CORRELATES AND CONSEQUENCES OF PHYSICAL ACTIVITY AMONG SINGLE MOTHERS

BY

DEIRDRE DLUGONSKI

DISSERTATION

Submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy in Kinesiology
in the Graduate College of the
University of Illinois at Urbana-Champaign, 2013

Urbana, Illinois

Doctoral Committee:

Associate Professor Robert Motl, Chair
Professor Jennifer Greene
Professor Edward McAuley
Associate Professor Steven Petruzzello

Abstract

Single motherhood has been associated with negative health consequences such as cardiovascular disease, depression, and stress. Participation in physical activity might improve the health of single mothers, yet little is known about the correlates and consequences of this health behavior among this group of women. The two primary aims of this study were to use social cognitive theory (SCT) to explain physical activity and to examine the health consequences of physical activity among single mothers with young children. Participants (N = 94) were single (i.e., never married, divorced/separated, or widowed), not living with a partner, aged 18 – 50 years, not pregnant, with at least one child under 5 years old. Participants completed a packet of SCT questionnaires (i.e., self-efficacy, outcome expectations, goal setting/planning, social support, and barriers) and then wore an accelerometer during all waking hours for one week. Participants then completed a second battery of physical activity and health outcomes questionnaires (i.e., GLTEQ, IPAQ, CVD symptoms, depression, anxiety, stress, physical self-perception, and health-related quality of life). Only ~24% of participants were meeting public health guidelines for physical activity based on accelerometer minutes of MVPA. SCT constructs were generally associated with self-reported and objective measures of physical activity. The relationships between health outcomes and physical activity were less consistent, but provided initial support for the importance of promoting physical activity among single mothers to improve health. Overall, results from this study support the use of SCT for explaining physical activity behavior and highlight potential targets for future physical activity interventions for single mothers. Given the levels of inactivity among single mothers, such physical activity interventions are necessary and might have important health consequences.

Keywords: single mothers; physical activity; health; social cognitive theory

Acknowledgements

Many people in my life deserve recognition for their assistance and support during my time at the University of Illinois, especially during the past year as I worked to complete my dissertation. I feel incredibly lucky to have such a great support system and the acknowledgements included here only begin to express how grateful I am to each of you.

Thank you to my doctoral advisor, dissertation committee chair, and mentor, Dr. Rob Motl. Your consistent guidance and support were integral to the successful completion of my doctoral degree. Your mentorship throughout my graduate career has far exceeded my expectations and I have learned many lessons from you that I will carry with me throughout my career. I hope to be as good of a mentor to my future students as you have been to me.

Thank you to Dr. Jennifer Greene, Dr. Edward McAuley, and Dr. Steven Petruzzello for serving on my dissertation committee and providing invaluable feedback that improved this project. Your time and efforts are much appreciated.

To all of the past and present members of the Exercise Neuroscience Research Lab, thank you! I have learned so much about being part of a productive research team from working with all of you. I could not have asked for a better group of collaborators and you made coming to work every day a pleasure.

To my mom, your love, encouragement, and unwavering support have been present throughout my entire life and the past five years have been no exception. You have been a consistently positive force in my life and I thank you for always making me believe that my goals were within reach. I strive to be as kind, compassionate, and loving of a mother to William as you have been to me.

To my brother, Nick, thank you for being so caring and supportive. Your dedication, drive, and work ethic are an inspiration to me and I thank you for all of your love and support.

Thank you to my in-laws, Clare and Bill, for countless hours spent babysitting, walking our dog, making home cooked meals, and many other things, so that I could focus on finishing my dissertation. Every time I asked for help, you didn’t hesitate to do whatever was needed to make my life a little easier. I am grateful for all of your love and assistance.

Thank you to Steve for being a loving and patient husband to me and an amazing father to William. You were always there to listen, provide words of encouragement, reassurance that I could reach my goals, or just a moment of comic relief. I am lucky to have you in my life and could not have asked for a more supportive and loving husband. Thank you for all you have done to make my goal of earning my doctoral degree a reality.

