support. Social support proved very important when encompassed in a coping mechanism. Additionally, higher levels of social support were associated with improved mental and physical health. Further studies report significant improvements in psychological well-being developed from group interactions and the sharing of life experiences. These situations create a sense of
community among support group members, helping to reduce feelings of isolation (Carter, 1989; Holland, 1992; Padilla, Ferrell, Grant, & Rhiner, 1990).

Not many studies have explicitly studied emotional support in HL survivors, but a meta-analysis reviewing research on HL and non-HL survivors found that HL survivors have lower social and emotional functioning compared to a healthy sample (Oerlemans et al., 2011). With the known connection of emotional support to improved HRQoL in other populations it is important to note that HL survivors are experiencing a lack of social support. Past research clearly highlights the benefits of emotional support in other populations indicating that by receiving necessary emotional support participants not only decreased mental complications such as depression, anxiety and post-traumatic stress disorder but also improved their physical health. The data proves that maintaining emotional support, especially during survivorship, is exceedingly important to decreasing frequent distress and activity limitations.

**Age and Age at Diagnosis Differences**

The differences in HRQoL due to age in HL survivors is a very important aspect to consider, as HL is commonly diagnosed in two distinct age groups: young adults (age 15-39) and in individuals over 55 years. The reports on HRQoL and age at diagnosis are mixed, which may be due to data collection methods or how the age groups were defined. Currently, there is a lack of research on the adolescent and young adult (AYA) population, or individuals aged 15-39. In many studies these individuals are grouped either with children or adults and the focus is taken away from this unique population (LiveStrong, 2006). The AYA population has explicit psychological, medical, economic and educational needs, particularly because they have increased vulnerability to stress coupled with major physical and social development changes that this age group, regardless of a cancer diagnosis, commonly experiences. AYA’s compared to the general population are more often exposed to known risk factors for developing adult malignances such as HPV, hepatitis B, lack of physical activity, tobacco use and a poor diet. AYA’s tend to present a more advanced stage of cancer than older aged populations, in part due to social and developmental characteristics, such as absence of awareness of cancer risk and a sense of invincibility, as well as a lack of routine medical care or health insurance (Keegan et al., 2012). Additionally, there are barriers to
quality care for the AYA population and this can lead to a lower HRQoL. For instance, services such as patient navigation and counseling may not be reimbursed (LiveStrong, 2006).

In terms of HRQoL, some studies suggest that although childhood cancer survivors are generally reported to have equally as good of HRQoL as their peers (Casillas et al., 2006; Langeveld, Grootenhuis, & Voute, 2004; Zebrack & Chesler, 2002), they are at a higher risk for chronic health problems and more concerns with physical functioning compared to their peers (Casillas et al., 2006; Kokkonen, Vainionpaa, & Winqvist, 1997). Additionally, older age at follow up and a younger age at diagnosis are considered risk factors for poorer HRQoL (Barrera et al., 2012; Casillas et al., 2006). One study looked at the differences in HRQoL and physical functioning between survivors of bone tumors, diagnosed as a child compared to those diagnosed as a young adult. Twenty-eight survivors between the ages of 18 and 32 years completed three generic and one disease-specific survey of HRQoL. The results indicated that those who were diagnosed as a child reported better HRQoL compared to participants diagnosed as a young adult, particularly for physical HRQoL and overall health (Barrera et al., 2012).

Little is known about the late effects of cancer treatment and how it will influence HRQoL in all age groups, yet specific concerns exist for AYA’s and childhood cancer survivors because they have many more years to live. These concerns include damage to bones causing some extremities to grow improperly, developing secondary cancers, cardiac damage and reproductive issues (Schwartz et al., 2007). Since young adulthood is commonly a time of prime sexual health, there are concerns about sexual functioning. A study by Zebrack et al. (2010), looked at 599 cancer survivors between the ages of 18 and 39 years to assess the prevalence and risk of sexual dysfunction. This study also considered the relationship between sexual dysfunction, HRQoL and psychosocial outcomes. Sexual dysfunction was assessed with the MOS Sexual Functioning survey and HRQoL was measured with the SF-36, both of which are widely used and validated survey instruments. The results suggested that more females (52%) than males (32%) reported ‘a little problem’ in one or more areas of sexual functioning. Moreover, females reported more problems than males with overall sexual functioning. Sexual dysfunction had a negative effect on HRQoL. In both genders it was significantly associated with more mental distress.
When looking specifically at HL survivors the research is very limited. A study directed by Wettergren and Björkholm (2004) assessed HRQoL in HL survivors. One hundred twenty-one HL survivors along with 236 controls participated in the study. Participants were interviewed using the Schedule for the Evaluation of Individual Quality of Life-Direct Weighting (SEIQoL-DW) and three standardized questionnaires: Hospital Anxiety and Depression (HAD) scale, Short Form 12 health survey questionnaire (SF-12) and Sense of Coherence (SOC) scale. One variable of interest within the HRQoL scale was time since diagnosis. Researchers discovered that those with a longer time since diagnosis reported higher HRQoL and fewer functional problems, yet if they were diagnosed at a younger age (i.e., when treatment was not as advanced as it is today) then HRQoL scores were lower. Likewise, a meta-analysis of HL and non-HL survivors suggests that older HL patients experience clinically worse outcomes whereas younger HL survivors exhibit more mental distress (Gil-Fernandez et al., 2003; Heutte et al., 2009; Joly et al., 1996; Loge et al., 1999).

