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Ruth Westby 4/20/2014

Understanding the Effects of Sociodemographic Factors, Cancer-related Factors, BMI, and Social Support on the Health-Related Quality of Life of Cancer Survivors: A Report from the American Cancer Society's Study of Cancer Survivors-II (SCS-II)

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Abstract

Understanding the Effects of Sociodemographic Factors, Cancer-related Factors, BMI, and Social Support on the Health-Related Quality of Life of Cancer Survivors: A Report from the American Cancer Society's Study of Cancer Survivors-II (SCS-II)
By Ruth Westby

Guided by the Stress and Coping Theory, this quantitative study assessed the main and interactive effects of BMI and social support on the health-related quality of life (HRQ_OL) of male and female cancer survivors but adapted the framework to take the main and interactive effects of race, and other sociodemographic factors, into account as well. A cross-sectional survey, entitled the Study of Cancer Survivors II (SCS-II), was administered by the American Cancer Society to identify HRQ_OL issues among female breast, colorectal, prostate, bladder, skin melanoma, and uterine cancer survivors at two, five, and ten years post-diagnosis. In this study, data from 1,767 cancer survivors was included in final bivariate and multiple linear regression models. Two-step multiple linear regressions were conducted separately to assess the physical and mental HRQ_OL of male and female cancer survivors. Step-one of the model included sociodemographic factors, cancer-related factors, BMI, and social support while step-two added bivariate BMI, social support, and race interaction terms into the model. Results provided mixed support for various sociodemographic factors that were significantly correlated with the physical and mental HRQ_OL of each gender, with breast cancer the only cancer-related factor to be significant (physical HRQ_OL of female survivors). BMI was found to have significant main effects for physical HRQ_OL across gender while social support was found to have significant main effects on both physical and mental HRQ_OL across gender. Race moderated the relationship between social support and physical HRQ_OL among female cancer survivors and between BMI and mental HRQ_OL for both genders. No evidence was found to support the buffering hypothesis of the Stress and Coping Theory. The results of this study contribute a unique gender- and racial-specific perspective to cancer survivorship research and warrant continued study of racial differences for alterable correlates of HRQ_OL. Future research may be able to expand these findings to provide justification for potentially important HRQ_OL interventions targeting modifiable behavioral and psychosocial factors among particular subgroups of cancer survivors.

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Chapter 1: Introduction

Background and Significance

In January 2012, there were an estimated 13.7 million cancer survivors alive in the United States (Siegel et al., 2012). Cancer survivorship includes all individuals with either active disease or disease-free status since the time of their cancer diagnosis (National Cancer Institute, 2012). Due to improvements in effective screenings and treatments, cancer survivors are now living longer than ever before with 65% living five or more years after diagnosis and 40% surviving for 10 or more years (de Moor et al., 2013). The most common cancer survivors include female breast (22%), prostate (20%), colorectal (9%), and gynecologic (8%) (Siegel et al., 2012). Currently, 59% of cancer survivors are aged 65 years or older (Siegel et al., 2012). As the prevalence of cancer increases and the effectiveness of screenings and treatment are enhanced, it is projected that the number of cancer survivors will increase by 31%, or 4 million people, by 2022 (Howlader et al., 2012).

In response to the growing number of cancer survivors, researchers have emphasized the importance of studying disease sequelae following cancer diagnosis and treatment in order to better understand and improve their health-related quality of life (HRQ_OL) (National Cancer Institute, 2012). Overall, research has shown that a significant number of cancer survivors experience diminished physical and mental HRQ_OL for years after treatment when compared to the general population (Kattlove & Winn, 2003; Schultz, Beck, Stava, & Vassilopoulou-Sellin, 2003; Sunga, Eberl, Oeffinger, Hudson, & Mahoney, 2005; Yabroff, Lawrence, Clauser, Davis, & Brown, 2004). Specific HRQ_OL issues related to cancer survivors include physical issues (e.g.,

physiological problems, sexual dysfunction, urinary and bowel dysfunction, pain, and fatigue) as well as mental issues (e.g., anxiety, depression, and fears of recurrence) (Bosompra, Ashikaga, O'Brien, Nelson, & Skelly, 2002; Bower et al., 2006; Deimling, Bowman, Sterns, Wagner, & Kahana, 2006; Deimling, Kahana, Bowman, & Schaefer, 2002; Frumovitz et al., 2005; C. H. Kroenke et al., 2004; Miller et al., 2005). In 2010, 24.5% and 10.1% of cancer survivors reported poor physical and mental HRQ_OL, respectively, in comparison to 10.2% and 5.9% of the general population without cancer (Weaver et al., 2012).

While cancer survivors disproportionately experience poor physical and mental HRQ_OL compared to those who are cancer free, certain cancer survivors suffer at a disproportionate rate. Correlates of poor physical and mental HRQ_OL among survivors include lack of a partner, low socioeconomic status (SES), advanced cancer stage, invasive or systemic treatments, shorter time since diagnosis, increased frequency of comorbidities and symptoms, obesity, lack of physical activity, and psychosocial factors such as low social support and spirituality (Botteman, Pashos, Hauser, Laskin, & Redaelli, 2003; Eton & Lepore, 2002; Montazeri, 2008; S. K. Smith, Crespi, Petersen, Zimmerman, & Ganz, 2010; Tessier, Lelorain, & Bonnaud-Antignac, 2012). Age affects each domain of HRQ_OL differently, with old age negatively correlated with physical HRQ_OL (Tessier et al., 2012) and young age negatively correlated with mental HRQ_OL (Jensen et al., 2013; S. K. Smith et al., 2010).

Differences in HRQ_OL according to race have been largely understudied to date due to limited minority representation within cancer survivorship studies. Studies assessing the relationship have had mixed results linking minority races to poorer

physical and mental HRQ_OL outcomes (Janz et al., 2009; Matthews, Tejeda, Johnson, Berbaum, & Manfredi, 2012; Rao, Debb, Blitz, Choi, & Cella, 2008). However, there has been some evidence suggesting that minority races are more likely to be obese, a factor associated with poorer HRQoL (Paxton et al., 2012). In addition, one study demonstrated that race can moderate relationships between social support and HRQ_OL (Matthews et al., 2012). As a result, more studies assessing differences in HRQ_OL among specific races are needed. Studies should consider whether certain races interact with specific predictors of HRQ_OL.

Many correlates of HRQ_OL, such as race, cancer stage, and cancer treatment cannot easily be targeted with interventions or are not generally alterable. Therefore, a more comprehensive understanding of modifiable physical and psychosocial correlates of HRQ_OL is especially warranted. It is also important to determine whether those modifiable relationships only exist among certain subgroups that would benefit from targeted interventions. Using interventions to modify these alterable correlates may subsequently improve the HRQ_OL of cancer survivors even if other negative but unalterable correlates are present.

One particular cross-sectional study in Germany assessed whether social support moderated the relationship between obesity and HRQ_OL. Specifically, this study was conducted among 3,184 German adults aged 35-74 years and found compelling evidence that social support moderated the relationship between obesity and physical HRQ_OL among males within the general population but not among females (Wiczinski, Doring, John, & von Lengerke, 2009). A negative association between obesity and physical HRQ_OL was found among all women as well as among men reporting little or some

social support but not among obese males with high social support. While no significant association was found between obesity and mental HRQ_OL, the overall study findings have direct implications for the care of obese males and suggest that interventions increasing social support may help improve their physical HRQ_OL. Because previous interventions aimed at decreasing BMI in obese populations have had limited success since weight loss involves sustained nutrition and physical activity lifestyle changes (Curioni & Lourenco, 2005; Douketis, Macie, Thabane, & Williamson, 2005), intervening on social support may be especially beneficial for this group since interventions providing increased social support have been shown to improve HRQ_OL in a few prospective cohort studies and randomized control trials (Allart, Soubeyran, & Cousson-Gelie, 2013; Bjorneklett et al., 2013; Epplein et al., 2011; Kwan et al., 2010).

Study Purpose

With the findings from Wiczinski and colleagues (2009) in mind, this study seeks to assess whether BMI, social support, and their interaction term predict physical and mental HRQOL among male and female cancer survivors in the United States. If study results are similar to the aforementioned study, social support may serve as a moderator between BMI and HRQ_OL which could provide a potential mechanism for intervention among cancer survivors. In addition, this research will expand on the Wiczinski and colleagues (2009) study to determine whether race moderates either the BMI and HRQ_OL relationship or the social support and HRQ_OL relationship among male and female cancer survivors. This will help identify whether BMI and social support main effects are significant with HRQ_OL among certain racial groups and will contribute much needed information about minority survivors to the literature. While no association was found

between obesity and mental HRQ_OL in the Wiczinski and colleagues (2009) study, mental HRQ_OL will be assessed in conjunction with physical HRQ_OL in this study in order to determine whether its associations with BMI, social support, race, and the relevant interaction terms are significant among cancer survivors.

Theoretical Framework

The Stress and Coping Theory is the predominant theory of social support and has been extensively supported by research since the 1960s (Cohen & Wills, 1985; R. Lazarus, 1966; Lazarus & Folkman, 1984). The theory asserts that perceived social support serves as a buffer between stressors and physical and mental health outcomes through adaptive appraisal (Lazarus & Folkman, 1984; R. S. Lazarus, 1966). Specifically, appraisals are positive interpretations of stressful events that directly stem from perceived social support (Lakey & Cohen, 2000). For example, a primary appraisal is directly linked to the actual stressor (e.g. "Am I in trouble?"), whereas a secondary appraisal focuses on the coping resources available for controlling the stressor (e.g. "Is there someone who can help me with this?"). Figure 1 highlights the relationship between relevant constructs. Although this figure depicts perceived support buffering stress through appraisals, few well-developed appraisal measures exist (Monroe & Kelley, 1995). As a result, research has extensively studied and supported the use of perceived support as a direct stress buffering mechanism and has appropriately named the mechanism the buffering hypothesis (Cohen & Wills, 1985).

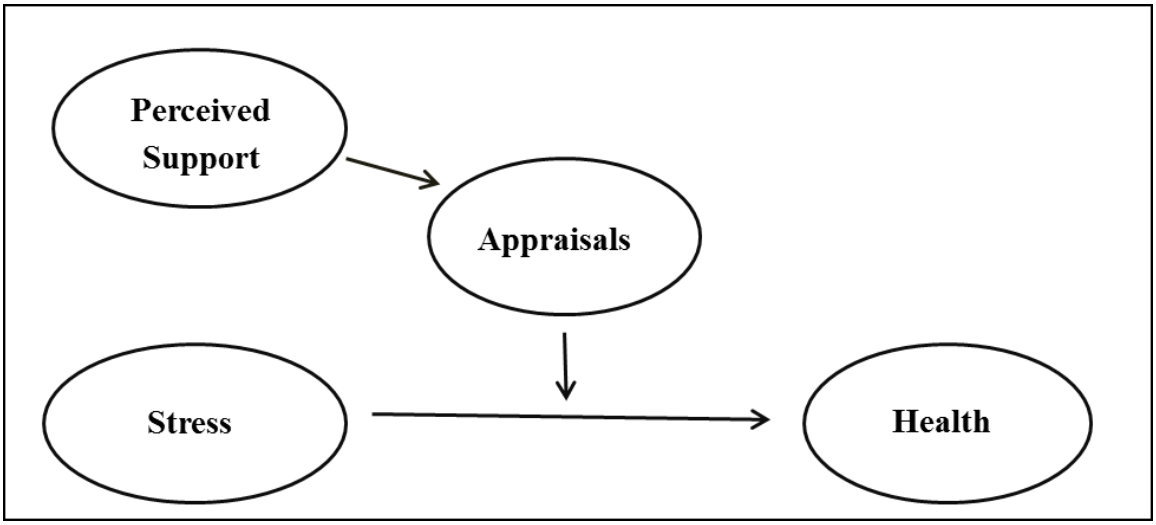

Figure 1. The Stress and Coping Theory, appraisal perspective & buffering hypothesis

Within the model, stressors range from major life events to chronic strains. The appraisal perspective of the theory explicitly relates to perceived support rather than actual received support (Thoits, 1995). The Stress and Coping Theory is a useful framework for the proposed study since obesity and cancer history are chronic stressful states that influence both mental experiences as well as the physical body (Kyrou, Chrousos, & Tsigos, 2006). Perceived support might include experiences of relatives or peers helping to alleviate physical limitations or offer emotional support with regard to the social stigmatization of obesity. Figure 2 highlights the adapted theoretical model for this study. In this adaptation, an arrow has been added linking perceived social support to HRQ_OL to indicate social support's main effect on HRQ_OL. Race has also been added to indicate its main effect on HRQ_OL as well as its role as a potential moderator between BMI and HRQ_OL as well as social support and HRQ_OL.

