9-24-2020

The roles of social support and personal mastery in the health behaviors of adults with cancer: A survey study

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THE ROLES OF SOCIAL SUPPORT AND PERSONAL MASTERY IN THE HEALTH BEHAVIORS OF ADULTS WITH CANCER: A SURVEY STUDY

by

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A Thesis

Submitted to the
Department of Psychology
College of Science and Mathematics
In partial fulfillment of the requirement
For the degree of
Master of Arts in Clinical Psychology
at
Rowan University
August 28, 2020

Thesis Chair: Danielle Arigo, Ph.D

Acknowledgments

I would like to give gratitude to my mentor, Dr. Dani Arigo, for always pushing my abilities as a budding independent researcher. You continue to inspire me and my work.

I would like to thank my family and friends who have been there at every step of this process. It was your encouragement that always kept me going despite many challenges.

This project was made possible with data provided by Rachel Pruchno and the New Jersey Institute of Successful Aging (NJISA) at Rowan University.

Abstract

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Cancer remains one of the leading causes of death in the United States. The majority of individuals struggle to adhere to recommended dietary and physical activity guidelines. Specifically, older adults with cancer struggle to meet health behavior recommendations, and tend to have additional risk factors, such as poor social support. Following the Transactional Theory of Stress and Coping, an individual's response to a stressful situation (cancer diagnosis) would be influenced by the interaction between their internal resources (personal mastery) and external resources (social support). Using archival data from the New Jersey Institute for Successful Aging, 725 older adults were surveyed to examine the moderating effects of personal mastery on the relations between social support and (1) Mediterranean diet and (2) physical activity. Differences in gender and time since cancer diagnosis were also explored.

Personal mastery did not moderate relations between social support and Mediterranean diet adherence nor total physical activity minutes. However, personal mastery moderated this relation with total walking minutes. No significant differences were found across gender and time since diagnosis. Preliminary findings suggest that a cancer patient's perception of greater control over their situation facilitate greater effectiveness of social support and its association with walking activity. Therefore, a Mastery Enhancement Therapy intervention might be useful for older adults with cancer.

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Chapter 1

Introduction

It is estimated that by 2019, there will be 1,762,450 new cases of cancer in the United States (American Cancer Society, 2018). This disease has been the second-leading cause of death in the U.S. since the early 1990s (Heron, 2016; Nichols, 2019). Despite its outranking by heart disease and very close ranking to a variety of other chronic illnesses in the list of common causes of mortality (i.e., stroke, diabetes; Heron, 2018), the perception that cancer is an automatic death sentence is common (Tritter, 2002). For example, compared to other chronic illnesses, the associated illness cognitions for cancer (i.e., "patient's perception, interpretation, and understanding of the disease and its treatment;" Leventhal, 1986) appear to be that of a more salient threat (Pizzoli et al., 2019). For example, a cancer diagnosis is often reported as significantly more stressful by the patient and surrounding social network than some other illnesses (e.g., diabetes; Pizzolli et al., 2019). These illness cognitions hold implications for mental and physical health outcomes, as patients who believe their diagnosis to be higher in severity also report greater rates of distress in multiple domains (i.e., physical, emotional, social; Hagger, 2003). Therefore, the perception of cancer as severe and deadly might meaningfully affect prognosis.

Unlike some other illnesses, there is a fluidity present with cancer, with the possibility of transition from treatment to remission and back. Estimates of survival rates after multiple relapses of cancer look different from that of other illnesses such as diabetes (Hanker et al., 2012). Even if the illness goes into remission (e.g., partial or complete lack of cancer cells), there is always the possibility of recurrence. Partial

remission might mean that it would be appropriate to tentatively cease treatment until cells grow again. Complete remission might mean that cancer cells are not visible to healthcare providers; though, having "no evidence of disease" does not preclude the possibility that cells are not there. This inability to declare whether cancer is "cured" is one such reason that cancer is often set apart from other chronic illnesses. Specifically, a great deal of attention is paid to monitoring for recurrence within the first five years since remission (American Cancer Society, 2019).

Health Perceptions and Health Behaviors in Cancer

The health implications of a cancer diagnosis include altering and adjusting to maintenance behaviors that coincide with current prognosis (i.e., partial remission often includes ceasing treatment and closely monitoring for growth of cancer cells compared to monitoring for the return of cancer cells with regular exams including blood and imaging tests for full remission). And for many patients, prognosis is relatively poor compared to other illnesses (Hebdon, Foli, & Mccomb, 2015). For these reasons, outcomes from cancer treatment have been described as quite variable (Hebdon, Foli, & Mccomb, 2015). Although some chronic illnesses such as cardiovascular disease have distinct and reliable biomarkers (e.g., cholesterol levels) that could assist with identification of severity and treatment planning, cancer does not (Peterson, 2017). A variety of cancer biomarkers exist, though, no there is no universal marker. Overall, a common concern for patients is the unpredictable nature of the illness.

Additional complications might include a plethora of illness- and treatment-specific symptoms. Cancer diagnoses can be accompanied by what is known as sickness behavior or a cluster of associated symptoms (i.e., difficulty concentrating, weakness,

malaise, lethargy, anhedonia, and depressed mood; Dantzer, 2001; Lee et al., 2004). Further, treatment-specific side effects for cancer diagnoses include increased anxiety and depressive symptoms and weight loss and/or gain (Pinto & Trunzo, 2005). Treatments such as chemotherapy and radiation are associated with change in taste sensitivity that affect nutritional preference and appetite and can induce nausea (Pinto & Trunzo, 2005). Fatigue is another common side effect of treatment that might decrease engagement in physical activity. Stress resulting from a cancer diagnosis alone can discourage general health behavior engagement and encourage poorer habits (Trudel-Fitzgerald et al., 2018).

These experiences could lead to a decrease in overall physical activity levels, which can be especially dangerous with a cancer diagnosis; sedentary behavior for an extended period of time has been known to induce a disuse syndrome with a variety of symptoms (i.e., simultaneous decrease of muscle mass, range of motion and cardiovascular ability, and increases of injury risk and perception of disability; Pinto & Trunzo, 2005). In addition, an altered relationship to the body and its abilities emerges (Pinto & Trunzo, 2005; Fingeret et al., 2014). For example, individuals with breast cancer experience body image alterations related to their diagnosis and associated mastectomy surgery (Fingeret et al., 2014).

For individuals who have a cancer diagnosis, risk for developing secondary chronic illness is increased due to a multitude of factors beyond genetic predisposition (Demark-Wahnefried et al., 2000). Additional risk is present depending on genetic makeup, health behavior engagement, and treatment (Li & Stovall, 1998). Individuals receiving certain treatments, especially that target regions at or near the heart, are at

greater risk for comorbid illness (e.g., radiation, hormone-ablation treatment, cardiac medication; Hull et al., 2003). Comorbidities with various chronic illnesses are common. As such, time during treatment is a crucial period for preventing secondary and worsening illnesses (American Cancer Society, 2018).

Overall, a cancer diagnosis tends to represent a salient threat, potentially in a different sense than other chronic illnesses. When considering perceived burden (i.e., through negative illness cognitions) and actual burden (i.e., with recurrence complication, illness- and treatment-specific symptoms, altered body image, comorbidity risk) of the diagnosis, it is not surprising that patients report an added complexity in the coping process. An additional step might be present in the coping phase immediately after diagnosis, in which the patient requires time to process the cancer label and cultivate hope for future survival (compared to an immediate phase of adjustment through "legitimization of symptoms" that occurs with the majority of chronic illnesses; Pizzolli et al., 2019). Unlike many other illnesses, cancer can imply a broad range of types, symptoms, treatments, incidence and mortality rates, and illness trajectories; it is even inconsistently categorized as a chronic condition for this reason (Hebdon et al., 2015). Considering the amount of burden accompanying the diagnosis, the adjustment phase might be especially taxing and more important to cancer patients. For this reason, examining the coping process soon after diagnosis provides potentially valuable information.

To date, however, the majority of empirical attention for cancer has been devoted to survivorship, rather than investigations among individuals with an active diagnosis (Kilari et al., 2016). Compared to those currently undergoing treatment, survivors might

have been historically more accessible, with respect to both their psychological availability (i.e. presumably reduced with the increased illness burden) and physical availability for participation in research. Recruitment for survivors might be more convenient given their comparatively low burden with treatment and appointments with healthcare providers, and fear might be present that studying patients will add to their already taxing diagnosis. Further, rest (rather than physical activity) was historically encouraged by health professionals to chronically ill individuals as a top recommendation (De Ridder et al., 2008). This encouragement was originally provided to reduce the likelihood of safety hazards. For example, one survey among a large sample of individuals with Medicare coverage found that having a history of cancer diagnosis was associated with self-reported frailty (i.e., 85 years or older, "limited by an activity of daily living, having any geriatric syndrome, or three or more chronic medical conditions;" Balducci & Extermann, 2000; see also Mohile et al., 2009). As such, continued effort should be put towards dispelling this myth among health professionals and individuals with a cancer diagnosis alike.

Health Behavior Intervention in Cancer

Despite the previous conception that promoting health behaviors (e.g., physical activity) for individuals actively undergoing cancer treatment was potentially dangerous and infeasible, it is now established as both safe and recommended (De Ridder et al., 2008). Further, the notion that this type of intervention might be perceived as unnecessary and frivolous relative to treatment directly targeting cancer prognosis is less accepted. According to the American Cancer Society (2018), healthy weight control (i.e., through physical activity and a healthy diet) is a top recommendation for patients in order

to prevent tumor proliferation and illness such as obesity, diabetes, cardiovascular disease, and osteoporosis. Further, healthy behaviors such as physical activity have been shown to lead to a variety of physical and psychological improvements among individuals with cancer. Physical improvements include increased oxygen uptake and decreases in weight gain (Winingham et al., 1989), fatigue (Schwartz, 2000), treatment-associated sleep difficulties, and neutropenia (i.e., reduced neutrophils within the blood which worsens infection susceptibility; Mock, Dow & Meares, 1997). Psychological improvements include increased body esteem (Pinto et al., 2004) and decreased reports of anxiety and depressive symptoms (Segar et al., 1998).

Not only are behavioral interventions now considered safe, feasible, and optimal for individuals with cancer, patients report an increased desire to make health behavior changes during treatment and recovery (Blanchard et al., 2003), creating "teachable moments" for health behavior promotion (McBride et al., 2000). Further, patients have demonstrated that their motivation translates to actual behavior change in the form of healthier diets, increased physical activity, and reduced tobacco use (Satia et al., 2004). However, studies done during earlier stages of the cancer continuum are still lacking (i.e., compared to that with later-stage patients or survivors; Kilari et al., 2016).

Health Behaviors among Older Adults with Cancer

One specific population that is increasingly in need of greater empirical attention is older adults with cancer, as advancing age is the main risk factor for developing cancer (Vaiserman & Lushchak, 2017). Data from the Surveillance, Epidemiology and End Results Program (SEER) reported that for an initial diagnosis of cancer, the median age is 65 years and range is between 65-74 years of age (Vaiseerman & Lushcak, 2017).

Furthermore, the quickest global average life expectancy increase has occurred since the 1960s (World Health Organization, 2019). Individuals are more likely to live to older ages compared to previous generations, and are spending a greater amount of time within the older adult period. Further, the U.S. Census Bureau's 2017 National Population Projections reports that by the year 2030, the number of older adults will far exceed the number of children in the country for the first time in documented history (U.S. Census, 2018). This substantial shift is primarily due to the amount of "baby boomers" who are to reach or surpass the age of 65 (i.e., 1 in 5 U.S. residents; 2018). This shift has received attention for its major healthcare implications (i.e., addressing the new needs of individuals living longer with disabilities and chronic conditions; Kahana & Kahana, 2001). Meeting new population health needs might mean examining experiences specific to older adult cohorts.

The baby boomer cohort has been known to interact differently with the healthcare system, such that they are more knowledgeable and active compared to prior cohorts at the same age (Kickbusch & Payne, 2003). For example, previous cohorts may have struggled to be assertive while navigating their healthcare, which has led some researchers to intervene in promoting communication between older adults and their providers (Kahana & Kahana, 2012). Overall, these differences suggest that examining cohort-specific characteristics could be useful in explaining overall trends and predicting that of future older adult cohorts. Given the recent and upcoming growth of the older adult population, there is much to learn about their experiences with cancer and other health conditions.