Some research suggests that younger cancer survivors report better HRQoL compared to older cancer survivors, particularly for physical HRQoL and overall health (Barrera et al., 2012). This is represented in a study conducted in Australia by Hall et al. (2012) that studied a subset of the Cancer Survival Study, which gathers data from participants at the baseline measure of 6-7 months post-diagnosis. The researchers studied 58 young adult cancer survivors and compared them to a gender and cancer matched older population of cancer survivors. They were interested in the impact of physical activity, smoking and alcohol consumption on HRQoL. Results indicated that older participants were less likely to engage in the recommended amounts of physical activity compared to younger cancer survivors and those that engaged in higher amounts of physical activity had better physical functioning regardless of age (Hall et al., 2012). The younger population reported lower disability than the older populations, which may be due to several factors. Younger survivors have had less time to develop other conditions that could reduce HRQoL, while advances in treatment led to better survival outcomes. Conversely, similarly designed studies have found that older survivors report better mental health but worse physical health, compared to their younger counterparts (Leak et al., 2011). Overall the data on age is mixed and may cause a distortion in the relationship between the variables of interest and HRQoL.
Sociodemographic variables include socioeconomic status (SES), gender, age and race/ethnicity. HL has the highest incidence in non-Hispanic whites, followed by African Americans and Hispanics. Yet even within this virtually mono-racial population, SES differences do exist and are an important determinant of HRQoL (Atherton et al., 2012). SES is a social health factor combining the income, educational attainment and environmental living space of an individual or community. SES affects nearly every aspect of an individual’s life. SES, more than race or ethnicity, predicts the likelihood of an individual’s or a group’s access to education, occupational opportunities, health insurance and suitable living conditions (Ashing-Giwa & Lim, 2009). Low SES is associated with a lack of resources including health insurance. The economically disadvantaged are less likely to have access to health care and information about their risks for disease. Cancer patients and survivors living in low SES neighborhoods have disproportionately higher death rates from cancer, regardless of race or ethnicity. Additionally, the five-year survival rate for people in low SES is greater than 10% less compared to those in higher SES neighborhoods (Feuerstein, 2007).

In terms of survivorship health, people with lower SES are less likely to undergo routine screenings for cancer, and are more likely to be diagnosed at a later stage in the cancer process (Palmer & Schneider, 2005). These individuals are also more likely to have risk factors associated with cancer, such as physical inactivity, excessive alcohol intake, tobacco use and obesity. This is in part due to the environmental landscape of lower SES neighborhoods with less access to fresh fruits and produce, as well as fewer safe areas to be physically active (ACS, 2012). SES also influences access to educational opportunities. Research by Ashing-Giwa and Lim (2009) studied the relationship between HRQoL and socioeconomic factors in breast cancer survivors. A cross-sectional study was conducted on 703 breast cancer survivors from Los Angeles, California. HRQoL was measured with SF-36®. SES was defined by household income, job status and educational attainment. HRQoL was significantly higher in those with a higher overall SES. Additionally, jobs indicating lower SES such as a laborer or operator were also associated with both lower physical and mental HRQoL. Higher income and higher education, regardless of ethnicity, showed the highest levels of both physical and mental HRQoL.
In terms of survival after diagnosis those with a lower SES are significantly more likely to have a shorter life than those of a higher SES. In a study conducted at the University of California, Irvine researchers studied the differences in individual and neighborhood SES on an individual’s quality of life in lymphoma and leukemia survivors. Individual and neighborhood SES are just as they sound, defining the SES level of either the individual regardless of the neighborhood or the neighborhood regardless of the individual’s SES. Quality of life had four domains in this study: physical health, psychological and emotional well-being, social relationships and life skills. Data from 110 individuals aged 16-40 years was pulled from the Socioeconomics and Quality of Life study (individual SES) and the California Cancer Registry (neighborhood SES level). The researchers discovered that individual SES was significantly associated with overall quality of life, whereas neighborhood SES was only associated with an individual’s physical quality of life. This implies that cancer survivors may not have access to healthy foods or safe places to exercise due to environmental aspects. An individual’s SES level had the biggest impact on their social health and relationships (Kent et al., 2012). From this and other studies (Bentley, Kavanagh, Subramanian, & Turrell, 2008; Thomas, Eberly, Neaton, & Davey-Smith, 2007) individual SES has been found to be more predictive of health outcomes than area-SES, as those with a higher SES are more likely to have access to the medical care and attention that they need.

Gender also has the potential to influence HRQoL. For instance, a study conducted with colorectal cancer survivors studied the influence of gender on HRQoL outcomes. The researchers assessed four female and four male focus groups with questionnaires regarding physical, mental, social and spiritual well-being. The results showed that both genders reported physical, psychological and sexual concerns, yet females were more likely to describe specific mental and social issues (Grant et al., 2011). In terms of lymphoma survivors specifically, a study by Arden-Close et al. (2011), assessed gender differences in HRQoL in non-HL and HL survivors with questionnaires regarding HRQoL, late effects, perceived vulnerability and clinic concerns. The results showed that men reported a worse mental HRQoL and social health than women. The researchers argue that this may be due to how women are socialized to seek medical help. Overall, sociodemographic circumstances
are very important to consider in cancer patients due to their considerable influence on the health outcomes of the individual.

**Co-Morbidities**

Co-morbidities are medical conditions that exist separately but in addition to the diagnosis (Merriam-Webster, 2013). Several studies indicated that cancer survivors are at a greater risk for developing common co-morbidities including cardiovascular disease, osteoporosis and diabetes compared to their healthy counterparts (Bines & Gradishar, 1997; Brown, Brauner, & Minnotte, 1993; Li & Stovall, 1998; Newschaffer, Otani, McDonald, & Penberthy, 2000; Talamini et al., 1997; Wingo, Ries, Parker, & Heath, 1998). An increased risk for the development of co-morbidities in cancer survivors may be due to genetic variation, treatment, or lifestyle factors. Past research illustrates that cancer patients report more co-morbidities than those without a history of cancer leading to further medical concerns (Bellizzi, Rowland, Jeffery, & McNeel, 2005). A study conducted by Yabroff, Lawrence, Clauser, Davis, and Brown (2004) of 1,823 cancer survivors compared these individuals to 5,469 sex, education and age-matched controls to determine the burden of illness in cancer survivors. Results indicated that the burden of illness was significantly greater among the cancer survivors.