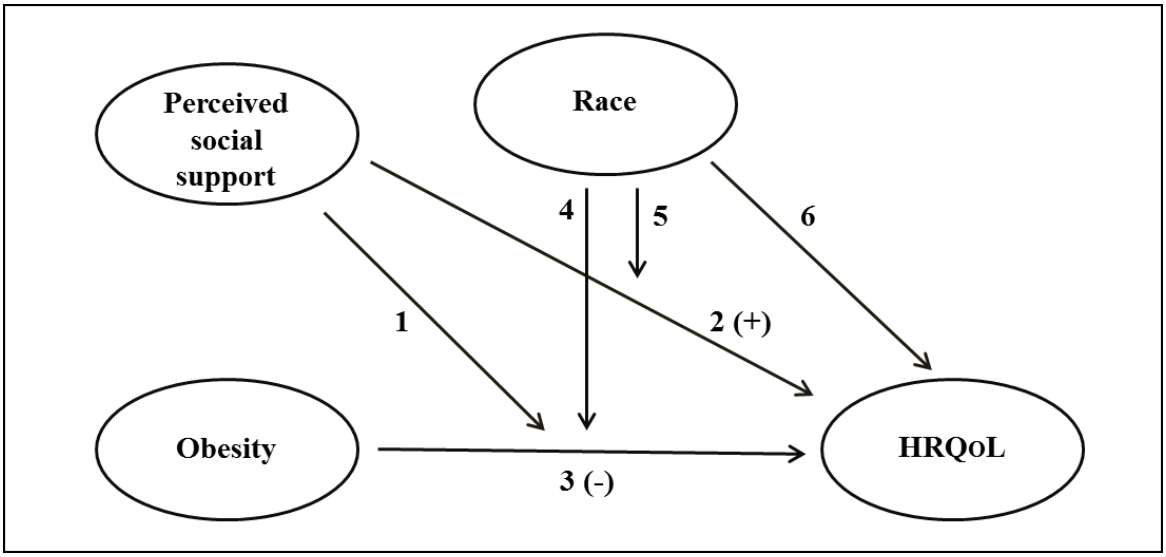

Figure 2. Adapted Stress and Coping Theory
1 Social support moderates obesity-HRQ_OL relationship (buffering hypothesis)
2 Social support main effects on HRQ_OL (main effect hypothesis)
3 Obesity main effects on HRQ_OL
4 Race moderates obesity-HRQ_OL relationship
5 Race moderates social support-HRQ_OL relationship
6 Race main effects on HRQ_OL

Research Aims

There are three aims of this study. Each aim will be accomplished separately for males and females across each of the physical and mental HRQ_OL domains.

Aim 1 seeks to determine whether specific sociodemographic and cancer-related factors are associated with HRQ_OL among cancer survivors. While differences are expected across gender and HRQ_OL domains, it is hypothesized that lower SES and later cancer stage will be negatively associated with HRQ_OL (Tessier et al., 2012; Wong, Lam, Poon, & Kwong, 2013) and it is possible that individuals from minority races may also experience poorer HRQ_OL (Pathway 6 in Figure 2) (Rao et al., 2008).

Aim 2 will assess the main effects of BMI (Pathway 3 in Figure 2) and social support (Pathway 2 in Figure 2) on HRQ_OL among cancer survivors. It is hypothesized that BMI will be negatively associated with physical HRQ_OL and that social support will

be positively associated with both physical and mental HRQ_OL (Blanchard, Stein, & Courneya, 2010; Courneya et al., 2005; Mehnert, Lehmann, Graefen, Huland, & Koch, 2010). Gender differences are expected with regards to the magnitude of these main effects (Clarke, Booth, Velikova, & Hewison, 2006; Wiczinski et al., 2009).

Aim 3 will assess the interaction effects that BMI, social support, and race have on each variable's respective relationship with HRQ_OL. The first interaction assessment will determine whether perceived social support moderates the relationship between BMI and HRQ_OL among cancer survivors (Pathway 1 in Figure 2). The second interaction assessment will determine whether race moderates the relationship between BMI and HRQ_OL among survivors (Pathway 4 in Figure 2). The third interaction assessment will determine whether race moderates the relationship between social support and HRQ_OL among survivors (Pathway 5 in Figure 2). While it is hypothesized that social support will significantly buffer the association between BMI and physical HRQ_OL among male survivors, it is unknown whether race will moderate either the relationship between BMI and HRQ_OL or social support and HRQ_OL among certain genders or HRQ_OL domains (Matthews et al., 2012; Wiczinski et al., 2009).

Chapter 2: Literature Review

Introduction

While extensive research has been done on the physical and mental HRQ_OL of cancer survivors in the past two decades, many research gaps still exist. As previously referenced, minority populations have been largely underrepresented in research, as have many types of less prevalent cancers. In the past, clinical or registry-based studies have

largely assessed participants based on specific cancer type in order to better understand disease-specific determinants of HRQ_OL. As a result, research has generally focused on the largest survivorships groups, with breast cancer research, in particular, contributing substantially to the literature on this issue. In fact, while little is known about some cancers with smaller survivorship rates, much of the breast cancer HRQ_OL research has shifted from identifying correlations to intervening on them (Duijts, Faber, Oldenburg, van Beurden, & Aaronson, 2011; Osborn, Demoncada, & Feuerstein, 2006; Rehse & Pukrop, 2003; Speck, Courneya, Masse, Duval, & Schmitz, 2010). Because of this discrepancy in disease-specific findings, this chapter seeks to briefly summarize findings on differences by specific cancer type for both physical and mental HRQ_OL domains. In addition, this chapter will highlight the respective relationships of race, BMI, and social support with physical and mental HRQ_OL across different cancer survivor types. With regards to the effects that BMI and social support have on HRQ_OL, efforts will be taken to highlight potential gender and racial differences. Lastly, this chapter will take a macro-level look at the role of the Stress and Coping Theory among cancer survivors.

Physical HRQ_OL among Cancer Survivors

As previously mentioned, specific physical HRQ_OL correlates found to be related to cancer survivors include disease and treatment specific factors, increased frequency of comorbidities and symptoms, obesity and/or lack of physical activity, and psychosocial factors. Disease and treatment specific factors, such as advanced cancer stage, systemic therapies (i.e. chemotherapy), and closer proximity to diagnosis, were positively associated with poorer physical HRQ_OL among breast, colorectal, prostate, cervical and

non-Hodgkin lymphoma cancer survivors (Eton & Lepore, 2002; Frumovitz et al., 2005; Montazeri, 2008; S. K. Smith et al., 2010; Tessier et al., 2012; Wong et al., 2013). Sexual dysfunction and urinary and bowel dysfunction affecting HRQ_OL were much more common among gynecological and urinary cancers, such as cervical, prostate, and bladder cancers (Botteman et al., 2003; Eton & Lepore, 2002; Frumovitz et al., 2005; Miller et al., 2005). These symptoms were also commonly found among breast cancer survivors (Montazeri, 2008). Additionally, greater comorbidity burden was found to reduce physical HRQ_OL among breast, colorectal, gynecological, lung, and hematological cancer survivors (Bosompra et al., 2002; Bower et al., 2006; Buffart et al., 2013; Jensen et al., 2013; C. H. Kroenke et al., 2004; Maguire et al., 2013; S. K. Smith et al., 2010). Obesity was found to affect physical HRQ_OL in breast, prostate, colorectal, uterine, skin melanoma, and endometrial cancer survivors (Blanchard et al., 2010; Courneya et al., 2005; Mosher et al., 2009; Paxton et al., 2012; Peuckmann et al., 2009). Moreover, the benefits of physical activity on physical and mental HQ_OL have been extensively studied among breast, colorectal, prostate, gynecological, and mixed groups of cancer survivors (Beesley, Eakin, Janda, & Battistutta, 2008; Blanchard et al., 2010; Duijts et al., 2011; Ferrer, Huedo-Medina, Johnson, Ryan, & Pescatello, 2011; Keogh & MacLeod, 2012; McNeely et al., 2006; Mosher et al., 2009; Paxton et al., 2012; Speck et al., 2010; Thraen-Borowski, Trentham-Dietz, Edwards, Koltyn, & Colbert, 2013). High levels of social support and/or spirituality has been associated with higher physical HRQ_OL in groups of breast, hematological, and mixed cancer survivors (Allart et al., 2013; Eom et al., 2013; Montazeri, 2008). In addition, breast, colorectal, prostate, and non-Hodgkin lymphoma studies have found that older age, not having a partner, and/or having a lower

SES is often correlated with poorer physical HRQ_OL (K. T. Ashing-Giwa & Lim, 2009; Jensen et al., 2013; C. H. Kroenke et al., 2004; Montazeri, 2008; S. K. Smith et al., 2010; Tessier et al., 2012).

Mental HRQ_OL among Cancer Survivors

Mental HRQ_OL among cancer survivors has similar and distinct correlates relative to physical HRQ_OL. Similar correlates include age, partner status, SES, cancer-specific factors (i.e. stage, treatment intensity, and time since diagnosis), comorbidities, physical activity, and psychosocial factors like social support and spiritual well-being (Allart et al., 2013; K. T. Ashing-Giwa & Lim, 2009; Beesley et al., 2008; Jensen et al., 2013; Kim, Carver, Spillers, Crammer, & Zhou, 2011; S. K. Smith et al., 2010; Tessier et al., 2012; Thraen-Borowski et al., 2013; Wong et al., 2013). However, mental HRQ_OL correlates also include anxiety, fear of recurrence, depression, health information needs, self-esteem, and coping strategies. Specifically, anxiety and/or stress have been negatively associated with mental HRQ_OL among breast, lung, and groups of mixed cancer survivors (Duijts et al., 2011; Maguire et al., 2013; Montazeri, 2008; Osborn et al., 2006; Speck et al., 2010), as have fears of recurrence among bladder, breast, colorectal, kidney, lung, non-Hodgkin lymphoma, ovarian, prostate, skin melanoma, and uterine cancer survivors (Kim, Carver, Spillers, Love-Ghaffari, & Kaw, 2012; Maguire et al., 2013). Similarly, depression has been shown to be associated with poorer mental HRQ_OL among breast, lung, and mixed groups of cancer survivors (Duijts et al., 2011; Maguire et al., 2013; Montazeri, 2008; Osborn et al., 2006; Reyes-Gibby, Anderson, Morrow, Shete, & Hassan, 2012; Speck et al., 2010). Finally, low health information needs, high self-

esteem, and greater coping strategies have been found to contribute to higher mental HRQ_OL among groups of breast, prostate, colorectal, and gynecological survivors (Allart et al., 2013; Kent et al., 2012). Breast and mixed cancer studies have shown that physical activity can often ameliorate many mental HRQ_OL issues (Duijts et al., 2011; Speck et al., 2010). Additionally, cognitive based-therapies have also been effective at reducing anxiety and depression and improving mental HRQ_OL among mixed groups of cancer survivors (Osborn et al., 2006; Rehse & Pukrop, 2003).