Finally, thank you to all of the women who volunteered to participate in this study. Your time and effort towards making this study a success are much appreciated. I was truly amazed by your willingness to find time in your busy lives to participate in this research study. I am grateful to each of you for helping me to learn more about the physical activity and health of single mothers.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION

Single mothers are a growing demographic group among the United States population and this trend might have a significant public health impact. The number of births to unmarried women has reached a high of ~40% and this percentage has more than doubled in the past 30 years (Martin et al., 2012). The prevalence of divorce (Kreider & Ellis, 2011) and changing attitudes about cohabitation and childbirth outside of marriage (Thornton & Young-DeMarco, 2001) have further contributed to the increasing number of single mothers. Overall, there has been a nearly three-fold increase in the number of single mothers living in the United States since 1970 who now represent nearly 30% of all households with children (U.S. Census Bureau, 2011).

The growing population of single mothers in the United States is a public health concern given the evidence that exists for a relationship between single motherhood and negative health consequences. Such consequences include an increased risk for cardiovascular disease and diabetes compared to married mothers (Young, Cunningham, & Buist, 2005) and compromised self-reported health at midlife for women who had a nonmarital birth even after controlling for subsequent marriage (Williams, Sassler, Frech, Addo, & Cooksey, 2011). Several studies have reported a greater prevalence of mental health problems for single mothers compared to partnered mothers, such as mental disability (Crosier, Butterworth, & Rodgers, 2007), depression (Cairney, Boyle, Offord, & Racine, 2003; Landero Hernández, Estrada Aranda, & González Ramírez 2009), and lower self-worth (Elfhag & Rasmussen, 2008). Single mothers report higher use of mental health services (Cairney & Wade, 2002), higher levels of chronic stress (Cairney et al., 2003), and lower quality of life (Landero Hernández et al., 2009) compared to married mothers. Collectively, these negative health consequences highlight the critical need to examine and improve the health and well-being of single mothers.

These negative health outcomes might be associated with rates of physical inactivity among single mothers. For example, evidence suggests that parenthood, especially for mothers, is associated with decreased levels of physical activity (Bellows-Riecken & Rhodes, 2008). However, the small number of studies that have explored the physical activity of single mothers compared to married/partnered mothers, or non-mothers have produced inconsistent results. For example, in one longitudinal study, becoming a single mother was associated with an increased risk of being classified as inactive (Brown & Trost, 2003). Two other studies have shown either no difference in physical activity between single and partnered mothers (Young, James, & Cunningham, 2004) or an increased likelihood of physical activity participation for lone mothers compared to partnered mothers (Young et al., 2005). A recently completed pilot study demonstrated that single mothers were less physically active than married mothers and non-mothers using both objective and self-report measures of physical activity (Dlugonski & Motl, 2013). Importantly, single mother participants in this pilot study (n = 22) were not meeting public health guidelines for physical activity based on accelerometer minutes spent in moderate to vigorous physical activity (Dlugonski & Motl)

There is strong evidence that physical inactivity is a risk factor for negative health consequences among the general population, but very little is known about this association among single mothers. For example, low levels of physical activity, and in particular, decreases in physical activity, are associated with increased risk of myocardial infarction, ischemic heart disease, and all-cause mortality (Petersen et al., 2012). These results might be particularly important to note because having a child has been associated with decreased levels of physical activity (Hull et al., 2010) and this might increase the long-term risk for the aforementioned health conditions. Previous research has further described negative associations between physical activity and depression (Strine et al., 2008), anxiety (Strohle et al., 2007), and stress (Gerber & Pühse, 2009). Additionally, physical activity participation has been positively associated with self-esteem and overall well-being (Fox, 1999) as well as quality of life (Penedo & Dahn, 2005). These and other important benefits of engaging in physical activity underscore the importance of examining physical activity behavior and its consequences among single mothers.