Cancer survivors may development co-morbid conditions prior to cancer diagnosis, from treatment or post-treatment due to either the treatment itself or the aging process. Research by Hewitt, Rowland, and Yancik (2003) of 4,878 elderly cancer survivors compared to 90,737 race and age matched controls, found a significant relationship between co-morbidities and cancer diagnosis. Elderly cancer survivors were twice as likely to have at least one functional limitation. This risk continued to climb in the presence of an additional co-morbidity (Odds Ratio [OR] = 5.06, 95% CI 4.47-5.72) and even still higher when a tertiary co-morbidity was considered (OR = 11.08, 95% CI 9.70-14.37). Evidently, co-morbidities are linked with more functional limitation and increased burden of illness.

Common co-morbidities in cancer diagnosis include diabetes and obesity. Diabetes is characterized by hyperglycemia due to defects in insulin secretion, resistance or both. Insulin regulates the movement of sugar into cells and irregularities could lead to the destruction of B-cells within the pancreas and concerns with protein metabolism (American Diabetes
According to the American Diabetes Association, long-term complications from diabetes include loss of vision, nephropathy, foot ulcers, sexual dysfunction and cardiovascular concerns. In cancer survivors, those with diabetes have a 50% increased risk of mortality compared to survivors without diabetes. Furthermore, those with diabetes are more likely to respond unfavorably to treatment and to be hospitalized for anemia, fever, neutropenia, infections and chemotherapy-related toxicity (Peairs et al., 2011). A study of two comprehensive cancer center’s data from randomized, controlled trials of 661 patients above the age of 21, assessed the physical functioning, mental health and social functioning of cancer patients with diabetes compared to those without. The findings suggest that patients with diabetes presented lower levels of physical functioning, and those of an older age exhibited poorer mental health states (Hershey, Given, Given, Von Eye, & You, 2012). Diabetes also increases the risk of obesity, hypertension and cardiovascular concerns.

Similar to diabetes many Americans are obese. Currently, more than one third of Americans are obese or overweight (CDC, 2012). In adults aged 20 years or older, overweight is defined as a body mass index (BMI) of 25-29.9 kg/m² where as obesity indicates a BMI greater than 30 kg/m² (CDC, 2012). Obesity is associated with higher mortality rates and an increased risk for developing diabetes, hypertension, dyslipidemia, cardiovascular problems, sleep apnea, and poor quality of life (Daniels, Jacobson, McCrindle, Eckel, & Sanner, 2009; Flegal, Carroll, Ogden, & Curtin, 2010). For cancer survivors, obesity can lead to lower mortality. A prospective cohort study conducted by Calle, Rodriguez, Walker-Thurmond, and Thun (2003) assessed the relationship between obesity and mortality in cancer survivors. The findings indicated that in blood cancers, similar to other cancers, as BMI increased mortality decreased. In addition, compared to those of normal weights, overweight men and women had death rates over 50% higher. In a survey study considering HRQoL in 152 endometrial cancer survivors, 81% of those who qualified as obese, found that compared to those of a normal weight, women who were obese had lower quality of life scores and poorer physical activity (Fader, Frasure, Gil, Berger, & von Gruenigen, 2011). In immunosuppressed cancer survivors, obesity is particularly dangerous as it can contribute to or cause all of the aforementioned co-morbidities and prevent individuals from participating in needed physical activity. These two co-morbidities
are interrelated and controlling one may help to prevent or control another. It is important that these are assessed during follow-up treatment.

Overall, for all of these topics little is known specifically for HL survivors. Mixed reports for many of these factors exist, yet the general trend seems to suggest that a lack of physical activity, minimal social support, and lower life satisfaction are related to lower HRQoL. This study will aim to determine, even after controlling for a variety of variables, which health factor will be most associated with HRQoL. The research shows that assessed separately and in a range of other populations, these three variables are strongly associated with HRQoL, but the data is limited on the variables being assessed simultaneously. This study will provide new insight for HRQoL and by exploring the comparative relationships of these three variables to HRQoL, may help to inform intervention and prevention efforts aimed at improving HRQoL in HL survivors.
CHAPTER 3

METHODS

This cross-sectional study will use data collected by a telephone survey in 2009 to assess the association of physical activity, life satisfaction and emotional support with HRQoL among HL survivors.

STUDY DESIGN AND DATA SOURCE

The Behavioral Risk Factor Surveillance System (BRFSS) questionnaire is a cross-sectional phone-based survey that assesses the health of thousands of Americans across the United States, looking at chronic disease and injury. State health departments conduct these surveys monthly and the data are reported to the CDC for analysis. Interviewers followed standard procedures to collect the information. The questionnaire consists of three parts: (a) the core component, (b) optional modules, and (c) state-added questions. For this study only answers from the core component were assessed. A detailed description of the survey design and random sampling methods are available elsewhere (CDC, 1998; Ôunpuu, Chambers, Patterson, Chan, & Yusuf, 2001).

POPULATION

Non-institutionalized adults 18 and over were sampled from across the United States, Puerto Rico, Virgin Islands and Guam by state health departments provided with technological and methodical support from the CDC. At random through the computer-assisted telephone interviewing (CATI) system one adult was interviewed per household.

SAMPLE

From the initial sample of 432,607 individuals surveyed in 2009, 539 respondents positively to HL when asked, “With your most recent cancer diagnosis, what type of cancer was it?” From this sample, in order to include all variables of interest, 406 answered “Only one” to the question asking, “How many different types of cancer have you had?” and were
included in the study. Forty-one individuals were excluded due to missing values. A total sample size of 365 was used in the analysis (Figure 4).

**Figure 4. Selection of study sample, BRFSS 2009.**

**VARIABLES**

This section describes the outcome variable, the variables of interest, and the adjustment variables used in the analysis.