Race and HRQ_OL among Cancer Survivors

As mentioned previously, most cancer survivorship studies have not had adequate representation of minorities. As a result, continued attention has been placed on creating more inclusive studies that can make meaningful racial and ethnic assessments (Rao et al., 2008). One recent cross-sectional assessment of racial/ethnic differences among 2268 breast cancer survivors found that lower acculturated Latinas had significantly worse functional well-being, emotional well-being, and breast cancer concerns than Whites (Janz et al., 2009; Rao et al., 2008). In this same study, African Americans had significantly higher emotional well-being than Whites. Yet another cross-sectional study of 492 breast, prostate, and colorectal cancer survivors found African Americans to have poorer mental HQ_OL than Whites (Matthews et al., 2012). Overall, studies suggest good general HRQ_OL scores among various racial and ethnic groups, but the small sample sizes representing these groups results in inconsistent evidence within the domains of quality of life across the literature (K. Ashing-Giwa, Ganz, & Petersen, 1999;

Giedzinska, Meyerowitz, Ganz, & Rowland, 2004; Gotay, Holup, & Pagano, 2002; Krupski et al., 2005). More research is needed before conclusions can be drawn.

BMI and HRQ_OL among Cancer Survivors

As highlighted earlier, the relationship between BMI and HRQ_OL has been assessed fairly extensively and found to be negatively correlated among the general population (Anandacoomarasamy et al., 2009; Bentley et al., 2011; Cameron et al., 2012; Huisingh-Scheetz, Bilir, Rush, Burnet, & Dale, 2013; Soltoft, Hammer, & Kragh, 2009), comparably fewer studies have assessed the relationship among cancer survivors. Still, findings among cancer survivors generally suggest that an increase in BMI is associated with poorer physical HRQOL and that there are mixed results for the relationship between BMI and mental HRQOL (Blanchard et al., 2010; Chlebowski, Aiello, & McTiernan, 2002; Courneya et al., 2005; Peuckmann et al., 2009). One systematic review evaluated the relationship between excess weight and health outcomes within 159 observational and prospective breast cancer studies and found that being overweight or gaining weight after diagnosis were both associated with lower HRQ_OL and higher risks of recurrence and death (Chlebowski et al., 2002). In addition, population-based cross-sectional surveys in Canada and Denmark found significant relationships between BMI and global and physical HRQ_OL in endometrial and breast cancer types, respectively (Courneya et al., 2005; Peuckmann et al., 2009). One recently published American Cancer Society study using the Study of Cancer Survivors-II data (the same data set used in the current study) found that BMI was negatively associated with physical HRQ_OL among breast, prostate, colorectal, uterine, and skin melanoma cancer survivors

(Blanchard et al., 2010). Significant results for the BMI and mental HRQ_OL relationship were limited to colorectal cancer survivors (Blanchard et al., 2010). Neither the Canadian nor the American Cancer Society studies found BMI and physical activity to have interactive effects on HRQ_OL.

Only one study of which the authors are aware examined the relationship between BMI and HRQ_OL by race or ethnicity within the context of cancer survivorship. The Women's Healthy Eating and Living Study assessed over 3,000 breast cancer survivors with a baseline survey to evaluate the relationship between physical activity and BMI with HRQOL outcomes by race/ethnicity (Paxton et al., 2012). Results showed that African American women were significantly more likely to be obese than other races/ethnicities, but that differences in physical HRQOL and overall HRQOL between non-obese and obese participants were only significant among White participants (Paxton et al., 2012). Another cross-sectional study assessing racial differences in the BMI-HRQ_OL relationship outside of the cancer survivorship context found that while BMI was independently associated with worse physical HRQOL, the relationship was not different across racial/ethnic subgroups (Huisingh-Scheetz et al., 2013).

No cancer survivorship studies of which the author is aware examined the BMI-HRQ_OL relationship by gender. Within two general adult population-based studies, obese women were found to have significantly poorer physical and mental HRQ_OL scores than non-obese women (Bentley et al., 2011; Garner et al., 2012). This negative association between BMI and HRQ_OL was not found for men in one study (Garner et al., 2012) and was only found for physical HRQ_OL in another (Bentley et al., 2011).

Social support and HRQ_OL among Cancer Survivors

While Wiczinski and colleagues (2009) found that social support served as a buffering mechanism between obesity and HRQ_OL among the general population in Germany, this finding has not been shown among cancer survivors. In actuality, there is limited research assessing social support as a buffering mechanism between stressors and HRQ_OL among cancer survivors. One cross-sectional study of 260 gynecological cancer survivors 2 to 10 years from diagnosis provided evidence that social support from a broad network of friends moderated the relationship between cancer-related physical symptomatology and mental quality of life (Carpenter, Fowler, Maxwell, & Andersen, 2010). Another cross-sectional study with a sample of 511 prostate cancer survivors who had previously had a radical prostatectomy found that positive social support interacted with depression, anxiety, and post-traumatic stress disorder to improve mental HRQ_OL in addition to being independently and positively associated with both physical and mental HRQ_OL (Mehnert et al., 2010).

The main effects of social support have been more extensively studied and supported within the cancer survivorship literature. One widely cited prospective study assessed the social networks of women without breast cancer as part of the Nurse's Health Study (NHS) and found that women with larger networks who developed breast cancer over a 4-year time frame had better general and cancer-specific HRQ_OL than socially isolated women who developed breast cancer (Michael, Berkman, Colditz, Holmes, & Kawachi, 2002). Similarly, a prospective study of 175 prostate cancer survivors found that perceived social support at baseline predicted higher levels of HRQ_OL at two year follow-up. Further, the relationship was partially mediated by the

patient's perceived level of stress at baseline (Zhou et al., 2010). Numerous cross-sectional studies of cancer survivors have consistently found that social support is significantly associated with mental and global HRQ_OL. For example, a nationwide cross-sectional study of 1930 cancer survivors in Korea found that social support was positively associated with global health and HRQ_OL scores and negatively correlated with depression among a group of stomach, lung, liver, colorectal, breast, and cervical cancer survivors (Eom et al., 2013). A cross-sectional study in Turkey found that social support was significantly associated with physical and mental HRQ_OL scores among 226 breast cancer survivors (Filazoglu & Griva, 2008), whereas another cross-sectional study of 886 non-Hodgkin lymphoma survivors in the United States found that social support was just significantly associated with mental HRQ_OL (S. K. Smith et al., 2010).

Racial or ethnic differences, with regard to the buffering hypothesis of social support, have not been assessed among cancer survivors, but general differences in social support and its main effects on HRQ_OL among different races/ethnicities has been examined. Asian breast cancer survivors have reported smaller social networks for social support than White breast cancer survivors (Wen, Fang, & Ma, 2014), and African American breast cancer survivors have been shown to have more social support than African American healthy controls (Von Ah et al., 2012). Race also moderated the relationship between social support and mental HRQ_OL in one cross-sectional study of 492 breast, prostate, and colorectal cancer survivors such that higher social support was only associated with increased mental HRQ_OL among African Americans (Matthews et al., 2012). Similarly, while Whites reported significantly higher levels of perceived social support than Latinas among 280 cancer survivors in the northeastern United States

(Sammarco & Konecny, 2010), social support predicted 15.1% of the variance in general HRQ_OL among the 89 Latinas in that study (Sammarco & Konecny, 2008).

A few studies have highlighted differences in the types of social support sought by males and females, but studies assessing gender differences in the relationship between social support and HRQ_OL among cancer survivors have been limited. With regard to gender differences, research has shown that women are more comfortable expressing psychological and support-specific needs by asking for help, actively seeking information from medical professionals, and reporting symptoms compared to their male counterparts (Clarke et al., 2006; K. Kroenke & Spitzer, 1998). Women also tend to have larger social networks outside of the family, whereas men tend to rely on their partners and sometimes their doctors for support (Harrison, Maguire, & Pitceathly, 1995; Keller & Henrich, 1999). Despite these differences in types of support sought, a cross-sectional study assessing a mixed group of 342 cancer survivors found no difference in the relationship between social support and depressive symptoms according to gender (Hann et al., 2002). While not statistically significant, there was a trend suggesting that having a larger social network was associated with reporting less severe depression but only among females (Hann et al., 2002).

Theoretical Framework

Despite the relatively recent shift to studying HRQ_OL among cancer survivors, numerous studies have assessed varying coping strategies as buffering mechanisms for stress and quality of life outcomes. For example, a cross-sectional study assessed specific cognitive appraisals, coping strategies, and depressive symptoms among 65 advanced

breast cancer survivors and found that higher appraisals of harm/loss and higher use of escape-avoidance coping strategies led to an increased number of depressive symptoms (Bigatti, Steiner, & Miller, 2012). Another cross-sectional study of 1276 colorectal cancer survivors approximately 5 months out from diagnosis found that threat appraisal, coping resources, avoidant coping and benefit-finding directly impacted the quality of life outcome, while threat appraisal, social support and approach coping directly impacted benefit-finding appraisal (Rinaldis, Pakenham, & Lynch, 2012). Many other types of appraisals and coping mechanisms have been tested among cancer survivors, including appraisals of challenge and coping strategies that generally focus on altering the problem or the emotions associated with the problem (Franks & Roesch, 2006). Yet, despite an emphasis on stress and coping, relatively few studies have tested perceived social support as a specific coping strategy for cancer survivors (Allart et al., 2013; Bjorneklett et al., 2013; Kwan et al., 2010). As mentioned in the last section, most studies assessing perceived social support have looked at the relationship with regard to the independent main effects hypothesis within the Theory of Stress and Coping rather than the buffering hypothesis (Cohen & Wills, 1985; R. Lazarus, 1966).

Summary

Because of the limited and inconsistent knowledge regarding the roles that race, BMI, and social support play in the physical and mental HRQ_OL of male and female cancer survivors, this study aims to examine both the main effects (aim 2) and buffering effects (aim 3) that these variables have with regard to HRQ_OL. In addition, this study aims to better understand the sociodemographic and cancer-related factors associated

with HRQ_OL among survivors (aim 1). The nature of these relationships will have important implications for cancer survivorship care. Ideally, this study will also contribute to the generalizability of cancer-specific findings since it includes a large population-based sample and will assess relationships across genders, races, and cancer types.

Chapter 3: Methodology

Introduction

The purpose of this study was to determine whether specific sociodemographic and cancer-related factors are associated with HRQ_OL among cancer survivors (aim 1), assess the main effects of BMI and social support on HRQ_OL among cancer survivors (aim 2), and assess the interaction effects that BMI, social support, and race have on each variable's respective relationship with HRQ_OL (aim 3). The research design for the present study was a cross-sectional survey entitled the Study of Cancer Survivors II (SCS-II) and was administered by the American Cancer Society (ACS) to identify Q_OL issues among cancer survivors at two, five, and ten years post-diagnosis (T. Smith et al., 2007). Approval for the study was obtained from the Emory University Institutional Review Board as well as from each cancer registry where information was obtained. In addition, the Emory University Institutional Review Board determined that no additional IRB review was required for this subsequent secondary review of de-identified data.