If physical inactivity is associated with negative health outcomes among single mothers, then this emphasizes the importance of understanding correlates of physical activity among this group of women. Social cognitive theory (SCT; Bandura, 1986) has been widely used to explain, predict, and change health behaviors and might be particularly useful for identifying theoretically-based correlates of physical activity among single mothers. SCT is triadic (i.e., involves behavioral, individual, and environmental factors) and proposes reciprocal interactions between these three factors. The main components of SCT include self-efficacy, outcome expectations, impediments/facilitators, and goal setting. SCT is one of the most frequently used theories to promote lifestyle behavior change (Glanz & Bishop, 2010) and has been used to explain physical activity behavior in a wide range of populations including young adults (Rovniak, Anderson, Winett, & Stephens, 2002), older women (McAuley et al., 2009), persons with multiple sclerosis (Suh, Weikert, Dlugonski, Balantrapu, & Motl, 2011), and individuals who have type 1 and type 2 diabetes (Plotnikoff, Lippke, Courneya, Birkett, & Sigal, 2008). The specific relationships between SCT constructs have recently been described in detail (Bandura, 2004). Self-efficacy is the central construct in SCT and has direct effects on behavior, outcome expectations, goal setting, and facilitators/impediments. Self-efficacy further has indirect effects on behavior through outcome expectations, goal setting, and facilitators/impediments. Collectively, these proposed relationships among theory constructs clearly illustrate the ways SCT can be used to explain, predict, and change behavior within the context of individual, social, and environmental factors.

Specific Aims and Hypotheses

The two primary aims of this project were to apply SCT to explain variation in physical activity among single mothers and to identify possible health consequences of physical activity among this group of women. The third, exploratory purpose of this study was to examine differences in the correlates and consequences of physical activity based on social factors that have been associated with greater health disparity, including race, income, and education. It was hypothesized that:

1. SCT constructs of self-efficacy, outcome expectations, goal setting, and facilitators would be positively associated, whereas barriers (i.e., overall barriers and perceived stress) would be negatively associated, with self-reported and objective measures of physical activity.
2. Self-reported and objectively measured physical activity would be associated with lower levels of perceived stress, anxiety, and depression, decreased risk of cardiovascular disease, more positive physical self-concept, and enhanced health related quality of life.
3. Given the exploratory nature of the final purpose of this study and the lack of research on the physical activity of single mothers, no specific hypotheses were generated for this part of the study.

CHAPTER 2: REVIEW OF LITERATURE

This chapter details the increasing prevalence of single motherhood in the United States, the negative health consequences associated with this growing demographic and the potential for physical activity to ameliorate some of the negative health consequences of single motherhood. The final sections of this review describe the physical activity levels of single mothers, social cognitive theory constructs, and the potential for using social cognitive theory to explain physical activity among single mothers.

Prevalence of single motherhood

In 1970, there were 3.4 million single-parent households in the United States that represented ~13% of all households with children (U.S. Census Bureau, 2011). This number grew to nearly 12 million in 2011 and single parents now represent 31% of all households with children, with over 85% of these households maintained by single mothers (U.S. Census Bureau, 2011). Thus, more than a quarter of households with children in the United States are headed by single mothers and it is critical to better understand the health of this emergent demographic group.

Many factors have contributed to the increasing number of single mothers, including trends in nonmarital births, the prevalence of divorce, and changing attitudes towards cohabitation and nonmarital childbearing. In 2008, almost 41% of all births in the United States were to unmarried women, compared with 18.4% of births in 1980 (Martin et al., 2012). The composition of nonmarital births has also changed such that in 1970 half of all nonmarital births were to women under 20 years old compared to 23% in 2007 (Ventura, 2009). Similarly, the percentage of nonmarital births among women aged 20 – 29 years increased from 42% to 69% from 1970 to 2007 and from 8% to 17% among women older than 30 during the same time frame (Ventura, 2009). High divorce rates are a second contributing factor to the increasing number of single mothers. Despite the decreasing rates of divorce in the United States over the past few decades (Kreider & Ellis, 2011), more than half of all single mothers have been previously married (Mather, 2010), suggesting that divorce remains a significant contributing factor to single motherhood. Finally, societal attitudes towards premarital sex, cohabitation without marriage, and nonmarital childbearing have become more accepting in the past few decades further contributing to the increasing number of single mothers (Thornton & Young-DeMarco, 2001). For example, in 1976 nearly half of a sample of adults in the United States felt that unmarried childbearing violated a moral principle or was destructive to society compared to only ~35% in 1998 (Thornton & Young-DeMarco). It is evident from the aforementioned statistics that single mothers are a growing social demographic group among the United States population and there are multiple explanations for this trend. The following section of this review describes the negative health consequences associated with single motherhood and provides support for the need to study this expanding social demographic group among the United States population.