**Health-Related Quality of Life**

HL survivors were asked three questions related to their HRQoL. These questions and their construct validity have been described elsewhere (CDC, 2000). Overall unhealthy days were calculated as the sum of physically and mentally unhealthy days, with this sum not to exceed 30 days for an individual. Four dichotomous HRQoL variables categorized HL survivors into two mutually exclusive groups depending on whether they did or did not report 14 or more unhealthy days. The cut point of 14 unhealthy days defines a meaningful break for those reporting substantially impaired HRQoL and corresponds to the upper 10-15% of the distribution for each of the Healthy Days measures (CDC, 2000; Figure 5).
Life Satisfaction
“How satisfied are you with your life?”
- Very satisfied
- Satisfied
- Dissatisfied or very dissatisfied

Physical Activity (PA)
Calculated variable to assess PA
- Meets recommendations
- Insufficient PA to meet recommendations
- No PA

Emotional Support
“How often do you receive the emotional support that you need?”
- Always
- Usually
- Sometimes, rarely or never

HRQoL
Assessed with four outcome variables

Frequent Activity Limitation:
- ≥ 14 days, during the past 30 days, in which poor physical or mental health kept the participant from doing usual activities

Frequent Mental Distress:
- ≥ 14 days, during the past 30 days, in which mental health, including stress, depression and problems with emotions, was not good

Frequent Physical Distress:
- ≥ 14 days, during the past 30 days, in which physical health, including physical illness and injury was not good

Frequent unhealthy days:
- Calculated as sum of physically and mentally unhealthy days

Figure 5. Full model with variable definitions, BRFSS 2009.

Physical Activity
The physical activity variable used in this study was derived from several responses to physical activity questions throughout the survey (see Appendix). The physical activity variables was condensed into three categories: (A) Meets physical activity recommendations (respondents that reported doing 150 minutes or more of moderate and/or 75 minutes or more of vigorous physical activity a week), (B) Insufficient physical activity (respondents that reported doing less than 150 minutes of moderate and/or 75 minutes of vigorous physical activity a week), and (C) No physical activity (respondents that reported doing no moderate or vigorous physical activity).

Life Satisfaction and Emotional Support
Participants were asked categorical questions pertaining to their current life satisfaction and emotional support. Variables were collapsed into three categories for each (see Appendix and Figure 5).

Sociodemographic Factors
The income variable was coded into three categories: less than $25,000, $25,000 to less than $50,000, and over $50,000. Age was a continuous variable that was converted into a
categorical variable with three levels: 18-44, 44-54, and 55 or older. The responses for age at
diagnosis of their first cancer were continuous but for the purposes of this study they were
categorized into ages 0-39 and 40 or older. The races were classified as white, African
American, Asian, native Hawaiian, other Pacific Islander, Hispanic or Latino, American
Indian and Alaska native. For the purpose of analysis these races where divided into two
broad categories: (1) White and (2) African American, Hispanic and others, which included
Asian, Native Hawaiian or other Pacific Islander, American Indian, and Alaska Native (see
Appendix).

Co-Morbidities

BMI was a calculated from height and weight and included three categories: neither
overweight nor obese corresponding to BMI < 25, overweight corresponding to 25 ≤ BMI
< 30 and obese which corresponded to BMI ≥ 30. Participants also asked about their diabetes
status and were categorized as either “Yes” or “No” (see Appendix).

STATISTICAL ANALYSIS

The data was analyzed with the statistical software, SAS 9.2. Descriptive frequencies
of each independent variable and the outcome HRQoL variables were calculated. Two sets of
weighted multivariable logistic regression models were then fitted regressing each of the
HRQoL variables (frequent physical distress, frequent mental distress, frequent activity
limitation, and frequent unhealthy days) on physical activity, life satisfaction, and emotional
support (see Appendix). The first set of models did not control for potential confounders; the
second set controlled for age, gender, race/ethnicity, income, age at diagnosis and
co-morbidities. These models obtained odds ratios (ORs) and 95% confidence intervals
(95% CIs). Wald chi-square p-values were determined for each variable. All responses were
weighted with the BRFSS survey weight measure provided by the CDC. Each variable was
included in the final model, regardless of significance.
CHAPTER 4

RESULTS

The main purpose of this study was to determine of physical activity, life satisfaction and emotional support, which was most associated with HRQoL in HL survivors and to assess if that association remained consistent after controlling for several confounders. Demographics of the population were also investigated.

A majority of the population was female (56.4%), over 55 (54.8%), White (84.9%), not meeting the recommendations for physical activity (57%), earned over $50,000 a year (47.1%), reported feeling satisfied with their life (47.1%), always received the emotional support that they need (46.6%), did not have diabetes (84.9%), was overweight or obese (64.4%) and was diagnosed with HL as an adult over 40 (58.9%). In terms of HRQoL, less than half of the population experienced frequent distress or frequent unhealthy days. About 16% suffered frequent activity limitation, 13% reported frequent mental distress, just over 23% experienced frequent physical distress, and 30% encountered frequent unhealthy days (Table 1). Conversely, in the general population 10.8% of people reported frequent physical distress, 6.7% encountered frequent activity limitation, and 10.2% experienced frequent mental distress. Additionally, on average U.S. adults experience 6.1 unhealthy days whereas HL survivors report 10.2 unhealthy days (CDC, 2011d).