It appears that, in addition to this expanding older adult population, there has been a timely shift in focus within healthcare treatment and policy from increasing lifespan to increasing healthspan (i.e., "the period of life spent in good health, free from the chronic diseases and disabilities of aging;" Kaeberlein, 2018; see also Crimmins, 2015). Efforts have even grown into an international goal to increase healthspan; for example, the European Union has put forth the Europa Innovation Partnership on Active and Healthy Ageing (EIP-AHA) with the goal of improving healthspan and independence among European individuals (López-lluch & Rattan, 2015). Benefits from these efforts are potentially twofold: increased healthspan and improved quality of life (e.g., through improved independence; López-lluch & Rattan, 2015, Goldman et al., 2013). These outcomes might be especially ideal for those in the older adult age range. In line with a healthspan perspective, the goal for an older adult with a cancer diagnosis would be more than eliminating the illness, but increasing overall health (Goldman et al., 2013). In this way, increasing healthspan is not simply about preventing death through cancer treatment, but adding to the healthier years (Crimmins, 2015). This has major implications for how cancer is treated among older adults; the focus then shifts to health behavior and overall lifestyle to alter health status (Crimmins, 2015). Increased positive health behaviors (i.e., adequate diet, physical activity) could assist with overall prognosis as it is known to decrease mortality rates (de Magalhães, 2014). Further, it could assist with prevention of additional illness.

Specific Health Promotion Recommendations for Adults with Cancer

According to the American Cancer Society, weight maintenance (i.e., through physical activity and a healthy diet) is a top recommendation in order to prevent tumor

proliferation and illness such as obesity, diabetes, cardiovascular disease, and osteoporosis (ACS, 2018). Recently, the Clinical Oncology Society of Australia (COSA) has provided national guidelines for patients with cancer. COSA recommends that all patients refrain from sedentary lifestyles, and aim for 150 minutes of moderately intense or 75 minutes of vigorously intense aerobic activity (e.g., walking, swimming, running) in addition to two to three sessions of resistance activity (e.g., lifting weights) per week (Tello, 2018). This is with the caveat that this activity is a physical possibility for the patient. Further, population guidelines for nutrition have been promoted by the Center for Disease Control (i.e., "1.5-2 cups of fruit and 2-3 cups of vegetables per day;" US Department of Health and Human Services, 2017).

Unfortunately, it appears that these health behavior guidelines (i.e., cancer-specific and that for the general population) are rarely met (Mustian et al., 2006, Winkels et al., 2016). For example, qualitative interviews with a sample of olders with cancer revealed significant between-person variability in physical activity engagement, though 43% reported minimal activity (i.e., light activity less than 4 hours per week; Mikkelsen et al., 2019). Adults with cancer also fail to meet general recommendations for nutrition (i.e., plant-based diets; Winkels et al., 2016). Self-reports from another study showed that at least 19% of adults with cancer did not meet Center for Disease Control nutrition guidelines for fruits and vegetables (Krane et al., 2018).

Additionally, despite reporting positive feelings about exercise overall, the majority of patients with cancer acknowledge difficulty in maintaining sufficient activity while adjusting to their new "norm" of cancer, and as a result, are not currently engaged in regular physical activity (Mikkelsen et al., 2019). Older adults may experience such

barriers that are above and beyond that of cancer in other age groups. Older adults often have a variety of physical health declines independent of a cancer diagnosis, which then only provides an additive effect on decline (Hawkins & Wisell, 2003). A common barrier to healthy behavior among older adults is related to comorbidities (Mikkelsen et al., 2019). Concurrent conditions can often become decision criteria for physicians making treatment recommendations for older adults, which often results in less aggressive treatments for this population (Yancik et al., 2001). Previous literature has even been concerned with the effect of chemotherapy on nutrition within older adults (Chen et al., 2003). One major concern has been with undereating and resulting malnutrition. Compared to middle-aged adults who had higher BMIx, geriatric-specific assessments have suggested that older adults might be on the lower end of BMI with under-consumption of calories and key nutrients (i.e., iron, folic acid, Vitamins A, C, D, and E; da Silva et al., 2014).

With respect to comorbidity, fatigue often provides the greatest challenge to physical activity for older adults with cancer (Mikkelsen et al., 2019). Recently, a collection of institutions dedicated to researching older adult cancer patients and survivors (i.e., Cancer and Aging Research Group, National Cancer Institute, National Institute on Aging & University of Rochester Cancer Center) collaborated for a conference, with the goal of advancing knowledge for this population. This meeting resulted in a meta-analysis of literature on physical activity within geriatric oncology, which reported a variety of important knowledge gaps (Kilari et al., 2016). These included limited studies that focus on cancer patients' physical activity during their active treatment (i.e., compared to during survivorship), limited studies on cancer populations

other than breast and prostate cancer, and limited studies with individuals of "poor baseline functional status" (Kilari et al., 2016).

Social Support in Cancer

To better promote health behaviors such as physical activity and healthy eating among individuals with cancer, there is a need to better understand the influences on these behaviors, including individual differences in key influences. For example, among individuals actively in cancer treatment, it has been well-established that, across age, social networks are highly influential for both the adjustment process (Wolf, 2015; Koehly et al., 2011) and longer-term health outcomes (Mercken et al., 2012). However, older adults are more susceptible to weak social connections and insufficient social support than younger adults (Cattan, White & Bond, 2005). Further, the role of social influence on etiology and prognosis of illness for this population is especially important (Packer, 2001).

Health behavior does not exist within a vacuum and should be examined within the social environment (Uchino, 2006), particularly in the context of chronic illness (Cohen et al., 2004). For example, many eating behaviors occur in social settings, as eating is considered a social practice (Higgs & Thomas, 2016). Social networks can also influence goal development and attainment. Goals of family members and friends can inspire personal goals for an individual (i.e., goal contagion; Aarts, Gollwitzer & Hassin, 2014). Importantly, social factors need not be direct or explicit to have an influence on goal pursuits such as engaging in health behaviors; simply priming a participant with actual presence or mere thought of family or friends can provide a goal priming effect (Fitzsimmons & Bargh, 2003).

More specifically, both direct and indirect social support can be catalytic in the promotion of physical activity and diet (Uchino, 2006). Evidence points to social support as a key influence in the development and maintenance of health during illness, specifically with capabilities of the endocrine, immune and cardiovascular systems, though particular mechanisms are not easily parsed (DiMatteo, 2004). Patient adherence might be increased indirectly with social support (i.e., strengthened immune system from hormone and neuroendocrine impact with improved adherence) as evidenced by meta-analysis findings of a more than threefold greater chance of adherence when there is perceived practical support (DiMatteo, 2004). However, social support is a complex construct, and its definition and role(s) need to be considered carefully.

Social support can be reduced to three functions: emotional, instrumental, or informational assistance in response to an illness, or implicit aligning of underlying health cognitions and behaviors of the individual with that of their social group (Cohen et al., 2004). In other words, patients receive social support when a network member provides advice or information related to health (informational), when a network member assists with a physical task such as getting the patient to a medical appointment (instrumental), or when a member offers compassionate expression (emotional). Further, it appears to matter far less much *how much* received support a patient reports, compared to the *perceived nature* of support; quality of support is a greater predictor of health behavior than quantity (Helgeson et al., 2004). There has also been a push to tailor social support to match patient preference, indicating that not all patients have the same desires or responses to the various types of support (Strine et al., 2007).

Social support has occasionally been associated with improved mental and physical health outcomes. Specifically, improved dietary behavior and physical activity practices often follow with greater social support (Greaves, Sheppard & Abraham, 2011). In line with this, the rates of obesity are lower among individuals with high levels of social support (Strine et al., 2007). Additionally, the level of social support is positively related to better cancer prognosis among older adults (Mohile, Dale & Huria, 2012). Social support is largely helpful through access to resources. It has been associated with increasing longevity in cancer patients through encouragement to be proactive with screenings before (and health behaviors after) diagnosis, as well as with greater access and assistance with use of medical resources (Pinquart & Duberstein, 2009; Kroenke et al., 2006). Furthermore, support can be viewed as an interpersonal resource in itself, and might be especially important for individuals coping with and adjusting to the cancer diagnosis and treatment. This might be especially true earlier in the cancer diagnosis, when the salience of threat is high and uncertainty is potentially greatest (Pizzoli et al., 2019). In the absence of objective information (e.g, about prognosis), patients might look to others in their social environment to gather information and resources about and from others (e.g., social comparison, social support, respectively; Festinger, 1954; Sun, Qin & Wu, 2009).

Unfortunately, social influences such as support are not always health-protective. Negative social interactions are associated with unhealthy behaviors, and often are more predictive of health behaviors than positive interactions (Arigo, Pasko, & Mogle, 2019; DiMatteo, 2004; Helgeson et al., 2004). Yet social support is often incorrectly assumed to be universally helpful (Yan, 2018). Though great evidence exists for the health benefits

of increased social support (Barth, Schneider & von Känel, 2010; Melchior et al., 2003; Philogene et al., 2009), evidence also exists for health barriers associated with social support (Prins, 2019; Hakulinen et al., 2015; De Vogli, Chandola & Marmot, 2007; Rogers et al., 2014). Existing findings on the benefit of social support for individuals with chronic illness are mixed, indicating a need for more nuanced research (Pinquart & Duberstein, 2009; Maunsell, Brisson, & Deschtnes, 1995). Potential implications include recommendations to individuals that are not improving their health behavior, and potentially harming it. According to older adults with cancer, social support is key to short- and long-term motivation for physical activity (Mikkelsen et al., 2019). Social support has also been associated with consuming five or more servings of fruits or vegetables per day within cancer (Coleman et al., 2014). However, the majority of research on social support in cancer focuses on younger patients (Williams et al., 2018).

For those studies that focus on older patients, support needs are often unmet and inconsistently associated with survival outcomes (Williams et al., 2018; Verheijden et al., 2005). Further, gender differences in social support among older adults have emerged, which may be a result of social network differences with increasing age; for example, women tend to have larger social groups beyond their immediate family while men keep smaller social circles (Paskulin & Vianna, 2007). However, much is yet to be understood about the underpinnings of gender differences in support seeking behavior for individuals with life-threatening chronic illness, as older adult women tend to intentionally utilize social support as a coping skill while their male counterparts do not (Ketcher et al., 2019). This information is crucial given the call for "gender-sensitive models of research and intervention," (Ketcher et al., 2019; Gabriel, Beach & Bodenmann, 2010). At

present, insufficient studies exist to explain inconsistencies with social support among older adults.

Personal mastery. One potential explanation for individual differences in the social support-health behavior relation this population might lie with personal mastery, or "the belief about a person's own ability to mitigate the adverseness of an event" (Tang, Lai & Chung, 2010). From this perspective, personal mastery is similar to perceived locus of control. Given the wealth of age-related declines that often are accompanied by a loss of control (e.g., loss of physical functioning, frailty), personal mastery has long been established as an important contributor towards successful aging. Increases in mastery are also consistently associated with greater engagement in positive health behavior (Bandura, 1997; Drewelies et al., 2016).

One might imagine that mastery might be more important for an older adult with a cancer diagnosis, physical decline and unpredictability for future health (Pudrovska, 2010). For this reason, personal mastery has been examined among older adults successful aging using longitudinal methods. Secondary analysis of the MIDUS Study (Midlife Development in the United States) showed that the effect of personal mastery among individuals with cancer varied across aging cohorts, such that in the oldest cohorts (i.e., born between 1920-1930), personal mastery decreased more substantially, while in the youngest cohorts (i.e., born between 1950-1960), personal mastery increased (Pudrovska, 2010). As having a stronger (vs. weaker) sense of personal mastery is often accompanied by increases in preventative health behaviors (Baum & Posluszny, 1999), individuals with cancer who believe they can control their health may engage in more positive health behaviors.

According to the transactional model of stress and coping (Lazarus & Folkman, 1984), when an individual adjusts to a stressful event, response to the stressful event will be a product of the interaction between the internal and external environment and/or resources. Similar to social support, personal mastery has been cited as a type of resource (Spencer & Patrick, 2009). However, personal mastery has been cited as a type of personal or internal resource, given its basis within the individual (Spencer & Patrick, 2009), whereas social support is an indirect or external resource, given its basis outside of the individual. Therefore, if an older individual experiences the stress of a cancer diagnosis, treatment, or recovery in the midst of their age-related decline, their adjustment to this stress might depend on the interaction between their internal resources (i.e., personal mastery) and external resources (i.e., social support). Further, this would be reflected in their response of engagement in protective and recommended health behaviors (i.e., physical activity and diet), or lack thereof. However, this interaction effect has yet to be examined among older adults with cancer.