Negative Consequences of Single Motherhood

The increasing number of single mothers is concerning in light of the growing body of research documenting adverse health outcomes associated with single motherhood. Mental health outcomes and in particular, depression, have received the most attention, whereas relatively few studies have explored physical health outcomes such as diabetes, obesity, and cardiovascular disease in this population. This section describes the mental and physical health consequences associated with single motherhood including depression and anxiety, low self-esteem, stress, diabetes, cardiovascular disease, and reduced health related quality of life.

Depression and Anxiety

Depression is one of the most frequently studied health consequences among single mothers and numerous studies have demonstrated the association between single motherhood and depression. Previous research conducted in large samples from multiple countries suggests that depression and depressive symptoms are prevalent among single mothers. For instance, Turner (2006) studied depression rates among a random sample of 508 unmarried mothers who were 18 – 39 years old and living in rural or semi-rural locations. The percentage of single mothers in this study who reported an episode of major depressive disorder (37%) was significantly higher than the percentage of women in the general population who reported a similar episode (21%) (Turner, 2006). In another study of 140 mothers from Mexico, 81.8% of single mothers had symptoms of depression compared with 24.3% of mothers from two-parent families (Landero Hernández, Estrada Aranda, & González Ramírez, 2009). These results indicated that single mothers were more likely to report depressive symptoms than married mothers and the majority of all mothers who reported depression experienced low-severity symptoms (Landero Hernández et al., 2009). Similarly, the prevalence of depressive symptoms reported by single mothers was high among a sample of 205 low-income mothers with young children, aged 2 – 6 years old (Peden, Rayens, Hall, & Grant, 2004). In this study, half of the single mothers reported depressive symptoms that were moderate to severe according to the Beck Depression Inventory and two thirds of the sample scored in the high depressive symptoms range on the Center for Epidemiologic Studies Depression scale (Peden et al., 2004). Overall, these studies provide consistent evidence for the elevated prevalence of depressive symptoms among single mothers.

Several cross-sectional studies have highlighted the increased likelihood of depressive symptoms, mental disorders, and anxiety among single compared to partnered mothers. In a nationally representative study of Canadian mothers (*N* = 9,953), single mothers were more likely to have had an affective disorder during their lifetime than mothers in dual parent families (Lipman, Offord, & Boyle, 1997). Single mothers were also more likely than partnered mothers to be poor, but single mothers of all income levels reported a higher prevalence of affective disorders and more frequent use of mental health services compared to partnered mothers (Lipman et al., 1997). These results are corroborated by findings from two additional cross-sectional studies examining the mental health of single and married mothers in Canada (Cairney et al., 2003; Cairney & Wade, 2002). The first study compared the use of mental health care services among single (*n* = 512) and married mothers (*n* = 2,549) using the 1994-95 National Population Health Survey in Canada and reported that single mothers were significantly more likely to have visited a mental health professional in the previous year (Cairney & Wade, 2002). In a later study, using data from the same survey, rates of major depression were twice as high among single mothers (*n* = 725) compared to married mothers (*n* = 2,231), and these differences remained significant even after controlling for maternal education, age, and income (Cairney et al., 2003). Consistent with previous research, Wang (2004) reported a higher prevalence of a major depressive episode among single mothers compared to married mothers from a large sample (*N* = 13,225) of Canadian women aged 15 – 50 years. Similarly, in a large, nationally representative sample of Australian mothers (*n* = 354 single, 1,689 partnered) single mothers reported a higher prevalence of moderate-to-severe mental disability among compared to partnered mothers (Crosier et al., 2007). Even after considering the number of financial hardships experienced in the past year, lone mothers still reported poorer mental health compared to partnered mothers (Crosier et al., 2007). In yet another cross-sectional study examining the mental health problems among mothers, Jayakody and Stauffer (2002) reported higher levels of major depression, panic attack, and agoraphobia among single (n = 4,423) compared to married (n = 6,906) mothers. The highest levels of these diseases were present among low-income single mothers (Jayakody & Stauffer). Furthermore, levels of depression and distress were significantly higher among lone compared to partnered mothers in another U.S. sample of mothers (N = 2,184) (Young et al., 2004).