Two sets of models were reported. The unadjusted models showed that emotional support was not significantly associated with any HRQoL outcome. Compared to those who were meeting the recommendations for physical activity, those with no physical activity were more likely to experience frequent activity limitation (OR 10.4, 95% CI 2.9-35.9) and frequent physical distress (OR 4.8, 95% CI 1.6-14.0). Lastly, life satisfaction was significantly associated with all aspects of HRQoL. Those who reported dissatisfaction with life were more likely to experience frequent activity limitation (OR 30.1, 95% CI 6.4-140.6), frequent physical distress (OR 14.9, 95% CI 3.6-61.6), frequent mental distress (OR 12.8, 95% CI 1.9-87.1) and frequent unhealthy days (OR 43.9, 95% CI 8.4-228.6), compared to HL survivors who were very satisfied with their lives.
Table 1. Descriptive Frequencies in Hodgkin Lymphoma Survivors (n = 365), BRFSS 2009

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outcome</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HRQoL Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequent Activity Limitation ≥ 14 Days</td>
<td>57</td>
<td>15.62</td>
</tr>
<tr>
<td>Frequent Mental Distress ≥ 14 Days</td>
<td>49</td>
<td>13.42</td>
</tr>
<tr>
<td>Frequent Physical Distress ≥ 14 Days</td>
<td>84</td>
<td>23.01</td>
</tr>
<tr>
<td>Frequent Unhealthy Days (Physical or Mental) ≥ 14 Days</td>
<td>111</td>
<td>30.41</td>
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<td><strong>Main Variables</strong></td>
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<tr>
<td>Life Satisfaction</td>
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<td></td>
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<tr>
<td>Very satisfied</td>
<td>161</td>
<td>44.11</td>
</tr>
<tr>
<td>Satisfied</td>
<td>172</td>
<td>47.12</td>
</tr>
<tr>
<td>Dissatisfied or very dissatisfied</td>
<td>32</td>
<td>8.77</td>
</tr>
<tr>
<td>Emotional Support</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Always</td>
<td>170</td>
<td>46.58</td>
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<tr>
<td>Usually</td>
<td>125</td>
<td>34.25</td>
</tr>
<tr>
<td>Sometimes, rarely or never</td>
<td>70</td>
<td>19.18</td>
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<tr>
<td>Physical Activity</td>
<td></td>
<td></td>
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<tr>
<td>Meets recommendations</td>
<td>157</td>
<td>43.01</td>
</tr>
<tr>
<td>Insufficient physical activity</td>
<td>152</td>
<td>41.64</td>
</tr>
<tr>
<td>No physical activity</td>
<td>56</td>
<td>15.34</td>
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<td><strong>Sociodemographic Variables</strong></td>
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<td></td>
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<td>159</td>
<td>43.56</td>
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<tr>
<td>Female</td>
<td>206</td>
<td>56.44</td>
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<tr>
<td>Age</td>
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<td></td>
</tr>
<tr>
<td>18-44</td>
<td>55</td>
<td>15.07</td>
</tr>
<tr>
<td>45-54</td>
<td>110</td>
<td>30.14</td>
</tr>
<tr>
<td>55 or older</td>
<td>200</td>
<td>54.79</td>
</tr>
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</table>

(table continues)
Table 1. (continued)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency (n)</th>
<th>Percent (%)</th>
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<td>Ethnicity</td>
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<td>310</td>
<td>84.93</td>
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<tr>
<td>Hispanic, Black or Other</td>
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<td>15.07</td>
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<tr>
<td>Income</td>
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<tr>
<td>Less than $25,000</td>
<td>92</td>
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<td>$25,000 to less than $50,000</td>
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<tr>
<td>More than $50,000</td>
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<td>47.12</td>
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<td>Age at Diagnosis</td>
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<td>0-39</td>
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<td>40 or older</td>
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<td>58.90</td>
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<td>Co-Morbidities</td>
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<td>Diabetes</td>
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<td>Yes</td>
<td>55</td>
<td>15.08</td>
</tr>
<tr>
<td>No</td>
<td>310</td>
<td>84.92</td>
</tr>
<tr>
<td>BMI</td>
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<td></td>
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<tr>
<td>Neither overweight nor obese</td>
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<td>32.88</td>
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<tr>
<td>Overweight</td>
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<td>Obese</td>
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<td>25.75</td>
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<td>Refused</td>
<td>10</td>
<td>2.74</td>
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The final models for each of the outcome categories controlled for current age, gender, age at diagnosis, race/ethnicity, income and co-morbidities. Life satisfaction continued to be significantly associated with all HRQoL outcomes. Compared to those who were very satisfied with their lives, those who were dissatisfied or very dissatisfied were more likely to report frequent activity limitation (OR 36.5, 95% CI 5.4-245.3), frequent physical distress (OR 16.5, 95% CI 3.9-68.9), frequent mental distress (OR 18.2, 95% CI 5.3-62.1), and frequent unhealthy days (OR 49.9, 95% CI 9.8-254.4). Physical activity remained significantly associated with frequent physical distress and frequent
activity limitation. Compared to those who met the recommendations for physical activity, those with no physical activity were more likely to experience frequent activity limitation (OR 10.1, 95% CI 2.3-44.2) and frequent physical distress (OR 4.4, 95% CI 1.5-12.5). After controlling for a number of variables, emotional support was not significantly associated with HRQoL (Table 2).
<table>
<thead>
<tr>
<th>Variable</th>
<th>Unadjusted OR (95% CI)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>p-value&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Adjusted* OR (95% CI)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>p-value&lt;sup&gt;c&lt;/sup&gt;</th>
</tr>
</thead>
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<tr>
<td><strong>Frequent Activity Limitation</strong></td>
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<td></td>
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<tr>
<td>Physical Activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meets recommendations&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1</td>
<td>0.001</td>
<td>1</td>
<td>0.004</td>
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<td>3.2 (0.7-13.8)</td>
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<tr>
<td>No physical activity</td>
<td>10.4 (2.9-35.9)</td>
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<td>10.1 (2.3-44.2)</td>
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<td><strong>Life Satisfaction</strong></td>
<td></td>
<td>&lt; .001</td>
<td>&lt; .001</td>
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<tr>
<td>Very satisfied&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td>1</td>
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<tr>
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<td>1.1 (0.4-2.6)</td>
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<tr>
<td>Dissatisfied or very dissatisfied</td>
<td>30.1 (6.4-140.6)</td>
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<td>36.5 (5.4-245.3)</td>
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<td>0.12</td>
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<td>Usually</td>
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<td>0.005</td>
<td></td>
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<td>1</td>
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<td>1.1 (0.4-3.1)</td>
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<td>4.4 (1.5-12.5)</td>
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<td>&lt; .001</td>
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<td>Satisfied</td>
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<td>1.3 (0.4-3.8)</td>
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<td>Dissatisfied or very dissatisfied</td>
<td>14.9 (3.6-61.6)</td>
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<td>16.5 (3.9-68.9)</td>
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<td>0.18</td>
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<td>Always&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td>1</td>
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<td>Usually</td>
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<td>0.4 (0.1-1.4)</td>
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<td>0.3 (0.1-1.2)</td>
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(table continues)
Table 2. (continued)