Aims of the Present Study

To address the lack of information about the relation between social support, personal mastery, and health behaviors among older adults with cancer, we conducted a set of secondary analyses on an archival dataset containing a subsample of older adults with cancer. The original purpose of data collection was to study a large older adult sample that is representative of U.S. demographics (Pruchno et al., 2010), as well as a variety of variables beyond a cancer diagnosis that could contribute to successful aging (e.g., depressive symptoms, living conditions). The primary aim of these analyses was to test for a potential moderation effect of personal mastery on relations between social

support and (1) physical activity engagement, and (2) Mediterranean diet adherence. The secondary aim was to examine gender and time since diagnosis as exploratory moderators. Given the characteristics of the dataset, described below, these analyses have the potential to address some existing limitations in the body of literature on adults with cancer (Kilari et al., 2016).

Chapter 2

Methodology

Participants and Procedures of the Original Study

The proposed study used archival data housed at the New Jersey Institute for Successful Aging (NJISA) at Rowan School of Osteopathic Medicine. The original purpose of this study, titled ORANJ BOWL℠ (Ongoing Research on Aging in New Jersey: Bettering Opportunities for Wellness in Life), was to allow for the examination of the specific properties of successful aging, including individual differences and environmental factors. Older adults between the ages of 50-74 were recruited in the state of New Jersey as its residents demographic makeup is representative of older adults throughout the country (Pruchno et al., 2010). Inclusion criteria for participation consisted of an age requirement between 50-74 years of age, permanent residence in New Jersey, fluency in English, and availability to meet for a one-hour interview.

The original sample included 5,688 participants (64% women, M_{Age} = 60.7). The majority of participants identified their racial/ethnic background as Caucasian (83.3%); 11.8% identified as African American, and 4.9% was unidentified. More than half of participants indicated their relationship status as "married" (56.7%), followed by "divorced" (17.3%), "widowed" (14.2%), never married (9.2%), and separated (2.6%). Average household income was quite variable, with a range from $30,000 through $80,000 (29.8%); the remainder included 19.1% reporting income less than $30,000 and 41.1% reporting more than $80,000.

Initial recruitment was held across a span of 18 months (i.e., November 2006 through April 2008). Potential participants were contacted via phone by research staff

through cold calling and screened to ensure eligibility. If more than one individual met criteria in the same household, a gender-weighted Kish table (i.e., a selection table commonly used within survey research to select participants within the same residence; Kish, 1949) was used to randomly choose which individual would participate. Cooperation with phone screenings was average to above average for both the Cooperation Rate (i.e., 72.88%) and response rate (i.e., 56.73%) compared to that of the American Association for Public Opinion Research standards (as cited in Pruchino et al., 2010).

Data collection included completion of self-report measures (administered via telephone) across six time points during a 10-year timeframe. Eligible individuals were asked to participate in baseline survey that lasted an average of 60 minutes. In addition to demographic information, participants reported on a variety of experiences related to successful aging. These included mental and physical health status, sleep, pain, significant events, household makeup, body functionality, social network characteristics, subjective age, life satisfaction, religion and/or spirituality, occupational history, hospitalizations, volunteer and leisure activity, and health behaviors such as health checks, drinking, smoking, height and weight for body mass index [BMI] calculation, physical activity, nutritional habits). The original study was approved by the IRB for the University of Medicine and Dentistry of New Jersey School (UMDNJ; the state health-sciences university of New Jersey that has now been consumed by both Rutgers School of Biomedical and Health Sciences and Rowan University School of Osteopathic Medicine). Additional details can be found at http://rachelpruchno.net/OB.html#T6.

In order for a subset of this sample to be examined for the proposed study, the NJISA required completion of a data use agreement (see Appendix A). This allowed the researchers involved in the original data collection efforts the opportunity to assess whether the request is an appropriate use of the data. This agreement includes description of the nature of the study (i.e., intended purpose for use and dissemination of data, collaborator information, study summary, background, aims, hypotheses, methods, analysis plan, data security). The intended purpose section requests descriptions for all required variables of the present study accompanied by justifications for use and format of intended dissemination of results (i.e., academic manuscript, conference presentation). The collaboration information section requests a list of all study staff, their role, respective institution, and title. The study summary section requests a description, background, and implications of the present study. The storage section requests information on the protocol for ensuring security of data (i.e., type of devices used, physical storage placement). Finally, a list of requested variables were submitted that is consistent with the data use application.

Participants and Procedures of the Current Study

Consistent with the original study, older adults between the ages of 50-74 were included in the present analyses (M_{Age} = 61.62 age at baseline, 2006-2007). A subset of the original sample was requested, i.e., those who indicated that they had a cancer diagnosis at any point during data collection and completed a survey at Time 6 (n = 725). Slightly more than half of eligible participants were women (61%). At Time 6 of data collection (i.e., 10 years after baseline), about an equal number of participants were in their 50s and 60s (38.7% and 39.2%, respectively), with the remaining participants (15%)

in the 70-74 age range. Based on self-reported height and weight, BMIs for the largest subset of participants fell into the overweight category (36.5%). The majority of participants identified as Caucasian (81%). According to G*Power, it was estimated that in order to achieve power ≥ 0.80 for the analyses described below, 250 participants would be sufficient for detecting a moderate effect size ($R^2 = 0.50$; Faul, Erdfelder, Buchner et al., 2007). As such, the available sample of 725 older adults afforded more than sufficient power to detect the expected effects.

In addition to basic demographic information, a subset of the original variables were assessed. These include self-report measures of personal mastery, social support, physical activity, and diet during Time 6. After the data use application was approved by the ORANJ BOWL committee, all study procedures were submitted to Rowan University's Institutional Review Board (IRB; exempt category for analysis of deidentified data). Upon IRB approval, the necessary data were released by ORANJ BOWL and cleaned by the author for use to address the present aims. Complete documents and demographic information can be seen in Appendix A and Table 1, respectively.

Table 1

Participant Demographics

	Full sample (n = 725) *n (%)*
Gender	
Women	443 (61.1)
Men	282 (38.9)
BMI (kg/m²)	
Underweight	11 (1.5)
Healthy Weight	205 (28.3)
Overweight	257 (35.4)
Obese	147 (20.3)
Severely Obese	54 (7.4)
Morbidly Obese	31 (4.3)
Time Since Diagnosis*	
Time 6	123 (17)
Time 5	65 (9)
Time 4	91 (12.6)
Time 3	93 (12.8)
Time 1	353 (48.7)
Race/Ethnicity	
Caucasian/White	588 (81.0)
African American/Black	83 (11.4)
Asian or Pacific Islander	11 (1.5)
American Indian or Alaskan Native	3 (0.4)
Hispanic/Latino	21 (2.8)
Marital Status	
Married	399 (55.0)
Living with someone in a committed relationship	14 (1.9)
Separated	12 (1.7)
Divorced	114 (15.7)
Widowed	127 (17.5)
Single (never married)	59 (8.1)
Highest Education	
Less than high school	15 (2.1)
High school graduate or GED	136 (18.8)
Some college	106 (14.6)
Associate's degree	81 (11.2)
Bachelor's degree	168 (23.2)
Some master's degree credits	42 (5.8)
Master's degree	122 (16.9)
Some doctorate work	12 (1.7)
Doctoral degree	42 (5.8)

*Time 2 was not included as participants were not asked about a cancer diagnosis during this assessment.

Measures

Demographic information. Participants were asked to report their age at baseline, gender, height and weight (used to calculate BMI), and racial/ethnic identifiers.

Cancer diagnosis. Participants were asked to choose from a list of chronic conditions (i.e., arthritis, hypertension, heart conditions, diabetes, osteoporosis, stroke, lung conditions, or cancer) their previous and/or current diagnoses provided by their physician or healthcare provider, if applicable. Additionally, follow-up questions were included about use of prescription or non-prescription medicines and/or supplements for their condition(s). See Appendix B for the full text of these items.

Personal mastery. Participants were asked to complete the Pearlin & Schooler (1978) scale, the most-commonly used measure of personal mastery (see Appendix C). Items implying low mastery include statements such as "I have little control over the things that happen to me" and "What happens to me in the future mostly depends on me", with response options on a 7-point Likert scale (*strongly agree* to *strongly disagree)*. Internal reliability has been cited as $\alpha = 0.71\text{-}0.83$ (Ben-Zur, 1999 & Hobfoll et al., 2003) and test-test reliability cited as $r = 0.44$ (Pearlin et al., 1981). The present sample had an alpha of .81.

Social support. Participants were assessed using a 4-item scale (see Appendix D) that was created specifically for the original study to minimize participant burden and created by a leading researcher in the study of social support (i.e., Alex Zatura) who assisted with measure development to ensure consistency with other psychometrically validated questionnaires. Questions included items such as "How often do you feel there is someone you can count on to listen to you when you need to talk" and "How often do

you feel that there is someone you can count on to provide you with emotional support in talking over problems or helping you make a difficult decision" on a 5-point Likert scale (none of the time, a little of the time, some of the time, most of the time, all of the time). A summary score was derived for this variable by summing all four items, with higher scores indicating greater perceived social support. Previous ORANJ BOWL articles cited internal consistency as $\alpha = 0.88\text{-}0.89$ (Pruchno & Wilson-Genderson, 2010; Heid et al., 2016). In the present subset of participants, $\alpha = 0.92$.

Diet. Consumption was assessed using a 9-item scale (see Appendix E), focusing on the frequency of engaging in practices consistent with a Mediterranean diet. Items assessed diet practices during the course of a week using questions such as "How often do you have citrus fruits such as oranges, grapefruit, kiwi, or lemons (in a typical week)" and "How often do you have spinach, kale, bok choy, cabbage, mustard greens, or collard greens in a typical week" on a 4-point Likert scale (*almost every day, 3 or 4 days a week, 1 or 2 days a week, less often than that*). This measure was designed for the original study to minimize participant burden and created in a similar fashion to other common psychometrically validated questionnaires. Responses were scored with dichotomization into two categories for each food group (i.e. 0 = ate less frequently than 1 or 2 days a week, 1 = ate 1 or 2 days a week or more; Pruchno & Wilson-Genderson, 2012) with the sum of responses indicating level of adherence to the Mediterranean diet (i.e., total scores of 7 or higher considered "adherent").

Physical activity. Activity was assessed using a 4-item scale (see Appendix F), with items asking the frequency of activity in the previous week (i.e., "On average, how much time do you estimate you spend doing these moderate activities each week?"). This

measure was designed for the original study to minimize participant burden and created in a similar fashion to other common psychometrically validated questionnaires. A summary score was derived for frequency of activity by summing total minutes of moderate, vigorous, walking and strength exercise, with higher scores indicating more frequent physical activity.

Data Analysis

Descriptive statistics were computed for main variables of interest, using summary scores for personal mastery, social support, Mediterranean diet adherence, and total physical activity minutes. Missingness for Mediterranean diet adherence and total physical activity minutes were 5% and 10.1%, respectively which does not violate recommendations according to Dong & Peng (2013). A variety of possible reasons for missingness in this dataset (i.e., skipped survey items, loss during follow-up, attrition due to death). Multiple Imputation suggested no significant differences in analyses with vs without missingness, and therefore no changes were made to the data (See Appendix H). However, total physical activity (moderate, vigorous, walking, strength activity) was summed in order to capture all types of activity. Residual dependence plots and S-L plots showed relatively straight lines for both models, suggesting sufficient linearity and homoscedasticity. However, histograms of residuals for both models suggested that linearity should be further assessed with some positive skewness present. This is somewhat consistent for health behavior adherence, particularly physical activity. Additionally, the current standard is to refrain from using raw data with skewness above 2 and kurtosis above 8 (Kline, 2015). For this reason, models with raw data were prioritized, though supplementary analyses were provided with physical activity data

transformed by a log of 10 to allow for transparency and check for consistency (see Appendix G).

Given that the analyses of interest were interaction effects that heavily depend on levels of the moderating variable (i.e., personal mastery), main effects were not of primary interest but were included to examine the independent contribution of the interaction beyond main effects (Applebaum & Cramer, 1974). To address both study aims, we tested an interaction effect between social support and personal mastery total scores for predicting (1) Mediterranean diet adherence and (2) physical activity engagement. BMI and functional ability/mobility were included as covariates as these variables have been reported as barriers to healthy behavior, and thus, potential confounds for health behavior engagement in older adults (i.e., exercise, diet; Berthancourt et al., 2014; Rachmah et al., 2019). Bivariate analyses showed significant correlations between BMI and functional ability with both Mediterranean diet and total physical activity (ps < 0.01), and sensitivity analyses were performed to determine the impact of these covariates on interpretation. Interaction effects were mean-centered and tested using SPSS PROCESS v 3.5 (Hayes, 2012). Further, the model.comparison function using the flexplot package (Fife, 2019) within R Studio, Version 1.1.463 were used to obtain estimates above and beyond the *p*-value (RStudio Team, 2015).