Participants and Procedure

The SCS-II survey is composed of well-known psychosocial scales and other behavioral items of interest and was developed in consultation with a panel of medical and behavioral cancer experts, focus groups of cancer survivors, and through pilot-testing with survivors prior to distribution (T. Smith et al., 2007). Participants of the SCS-II study were identified through population-based cancer registries in Arizona, California, Colorado, Delaware, Illinois, Iowa, Maine, Massachusetts, Michigan, Nebraska, New Jersey, Pennsylvania, Washington, and Wyoming. By drawing probability samples from each state cancer registry, the SCS-II was more likely to include representation from all demographic groups. To ensure appropriate representation of cancer patients, the sample size for each state was stratified according to two, five, and ten year post-diagnosis cohorts, and cases were sampled to ensure approximate representation of the most common cancers within each cohort: 25% breast cancer, 25% colorectal cancer, 25% prostate cancer, and a 25% combination of melanoma, bladder cancer, and uterine cancers (T. Smith et al., 2007). Racial stratification was also conducted in states where further survivor distribution would not lead to empty or sparse cells. A full rationale and description of SCS-II methodology has been published elsewhere (T. Smith et al., 2007).

To be eligible for the study, participants had to be 18 years or older at the time of diagnosis, diagnosed with a local, regional, or distant SEER summary staged cancer (including in situ bladder cancer cases), a resident of the target state at the time of diagnosis, diagnosed in the calendar year either two, five, and ten years prior to sampling, and diagnosed with either female breast, colorectal, prostate, bladder, skin melanoma, or uterine cancers (T. Smith et al., 2007). Survivors were excluded if they were unable to

complete the survey because of mental incompetence, illness, or inability to communicate in English or Spanish. Overall, 36,372 cancer survivors were sampled from 16 registries across 14 states. Of these survivors, 2,586 were found to be ineligible due to invalid or missing cancer diagnosis information, and another 4,157 were deemed ineligible due to missing or not meeting eligibility criteria (e.g. not above age 18 or deceased). Of the remaining 29,629 participants, 26,802 survivors were contacted after their physicians gave active or passive consent for their patients to be contacted. From this sample, 7,616 survivors refused to participate, 2,885 were not locatable, and 7,196 did not respond. As a result, a total of 9,105 cancer survivors consented to be in the study with an adjusted overall consent rate of 32.7% (T. Smith et al., 2007). The final survey version took 60 minutes to complete and could be answered in English or Spanish.

In the sample of 9,105 respondents, only 3,306 participants were asked to self-report height and weight due to the addition of these variables after SCS-II survey distribution had already begun (Blanchard et al., 2010). Of these participants, 3,132 survivors self-reported height and weight allowing for BMI computation. Therefore, only those respondents were retained for analyses. Additionally, because HRQ_OL is the primary outcome of interest, those with missing HRQ_OL variables were excluded from analysis (n=144) as well as those currently undergoing treatment (n=1110) since treatment might serve as a confounder between BMI and HRQ_OL. Finally, because of small percentages within this subsample, Hispanics and those not categorized as White, Black, or Hispanic (n=111) were excluded from analysis resulting in a final sample size of 1,767.

Measures

Sociodemographic Characteristics. Age and gender were provided by the cancer registry, while race, marital status, education, employment status, and income were self-reported by participants at the time of survey-completion (T. Smith et al., 2007). Specifically, age was reported as a continuous variable and gender categories included male or female options. Race was self-reported with categories including non-Hispanic White, non-Hispanic Black, and Hispanic. In final analyses, the Hispanic category had to be dropped because of a small sample size. The larger non-Hispanic White category became the referent group. Marital status had two categories including being married or in a married-like relationship and being single, divorced, separated, or widowed. In final analyses, being married or in a married-like relationship became the referent group. Education had four categories including less than a high school degree, high school graduate, vocational school or some college, and college graduate or higher. In final analyses, less than a high school education became the referent group. Employment status had three categories including employed, unemployed, and retired. Income was recoded into four categories including less than $20,000, $20,000 - $39,999, $40,000 - $74,999, and $75,000 or more.

Cancer-related Factors. Time since diagnosis, cancer type, and cancer stage were all provided by the cancer registry. Time since diagnosis, or cohort, was categorized as either two, five, or ten years post-diagnosis. Cancer type was listed as breast, prostate, colorectal, bladder, uterine, or skin melanoma. In final analyses, skin melanoma became the referent group in order to remain consistent with prior American Cancer Society research studies. Finally, cancer stage was recorded as a dichotomous variable with

categories of in situ or localized disease and regional or distant disease. In final analyses, in situ or localized disease became the referent group.

BMI. BMI was used as a continuous variable in all analyses and was calculated based on self-reported height and weight [weight lb/ (height in²)*703] (Centers for Disease Control and Prevention, 2011). For the descriptive analysis, BMI was also treated as a categorical variable according to World Health Organization standards in order to assess frequencies of each BMI category. BMI categories included underweight (BMI<18.5 kg/m²), normal weight (BMI=18.5-24.99 kg/m²), overweight (BMI=25.0-29.99 kg/m²), and obese (BMI≥30.0 kg/m²) (World Health Organization, 2006).

Social Support. The Multidimensional Scale of Perceived Social Support (MSPSS) is a 12-item scale reflecting perceived social support from family, friends, and a significant other without a specific timeframe (Zimet, Dahlem, Zimet, & Farley, 1988). Sample items include "I can talk about my problems with my family" (family), "I can count on my friends when things go wrong" (friends), and "There is a special person who is around when I'm in need" (significant other). The level of perceived support for each question is scored on a Likert-scale from (1) "very strongly disagree" to (7) "very strongly agree" resulting in a total summed score ranging from 12 to 84. Higher summed total scores indicate higher perceived social support.

HRQ_OL. The RAND-36 Health Status Inventory was used to assess health-related quality of life. It is a well-validated measure and is one of the most frequently used instruments to assess HRQ_OL in cancer survivors (Blanchard et al., 2004; Camilleri-Brennan & Steele, 2001; Ganz, Rowland, Desmond, Meyerowitz, & Wyatt, 1998; Hays, 1998). The measure includes four physical HRQ_OL domains (i.e. physical functioning,

role-physical, bodily pain, and general health) and four mental HRQ_OL domains (i.e. vitality, social functioning, role-emotional, and mental health). Each related domain is summed and weighted to create separate physical and mental composite scores that are then compared to the United States population using a norm-based algorithm. The U.S. norm for both physical and mental HRQ_OL has been scored to have a mean of 50 and a standard deviation of 10 points. Therefore, a composite score below 50 indicates a below average health status with each point serving as one-tenth of a standard deviation (Ware, n.d.). Similarly, a composite score above 50 indicates an above average health status compared to the United States population.

Statistical Analysis

The data from the surveys was screened and analyzed using IBM SPSS version 21.0. Descriptive characteristics were first generated to highlight sociodemographic information, cancer-related factors, and variables of interest for the entire sample. Pearson r correlations, independent t-tests, and one-way ANOVA analyses were conducted in order to determine whether the variables of interest were significantly related to either physical or mental HRQ_OL composite scores at the bivariate level. Multicollinearity of variables was then assessed to examine whether variables were correlated with each other above $r>.70$. Next, two-step multiple linear regressions using the Enter method were conducted separately for both males and females: step 1 included sociodemographic and cancer-related factors as well as main effects of both BMI and social support, and step 2 subsequently added BMI*MSPSS, BMI*Race, and MSPSS*Race interaction terms. Finally, post hoc Pearson r correlation tests were

conducted when necessary to better understand the relationship between significant interaction terms and physical and mental HRQ_OL.

Chapter 4: Results

Study Participants

Among the sample of 1,767 participants, demographic characteristics, cancer-related factors, and outcomes of interest were first assessed. All participant characteristics are highlighted in Table 1. Overall, the average age was 67.36 (SD=11.51). The majority of the sample was female (53.3%; n=941) and non-Hispanic White (85.9%; n=1517). With regard to marital status, 69.7% (n=1232) reported being married or in a married-like relationship and 29.8% (n=526) reported being single, divorced, separated, or widowed. For education status, 12.1% (n=214) had less than a high school degree, 26.6% (n=470) had graduated from high school, 25.7% (n=455) had attended vocational school or some college, and 31.8% (n=562) had graduated from college or a received a higher degree. With regard to employment status, 35.3% (n=623) were employed, 12.0% (n=212) were not employed, and exactly 50.0% (n=883) of the sample was retired. Reported income varied across the sample with 15.1% (n=266) making less than $20,000 a year, 26.8% (n=473) making between $20,000 and $39,999, 22.0% (n=389) making between $40,000 and $74,999, 15.6% (n=276) making $75,000 or more, and 20.6% (n=363) either preferring not to answer or leaving the question blank.

Cancer-related factors also differed across the sample. Two, five, and ten years post-diagnosis cohort group sizes varied with 27.8% (n=492) being approximately two years out from diagnosis, 41.5% (n=734) being roughly five years out, and 30.6%

(n=541) being ten years out from diagnosis. For cancer type diagnosis, 26.8% (n=473) of the sample reported having had breast cancer, 24.6% (n=434) prostate cancer, 22.5% (n=398) colorectal cancer, 10.6% (n=187) skin melanoma, 9.1% (n=160) uterine cancer, and 6.5% (n=115) bladder cancer. Approximately three-fourths of the sample had in situ or localized cancer stage (75.3%; n=1331).

The participants' BMI, social support, and HRQ_OL values also ranged. The average continuous BMI measurement was 28.33 (SD=5.90), and when separated into BMI categories, 28.4% (n=503) were either underweight or of normal weight, 41.3% (n=729) of the sample were overweight, and 30.3% (n=535) were obese. The average social support score was 68.21 (SD=14.03). Lastly, the norm-based composite averages for HRQ_OL was 47.04 (SD=10.92) for physical HRQ_OL and 53.02 (SD=9.07) for mental HRQ_OL.

Multicollinearity and Variable Inclusion

Bivariate analyses were conducted to determine whether sociodemographic, cancer-related, BMI, and MSPSS variables were significantly associated with the physical and mental HRQ_OL composite scores as well as to assess multicollinearity among all variables. While no variables were found to be correlated with each other at $r>.70$, income and education were significantly correlated ($r=.221$; $p<.001$) enough to warrant selection of one factor for inclusion in the multivariate analyses. We chose to use education as a socioeconomic proxy due to the high percentage of missing income data. Table 1 shows the results from bivariate analyses assessing correlates of both physical and mental HRQ_OL.