<table>
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<tr>
<th>Variable</th>
<th>Unadjusted OR (95% CI)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>&lt;sup&gt;p&lt;/sup&gt;-value&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Adjusted* OR (95% CI)&lt;sup&gt;a&lt;/sup&gt;</th>
<th>&lt;sup&gt;p&lt;/sup&gt;-value&lt;sup&gt;c&lt;/sup&gt;</th>
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</thead>
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<td><strong>Frequent Mental Distress</strong></td>
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<tr>
<td>Physical Activity</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Meets recommendations&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>0.6 (0.3-1.4)</td>
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<td>0.9 (0.3-2.4)</td>
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<td>1</td>
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</tr>
<tr>
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<td>2.1 (0.8-5.3)</td>
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<tr>
<td>Dissatisfied or very dissatisfied</td>
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<td>18.2 (5.3-62.1)</td>
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<td></td>
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<tr>
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<td>1.2 (0.4-2.9)</td>
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<td><strong>Frequent Unhealthy Days</strong></td>
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<td>1.8 (0.7-4.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Life Satisfaction</strong></td>
<td></td>
<td>&lt; .001</td>
<td>&lt; .001</td>
<td></td>
</tr>
<tr>
<td>Very satisfied&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Satisfied</td>
<td>1.4 (0.6-3.6)</td>
<td></td>
<td>1.5 (0.5-4.0)</td>
<td></td>
</tr>
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<td>Dissatisfied or very dissatisfied</td>
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<td>49.9 (9.8-254.4)</td>
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<td><strong>Emotional Support</strong></td>
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<td>Always&lt;sup&gt;b&lt;/sup&gt;</td>
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<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Usually</td>
<td>0.6 (0.2-1.4)</td>
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<td>0.5 (0.2-1.3)</td>
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</tr>
<tr>
<td>Sometimes, rarely or never</td>
<td>1.6 (0.2-2.1)</td>
<td></td>
<td>0.5 (0.2-1.5)</td>
<td></td>
</tr>
</tbody>
</table>

* = Adjusted for income, age at diagnosis, co-morbidities, gender, age and race/ethnicity  
<sup>a</sup> = Odds Ratio and 95% Confidence Interval  
<sup>b</sup> = Reference category  
<sup>c</sup> = Wald-chi square <sup>p</sup>-value
CHAPTER 5

DISCUSSION

The purpose of this cross-sectional study of 365 HL survivors was to determine the association between physical activity, life satisfaction and emotional to HRQoL and to assess which variable was mostly strongly associated with HRQoL. In this analysis each category of HRQoL was influenced differently, but life satisfaction proved to be most associated with all aspects of HRQoL, even after controlling for sociodemographic variables and co-morbid conditions. Emotional support was not significant in either the unadjusted or adjusted models. In the presence of physical activity and life satisfaction, emotional support is not significantly associated with HRQoL.

KEY FINDINGS

The results indicated that life satisfaction was found to be most associated with all aspects of HRQoL. Even after controlling for demographics, income, age at diagnosis and co-morbidities, compared to HL survivors who were very satisfied with their lives, those who were dissatisfied or very dissatisfied with their lives were exceedingly more likely to experience frequent physical distress, frequent mental distress, frequent activity limitation and frequent unhealthy days. The difference between those who were satisfied or very satisfied with their lives was basically null, suggesting that these two categories are virtually comparable. Of those who reported being very satisfied and satisfied with their lives, a smaller percentage experienced frequent activity limitation, frequent physical distress, frequent mental distress and frequent unhealthy days, compared to those who reported being dissatisfied or very dissatisfied with their lives (Figure 6). These results may suggest that life satisfaction acted as a protective factor against mental and physical distress as well as activity limitation. Conversely, this may indicate that HL survivors who are less mentally and physically distressed and who are experiencing fewer activity limitations, may in turn have higher life satisfaction. Comparable to previous research, these results suggest a strong connection between HRQoL and life satisfaction.
Physical inactivity was strongly associated with frequent physical distress and frequent activity limitation. Regardless of demographics, income, age at diagnosis and co-morbidities, those who reported no physical activity were more likely to experience both frequent physical distress and frequent activity limitation than those who met the physical activity recommendations. Similar to other studies, the majority of HL survivors were not meeting the physical activity recommendations. Furthermore, of those reporting no physical activity there were a higher percentage of individuals experiencing frequent physical distress and frequent activity limitation than those reporting at least some physical activity (Figure 7). These results suggest a dose-response relationship between physical activity and HRQoL. Physical activity may have been a protective factor in preventing frequent physical distress and frequent activity limitation. Conversely, those who reported less physical distress and activity limitations may have had the ability to be more physical active. In addition, there was only a significant difference between those with no physical activity and those meeting the recommendations; the difference between those meeting the recommendations and those getting insufficient physical activity was virtually null. This could imply that any amount of physical activity is beneficial to the health of HL survivors.

Past research shows that HL survivors are a population that is living longer with the possibility of developing more physical problems as they age. By assessing HRQoL in this
Figure 7. Percent of Hodgkin Lymphoma survivors with frequent physical distress and frequent activity limitation based on physical activity (n = 365), BRFSS 2009.

Population it is clear that a higher percentage of physically inactive individuals are reporting frequent activity limitation and frequent physical distress. Physical activity is important to not only prevent the possibility of future physical complications, but also to possibly hinder other adverse late effects of treatment such as depression or anxiety, even though physical activity in this population did not show significance in terms of frequent mental distress or frequent mentally or physically unhealthy days. This may be due to the fact that individuals did not accurately report their mentally unhealthy days or because in this sample few reported mental distress.