Graphics were used to initially interpret the interaction effect. The model.comparison function compared nested models (i.e., interaction analysis with and without main effect analyses) to produce estimates in addition to *p*-value (AIC, BIC, Bayes Factor, semi-partial R squared). The better-fitting model was chosen based on which is favored by the majority of the estimates. However, simple slopes (1 SD above

the mean, 1 SD above the mean) obtained through PROCESS were used to support or refute patterns specified in the hypotheses.

Hypotheses

We hypothesized that the interaction effect (personal mastery x social support) would be statistically significant for predicting both Mediterranean diet adherence and physical activity minutes. Specifically, we expect to observe that participants with higher (vs. lower) personal mastery would show a positive linear relation between social support and health behavior outcomes. Conversely, participants lower (vs. higher) in personal mastery would show a negative linear relation between social support and health behavior outcomes. Secondary aims included exploratory analysis to determine differences in these relations based on gender or time since diagnosis were present.

Chapter 3

Results

Descriptive Statistics

With respect to time since diagnosis, a diagnosis at Time 1 was most common (48.7%), followed by Time 6 (17%), Time 3 (12.8%), Time 4 (12.6%), Time 5 (9.0%). Functional ability was spread evenly, with scores tending to skew slightly towards higher levels of functioning (M = 38.8, SD = 6.7). Social support showed a similar pattern to functional ability in spread (M = 16.62, SD = 3.54) and was nearly identical to that reported in previous ORANJ BOWL articles (M = 16.60; Heid et al., 2016; Pruchno & Wilson-Genderson, 2010). Only 33.2% of participants were considered adherent to the Mediterranean diet (i.e., received a score of 7 or above). On average, participants reported engaging in 442 minutes per week of total physical activity (moderate, vigorous, walking, strength exercise) and 180 minutes per week of walking alone, on average. See Tables 1 & 2 for additional descriptive information.

Table 2

Descriptive Statistics and Correlations between Variables of Interest

Variable	n	*M*	*SD*	1	2	3	4	5	6
1. Personal Mastery	719	21.12	6.38	-					
2. Social Support	723	16.62	3.54	-.32**	-				
3. Mediterranean Diet	687	5.44	1.95	.11**	.11**	-			
4. Physical Activity	628	442.73	424.8	.20**	.14**	.19**	-		
5. BMI (kg/m^2)	718	28.26	5.92	-.1**	-.07	-.1*	-.21**	-	
6. Functional Ability	725	38.8	6.68	.31**	.17**	.16*	.27**	-.37***	-

Note. $N = 725$.

$^*p < .05$, $^{**}p < .001$.

Mediterranean Diet Moderation Analysis

We hypothesized that personal mastery would moderate the relation between social support and Mediterranean diet adherence. Specifically, we specified that participants with higher (vs. lower) personal mastery would show a positive linear relation between social support and Mediterranean diet adherence. Conversely, participants lower (vs. higher) in personal mastery would show a negative linear relation between social support and Mediterranean diet adherence. The overall model was significant ($F[5, 673] = 5.0411$, $p = 0.002$, $R^2 = 0.04$). Functional ability was the only marginally predictive covariate such that as functional ability increased, diet adherence

increased (b = 0.035, p = 0.005). Sensitivity analyses suggested that the models were nearly identical, and the interaction was insignificant, with and without covariates in the model (b = -0.0027, p = 0.60; b = -0.0027, p = 0.60). To further provide support for the better-fitting model (i.e., reduced model with main effects vs. full model with interaction), a model comparison was conducted. This comparison showed that the reduced model was favored (Bayes Factor = 22.731, 0.044; p = 0.60, $\triangle R^2 = 0$). Thus, overall, the first hypothesis was not supported, as the proposed interaction effect was not significant and the reduced model was supported above and beyond information provided by the p-value (i.e., Bayes Factor, $\triangle R^2$). See Table 3 and Figure 1 for further information.

Table 3

Moderation of Relations between Social Support and Health Behaviors by Personal Mastery

	Analysis 1: Mediteranean Diet						Analysis 2: Total Physical Activity					
Predictor	*b*	*SE*	95% CI	*t*	*df*	*p*	*b*	SE	95% CI	*t*	*df*	*p*
Social Support	.04	.02	[-.01, .08]	1.57	673	<.001	9.33	5.1	[-.68, 19.40]	1.83	615	.067
Personal Mastery	.02	.02	[-.02, .07]	1.03	673	.301	13.0	4.89	[3.40, 23.60]	2.66	615	.008
Social Support X Personal Mastery	-.002	.005	[-.01, .01]	-.52	673	.602	2.0	1.18	[-.31, 4.31]	1.70	615	.090

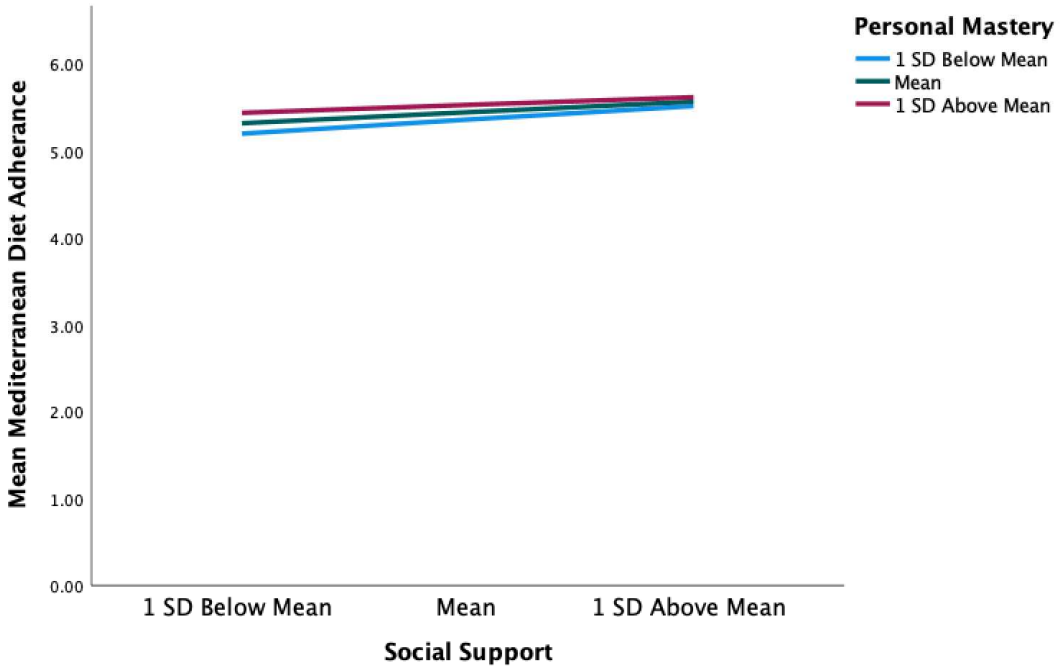

Figure 1. Relation between Social Support and Mediterranean Diet Adherence Moderated by Personal Mastery

Physical Activity Moderation Analysis

Similarly, we hypothesized that personal mastery would moderate the relation between social support and physical activity (total minutes), such that participants with higher (vs. lower) personal mastery would show a positive linear relation between social support and activity. Conversely, participants lower (vs. higher) in personal mastery would show a negative linear relation between social support and activity. Results showed that this overall model was significant ($F[5, 6155] = 16.2138$, $p < .001$, $R^2 = 0.1165$). Both BMI and functional ability were predictive covariates. As BMI increased, physical activity decreased ($b = -11.83$, $p < 0.001$) and as functional ability increased, activity increased ($b = 13.95$, $p < 0.001$). Lastly, there was no moderating effect of personal mastery on the relation between social support and total physical activity

minutes (b = 2.00, p = 0.09). Similar to the above model, the hypothesis was not supported with a model comparison, as the reduced model was favored (Bayes Factor = 5.828, 0.172; p = 0.09; $\triangle R^2$ = 0.004).[1] See Table 3 and Figure 2.

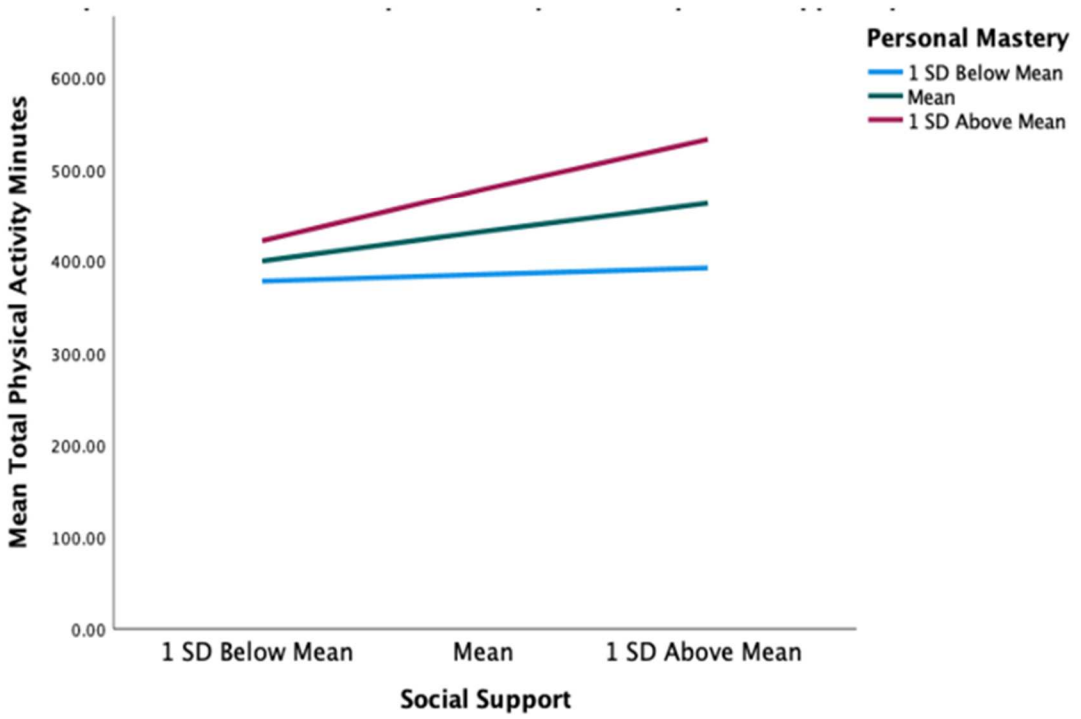

Figure 2. Relation between Social Support and Total Physical Activity Moderated by Personal Mastery

Exploratory Analyses

Although the moderation model was not significant with total minutes of physical activity (i.e., moderative, vigorous, stretching, walking) as the outcome, the interaction

[1]Given the nature of the physical activity data (i.e., slightly positively skewed), the physical activity model was also examined using transformed data by a log of 10. Estimates for models using transformed physical activity data can be found in Appendix G.

effect was significant with average minutes reported walking per week, when controlling for BMI and functional ability ($b = 2.3173$, $p < 0.001$), with the interaction adding a significant change in R^2 ($p < 0.001$, $\triangle R^2 = 0.029$). For participants with low personal mastery, there was an insignificant negative linear relation between social support and walking (simple slope = -5.439, $SE = 2.98$, $p = 0.07$). For participants with high personal mastery, there was a significant positive linear relation between social support and walking (simple slope = 11.25, $SE = 3.73$, $p = 0.0027$). This interaction is illustrated in Table 4 and Figure 3.