Table 1. Participant characteristics and bivariate analyses examining correlates of health-related quality of life (HRQ_OL)

	Total	Physical HRQ_OL		Mental HRQ_OL	
Variable	**M (SD) or N (%) [a]**	**M (SD) or r [b]**	**p-value**	**M (SD) or r [b]**	**p-value**
Age (n=1765)	67.36 (11.51)	-.222	<.001	.156	<.001
Gender			.011		.001
Male	826 (46.7%)	47.75 (10.20)		53.77 (8.09)	
Female	941 (53.3%)	46.43 (11.48)		52.36 (9.80)	
Race			<.001		.468
White	1517 (85.9%)	47.54 (10.67)		53.09 (8.90)	
Black	250 (14.1%)	44.06 (11.91)		52.60 (10.02)	
Marital Status			<.001		.004
Married or Married-like relationship	1232 (69.7%)	48.27 (10.44)		53.48 (8.41)	
Single/Divorced/ Separated/ Widowed	526 (29.8%)	44.24 (11.49)		51.99 (10.27)	
Missing	9 (0.5%)				
Education			<.001		.014
Less than HS	214 (12.1%)	43.89 (10.49)		51.63 (9.46)	
HS Grad	470 (26.6%)	45.37 (11.62)		52.65 (9.55)	
Vocational school/ some college	455 (25.7%)	47.08 (11.22)		52.92 (9.17)	
College grad or more	562 (31.8%)	49.80 (9.41)		53.85 (8.19)	
Missing	66 (3.7%)				
Employment			<.001		<.001
Employed	623 (35.3%)	51.03 (8.71)		52.69 (8.46)	
Not Employed	212 (12.0%)	43.27 (12.84)		50.83 (11.36)	
Retired	883 (50.0%)	45.19 (11.01)		53.83 (8.76)	
Missing	49 (2.8%)				
Income		*	-	*	-
Less than $20,000	266 (15.1%)	-		-	
$20,000-$39,999	473 (26.8%)	-		-	
$40,000-$74,999	389 (22.0%)	-		-	
$75,000 or more	276 (15.6%)	-		-	
Prefer not to answer/ Missing	363 (20.6%)	-		-	
Cohort			.059		.846
Two Years Post-Diagnosis	492 (27.8%)	48.02 (10.14)		52.82 (9.29)	
Five Years Post-Diagnosis	734 (41.5%)	46.54 (11.43)		53.11 (8.76)	
Ten Years Post-Diagnosis	541 (30.6%)	46.84 (10.86)		53.08 (9.28)	
Cancer Type			<.001		.001
Breast	473 (26.8%)	46.13 (11.41)		52.36 (9.99)	
Prostate	434 (24.6%)	48.31 (9.98)		54.61 (7.74)	
Colorectal	398 (22.5%)	45.79 (11.40)		53.02 (8.58)	
Skin Melanoma	187 (10.6%)	51.32 (9.23)		52.64 (8.63)	
Uterine	160 (9.1%)	45.47 (11.18)		51.64 (10.72)	
Bladder	115 (6.5%)	45.58 (10.65)		52.25 (8.96)	

Table 1. (continued)

	Total	Physical HRQ_OL		Mental HRQ_OL	
Variable	**M (SD) or N (%)** [a]	**M (SD) or r** [b]	**p-value**	**M (SD) or r** [b]	**p-value**
Stage			.009		.659
In situ/ Localized	1331 (75.3%)	47.43 (10.87)		53.07 (8.99)	
Regional/ Distant	436 (24.7%)	45.86 (11.00)		52.85 (9.32)	
BMI-continuous	28.33 (5.90)	-.254	<.001	-.070	.003
BMI-categorical			-		-
Underweight/ Normal weight	503 (28.4%)	-		-	
Overweight	729 (41.3%)	-		-	
Obese	535 (30.3%)	-		-	
MSPSS Total (n=1722)	68.21 (14.03)	.122	<.001	.226	<.001
SF-36 Physical HRQ_OL	47.04 (10.92)	-	-	-	-
SF-36 Mental HRQ_OL	53.02 (9.07)	-	-	-	-

[a]M (SD) for continuous variables; N (%) for categorical variables.
[b]M (SD) for categorical variables; r for continuous variables.
*Not included due to high correlation with education.

Physical HRQ_OL

Bivariate Analyses. First, Pearson r correlations were conducted between physical HRQ_OL and other continuous variables. Younger age (r=-.222; p<.001), lower BMI (r=-.254; p<.001), and higher MSPSS (r=.122; p<.001) were related to higher physical HRQ_OL. Second, independent t-tests were conducted to compare mean physical HRQ_OL scores across dichotomous groups. In this sample, males had significantly higher physical HRQ_OL scores (M=47.75; SD=10.20) than females (M=46.43; SD=11.48) (t=2.56; df=1764.72; p=0.11) and non-Hispanic Whites had significantly higher physical HRQ_OL scores (M=47.54; SD=10.67) than non-Hispanic Blacks (M=44.06; SD=11.91) (t=4.33; df=318.38; p<.001). Those who were married or in a married-like relationship had significantly higher physical HRQ_OL scores (M=48.27; SD=10.44) than those who were single, divorced, separated, or widowed (M=44.24; SD=11.49) (t=6.91; df=912.09; p<.001). Finally, those with in situ or localized cancer stage had significantly higher physical HRQ_OL scores (M=47.43; SD=10.87) than those with a regional or distant cancer stage (M=45.86; SD=11.00) (t=2.61; df=1765; p=.009).

Third, one-way Analysis of Variance (ANOVA) tests were conducted to compare mean physical HRQ_OL scores across variables with more than two groups. Specifically, these variables included education, employment, cancer cohort, and cancer type. A statistically significant difference was observed in mean physical HRQ_OL scores among the four education groups ($F(3, 1697)=22.50$, $p<.001$). Tamhane's T2 post hoc test suggests that there was no statistical difference in mean physical HRQ_OL scores among those with less than a high school degree and high school graduates ($p=.463$) or among high school graduates and participants attending vocational school or some college ($p=.132$). However, the mean physical HRQ_OL score for those with a college degree or higher ($M=49.80$; $SD=9.41$) was significantly higher than for those attending vocational school or some college ($M=47.08$; $SD=11.22$; $p<.001$), high school graduates ($M=45.37$; $SD=11.62$; $p<.001$), and those with less than a high school degree ($M=43.89$; $SD=10.49$; $p<.001$). Similarly, the mean physical HRQ_OL score was significantly higher for those attending vocational school or some college ($M=47.08$; $SD=11.22$) than for those with less than a high school degree ($M=43.89$; $SD=10.49$; $p=.002$). In regard to employment, a statistically significant difference was observed in mean physical HRQ_OL scores among the three employment groups ($F(2, 1715)=72.31$, $p<.001$). Tamhane's T2 post hoc test suggests that there was no statistical difference in mean physical HRQ_OL scores among unemployed or retired participants ($p=.128$). However, the mean physical HRQ_OL score for employed participants ($M=51.03$; $SD=8.71$) was significantly higher than for unemployed ($M=43.27$; $SD=12.84$; $p<.001$) or retired participants ($M=45.19$; $SD=11.01$; $p<.001$). No significant differences in physical HRQ_OL scores were found among the three cancer cohort groups ($F(2, 1764)=2.83$, $p=.059$). Finally, a statistically significant

difference was observed in mean physical HRQ_OL scores among the six cancer types ($F(5, 1761)=9.93$, $p<.001$). Tamhane's T2 post hoc test suggests that the mean physical HRQ_OL score for those with skin melanoma ($M=51.32$; $SD=9.23$) was significantly higher than for those with breast cancer ($M=46.13$; $SD=11.41$; $p<.001$), prostate cancer ($M=48.31$; $SD=9.98$; $p=.005$), colorectal cancer ($M=45.79$; $SD=11.40$; $p<.001$), bladder cancer ($M=45.58$; $SD=10.65$; $p<.001$), or uterine cancer ($M=45.47$; $SD=11.18$; $p<.001$). Additionally, the mean physical HRQ_OL score was significantly higher for those with prostate cancer ($M=48.31$; $SD=9.98$) than for those with breast cancer ($M=46.13$; $SD=11.41$; $p=.033$) or colorectal cancer ($M=45.79$; $SD=11.40$; $p=.011$).

Multivariate Analyses. All variables assessed in bivariate analyses were included in subsequent two-step multiple linear regression models using the Enter method. Although cancer cohort had not been significantly associated with physical HRQ_OL at the bivariate level, it was included in the regression models because of its potential importance as a cancer-related factor. Regressions were run separately for both male and female genders and variables were added in two-steps: sociodemographic variables, cancer-related factors, BMI, and social support in step 1 (Model A) and BMI*MSPSS, BMI*Race, and MSPSS*Race interaction terms in step 2 (Model B). Results for each of these models are included in Table 2.

Males. Regression results among male cancer survivors suggest that Model A explains 18.8% of the variance of physical HRQ_OL and Model B explains 19.3% of the variance of physical HRQ_OL. Final Model B results will be reported here, with any significant differences from Model A noted. In Model B, results suggest that age, vocation school or some college, a college degree or higher, unemployment, retirement,

and BMI are all associated with physical HRQ_OL when controlling for other sociodemographic and cancer-related factors. Specifically, for each year increase in age, physical HRQ_OL composite scores decrease on average by .244 points (β=-.244; 95%CI=-.329, -.159; p<.001). When compared with those who had less than a high school degree, those who attended vocation school or some college had a physical HRQ_OL score that was on average 2.992 points higher (β=2.992; 95%CI=.702, 5.283; p=.011) and those with a college degree or higher had a physical HRQ_OL score that was on average 4.670 points higher (β=4.670; 95%CI=2.447, 6.893; p<.001). Additionally, when compared to employed participants, those who were unemployed had a physical HRQ_OL score that was 6.488 points lower on average (β=-6.488; 95%CI=-9.809, -.3.167; p<.001) and those who were retired had a physical HRQ_OL score that was 1.764 points lower on average (β=-1.764; 95%CI=-3.447, -.081; p=.040). This slightly contrasts with Model A because retirement had previously had a p-value just greater than .05 (p=.053). With regards to BMI in Model B, for every unit increase in BMI, physical HRQ_OL decreased by 1.232 points on average (β=-1.232; 95%CI=-2.044, -.421; p=.003). Main effects for MSPSS had previously been significant in Model A (β=.085; 95%CI=.035, .136; p=.001) but became insignificant in Model B (β=-.200; 95%CI=-.522, .123; p=.225). Finally, none of the new interaction terms added in Model B were significantly associated with physical HRQ_OL among male cancer survivors, although the interaction between BMI and MSPSS was somewhat approaching significance (p=.078).

Females. Regression results among female cancer survivors suggest that Model A explains 24.9% of the variance of physical HRQ_OL and Model B explains 25.5% of the variance of physical HRQ_OL. Once again, final Model B results will be reported here

with only significant differences from Model A noted. In Model B, results suggest that age, black race, marriage or a marriage-like relationship, unemployment, retirement, breast cancer, and the interaction term between MSPSS and race are all associated with physical HRQ_OL when controlling for other sociodemographic factors and cancer-related factors. Specifically, for each year increase in age, physical HRQ_OL composite scores decreased on average by .179 points (β=-.179; 95%CI=-.255, -.103; p<.001). On average, black participants had a physical HRQ_OL score that was 13.451 points lower than white participants (β=-13.451; 95%CI=-25.522, -1.381; p=.029), and participants who were married or in a married-like relationship had a physical HRQ_OL score that was 1.668 points higher than those who were single, divorced, separated, or widowed (β=1.668; 95%CI=.129, 3.207; p=.034). Additionally, when compared to employed participants, those who were unemployed had a physical HRQ_OL score that was 4.728 points lower on average (β=-4.728; 95%CI=-6.737, -2.718; p<.001) and those who were retired had a physical HRQ_OL score that was 3.225 points lower on average (β=-3.225; 95%CI=-5.086, -1.364; p<.001). On average, those with a breast cancer diagnosis had a physical HRQ_OL score that was 3.006 points lower (β=-3.006; 95%CI=-5.355, -.658; p=.012) than those with a skin melanoma diagnosis.