LIMITATIONS

One limitation of this study is the small sample size. This greatly affected the odds ratios and confidence intervals for the “no physical activity” and “dissatisfied or very dissatisfied” categories. This caused the odds ratios to be inflated and created wide confidence intervals. This indicates that the study lacks very precise estimates of the corresponding odds ratios. Additionally, due to the lack of data on current treatment status there was an inability to control for this factor’s influence on HRQoL, which may have accounted for self-reported mental and physical distress. Another limitation of this study was
the way the data were collected. As a cross-sectional design, the causal relationship between HRQoL, physical activity, life satisfaction and emotional support cannot fully be determined. In light of these limitations, strong associations are still present and this warrants further longitudinal study.

**STRENGTHS**

A benefit to using the BRFSS and weighted measures is the generalizability of the results. Even though the majority of the response sample was female, over 55, white and of higher SES, with the weighted measure those not interviewed and individuals with zero probability of being included in the sample are, on average, similar to those who were interviewed. The weighted measure accounts for non-response bias, telephone non-coverage, and adjusts data for underrepresented groups. An additional strength of this study was the way in which the sample was determined. It was limited to only those with one diagnosis of cancer and that being HL. This eliminated those with secondary malignancies who may have self-reported more frequent distress and activity limitation purely due to the long-term effects associated with a secondary cancer diagnosis. Furthermore, this study controlled for many possible confounders and life satisfaction still proved to be strongly associated with all aspects of HRQoL, indicating a strong relationship between the two variables.

**IMPLICATIONS**

These results suggest imperative implications for long-term treatment. For instance, those who were dissatisfied or very dissatisfied with life reported a much higher percentage of frequent distress and activity limitation. This further indicates the importance of life satisfaction to all aspects of HRQoL and in turn may be a sign of gaps in medical care. It highlights the need of these individuals’ specific risks and conditions to be studied so as to determine which behaviors attribute most to increased life satisfaction. Currently, life satisfaction is an infrequently studied variable with limited research, especially in terms of HL survivors. Yet these results further purport the theories of positive psychology and flourishing, which indicates a strong connection between life satisfaction and physical health. As no causality can be determined from this cross-sectional study, it does shed light onto the field of survivorship, suggesting that a strong association exists between life satisfaction and HRQoL, highlighting current disability and service needs in this population.
Similar to previous research, this study shows that a majority of the population was not meeting the physical activity recommendations set forth by the CDC. This may be due to the conventional idea that cancer survivors should rest after treatment, but this has been perpetuated so much so that individuals are becoming far too sedentary. These results show that physical inactivity is significantly associated with a higher percentage of frequent activity limitation and frequent physical distress. This may suggest the need for physical activity interventions in long-term follow-up care.

These results can have broader implications to survivorship research by reinforcing the necessity of continued long-term medical follow-up care to assess for conditions that may arise that will hinder an individual’s mental or physical health. The results also highlight the importance of utilizing HRQoL as an outcome variable to assess chronic disease burden. This information could be helpful to track and develop a screening process to identify HL survivors who may be at risk for frequent distress and activity limitation. Additionally, this model could be used for any population of interest, as all three variables are common aspects of people’s lives. For instance, this model could assess the HRQoL in breast cancer patients undergoing chemotherapy or even the general population. These results have the potential to pull together health professionals from different fields to determine the specific physical, psychological, emotional and social needs of their patients as well as identify gaps in care, especially in terms of physical activity and life satisfaction.

**Future Directions**

After successful medical treatment of HL, survivors are still experiencing frequent distress and frequent activity limitation. These results suggest the need for future research that can study these participants longitudinally to fully understand the relationship between life satisfaction, physical activity, emotional support and HRQoL. In order to address the non-significance of emotional support future studies should assess this variable with a number of questions rather than just one. Additionally, only the co-morbidities of diabetes and BMI were assessed in this study due to the small sample size. In future research it is recommended that other co-morbidities, such as arthritis and hypertension, are also controlled for to prevent any confounding effects. Furthermore, the conclusions drawn from this study provides evidence that BRFSS has the potential to be used as a population-based
surveillance system of HRQoL in cancer survivors. These results provide supplemental information to the National Cancer Institute’s Cancer Surveillance Research Implementation Plan by providing annual ongoing HRQoL details in a larger population (Gotay, 2004; National Cancer Institute, 1999). With this dynamic dataset, the results could also be stratified by gender, race/ethnicity or SES to more accurately target interventions. Specifically for HL survivors, as it is a disease with high prevalence in two distinct age groups, it would benefit future researchers to study the two age groups separately to assess for gaps in resources.

Overall, these results are comparable to past research and additionally supplement the minimal research on life satisfaction and HRQoL in HL survivors, supporting the strong relationship between the two. HL survivors are living well past 40 years post-treatment and it is clear that regardless of income, demographics, age at diagnosis, and co-morbidities, lower amounts of physical activity and life dissatisfaction are strongly associated with more frequent distress and frequent activity limitation. These results should be taken into consideration when developing comprehensive treatment plans that aim to maintain contact with survivors, even many years post-remission to guarantee that they are maintaining a socially, mentally and physically healthy lifestyle. Understanding the true relationship of physical activity, life satisfaction and emotional support to HRQoL can help to develop targeted interventions that will manage and maybe even prevent late effects of HL.
REFERENCES


assessing quality of life, unmet needs, and health behaviors. *Supportive Care in Cancer, 20*(6), 1333-1341. doi:10.1007/s00520-011-1221-x


Horwitz, A. V. (2002). Outcomes in the sociology of mental health and illness: Where have we been and where are we going? *Journal of Health and Social Behavior, 43*, 143-151.