Table 4

Moderation of Relations between Social Support and Walking by Personal Mastery

Predictor	*b*	*SE*	95% CI	*t*	*df*	*p*
Social Support	2.91	2.59	[-2.19, 8.00]	1.12	488	.263
Personal Mastery	1.76	2.40	[-2.96, 6.47]	.73	488	.465
Social Support X Personal Mastery	2.32	.60	[1.14, 2.49]	3.87	488	<.001

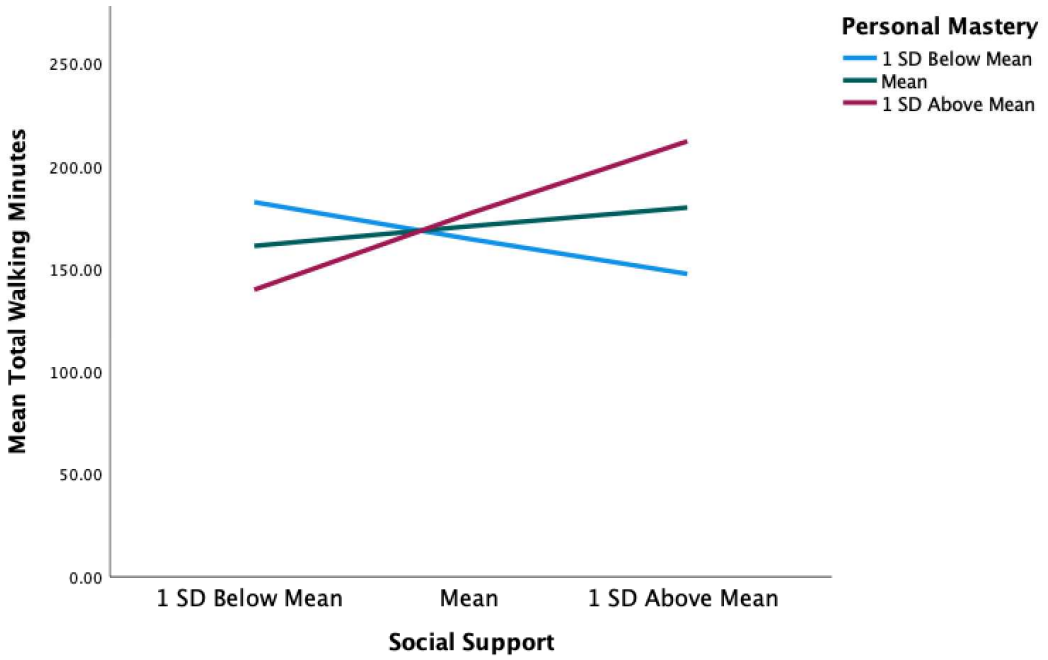

Figure 3. Relation between Social Support and Total Walking Minutes Moderated by Personal Mastery

In line with the secondary aim of this study, this model (outcome of total walking minutes) was further explored with additional moderators. First, a three-way interaction was examined with self-reported gender ($F[9, 484] = 3.64$, $p < 0.001$, $R^2 = 0.06$). Gender did not moderate the relation between personal mastery, social support, and walking after controlling for BMI and functional ability ($b = -1.68$, $p = 0.17$). Of note, unique patterns emerged when examining simple slopes of men compared to women, such that the pattern for men mirrored the two-way interaction (see Figures 3 & 4). For men with low personal mastery, there was a significant negative linear relation between social support and walking (simple slope = -14.07, $p < .01$, SE = 4.53). For men with high personal mastery, there was an insignificant positive linear relation between social support and

walking (simple slope = 8.66, $p = 0.08$, $SE = 4.96$). However, for women across low and high levels of personal mastery, there were positive linear relations between social support and walking ($b = 1.50$, $p = 0.71$; $b = 6.82$, $p = 0.06$; $b = 12.13$, $p = 0.04$). See Table 5 & Figure 4).

Table 5

Moderation of Relations between Social Support and Walking by Personal Mastery, Gender, and Time Since Diagnosis

	Analysis 1: Walking Minutes, Gender						Analysis 2: Walking Minutes, Time Since Diagnosis					
Predictor	*b*	*SE*	95% CI	*t*	*df*	*p*	*b*	SE	95% CI	*t*	*df*	*p*
Social Support	3.02	2.65	[-2.19, 8.23]	1.14	484	.246	3.12	2.63	[-2.02, 8.29]	1.19	484	.235
Personal Mastery	2.16	2.43	[-2.62, 6.94]	.89	484	.374	1.64	2.42	[-3.12, 6.41]	.68	484	.498
Gender	-7.63	17.24	[-41.51, 26.25]	-.44	484	.658						
Time Since Diagnosis							7.52	5.40	[-3.09, 18.12]	1.39	484	.164
Social Support X Personal Mastery X Gender	-1.68	1.23	[-4.10, 0.74]	-1.36	484	.173						
Social Support X Personal Mastery X Time Since Diagnosis							.19	.34	[-.48, .87]	.57	484	.571

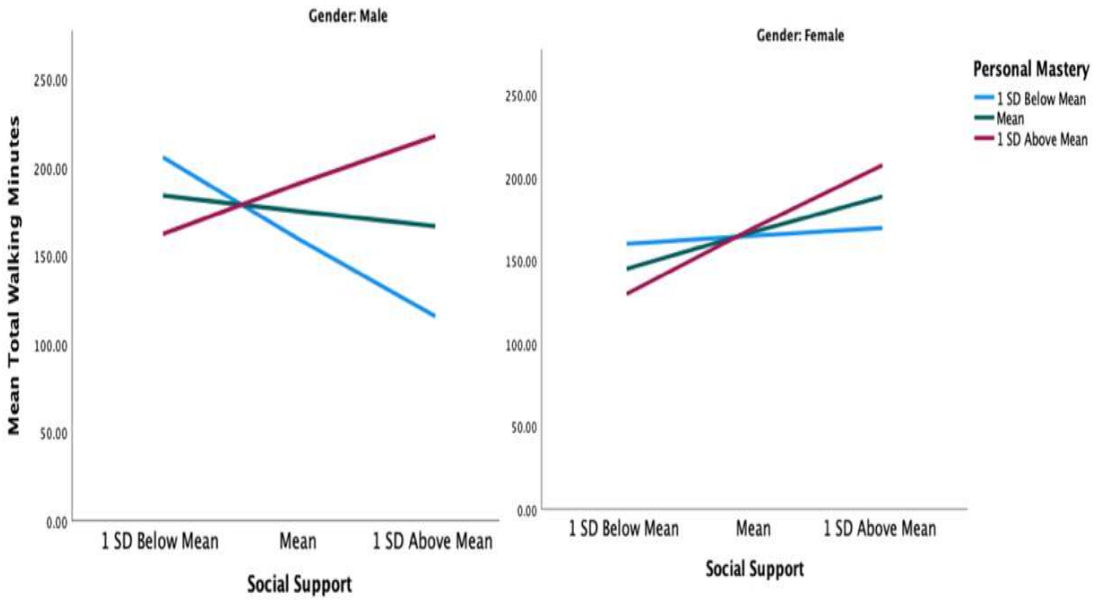

Figure 4. Relation between Social Support and Total Walking Minutes Moderated by Personal Mastery and Gender

Time since diagnosis was also examined as an exploratory moderator (F[9, 484] = 3.16, p = 0.001, R^2 = 0.06). Once again, the three-way interaction was not significant for predicting walking. However, there was variability across different time points such that those with low personal mastery did not consistently show a negative relation between social support and walking, and those with high personal mastery did not consistently show a positive relation with walking, across time since diagnosis (see Table 5 & Figure 5).

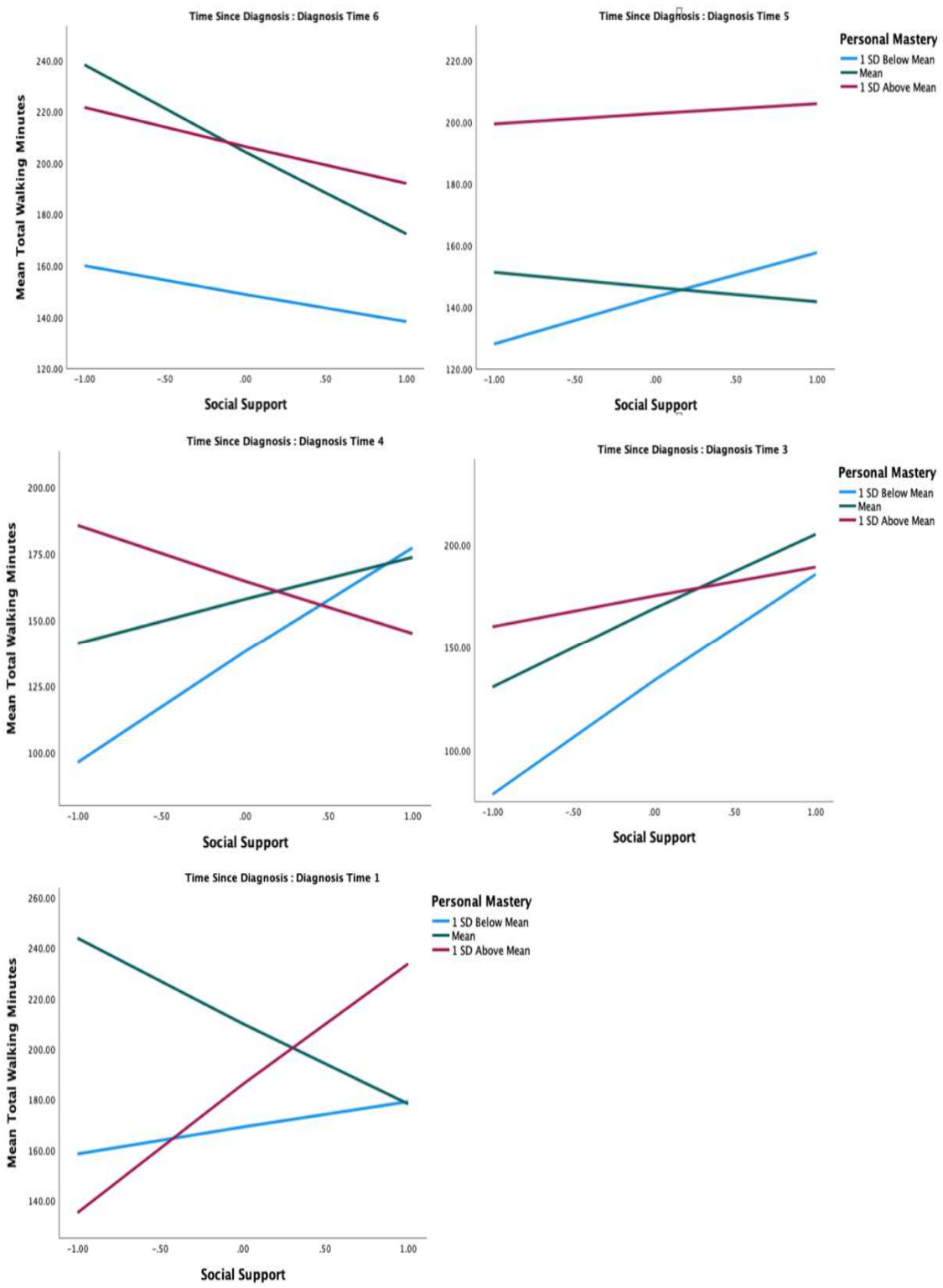

Figure 5. Relation between Social Support and Total Walking Minutes Moderated by Personal Mastery and Time Since Diagnosis

Chapter 4

Discussion

The present study used an existing longitudinal dataset at Rowan University to improve upon the current understanding of relations between social support and healthy behaviors among older adults with previous diagnoses of cancer. Specifically, the goal of this study was to examine relations between internal resources (personal mastery), external resources (social support), and recommended health behaviors in this population. The proposed secondary analyses also were intended to provide needed insight into the roles of gender and time since diagnosis to help explain these relations. Together, findings from this study could help to refine aims and hypotheses for future work with this population.

Mediterranean Diet Moderation

Specifically, the moderating effect of personal mastery was examined in the relations between social support and (1) Mediterranean diet adherence and (2) physical activity (defined as total minutes of vigorous, moderate, walking, strength activity). Focusing first on Mediterranean diet, hypotheses were not supported. Despite its impressive health benefits, including 25% lower risk for all-cause death among elderly individuals (Bonaccio et al., 2018), adherence to this diet has been suggested to decline around age 60 (Bonaccio, et al., 2014). Participants in the present study showed poor overall adherence, which may have limited the extent of between-person variability and thus, the predictive power of the model. Also possible is that personal mastery may not be a meaningful predictor of diet adherence. For example, previous research has suggested that personal mastery does not moderate the relation between closeness to

unhealthy food and diet quality (Machenbach et al., 2018). Previous studies much more often examined social support and personal mastery in relation to physical activity (compared to diet) or tended to collapse health behavior engagement. For example, one longitudinal study suggested that the individuals with the poorest health behaviors also had a low sense of control and poor social support, though diet and physical activity engagement were combined (Seeman, Seeman & Sayles, 1985). Though it might be useful to explore this further, it is possible that targeting individuals with a cancer diagnosis with low personal mastery might not be useful for promoting adherence to healthy diet.