Main effects for BMI and MSPSS were significant in Model A but not significant in Model B. In Model A, with each unit increase in BMI, physical HRQ_OL decreased on average by .424 points (β=-.424; 95%CI=-.526, -.322; p<.001), and with each unit increase in MSPSS, physical HRQ_OL increased by .069 points (β=.069; 95%CI=.020, .117; p=.006). However, in Model B, neither BMI (p=.078) nor MSPSS (p=.649) remained significant. Finally, the interaction term for MSPSS and race was significantly

associated with physical HRQ_OL among female cancer survivors (β=.163; 95%CI=.036, .291; p=.012). Therefore, post hoc Pearson r correlation tests were conducted to assess the association of MSPSS and physical HRQ_OL among respective non-Hispanic White and non-Hispanic Black female cancer survivor groups. Pearson r correlation results show that for each unit increase in MSPSS among non-Hispanic White female survivors, physical HRQ_OL composite scores increased on average by .099 points (r=.099; p=.006). Results were also significant among non-Hispanic Black female survivors and showed that for each unit increase in MSPSS among non-Hispanic Black female survivors, physical HRQ_OL composite scores increased on average by .201 points (r=.201; p=.014).

Mental HRQ_OL

Bivariate Analyses. Like with physical HRQ_OL, Pearson r correlations were first conducted to assess the association between mental HRQ_OL and other continuous variables. Older age (r=.156; p<.001), lower BMI (r=-.070; p=.003), and higher MSPSS (r=.226; p<.001) all had statistically significant associations with mental HRQ_OL. Next, independent t-tests were conducted to compare mean mental HRQ_OL scores across dichotomous groups. In this sample, males had significantly higher mental HRQ_OL scores (M=53.77; SD=8.09) than females (M=52.36; SD=9.80) (t=3.31; df=1758.34; p=.001), and those who were married or in a married-like relationship had significantly higher mental HRQ_OL scores (M=53.48; SD=8.41) than those who were single, divorced, separated, or widowed (M=51.99; SD=10.27) (t=2.92; df=839.42; p=.004). No significant difference in mental HRQ_OL was observed between non-Hispanic Whites and non-

Hispanic Blacks (t=.727, df=317.04, p=.468) or between those with in situ or localized cancer stage and those with regional or distant disease (t=.441; df=1765; p=.659). Lastly, one-way ANOVA tests were conducted to compare mean mental HRQ_OL scores across education, employment, cancer cohort, and cancer type groups. A statistically significant difference was observed in mean mental HRQ_OL score between the education groups (F(3, 1697)=3.57, p=.014). Tamhane's T2 post hoc test suggests that there was only a statistical difference in mean mental HRQ_OL scores between those without a high school degree and those with a college degree or higher. The mean mental HRQ_OL score for those with a college degree or higher (M=53.85; SD=8.18) was significantly higher than for those with less than a high school degree (M=51.63; SD=9.46; p=.016). In terms of employment, a statistically significant difference was observed in mean mental HRQ_OL scores among the employment groups (F(2, 1715)=10.24, p<.001). Tamhane's T2 post hoc test suggests that there was no statistical difference in mean mental HRQ_OL scores between employed or unemployed participants (p=.086). However, the mean mental HRQ_OL score for retired participants (M=53.83; SD=8.76) was significantly higher than for employed (M=52.69; SD=8.46; p=.033) or unemployed participants (M=50.83; SD=11.36; p=.001). No significant differences in mental HRQ_OL scores were found among the three cancer cohort groups (F(2, 1764)=.168, p=.846). Finally, a statistically significant difference was observed in mean mental HRQ_OL scores among the cancer types (F(5, 1761)=4.19, p=.001). Tamhane's T2 post hoc test suggests that the mean mental HRQ_OL score for those with prostate cancer (M=54.61; SD=7.74) was significantly higher than for those with breast cancer (M=52.36; SD=9.99; p=.002) and uterine cancer (M=51.64; SD=10.72; p=.023). No other statistical differences were found

Table 2. Multiple linear regression results for Physical Health-related Quality of Life (HRQ_OL) among males and females

	Males [a]						Females [b]					
	Model A			Model B			Model A			Model B		
Variable	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**
Age	-.245	-.331, -.161	<.001*	-.243	-.329, -.159	<.001*	-.182	-.250, -.098	<.001*	-.188	-.255, -.103	<.001*
Race												
White	Reference			Reference			Reference			Reference		
Black	.041	-.868, 3.499	.237	.194	-11.544, 23.961	.493	-.083	-4.603, -.607	.011*	-.427	-25.522 -1.381	.029*
Marital Status												
Single/ Divorced/ Separated/ Widowed	Reference			Reference			Reference			Reference		
Married/ Married-like relationship	.008	-1.692, 2.166	.809	.016	-1.483, 2.400	.643	.074	.164, 3.246	.030*	.072	.129, 3.207	.034*
Education												
Less than HS Grad	Reference			Reference			Reference			Reference		
HS Degree	.047	-1.208, 3.425	.348	.042	-1.316, 3.328	.395	.005	-2.272, 2.502	.925	.007	-2.207, 2.562	.884
Vocation School/ Some College	.128	.649, 5.230	.012*	.130	.702, 5.283	.011*	.008	-2.263, 2.666	.873	.009	-2.232, 2.696	.853
College Grad or More	.220	2.480, 6.925	<.001*	.219	2.447, 6.893	<.001*	.078	-.544, 4.333	.128	.077	-.563, 4.315	.132
Employment												
Employed	Reference			Reference			Reference			Reference		
Unemployed	-.126	-9.343, -2.765	<.001*	-.135	-9.809, -3.167	<.001*	-.165	-6.746, -2.735	<.001*	-.165	-6.737, -2.718	<.001*
Retired	-.080	-3.338, .022	.053	-.085	-3.447, -.081	.040*	-.147	-5.228, -1.510	<.001*	-.141	-5.086, -1.364	.001*
Cohort												
2 years Post-Diagnosis	Reference			Reference			Reference			Reference		
5 years Post-Diagnosis	-.038	-2.387, .825	.340	-.036	-2.353, .862	.363	-.060	-3.078, .312	.110	-.066	-3.202, .188	.081
10 years Post-Diagnosis	-.008	-1.992, 1.634	.846	-.002	-1.865, 1.769	.958	-.030	-2.515, 1.082	.435	-.031	-2.548, 1.049	.414

Table 2. (continued)

	Males [a]						Females [b]					
	Model A			Model B			Model A			Model B		
Variable	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**
Cancer Type												
Skin Melanoma	Reference			Reference			Reference			Reference		
Prostate Cancer	.057	-1.104, 3.431	.314	.057	-1.103, 3.432	.314	N/A	N/A	N/A	N/A	N/A	N/A
Breast Cancer	N/A	N/A	N/A	N/A	N/A	N/A	-.129	-5.272, -.570	.015*	-.133	-5.355, -.658	.012*
Colorectal Cancer	-.036	-3.347, 1.693	.520	-.037	-3.383, 1.655	.501	-.032	-3.777, 1.963	.535	-.041	-4.036, 1.713	.428
Bladder Cancer	.000	-2.881, 2.895	.996	.001	-2.854, 2.924	.981	-.058	-8.275, .604	.090	-.061	-8.430, .447	.078
Uterine Cancer	N/A	N/A	N/A	N/A	N/A	N/A	-.051	-4.302, 1.224	.275	-.053	-4.356, 1.166	.257
Cancer Stage												
In situ/ Localized	Reference			Reference			Reference			Reference		
Regional/ Distant	-.005	-1.924, 1.673	.891	-.010	-2.048, 1.563	.792	-.061	-3.192, .125	.070	-.055	-3.057, .264	.099
BMI	-.231	-.703, -.379	<.001*	-.526	-2.044, -.421	.003*	-.264	-.526, -.322	<.001*	-.258	-.877, .047	.078
MSPSS	.114	.035, .136	.001*	-.267	-.522, .123	.225	.087	.020, .117	.006*	.059	-.154, .247	.649
Interaction continuous BMI & MSPSS	-	-	-	.498	-.001, .022	.078	-	-	-	-.010	-.007, .007	.956
Interaction continuous BMI & Race	-	-	-	-.143	-.664, .344	.534	-	-	-	.002	-.260, .264	.987
Interaction MSPSS & Race	-	-	-	-.009	-.162, .154	.960	-	-	-	.349	.036, .291	.012*

[a]R-squared for Models A and B are .188 and .193, respectively. Change in R-squared for step 2 in Model B = .005.
[b]R-squared for Models A and B are .249 and .255, respectively. Change in R-squared for step 2 in Model B = .006.
[c] Unstandardized Betas are used throughout the Results section to allow for meaningful interpretation while standardized Betas are reported in Table 2 to allow for easier comparison across variables.
*=Significant at P<.05

between cancer types.

Multivariate Analyses. Like with physical HRQ_OL, all variables assessed in bivariate analyses with mental HRQ_OL were included in subsequent two-step multiple linear regression models using the Enter method. Although race, cancer cohort, and cancer stage had not been significantly associated with mental HRQ_OL at the bivariate level, those variables were included in the regression models because of their potential importance as sociodemographic and cancer-related factors. Like in physical HRQ_OL analyses, regressions were run separately for both male and female genders and included variables in two-steps: sociodemographic characteristics, cancer-related factors, BMI, and MSPSS in step 1 (Model A) and BMI*MSPSS, BMI*Race, and MSPSS*Race interaction terms in step 2 (Model B). Results for each of these models are included in Table 3.

Males. Regression results among male cancer survivors suggest that Model A explains 10.1% of the variance in mental HRQ_OL and Model B explains 11.0% of the variance in mental HRQ_OL. Final Model B results will be reported here with any significant differences from Model A noted. In Model B, results suggest that marriage or a marriage-like relationship, a college degree or higher, and the BMI and race interaction term are all associated with mental HRQ_OL when controlling for other sociodemographic factors and cancer-related factors. Specifically, those who married or in a married-like relationship had a mental HRQ_OL score that was on average 2.219 points higher (β=2.219; 95%CI=.593, 3.846; p=.008) than those who were single, divorced, separated, or widowed. Additionally, on average, those with a college degree or higher had a mental HRQ_OL score that was 2.613 points higher than those with less than a high school degree

(β=2.613; 95%CI=.750, 4.475; p=.006). Finally, the interaction term for BMI and race was significantly associated with mental HRQ_OL among male cancer survivors (β=.476; 95%CI=.054 .898; p=.027). Therefore, post hoc Pearson r correlation tests were conducted to assess the association of BMI and mental HRQ_OL among respective non-Hispanic White and non-Hispanic Black male cancer survivor groups. Pearson r correlation results show that for each unit increase in BMI among non-Hispanic White male survivors, mental HRQ_OL composite scores decreased on average by .094 points (r=-.094; p=.011). There was no significant association between BMI and mental HRQ_OL among non-Hispanic Black male survivors (p=.410).

Differences in Model A and Model B with regards to the mental HRQ_OL of male cancer survivors include that non-Hispanic Black race, unemployment, and MSPSS had been significant in Model A but did not remain significant in Model B. With regards to race, Model A shows that non-Hispanic Black participants had a mental HRQ_OL score that was 2.035 points higher on average than non-Hispanic White participants (β=2.035; 95%CI=.201, 3.868; p=.030) whereas it was no longer significant in Model B (p=.548). Similarly, in Model A, those who were unemployed had a mental HRQ_OL score that was 2.786 points lower on average than those who were employed (β=-2.786; 95%CI=-5.548, -.024; p=.048) but the unemployment p-value shifted slightly higher to p=0.50 in Model B. Finally, with regard to MSPSS, Model A showed that for each unit increase in MSPSS, mental HRQ_OL increased on average by .128 points (β=.128; 95%CI=.086, .170; p<.001), whereas MSPSS in Model B did not remain significant (p=.509).