APPENDIX

VARIABLE DESCRIPTIONS
**Outcome**
Health-Related Quality of Life

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

__ Number of days__
88 None
77 Don’t know / Not sure
99 Refused

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

__ Number of days__
88 None
77 Don’t know / Not sure
99 Refused

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

__ Number of days__
88 None
77 Don’t know / Not sure
99 Refused

**Variables of Interest**
Calculated Physical Activity Variable

First, it takes into account responses from the following questions regarding moderate and vigorous activity: (1) “How many days per week do you do these moderate activities for at least 10 minutes at a time?”, (2) “On days when you do moderate activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?” (Responses are in hours and minutes per day), (3) “How many days per week do you do these vigorous activities for at least 10 minutes at a time?” and (4) “On days when you do vigorous activities for at least 10 minutes at a time, how much total time per day do you spend doing these activities?” (Responses are in hours and minutes per day). From this, two PA variables are derived for the total minutes of moderate and vigorous activity in a week. It is calculated by multiplying the hours portion of question two and four by 60 and adding it to the minutes proportion of each question respectively.

Next, a second calculated variable categorized these responses into three categories per moderate or vigorous PA. Moderate PA: (A) Meets recommendations for moderate physical activity (Respondents that reported doing 30 or more minutes per day on five or more days per week of moderate physical activity), (B) Insufficient activity to meet moderate recommendations (Respondents that reported doing less than 30 minutes per day on less than five days per week of moderate physical activity), and (C) No moderate physical activity (Respondents that reported doing no moderate physical activity). Vigorous physical activity: (A) Meets recommendations for vigorous physical activity (Respondents that reported doing 20 or more minutes per day on three or more days per week of vigorous physical activity), (B) Insufficient activity to meet vigorous recommendations (Respondents that reported doing less than 20 minutes per day on less than three days per week of vigorous physical activity),
and (C) No vigorous physical activity (Respondents that reported doing no vigorous physical activity).

Lastly, the PA variable used in this study took the above categories and condensed them into three sections: (A) Meets PA recommendations (respondents that reported doing enough moderate or vigorous physical activity to meet one or both of the recommendations), (B) Insufficient PA (respondents that reported doing insufficient moderate or vigorous physical activity to meet either of the recommendations), and (C) No PA (Respondents that reported doing no moderate or vigorous physical activity).

Life Satisfaction
21.2 In general, how satisfied are you with your life? Please read:
1 Very satisfied
2 Satisfied
3 Dissatisfied
4 Very dissatisfied
Do not read:
7 Don't know / Not sure 9 Refused

Emotional Support
21.1 How often do you get the social and emotional support you need?
INTERVIEWER NOTE: If asked, say “please include support from any source.”
Please read:
1 Always
2 Usually
3 Sometimes
4 Rarely
5 Never
Do not read:
7 Don't know / Not sure 9 Refused

Demographics
Income
Is your annual household income from all sources—
If respondent refuses at ANY income level, code ‘99’ (Refused)
Read only if necessary:
04 Less than $25,000 If “no,” ask 05; if “yes,” ask 03 ($20,000 to less than $25,000)
03 Less than $20,000 If “no,” code 04; if “yes,” ask 02 ($15,000 to less than $20,000)
02 Less than $15,000 If “no,” code 03; if “yes,” ask 01 ($10,000 to less than $15,000)
01 Less than $10,000 If “no,” code 02
05 Less than $35,000 If “no,” ask 06 ($25,000 to less than $35,000)
06 Less than $50,000 If “no,” ask 07 ($35,000 to less than $50,000)
07 Less than $75,000 If “no,” code 08 ($50,000 to less than $75,000)
08 $75,000 or more
Age
What is your age?
   ___ Code age in years
   07 Don’t know/Not sure
   09 Refused

Age at diagnosis
22.3 At what age were you told that you had cancer?
Code age in years [97 = 97 and older] Don’t know / Not sure  Refused
CATI note: If Q22.2 = 2 (Two) or 3 (Three or more), ask: “At what age was your first diagnosis of cancer?”
INTERVIEWER NOTE: This question refers to the first time they were told about their first cancer.

Race/Ethnicity (Calculated from following variables)
12.2 Are you Hispanic or Latino?
   1 Yes
   2 No
   7 Don’t know / Not sure  9 Refused
12.3 Which one or more of the following would you say is your race?
(Check all that apply)
Please read:
   1 White
   2 Black or African American
   3 Asian
   4 Native Hawaiian or Other Pacific Islander
   5 American Indian or Alaska Native
   Or
   6 Other [specify]______________
   Do not read:
   8 No additional choices
   7 Don’t know/Not sure
   9 Refused
12.4 Which one of these groups would you say best represents your race?
   1 White
   2 Black or African American
   3 Asian
   4 Native Hawaiian or Other Pacific Islander
   5 American Indian or Alaska Native
   6 Other [specify]______________
   Do not read:
   7 Don’t know/Not sure
   9 Refused
Co-morbidities
BMI: Calculated from Height and Weight

12.11 About how much do you weigh without shoes?
____ Weight (pounds/kilograms)
7 7 7 7 Don’t know/Not sure
9 9 9 9 Refused

12.12 About how tall are you without shoes?
__/__ Height (’ft / inches/meters/centimeters)
7 7/7 7 Don’t know/Not sure
9 9/9 9 Refused

Diabetes
6.1 Have you ever been told by a doctor that you have diabetes?
If “Yes” and respondent is female, ask: “Was this only when you were pregnant?”
If respondent says pre-diabetes or borderline diabetes, use response code 4.
1 Yes
2 Yes, but female told only during pregnancy
3 No
4 No, pre-diabetes or borderline diabetes
7 Don’t know/Not sure 9 Refused

Weight Formula

FINALWT = STRWT* 1 OVER NPH * NAD * POSTSTR

STRWT: accounts for differences in the basic probability of selection among strata (subset of area code/prefix combinations)

1/NPH: is the inverse of the number of residential telephone numbers in the respondent’s household

NAD: number of adults in the respondent’s household

POSTSTR: adjusts for non-coverage and non-response, and forces the sum of the weighted frequencies to equal the population estimates for the region or state