Physical Activity Moderation

With respect to physical activity, specific hypotheses also were not supported. As mentioned earlier, it may be that older adults, especially those with a cancer diagnosis, are not engaging in adequate amounts of physical activity, with only 36% of participants in the present study reporting at least 300 minutes of moderate or 75 minutes of vigorous activity per week. One systematic review cited many articles showing a significant portion of older adults reported engaging in leisure time physical activity (LTPA; i.e., up to 68%), with some older adults working to meet physical activity guidelines with LTPA alone (Sun, Norman & While, 2013). This could once again lower the potential predictive power of the model. Importantly, however, the data showed a different pattern when examining walking minutes, rather than total minutes of physical activity, such that personal mastery moderated the relation between social support and physical activity when only walking minutes were included, compared to all activity types (moderate, vigorous, walking, strength). This is consistent with recent meta-analyses that have

shown that social support is linked with physical activity across multiple studies, but is much more likely when considering just leisure time physical activity (which often included lighter activity such as walking for pleasure), compared to combining a variety of physical activity levels (Smith et al., 2017).

The U.S. Department of Health and Human Services advises that older adults refrain from sedentary behavior as much as possible, and any increase in physical activity is preferable (HHS, 2018). Bodies such as the American Cancer Society recommend engaging in lighter activity (e.g., a brisk walk) if there are significant barriers to more strenuous activity, especially if individuals are currently or recently undergoing cancer treatment (ACS, 2020). One randomized control trial suggested that even lighter activity such as walking could increase self-efficacy for increasing later activity among previously sedentary older adults (McAuley et al., 2003). Further, exercise-specific social support offered significant indirect effects between frequency of physical activity and self-efficacy. Part of the benefit from social support might be an increase in intrinsic motivation. It has been found that greater emotional support was associated with greater pleasure and engagement in leisure-time moderate to vigorous activity and walking (e.g., an individual may have an increase in intrinsic motivation for physical activity when other individuals are present and providing social reinforcements; Haughton et al., 2006). Keeping in mind these potential benefits of increased walking among older adults, findings from the present study might be worth further examination. Overall, general patterns were in the expected direction. When examining simple slopes, it can be seen that, for individuals with low personal mastery, there was a negative relation between social support and walking, compared to individuals with high personal

mastery, for whom there was a positive relation. Adding the personal mastery-by-social support interaction showed a significant improvement in the model, even while controlling for functional ability and BMI.

This finding suggests that not only might one's belief of control over their situation (i.e., cancer diagnosis) facilitate greater effectiveness of social support (and thereby their walking activity), but that this is irrespective of one's potential physical limitations. Therefore, this finding hones in on the moderating power of one's *perception* of their control compared to their reported physical limitations. Overall, this is in line with the Theory of Stress and Coping (Lazarus & Folkman, 1984), such that an individual's response to a stressful situation will be the product of their internal and external resources. In this case, the external resources of social support might only be as helpful as the internal resources of personal mastery allow one to believe they have control over their situation and therefore, should engage in positive health behavior. In other words, if an individual does not perceive that they have control over their circumstances, they may not be motivated to engage in healthy behavior as "it won't make a difference" Therefore, when social support is received, it may not be as motivating as it could be in motivation for healthy behavior.

For this reason, it might be useful to engage in intervention with individuals with a cancer diagnosis who demonstrate (either passively or actively, via a validated measure) that they have low personal mastery or belief that they have control over their situation (i.e., diagnosis), as it might help to maximize the perception of social support and its motivating power for physical activity. Mastery Enhancement Therapy (MET) programs have previously been developed and utilized for individuals with cancer (e.g.,

based on the Self-Regulation Model; Carver & Scheier, 1998). One RCT demonstrated that brief MET (compared to usual care) among a sample of individuals with cancer improved mental health outcomes such as coping efficacy and adjustment immediately after treatment, while the control group showed some (though not comparable) improvement at three months post-treatment (Nairn, 2004; Nairn & Merluzzi, 2019). Personal mastery also has been a significant mediator of the relations between physical activity and (1) fatigue, (2) distress and (3) quality of life, and suggested as a useful tool for future intervention during a cancer diagnosis (Buffart et al., 2013). However, these interventions included individuals 18 years old and older and did not examine health behavior outcomes. It might be useful to adapt an MET intervention for examining physical health outcomes such as physical activity for a cancer population, particularly for older adults with low personal mastery (Bandura, 1977).

When examining personal mastery as a moderator between social support and walking minutes, there were less clear patterns when looking between time since diagnosis. It is worth noting that patterns did not appear to be a clear progression (in either direction) over time. This was interesting considering the potential expectation that personal mastery would matter more earlier in the diagnosis when uncertainty is highest. It might be that given the unique nature of a cancer diagnosis (e.g., possibility of recurrence), patterns with mastery could be more variable, especially between age cohorts (Pudrovska, 2010). Given the preliminary differences found between gender and time since diagnosis, this might be a further point for tailoring. For example, it was seen that the differences between low and high personal mastery were much more prominent for individuals who identified as men compared to those who identified as women. Men

with low personal mastery appeared to have a negative association between social support and walking, while women had mostly positive associations at both levels of personal mastery. Therefore, individuals who identify as men might have more to gain from an intervention. Specifically, it might be helpful to begin with assessment and promotion of personal mastery. Gender differences have previously emerged in social support among older adults (i.e., social support showing stronger positive effects for men; Fischer & Beresford, 2015), however the addition of personal mastery in this context allows for a greater level of understanding. One recent study showed that mastery mediated the relation between cancer diagnosis and physically burdening symptoms (e.g., fatigue, pain, poorer strength), and that a decline in personal mastery was significantly more common among Caucasian men compared to women and African American men, which the author attributes to potential threat to privilege as a result of decline of masculine body (Pudrovska, 2018). Considering the large proportion of Caucasian participants, this might be a relevant pattern for the present study's gender differences.

When examining model comparison estimates, noteworthy differences emerge between the Mediterranean diet and physical activity. AIC and BIC estimates produced from the model comparison suggested almost identical closeness of fit of the full and reduced models for both Mediterranean diet and physical activity, but the Bayes factors suggested a substantial discrepancy between full and reduced models for diet though not physical activity. Specifically, Bayes factor in the Mediterranean diet model suggested very strong evidence for the reduced model over the full model, while Bayes factor for the physical activity model suggested anecdotal to moderate level of evidence for the reduced compared to the full model. Therefore, the Mediterranean diet model comparison

suggested far greater certainty that the reduced model without the interaction fit the data better than the full model. However, the model comparison for physical activity suggested that there was far smaller discrepancy (i.e., less evidence) supporting the reduced model over the full model compared to the diet model.

It is possible that, compared to diet, personal mastery might have greater relevance for physical activity for this population, given the more substantial changes in individuals' relationship with their functional abilities and implications for safety (i.e., lower personal mastery and social support were two significant predictors of fear of falling among older adults; Deshpande et al., 2009). Further, physical activity might require additional effort and be perceived as not essential for health or survival, while eating may be seen as automatic and essential. For example, physical activity might require a greater amount of energy, which could be perceived as a barrier given the diagnosis and treatment-induced fatigue and weakness (Keogh et al., 2014). Physical activity and dietary habits are often studied together, which could be helpful, though researchers should take care to ensure that health behaviors are not lumped together, as assumptions could easily be made such that one model can explain engagement in one health behavior simply because it could explain another behavior.

Chapter 5

Strengths, Limitations & Future Directions

The present study was a secondary analysis from a large, archival dataset (ORANJ BOWL) that was originally collected to understand predictors of successful aging in a sample of older adults in the state of New Jersey. This set of analyses examined personal mastery as a moderator between social support and health behaviors in a midlife to older adults with cancer. As mentioned earlier, top limitations of health behavior research in the cancer population are greater focus (1) on cancer survivors' physical activity compared to patients, (2) breast and prostate cancers compared to other localizations and (3) higher baseline status compared to poor (Kilari et al., 2016). As such, a strength of the present study was its use of minimal exclusion criteria, which might have facilitated greater inclusion of individuals across the cancer continuum and range of cancer types and no exclusion on the basis of functional status.

Therefore, it was useful to engage in secondary analysis as ORANJ BOWL, as it was not designed for the present purpose and captured a potentially more heterogeneous sample, including individuals with comorbidities as they may occur naturally. The relatively large, longitudinal nature of the original data collection effects also meant a sizable sample, which afforded us the ability to explore differences in the expected relations between groups. Specifically, the time since diagnosis was examined to determine whether variability existed earlier versus later in the cancer experience, which might be useful given the bias within cancer literature examining survivors and the potential differences previously cited on the cancer continuum (Pizzolli et al., 2019). Finally, the present study was the first (to our knowledge) to examine personal mastery as

a moderator of the relation between social support and health behaviors in a cancer population. Although both social support has been examined frequently as a crucial determinant of health (Bandura, 1977) and Active Aging (WHO, 2002), especially among chronically ill populations, findings tend to be mixed with respect to the benefit of support (Pinquart & Duberstein, 2009). Therefore, there is much yet to understand about how to maximize the effectiveness of social support for individuals with illnesses such as cancer.

As a secondary analysis project, this study also had noteworthy limitations. Recruitment for original sample for ORANJ BOWL was exclusively done in the state of New Jersey, which was intended to represent similar characteristics in the general U.S. population (Pruchno et al., 2010). However, it is possible that this specific sample is not as representative as desired. Further, only individuals who returned their survey at Time 6 could be included in this study, as this was the only time point in which all variables of interest were available. Therefore, the present sample might be restricted to a very specific set of individuals who participated for the duration of data collection. Attrition due to death or failing health and a variety of successful aging variables occurred, which might mean that these results skew slightly towards individuals with more positive health outcomes (Heid et al., 2018). Further, caution is always needed when using cross-sectional, self-report data, as self-report is often biased, particularly with respect to healthy behaviors (Althubaiti, 2016). Utilizing repeated measures might have been useful in understanding temporal patterns and causal relations; however, this was not an option in the present analyses, as all variables of interest were only during one time point.

In addition, many of the measures of interest for the present study were created for the purpose of the original study and have not been validated using traditional methods. Although they were created to minimize participant burden and mimicked important features of commonly used measures, it is possible that these measures perform differently than those that have more extensive psychometric evidence. As a result, previous ORANJ BOWL articles were used as reference points to provide context for the present sample's average scores. Further, the operational definitions for some variables of interest for the present study were limited. For example, the social support measure appears to primarily measure emotional support (compared to instrumental, informational, or a combination) and the healthy diet measure was specifically examining Mediterranean adherence (a very specific type of diet). From the perspective of measurement, if the operational definition of healthy diet was servings of fruits and vegetables per week, the results might have been different, and potentially easier to compare to recommendations. Further, a recent meta-analysis suggested that the relation between social support and physical activity among older adults was sensitive to measurement differences. Physical activity engagement and physical activity-specific social support from family members showed a positive association overall, while no associations were present between physical activity engagement and (1) physical activity-specific social support from friends, (2) general social support or (3) loneliness (Smith et al., 2017).

Finally, the data for the physical activity outcome (total minutes on average per week) as well as broken up into individual activity types (moderate, vigorous, walking, strength exercises) included some missing data, were slightly positively skewed. This is

consistent with existing evidence showing low engagement in physical activity, especially among older adults with cancer (Mikkelsen et al., 2019). Skewness and kurtosis were not extensive enough to violate assumptions of normality (Kline, 2015). However, log-transformed versions were included as well to ensure that statistical significance was consistent.

Moving forward from the present study, it would be beneficial to further examine poor engagement in health behaviors specifically among older adults with cancer. It is possible that the present findings are an artifact of this particular sample, who were not recruited for their experiences with cancer. However, the expected patterns were fairly consistent throughout the physical activity models (i.e., high personal mastery meaning positive relations between social support and physical activity, low personal mastery meaning less positive, and in some cases, negative relations). Further examining differences in personal mastery might provide insight into how to maximize social support, and therefore health behavior in this population.