Females. Regression results among female cancer survivors suggest that Model A explains 11.2% of the variance in mental HRQ_OL and Model B explains 11.9% of the

variance in mental HRQ_OL. In Model B, results suggest that age, vocation school or some college, a college degree or higher, MSPSS, and the BMI and race interaction term are all associated with mental HRQ_OL when controlling for other sociodemographic factors and cancer-related factors. Specifically, for each year increase in age, mental HRQ_OL composite scores increased on average by .203 points (β=.203; 95%CI=.133, .274; p<.001). When compared to those with less than a high school degree, those who had attended vocation school or some college had a mental HRQ_OL score that was 2.497 points higher on average (β=2.497; 95%CI=.205, 4.789; p=.033), and those with a college degree or higher had a mental HRQ_OL score that was 3.352 points higher on average (β=3.352; 95%CI=1.083, 5.620; p=.004). Additionally, for each unit increase in MSPSS, mental HRQ_OL composite scores increased on average by .264 points (β=.264; 95%CI=.077, .451; p=.006). Lastly, the interaction term for BMI and race was significantly associated with mental HRQ_OL among female cancer survivors (β=.274; 95%CI=.031, .518; p=.027). Therefore, post hoc Pearson r correlation tests were conducted to assess the association of BMI and mental HRQ_OL among respective non-Hispanic White and non-Hispanic Black female cancer survivor groups. Pearson r correlation results show that for each unit increase in BMI among non-Hispanic White female survivors, mental HRQ_OL composite scores decreased on average by .101 points (r=-.101; p=.005). There was no significant association between BMI and mental HRQ_OL among non-Hispanic Black female survivors (p=.079).

Chapter 5: Discussion

Introduction

The three aims of this study were to determine whether specific sociodemographic and cancer-related factors are associated with HRQ_OL among cancer survivors (aim 1), assess the main effects of BMI and social support on HRQ_OL among cancer survivors (aim 2), and assess the interactive effects that BMI, social support, and race have on HRQ_OL (aim 3). Each aim was accomplished through the assessment of four two-step multiple linear regressions: male physical HRQ_OL, female physical HRQ_OL, male mental HRQ_OL, and female mental HRQ_OL. The first step of each multiple linear regression incorporated sociodemographic and cancer-related factors as well as BMI and social support main effects (aims 1 and 2). The second-step of each multiple linear regression added the specific BMI, social support, and race interaction terms into the model (aim 3); the interaction terms were: BMI and social support, BMI and race, and social support and race. Each of the aims is discussed in this chapter according to both type of HRQ_OL and gender.

Theoretical Framework

The Stress and Coping Theory was used as a framework for testing both the main and buffering effects of social support on HRQ_OL in addition to the main effects of a high BMI stressor on HRQ_OL among male and female cancer survivors. In addition, the theoretical framework was adapted to allow for the assessment of the main and moderating effects of race on those relationships. This adaptation allows for more heightened assessment of how race influences correlates of HRQ_OL among cancer

Table 3. Multiple linear regression results for Mental Health-related Quality of Life (HRQ_OL) among males and females

	Males [a]						Females [b]					
	Model A			Model B			Model A			Model B		
Variable	**β[c]**	**CI**	**β[c]**	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**
Age	.085	-.003, .140	.060	.084	-.004, .139	.064	.247	.131, .272	<.001*	.249	.133, .274	<.001*
Race												
White	Reference			Reference			Reference			Reference		
Black	.080	.201, 3.868	.030*	-.178	-19.419, 10.323	.548	.017	-1.405, 2.313	.632	-.292	-19.104 3.350	.169
Marital Status												
Single/ Divorced/ Separated/ Widowed	Reference			Reference			Reference			Reference		
Married/ Married-like relationship	.101	.654, 3.893	.006*	.099	.593, 3.846	.008*	.056	-.327, 2.540	.130	.055	-.340, 2.523	.135
Education												
Less than HS Grad	Reference			Reference			Reference			Reference		
HS Degree	.075	-.524, 3.367	.152	.083	-.368, 3.522	.112	.093	-.241, 4.201	.080	.096	-.174, 4.262	0.71
Vocation School/ Some College	.091	-.254, 3.593	.089	.092	-.238, 3.599	.086	.112	.159, 4.745	.036*	.114	.205, 4.789	.033*
College Grad or More	.148	.652, 4.384	.008*	.153	.750, 4.475	.006*	.165	1.161, 5.699	.003*	.162	1.083, 5.620	.004*
Employment												
Employed	Reference			Reference			Reference			Reference		
Unemployed	-.073	-5.548, -.024	.048*	-.073	-5.558, .006	.050	-.054	-3.189, .543	.164	-.058	-3.287, .450	.137
Retired	-.055	-2.330, .492	.201	-.054	-2.305, .514	.213	.008	-1.573, 1.887	.859	.004	-1.662, 1.800	.938
Cohort												
2 years Post-Diagnosis	Reference			Reference			Reference			Reference		
5 years Post-Diagnosis	.021	-1.008, 1.689	.620	.024	-.956, 1.737	.570	.014	-1.303, 1.851	.733	.017	-1.247, 1.906	.682
10 years Post-	-.023	-1.939,	.591	-.024	-1.959,	.573	.022	-1.207,	.585	.024	-1.180,	.563

Diagnosis		1.105			1.085			2.140			2.165	

Table 3. (continued)

	Males [a]						Females [b]					
	Model A			Model B			Model A			Model B		
Variable	**β[c]**	**CI**	**β[c]**	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**	**β[c]**	**CI**	**P**
Cancer Type												
Skin Melanoma	Reference			Reference			Reference			Reference		
Prostate Cancer	.068	-.802, 3.006	.256	.064	-.863, 2.936	.284	N/A	N/A	N/A	N/A	N/A	N/A
Breast Cancer	N/A	N/A	N/A	N/A	N/A	N/A	-.049	-3.135, 1.240	.396	-.043	-3.029, 1.340	.448
Colorectal Cancer	.033	-1.506, 2.725	.572	.034	-1.480, 2.740	.558	-.037	-3.576, 1.765	.506	-.030	-3.415, 1.932	.586
Bladder Cancer	-.030	-3.225, 1.625	.517	-.029	-3.174, 1.667	.541	.019	-3.064, 5.197	.612	.025	-2.748, 5.509	.512
Uterine Cancer	N/A	N/A	N/A	N/A	N/A	N/A	-.053	-3.929, 1.213	.300	-.047	-3.770, 1.366	.359
Cancer Stage												
In situ/ Localized	Reference			Reference			Reference			Reference		
Regional/ Distant	-.012	-1.758, 1.262	.747	-.011	-1.722, 1.303	.786	.012	-1.279, 1.807	.737	.016	-1.193, 1.896	.655
BMI	-.037	-.204, .068	.324	-.132	-.926, .434	.478	-.006	-.102, .087	.875	.164	-.204, .655	.303
MSPSS	.215	.086, .170	<.001*	.153	-.179, .361	.509	.209	.096, .187	<.001*	.389	.077, .451	.006*
Interaction continuous BMI & MSPSS	-	-	-	.109	-.008, .011	.714	-	-	-	-.264	-.010, .002	.187
Interaction continuous BMI & Race	-	-	-	.535	.054, .898	.027*	-	-	-	.333	.031, .518	.027*
Interaction MSPSS & Race	-	-	-	-.273	-.236, .029	.124	-	-	-	-.010	-.122, .114	.949

[a] R-squared for Models A and B are .101 and .110, respectively. Change in R-squared for step 2 in Model B = .009.
[b] R-squared for Models A and B are .112 and .119, respectively. Change in R-squared for step 2 in Model B = .007.
[c] Unstandardized Betas are used throughout the Results section to allow for meaningful interpretation while standardized Betas are reported in Table 2 to allow for easier comparison across variables.
*=Significant at P<.05

survivors and advances a largely understudied area of both the Stress and Coping Theory and cancer survivorship research in general. As such, the main and moderating effects of each variable within the Adapted Stress and Coping Theory model in Figure 2 will be discussed in the context of the three research aims.

Aim 1: Sociodemographic and Cancer-Related Factors on HRQ_OL

The first aim of this study was to determine whether specific sociodemographic and cancer-related factors are associated with HRQ_OL among cancer survivors.

Physical HRQ_OL. Male and female cancer survivors share some common sociodemographic correlates of high physical HRQ_OL and have some distinct correlates as well. In particular, younger age and being employed (when compared to being unemployed or retired) were associated with a higher physical HRQ_OL among both male and female survivors. Among male cancer survivors, having attended vocation school or some college and having a college education or higher were both significantly associated with higher physical HRQ_OL when compared to having less than a high school degree. Among female cancer survivors, being non-Hispanic White and being married or in a married-like relationship were both significantly associated with higher physical HRQ_OL.

The relationship between age and physical HRQ_OL is not unexpected since younger age has been linked to higher physical HRQ_OL among both male and female cancer survivors in prior research (S. K. Smith et al., 2010; Tessier et al., 2012). However, it is interesting to note the varying degrees to which SES variables influenced physical HRQ_OL, with employment status influencing both genders and education status only influencing male survivors. This may indicate different gender perceptions on SES

issues like education, or that a male's education might restrict the type of employment he is able to find. However, based on previous studies, it had been expected that both of these variables would be associated with higher physical HRQ_OL (K. T. Ashing-Giwa & Lim, 2009; Tessier et al., 2012). Additionally, while it was not surprising that being married or in a married-like relationship might be correlated with higher physical HRQ_OL among females (Jensen et al., 2013), it was not entirely anticipated that non-Hispanic White females would have higher physical HRQ_OL than non-Hispanic Black females; thus, future research examining the relationship between race and physical HRQ_OL is warranted.

The only cancer-related factor that was correlated with high physical HRQ_OL was a breast cancer diagnosis among females when compared to a referent skin melanoma diagnosis. These results are surprising since both higher cancer stage and closer time to diagnosis have been found to be associated with lower physical HRQ_OL in prior research (Tessier et al., 2012; Wong et al., 2013). Additional research is needed to examine mean physical HRQ_OL composite scores across different cancer types in order to better understand why only breast cancer was negatively associated with physical HRQ_OL when compared to skin melanoma. This may indicate that other referent categories should be considered and explored. Specific attention should be paid to the particular cancer stage and time since diagnosis represented across each cancer type since differences may exist across these subsamples.

Mental HRQ_OL. Male and female cancer survivors shared only one sociodemographic correlate of mental HRQ_OL. Specifically, a college degree or higher was associated with higher mental HRQ_OL for both gender groups. Among male

survivors, being married or in a married-like relationship was also associated with higher mental HRQ_OL. Additionally, when only the main effects were considered in Model A, being non-Hispanic Black and being employed were also significant correlates of mental HRQ_OL among male survivors. Among female survivors, older age and attending vocation school or some college were also significantly associated with higher mental HRQ_OL. Once the interactive effects were added into Model B for male survivors, race was no longer a significant sociodemographic factor for mental HRQ_OL.

Once again, it is not surprising that higher education, as a proxy for SES, is significantly correlated with higher mental HRQ_OL (K. T. Ashing-Giwa & Lim, 2009; Rehse & Pukrop, 2003; Tessier et al., 2012), yet it is interesting that the significant levels of education remain different across male and female survivors as well as contrast the significance of employment. Here, education level appears to have a greater and more significant effect on the mental HRQ_OL of both genders than employment status did. Additionally, it is not surprising that the mental HRQ_OL of male survivors significantly improved with marriage or a marriage-like relationship, and that males benefitted from a marriage or marriage-like relationship more than females (Harrison et al., 1995; Jensen et al., 2013). Gender differences also existed with regards to age since older age was only significantly associated with higher mental HRQ_OL among female survivors; however, this age relationship was approaching significance among male survivors ($p=.064$). Overall, gender differences with regard to sociodemographic factors should continue to be assessed in future research.