From a more general perspective, personal mastery (and self-efficacy more broadly) have long been considered crucial for health behavior engagement. Considering the wide gap between health behavior recommendations for older adults and their actual engagement, a shift in focus to identifying barriers and focusing on interventions to increase personal mastery or self-efficacy might be practical. If there is further evidence that individuals who are recently or currently undergoing cancer treatment have uniquely altered physical activity patterns compared to diet due to safety concerns (i.e., fear of frailty or falling), a stepped-care approach prioritizing personal mastery or self-efficacy might be appropriate. As mentioned, intervention to improve exercise efficacy with

walking has been effective (McAuley et al., 2003). As suggested by the present study, much of the barrier may come from perception of poor functional ability compared to actual functional ability. Therefore, intervention to build upon current activity levels among older adults could only improve their engagement with physical activity overall.

Lastly, meta-analyses have suggested that most recent articles on the relations between social support and physical activity among older adults were cross-sectional and described between-person relations (Smith et al., 2017). Even though the present study utilized a longitudinal dataset, the surveys were not consistent at each time point, and therefore, neither temporal relations nor differences within-person could be examined. Considering the great amount of variability suggested from these findings (i.e., differences by time since diagnosis), and the variability that seems to be present with individuals across the cancer continuum, it might be useful to explore other research methods when possible (e.g., examining individuals across a prognostic continuum compared to solely patients or survivors alone). Without expansion of methods, it is difficult to infer directionality with social support, physical activity and other related variables (Smith et al., 2017). Additionally, methodological limitations hinder the development of interventions that can assist individuals throughout their unique prognosis from cancer patient to survivor.

Conclusions

In sum, personal mastery did not moderate the relation between social support and (1) Mediterranean diet adherence or (2) total physical activity minutes among older adults who reported a diagnosis of cancer. However, for individuals with low personal mastery, there was a negative relation between social support and walking minutes, while those

with high personal mastery showed a positive relation. Further, there were noteworthy differences among men, who seemed to have more prominent differences between levels of mastery and some variability across the time since reported cancer diagnosis. Future research should clarify the role of personal mastery as well as explore how it could be useful in reducing the overall gap between health behavior recommendations and engagement in this population. Additionally, greater use of longitudinal methods would be helpful in investigating psychosocial influences on health behaviors in cancer, to understand nuances unique to individuals across the unique cancer continuum.

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Appendix A

Data Use Application

ORANJ BOWL℠
Data Use Application

In order to access ORANJ BOWL data, please fill out the following forms and submit to Rachel Pruchno, Ph.D., at pruchnra@rowan.edu for review. The ORANJ BOWL team will review all applications before data are made available for use.

NAME: Kristen Pasko, B.S. **DATE**: 3/09/20

INSTITUTION: Department of Psychology, Rowan University

ADDRESS: 201 Mullica Hill Drive, Robinson Hall, 109H

PHONE: (856)256-4872 **E-MAIL**: paskok45@students.rowan.edu

A. Study Information
Title: The Roles of Social Support and Personal Mastery in the Health Behaviors of Adults with Cancer

Authors/Collaborators:

Name	Role on Project	Title and Institution
Danielle Arigo, Ph.D.	Co-author	Assistant Professor, Department of Psychology, Rowan University
Megan Brown, B.S.	Data Manager	Research Coordinator, Clinical Health and Social Experiences Research Lab

1. *Purpose*
The purpose of the proposed study is to examine a potential interaction effect between personal mastery and social support for predicting health behavior engagement (i.e., physical activity, diet) among older adults who self-report a cancer diagnosis, above and beyond the influence of BMI and functional ability. Original use of ORANJ BOWL data suggested that social support is a key predictor of successful aging. Although this is consistent with some of the existing research on the role of social support in health, a subset of this literature suggests that social support is not universally beneficial for individuals with chronic illnesses, and that its benefit might differ by gender. Additionally, some literature has suggested that the experience of social influence might be more salient during the earlier stages of a cancer diagnosis. The proposed study would contribute to a better understanding of previous equivocal findings, by testing (1) the moderating effect of personal mastery on the relation between social support and health behavior engagement in cancer, and (2) whether this effect differs by gender or time since cancer

diagnosis. Findings from this project would be submitted as a Masters Thesis in clinical psychology, for publication within a peer-reviewed journal, and for presentation at national conferences (i.e., poster and/or oral presentations). These results could provide much-needed insight on the role of social support for older adults with a cancer diagnosis.

2. *Description*
    a. Summary
        i. This is a secondary analysis project designed to examine the interaction effect between self-reported personal mastery and social support on health behavior engagement (i.e., physical activity, diet) among older adults with a cancer diagnosis. An additional aim is to determine whether any observed effects differ by gender and time since cancer diagnosis.
    b. Background
        i. Despite growing emphasis on health behavior maintenance for older adults with a cancer diagnosis, crucial recommendations (such as those for maintaining physical activity and a healthy diet) often are not met (Winkels et al., 2016; Mustian et al., 2006). Social support has been demonstrated as useful in promoting health behavior in this population (Barth, Schneider & von Känel, 2010; Melchior et al., 2003; Philogene et al., 2009). However, there is conflicting evidence as to whether social support is health-protective (Prins, 2019; Hakulinen et al., 2015; De Vogli, Chandola & Marmot, 2007) and if its support processes differ by gender (Larsen, 2011). Similar to social support, personal mastery (i.e., one's belief that they can control the outcome of their event, Tang, Lai, & Chung, 2010) has been identified as a useful resource (Spencer & Patrick, 2009). According to the Transactional Model of Stress and Coping, when an individual experiences a highly stressful event, their reaction to that event is a product of the interaction between the individual's internal and external resources (Lazarus & Folkman, 1984). Therefore, for an older adult with a cancer diagnosis, the effectiveness of their external social support might depend on their internal personal mastery. However, this has not previously been examined, nor have potential gender or time since diagnosis differences in relations between personal mastery, social support, and health behaviors in this population. Further, BMI and functional ability/mobility would be helpful to include as covariates as these variables have been reported as barriers (and thus, potential confounds) to health behavior engagement in older adults (i.e., exercise, diet; Berthancourt et al., 2014; Rachmah et al., 2019). This might provide insight into distinction between perceived and actual ability with respect to health behavior for this population.
    c. Aims
        i. To test the potential interaction effect of personal mastery and social support for predicting physical activity engagement (T6), and healthy diet (T6), among individuals who self-report a cancer diagnosis (T1,3,4,5,6 – will be used to calculate approximate time since diagnosis). Covariates for these models will be BMI (i.e., calculated with height and weight from T6) and functional ability/mobility (T6).
        ii. To engage in exploratory analysis to examine gender (T1) and time-since cancer diagnosis differences (i.e., estimated from self-reports of cancer diagnosis from T1,3,4,5,6) in this potential interaction effect of personal mastery and social support on physical activity engagement, and healthy diet. Covariates for these models will be BMI and functional ability/mobility.

B. Hypotheses

a. We hypothesize that, controlling for BMI and functional ability/mobility, an interaction effect (between personal mastery and social support) on physical activity and dietary habits will be statistically significant.
   1. Specifically, we expect to observe that participants with higher (vs. lower) personal mastery will show a positive linear relation between social support and health behavior outcomes (physical activity and dietary habits).
   2. Conversely, participants lower (vs. higher) in personal mastery will show a negative linear relation between social support and health behavior outcomes (physical activity and dietary habits).

C. Methods

1. *Design*
   a. Independent variable: Social support
   b. Dependent variables: Physical activity engagement, dietary intake
   c. Covariates or moderator variables: Personal mastery (moderator), gender (moderator) time since diagnosis (moderator), BMI (covariate), functional ability/mobility (covariate)
2. *Planned Sample*

   Participants in the original ORANJ BOWL study who indicated "yes" when asked, "Have you ever been told by a doctor or other health professional that you had cancer?" at any assessment point and submitted the Time 6 survey will be included.

D. Analysis Plan

1. Statistical technique(s)
   a. We will use separate general linear models to test the proposed interaction (moderator) effect between social support and personal mastery on (1) physical activity, and (2) dietary habits as well as examine gender and time since diagnosis as additional exploratory moderators. Assessments of social support, personal mastery, physical activity, and dietary habits will be used at Time 6. Assessments of gender and time since cancer diagnosis will be used at Time 1 and Time 1,3,4,5,6, respectively. Estimates of time since cancer diagnosis will be calculated by subtracting the earliest survey return date in which participants self-reported a cancer diagnosis from the Time 6 survey return date. These models will control for BMI and functional ability/mobility from assessments at Time 6.
2. Each variable's role in the technique (e.g. IV, DV, moderator, mediator, covariate)
   a. Social support (IV), physical activity (DV), dietary intake (DV), personal mastery (moderator), gender (moderator), time since cancer diagnosis (moderator), BMI (covariate), functional ability (covariate)
3. Rationale for each covariate used.
   a. BMI and functional ability/mobility will be used as covariates given their potential to influence the outcome variables of physical activity and dietary habits.

E. Data Security

All data files shared through ORANJ BOWL must be secured to prevent unauthorized access. Please describe how and where the data will be stored by addressing each of the following points for each device the data will be stored on:

a. Device type.
    a. Desktop PC
b. Does this device have internet access?
    a. Yes
c. Is there firewall protection technology in place for devices that are connected to the internet?
    a. Yes, this protection is standard for Rowan University's network
d. Does this device require a login and password at startup and after a period of inactivity?
    a. Yes
e. Is the directory containing the data restricted to authorized users?
    a. Yes
f. Is there anti-virus software installed on the device?
    a. Yes
g. Where is the device stored?
    a. In a research suite housed within Rowan University
h. Describe the physical security of the location where the device is stored.
    a. This device is stored in a locked room in a locked suite within the Rowan Psychology department. Further, this suite is not accessible by others outside of lab members.

Please use the ORANJ BOWL construct chart that outlines all constructs and variables in the data repository (available upon request from the project team) to identify the variables that you would like to use to answer your research questions. Submit your list with this form.

**Requested variables highlighted in blue*

ORANJ BOWL℠
Data Use Application Terms of Use

This Data Use Agreement ("Agreement") governs the disclosure and use of non-protected health information (PHI) data in the ORANJ BOWL database, which is owned and maintained by Rowan University School of Osteopathic Medicine. Rowan University's ORANJ BOWL team reserves the right to classify persons as authorized users of ORANJ BOWL data. Only authorized users may access ORANJ BOWL data. Approval is contingent upon review of the Data Use Application and completion of this Data Use Application Terms of Use. All ORANJ BOWL users must read and agree to the terms of use in this Agreement before access to the data will be granted, by signing at the bottom of this form.

As a data repository, all ORANJ BOWL users must also adhere to the Institutional Review Board (IRB) requirements put forth by Rowan University School of Osteopathic Medicine. This agreement does not act in place of an IRB approval. All approvals of data use must then be submitted for IRB approval as a secondary data analysis project with de-identified data through the investigator's home institution (pending institution regulations). Please forward notice of IRB approval to our study office for our records.

Privacy of Research Subjects

A research subject is a person who responded to ORANJ BOWL surveys or any other person who authorized the subject to provide information on that person's behalf. Any intentional identification of a research subject or unauthorized disclosure of his or her confidential information violates the agreement of confidentiality given to all participants. Therefore, the undersigned agrees to:

- Ensure that the data are kept in a secured environment and that only authorized users will have access to the data;
- Use these data solely for research or statistical purposes and not for investigation of specific research subjects;
- Not attempt to establish the identity of, or attempt to contact any of the research subjects; and
- Make no use of the identity of any research subject discovered inadvertently and to advise the ORANJ BOWL team (pruchnra@rowan.edu) of any such discovery immediately.

Redistribution of Data

An authorized user is an individual who has been given written permission by the ORANJ BOWL team to access and use the data or is a listed collaborator on an approved project. Therefore, the undersigned agrees to:

- Not redistribute data or other materials without the written agreement of the ORANJ BOWL team unless collaborating with another authorized user to analyze the data for research or instructional purposes;
- Include all accompanying files with the data, including terms of use, when sharing data or other materials with collaborating users;
- Ensure that collaborating users have appropriate administrative, physical and technical safeguards in place to prevent use or disclosure of data other than as provided for by this Agreement;
- Require that collaborating users promptly report any use or disclosure of data that does not comply with the guidelines established by this Agreement; and
- Require all collaborating users to abide by the ORANJ BOWL terms of use.

Updated 8/7/19

Citing Data

The undersigned agrees to consult with Principal Investigator, Rachel Pruchno, Ph.D., for all funding acknowledgements prior to any data use and shall include such acknowledgements in all applicable distribution of work. The undersigned agrees to reference the data in the following way with acknowledgement to the funding sources identified by Dr. Pruchno:

> Rachel Pruchno. ORANJ BOWL℠ (Ongoing Research on Aging in New Jersey: Bettering Opportunities for Wellness in Life) Project, Stratford, NJ: Rowan University School of Osteopathic Medicine.

Authors of publications and presentations based on ORANJ BOWL data are required to send citations of their published work and copies of final manuscripts to the ORANJ BOWL team (pruchnra@rowan.edu) for inclusion in a database of ORANJ BOWL work. Copies of presentations on ORANJ BOWL must also be submitted to pruchnra@rowan.edu within one month after the presentation was given. If no publication, presentation or other work is produced within one year, the researcher is required to send a summary of findings to date and a revised plan for dissemination annually (from date of data receipt) until project purpose is accomplished. If a team is not moving forward on a proposed project, the Principal Investigator, Rachel Pruchno, Ph.D., in consultation with the ORANJ BOWL Research team, reserves the right to revoke agreement for use of data and allow another interested party to explore the proposed analyses.

Disclaimer

The undersigned acknowledges that the original collector of the data and the relevant funding agency bear no responsibility for use of the data or for interpretations or inferences based upon such uses. The undersigned agrees to indemnify, defend and hold harmless Rowan University and the ORANJ BOWL team from any or all claims and losses accruing to any person, organization or other legal entity as a result of violation of this Agreement.

Violations

If the ORANJ BOWL team determines that the terms of this Agreement have been violated, Rowan University will act according to the following policy on terms of use violations. Sanctions include, but are not limited to:

- Rowan University may revoke this Agreement, demand the return of the data in question, and deny all future access to ORANJ BOWL data;
- Rowan University may report the violation to the Research Integrity Officer, Institutional Review Board, or the user's institution, for necessary sanctions to be enforced. If the confidentiality of human subjects has been violated, Rowan University may report the case to the Federal Office for Human Research Protections. This may result in an investigation of the user's institution, which can result in institution-wide sanctions including the suspension of all research grants; and/or
- A court may award the payment of damages to any individual harmed by breach of this Agreement.

My signature indicates that I understand the terms of this Agreement and that I agree to comply with its terms.

Kristen Pasko	Kristen Pasko	03/09/2020
PRINTED NAME APPLICANT	SIGNED NAME	DATE

Signature below indicates approval of data use for the above signed applicant:

Rachel Pruchno PhD		3/17/20
PRINTED NAME ROWAN UNIVERSITY REPRESENTATIVE	SIGNED NAME	DATE

Updated 8/7/19

Appendix B

Cancer Measure

Now I will read a list of health conditions and diseases. As I do, please tell me whether a doctor or other health professional has ever told you that you had that condition.

NOTE: DON'T KNOW (DK) AND REFUSED (RF) WILL BE AVAILABLE FOR ALL QUESTIONS IN THIS BATTERY.

Have you ever been told by a doctor or other health professional that you had …

1. Arthritis

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

2.Hypertension or high blood pressure

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

3.Any kind of heart condition or heart disease, such as coronary artery disease, angina, or heart attack (sometimes called a coronary, MI, or myocardial infarction)

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

4. Cancer

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

5. Diabetes

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

6. Osteopenia or osteoporosis

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

7. A stroke

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

8.Liver disease or hepatitis

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

9. Lung or breathing problems, such as chronic bronchitis, asthma, or emphysema

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

10. Parkinson's Disease

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

11. Multiple Sclerosis

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

12. Migraine headaches, not just headaches

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

13. Depression, anxiety, or other emotional problems

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

14. HIV or AIDS

Y/N_____

Are you taking any prescription medications for that?

Y/N_____

And are you taking any non-prescription medicines or dietary supplements for that?

Y/N_____

Appendix C

Personal Mastery Measure

On a scale of 1 to 7 with 1 meaning "Strongly agree" and 7 meaning "Strongly disagree", how strongly do you agree or disagree with these statements about yourself?

[*Items 4 & 6 must be reverse-scored. Higher scores indicate a higher level of self-mastery]

Strongly agree Neither agree nor disagree Strongly disagree

1 2 3 **4** 5 6 **7**

1. There is really no way I can solve some of the problems I have.

2. Sometimes I feel that I'm being pushed around in life.

3. I have little control over the things that happen to me.

*4. I can do just about anything I really set my mind to.

5. I often feel helpless in dealing with the problems of life.

*6. What happens to me in the future mostly depends on me.

7. There is little I can do to change many of the important things in my life.

Appendix D

Social Support Measure

1. How often do you feel there is someone you can count on to listen to you when you need to talk?

 None of the time

 A little of the time

 Some of the time

 Most of the time

All of the time

2. How often do you feel that someone is available to give you good advice about a problem?

 None of the time

 A little of the time

 Some of the time

 Most of the time

All of the time

3. How often do you feel that someone shows you love and affection ?

 None of the time

 A little of the time

 Some of the time

 Most of the time

All of the time

4. How often do you feel that there is someone you can count on to provide you with emotional support in talking over problems or helping you make a difficult decision?

None of the time

A little of the time

Some of the time

Most of the time

All of the time

Appendix E

Diet Measure

1. How often do you have beef, pork, or lamb (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

2. How often do you have margarine or shortening, not including butter (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

3. How often do you have dark chocolate or cocoa (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

4. How often do you have ice cream or frozen yogurt (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

5. How often do you have candy, honey, or syrup (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

6. How often do you have whole eggs, that is, eggs including the yolks (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

7. How often do you have milk, cheese, yogurt, or other dairy products (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

8. How often do you have tomato juice or tomato-based blends such as V-8 (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

9. How often do you have red spaghetti sauce or other forms of stewed or cooked tomatoes (in a
typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

10. How often do you have any kind of nuts or seeds not including peanut butter, or other nut or seed spreads or butters (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

11. How often do you have citrus fruits such as oranges, grapefruit, kiwi, or lemons (in a typical

week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

12. How often do you have dark or whole grain breads, rolls, pasta, or cereals, such as bran, rye, or oatmeal (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

13. How often do you have white rice, pasta, white bread or foods made from white or bleached flour (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

14. How often do you have broccoli, cauliflower, or Brussel sprouts (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

15. How often do you have spinach, kale, bok choy, cabbage, mustard greens, or collard greens (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

16. How often do you have hot dogs, bacon, lunch or deli meats, cold cuts, spam, smoked fish, or
jerky (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

17. How often do you have fish, not including shellfish (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

18. How often do you have packaged baked goods, such as cookies or cakes (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

19. How often do you have lentils or beans such as chick peas, red beans, or black-eyed peas (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

20. How often do you have potato chips or corn chips (not pretzels or crackers) (in a typical week)?

 Almost every day

 3 or 4 days a week

 1 or 2 days a week

 Less often than that

21. When a reduced fat or “lite” version of a food is available, how often do you tend to choose that product?

 Never

 Rarely

 Some of the time

 About half the time

Most of the time

Almost always

22. When a reduced sodium or low salt version of a food is available, how often do you tend to

choose that product?

 Never

 Rarely

 Some of the time

 About half the time

Most of the time

Almost always

23. When a sugar free or artificially sweetened version of a food is available, how often do you tend to choose that product?

 Never

 Rarely

 Some of the time

 About half the time

Most of the time

Almost always

Appendix F

Physical Activity Measure

1. Over the past 30 days, did you do any vigorous exercise activities for at least 10 minutes? Some examples of vigorous exercise activities include running, lap swimming, aerobic exercising, or fast bicycling.

Over the past 30 days, did you do any vigorous activities for at least 10 minutes?

Y/N _____

On average, how much time would you estimate you spend doing these vigorous activities each week?

_____ minutes/minutes

2. Over the past 30 days, did you do any moderate exercise activities for at least 10 minutes? Some examples of moderate exercise activities include brisk walking, bicycling for pleasure, golfing, or dancing.

Over the past 30 days, did you do any moderate activities for at least 10 minutes?

Y/N_____

a. On average, how much time would you estimate you spend doing these moderate

activities each week?

_____minutes/week

3. Over the past 30 days, did you take a walk for at least 10 minutes? Please include taking a walk around town or in a park for pleasure, walking several blocks to a store, taking a dog for a walk, and other things like that (but do not include brisk walking you have already included in the prior category).

Over the past 30 days, did you walk for at least 10 minutes?

Y/N_____

a. On average, how much time would you estimate that you walk each week?

_____minutes/week

4. Over the past 30 days, did you do any physical activities designed specifically to strengthen your muscles, such as lifting weights, or doing push-ups or sit-ups? Please include all such activities, even if you had included them in your prior answers.

Y/N_____

a. On average, how much time would you estimate that you spend doing these strengthening exercises each week?

_____minutes/week

5. Over the past 30 days, did you practice yoga, Tai Chi, or QuiChong?

Y/N_____

a. On average, how much time would you estimate you practice this during each week?

_____minutes/week

Appendix G

Supplementary Analysis A

As mentioned, the physical activity data was positively skewed for total minutes and walking minutes (1.93 and 1.98, respectively). Additionally, kurtosis was somewhat elevated (4.77 and 3.82). This raised a question about the appropriateness of using raw data. As a result, the models including physical activity were also run with data transformed by a log of 10, bringing skewness and kurtosis to more reasonable levels for walking (i.e., -0.06, -0.31) and total physical activity (-0.55, 0.03). It should be noted that experts have recently updated their guidelines and stated that only skewness above 2 and kurtosis above 8 were cause for concern (Kilne, 2015). However, to allow for transparency and to ensure that patterns were still similar regardless of use of raw or transformed data, both were examined.

The overall model examining personal mastery as a moderator of the relation between social support and transformed total physical activity minutes was significant, ($F[5, 615] = 21.6994$, $p < 0.001$, $R^2 = 0.15$. The main effect of personal mastery was significance ($b = 0.01$, $p = 0.005$), while the main effect of social support was not ($b = 0.005$, $p = 0.34$). Both covariates were significant predictors of total physical activity (ps <0.001). Similar to the model with raw data, personal mastery was not a significant moderator of total physical activity minutes ($b = 0.001$, $p = 0.22$).

With the outcome of transformed walking minutes, the total model was significant, $F(5, 488) = 5.0101$, $p < 0.001$). Neither social support nor personal mastery

showed significant main effects (ps > 0.08). Both covariates were significant (ps < 0.05) as well as the interaction effect (p < 0.05). This was also similar to the raw data model such that personal mastery did moderate the relation. However, when examining simple slopes, patterns were somewhat different. Individuals with low personal mastery showed insignificant positive relations between social support and walking minutes, compared to those with high personal mastery, who showed significant positive relations. In the model with raw data, those with low personal mastery showed negative relations between social support and walking.

Appendix H

Supplementary Analysis B

To provide further information about the data above and beyond SPSS output (i.e., simple slopes, *p*-values), RStudio was also used to (1) perform multiple imputation to ensure that observed effects were not a product of missingness, (2) perform a sensitivity analysis between transformed and non-transformed physical activity models (total physical activity and walking minutes), and (3) produce graphs that are defaulted to Loess lines (i.e., can curve more to the data).

Multiple imputation suggested that the observed effects were not a function of missingness. Specifically, estimates of the moderating power of personal mastery were quite similar with and without imputation for diet (*b*s = -0.0027, -0.0029), total physical activity (*b*s =2.00, 0.83, and walking minutes (*b*s =2.317, 2.317). This suggests that regardless of missingness, results were relatively unchanged.

Sensitivity analyses performed using the model.comparison function suggested strong evidence for the reduced (compared to full) total activity minute models with (Bayes Factor: 44.023, 0.023) and without transformations (Bayes Factor: 22.731, 0.044), such that the reduced models were favorited by about 20-points in both instances. However, the sensitivity analyses showed some discrepancies in the walking minutes model. This model comparison suggested very strong evidence for the full (compared to reduced) transformed walking minutes model (Bayes Factor: 0.013, 78.416), but anecdotal evidence for the non-transformed reduced model compared to the full model

(Bayes Factor: 2.473, 0.404). This suggests that transformations might not significantly alter the results for the total physical activity model, though transformations might greatly alter results for walking minutes. As such, claims about the moderating power of personal mastery on the relations between social support and walking should be made with caution.

Supplementary figures (below) show that the data possessed some curvilinearity that was not present using SPSS graphs, as the SPSS graph default is a more linear fit of the data. Therefore, once again the results should be interpreted with caution, especially the exploratory models using walking minutes as the outcome.