There were no cancer-related factors associated with mental HRQ_OL among either gender group. Like with physical HRQ_OL, this lack of association is surprising since

other studies have noted statistically significance relationships between both cancer stage and mental HRQ_OL and time since diagnosis and mental HRQ_OL (S. K. Smith et al., 2010; Wong et al., 2013). Additional research is needed for further assessment, especially among different cancer types.

Aim 2: Main Effects of BMI and Social Support on HRQ_OL

The second aim of this study was to assess the main effects of BMI and social support on HRQ_OL among cancer survivors.

Physical HRQ_OL. There were many inconsistencies with regard to the main effects of BMI and social support on physical HRQ_OL among both genders. Specifically, BMI and social support were often associated with physical HRQ_OL in Model A but did not remain significant in Model B. With regard to BMI, lower BMI was significantly associated with higher physical HRQ_OL among male survivors in both models, whereas lower BMI was only significantly associated with higher physical HRQ_OL among female survivors in Model A. With regard to social support, higher social support was significantly associated with higher physical HRQ_OL among both male and female survivors, but only in Model A. Overall, these results suggest that both BMI and social support have main effects on physical HRQ_OL among both male and female survivors, as has been found elsewhere (Blanchard et al., 2010; Filazoglu & Griva, 2008; Garner et al., 2012; Michael et al., 2002). Inconsistencies of significance across the two different models was the result of the added BMI and social support interaction terms explaining some of the variance associated with each respective variable in Model B.

Mental HRQ_OL. BMI was not significantly associated with mental HRQ_OL among either male or female survivors. Because another study using the same dataset found this relationship to be significant among colorectal cancer survivors (Blanchard et al., 2010), additional analyses on specific genders and races of colorectal cancer survivors are warranted. On the other hand, higher social support was associated with higher mental HRQ_OL among females in both Models, and among males in only Model A. This evidence that social support is positively correlated with mental HRQ_OL has also been found elsewhere in the literature (Eom et al., 2013; Filazoglu & Griva, 2008; S. K. Smith et al., 2010; Zhou et al., 2010).

Aim 3: Bivariate Interactive Effects of BMI, Social Support, and Race on HRQ_OL

The third aim of this study was to assess the interactive effects that BMI, social support, and race have on HRQ_OL.

Physical HRQ_OL. Adding the BMI and social support, BMI and race, and social support and race interaction terms only explained an additional .5% of the variance in physical HRQ_OL among male survivors and an additional .6% of the variance in physical HRQ_OL among female survivors. In actuality, none of the interaction terms were significantly associated with physical HRQ_OL among males, although the BMI and social support interaction term was somewhat nearing significance ($p=.078$). As a result, it may be possible that social support could serve as a moderator between BMI and physical HRQ_OL among a specific subset of this male sample (Wiczinski et al., 2009). However, it was not found to be the case among all male cancer survivors in this sample, and therefore the buffering hypothesis of the Stress and Coping Theory is not supported.

Among female survivors, the social support and race interaction term was found to be significantly associated with physical HRQ_OL. Upon further bivariate examination of the relationship between social support and physical HRQ_OL among both non-Hispanic White and non-Hispanic Black females, high social support was found to be significantly associated with high physical HRQ_OL for both races. This indicates that the moderation of race on this relationship is evident through the magnitude of the correlation, and that social support is more strongly correlated with physical HRQ_OL among non-Hispanic Black females than non-Hispanic White females. Explorative research studies should seek to better understand this relationship since it may be a result of the types of social support offered among each racial group or the way in which each respective group appraises the social support offered. Additional research is also warranted to determine whether this relationship continues to exist with larger subsamples of non-Hispanic Black females, as well as with other races.

Mental HRQ_OL. Adding the BMI and social support, BMI and race, and social support and race interaction terms only explained an additional .9% of the variance in mental HRQ_OL among male survivors and an additional .7% of the variance in mental HRQ_OL among female survivors. Despite previous research suggesting that race moderated the relationship between social support and mental HRQ_OL (Matthews et al., 2012), the only interaction term significantly associated with mental HRQ_OL was the BMI and race interaction term, which was significant across both male and female survivor groups. Results from subsequent Pearson r correlation tests indicated that BMI was significantly associated with mental HRQ_OL among non-Hispanic White males but not among non-Hispanic Black males. Similarly, there was only a significant association

between BMI and mental HRQ_OL among non-Hispanic White females but not among non-Hispanic Black females. Thus, it appears that race moderates the relationship between BMI and mental HRQ_OL among both gender groups, and that BMI is negatively associated with mental HRQ_OL only among non-Hispanic White cancer survivors. As previously mentioned, continued research should be done to assess whether perceptions of high BMI on HRQ_OL are different among each racial group as well as with larger and more diverse racial subsamples.

Conclusions

Overall, this study sheds important light on the effects of sociodemographic characteristics, cancer-related factors, BMI, and social support on physical and mental HRQ_OL and highlights differences according to gender and race. While many of the sociodemographic characteristics found to be associated with the physical and mental HRQ_OL of cancer survivors had also been realized in prior research, many interesting differences were noted between male and female survivors, particularly with regard to racial, marital status, and education status. Additionally, the limited number of cancer-related factors that were found to be significantly associated with the physical and mental HRQ_OL of survivors suggests that additional research is warranted with regards to cancer type, cancer stage, and time since diagnosis. Because survivors with specific cancer types and lower cancer stages may live longer or suffer disproportionately from certain correlates, future studies should continue to assess correlates of HRQ_OL within and between these cancer groups.

BMI and social support were both found to have significant main effects on the HRQ_OL of male and female survivors as anticipated in the Adapted Stress and Coping

Theory model in Figure 2. Specifically, BMI and social support both contributed significantly to the physical HRQ_OL of male and female survivors while social support contributed significantly to the mental HRQ_OL of male and female survivors. Therefore, they may present possible avenues for future interventions targeting the improvement of HRQ_OL among cancer survivors in their own respective manner.

Finally, the effects of the BMI, social support, and race interaction terms on the physical and mental HRQ_OL of male and female survivors were mixed. Unlike the Wiczinski et al.(2009) study, social support was not found to be a moderator for BMI and physical HRQ_OL among males in this study of cancer survivors. Thus, the buffering hypothesis of the Stress and Coping Theory was not supported. Similarly, race was not found to moderate the relationships between BMI and physical HRQ_OL among either gender. However, there was evidence that race was a moderator between social support and physical HRQ_OL among females and between BMI and mental HRQ_OL among both male and female survivors. Specifically, social support was found to be positively correlated with physical HRQ_OL among both non-Hispanic White and non-Hispanic Black females, but had a significantly stronger magnitude for non-Hispanic Black females. Additionally, BMI was found to be negatively correlated with mental HRQ_OL among only non-Hispanic White male and female survivors. This evidence contributes a unique racial perspective to cancer survivorship research and warrants continued study of racial differences for alterable correlates of HRQ_OL.

Strengths & Limitations

Strengths. This study has numerous strengths attributable to both the study design and to the research question. First, inherent to the nature of the American Cancer Society's SCS-II study design is the fact that the survey includes a national sample of survivors with six different cancer diagnoses spanning two, five, and ten years prior to sampling (T. Smith et al., 2007). As a result, the study includes a large geographically, demographically, and diagnostically diverse sample. Second, the SCS-II study oversampled minority, low-income, and male survivors so that correlational results would be reasonably accurate and meaningful for those populations (T. Smith et al., 2007). Third, because cancer type, date of diagnosis, and cancer stage were provided by state cancer registries, cancer-related factors were not limited to self-report methods (T. Smith et al., 2007).

Strengths related to this specific research question include that it investigates modifiable behavioral and psychosocial factors like BMI and social support, which could be intervened on to improve the HRQ_OL of cancer survivors. Moreover, the study investigates BMI, social support, and HRQ_OL according to sociodemographic and cancer-related factors. By focusing specifically on gender and racial differences across each outcome, study findings may be meaningful to subsamples that disproportionately suffer from low physical and mental HRQ_OL or its correlates. As a result, findings may help inform future research studies or interventions.

Limitations. Despite the contributions of this study, there are limitations that should be considered. First, this was a cross-sectional observational study which restricts its ability to make causal inferences about the correlates of HRQ_OL or to assess what each

survivors' HRQ_OL was like before cancer. Second, because of the nature of the cross-sectional survey, respondents were asked to self-report any responses not retrieved from the cancer registry which may result in response bias, especially with regard to self-reported height and weight (needed to calculate BMI). Any reporting inaccuracies would subsequently introduce measurement error into the study. As such, it would have been ideal if more cancer treatment information would have been available through medical abstraction. Third, there was a relatively low response rate for the entire SCS-II survey with only 32.7% of the sample completing the survey. As a result, the study's ability to generalize findings to all cancer survivors is limited.

Another four limitations exist due to data analysis decisions. First, those currently undergoing treatment were excluded from this study because of the potential confounding nature of treatment since treatment itself may influence BMI or HRQ_OL. Second, Hispanics and "Other races" were excluded from analyses due to the difficulty of meaningfully assessing associations across their small sample sizes. Third, education and employment served as SES proxies for income, which was not included in the analysis since 20.6% of respondents chose not to answer the question. If included, it might have presented meaningful data as a covariate. Fourth, the final dataset used for analysis was unable to make interpretations across each specific cancer type because the groups were too small to make meaningful interpretations about them.

Implications and Recommendations for Future Research

Both the limitations and findings of this study should be taken into account when designing future research studies. In response to study limitations, future research should

continue to employ prospective longitudinal studies or randomized clinical trials in order to improve the ability to make causal inferences. Additionally, objective measurement techniques should be used where possible to avoid self-report bias, especially with regard to height and weight. Finally, because the ability to draw generalizable conclusions largely stems from sampling measures, future studies should continue to oversample minority, low-income, and male respondents from geographically, demographically, and diagnostically diverse national populations as well as encourage high response rates when possible. However, smaller randomized controlled trials where generalizability is not feasible may be beneficial for drawing internally valid conclusions, especially with regard to cancer-related factors. More intimate studies may also result in less missing income data if researchers can be present to ensure confidentiality of responses.

Study findings warrant expansion of study questions across more diverse racial samples as well as across samples with larger cancer groups. Doing so will shed insight on significant sociodemographic and cancer-related factors among subsamples and might help clarify discrepancies across the cancer survivorship literature to date. More clarity is especially warranted with regards to the effects of gender, race, SES, and cancer-related factors like cancer type, stage, and time since diagnosis. In addition, future research should continue assessing the main effects of modifiable behavioral and psychosocial factors on physical and mental HRQ_OL but should also begin or continue intervening on them where research shows it may be warranted. For example, BMI interventions among the obese may help improve physical HRQ_OL, and social support interventions may help improve both physical and mental HRQ_OL among cancer survivors. Also, determining moderators or differences across specific survivor groups may give researchers and

practitioners clearer insight into which interventions may help specific individuals or groups of individuals improve their overall physical and mental HRQ_OL. While interventions should not be offered exclusively to any particular gender or racial group, it may be informative when prioritizing specific interventions. For example, if a non-Hispanic White cancer survivor is obese and experiences poor mental HRQ_OL, an intervention targeting BMI reduction may help improve their mental health. Additionally, since non-Hispanic Black female survivors were found to experience worse physical HRQ_OL than non-Hispanic White female survivors but were found to have a higher correlation between social support and physical HRQ_OL, interventions targeting social support among this target audience may be especially appropriate. However, additional research is needed to support specific interventions as well as realize their effects on HRQ_OL. In the meantime, clarifying significant correlates of HRQ_OL among cancer survivors may help advance cancer survivorship research and provide justification for potentially important HRQ_OL interventions.

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