The previously described data from cross-sectional studies is supported by longitudinal work conducted by Brown and Moran (1997) and Wade and Cairney (2000). Brown and Moran provided information about depression, financial hardship, and depressive risk factors over a 2 year period among 101 single and 404 married mothers. During the study period, single mothers were more likely to experience financial hardship, reported more risk factors for depression (e.g., negative evaluation of oneself and a difficult personal relationship) and had double the risk of onset of depression compared to married mothers (Brown & Moran). The second longitudinal study used a nationally representative sample of 2,169 Canadian mothers who reported depression and marital status at two time points (Wade & Cairney, 2000). Results indicated that mothers who became single parents during the study period had a significantly higher rate of depression at Time 1 that was increased at Time 2. Interestingly, becoming married during the study was not associated with a decreased prevalence of major depression (Wade & Cairney), underscoring the need to explore factors beyond marriage for reducing rates of depression among single mothers. Examined together, these cross-sectional and longitudinal studies demonstrate the significantly higher prevalence of depression among single mothers compared to partnered/married mothers. These studies provide initial evidence suggestive of an association between single motherhood and anxiety that should be studied further among single mothers given the relative lack of attention paid to anxiety compared to depression in this population of women.

Self-esteem

Self-esteem is defined as a judgment of one's self-worth that is based on the evaluation of one's physical, mental, and social functioning (Rosenberg, 1989). Three studies have reported lower levels of self-esteem among single compared to married mothers (Brown & Moran, 1997; Demo & Acock, 1996; Elfhag & Rasmussen, 2008). The first study provided initial evidence of a relationship between self-esteem and single motherhood from prospective data among 404 mothers (n = 101 single mothers) (Brown & Moran). In this study, single mothers reported higher levels of negative self-evaluation compared to married mothers and these negative evaluations were associated with higher levels of depression among single mothers (Brown & Moran). In a more recent cross-sectional study, single mothers (n = 278) had lower global self-worth scores compared to married mothers (n = 1503) and this difference remained statistically significant even after controlling for the lower education level of single mothers (Elfhag & Rasmussen). The third study compared global self-esteem between married, divorced, and continuously single mothers and reported similar levels of self-esteem for married and divorced mothers, but significantly lower levels of self-esteem among continuously single mothers (Demo & Acock). These results highlight the potential relationship between global self-esteem and single motherhood and future studies should further explore this important construct and its correlates and consequences among single mothers.

Stress

Quite a few studies have demonstrated the association between stress and single motherhood and stress and depression among single mothers. For example, in a cross-sectional study of 2,921 mothers, single mothers had higher levels of chronic strains, recent stressful life events, and childhood adversities compared to married mothers (Cairney et al., 2003). In this sample, more than a third of the variance in the relationship between single motherhood status and depression was accounted for by stress (Cairney et al., 2003). Other studies have focused on the differences that exist among single mothers. For example, in two additional studies that used the same sample of 508 single mothers, there was a higher level of stress among divorced/separated (Turner, 2006) and unemployed (Turner, 2007) single mothers compared to never-married and employed single mothers, respectively. Within this sample, sources of stress, including recent life events, financial strain, and parenting strain explained 43% of the variance in depression among rural single mothers (Turner, 2006). The most commonly cited stressors reported in daily logs over a 2-week period by 52 low-income single mothers with young children were related to children (56%), interpersonal conflicts with adults (21%), and financial strain (8%) (Olson & Banyard, 1993). Despite experiencing many of the same stressors, there was variability in coping strategies used by single mothers in this study, emphasizing the need to explore factors associated with stress and coping strategies among single mothers (Olson & Banyard).

Data from two longitudinal studies support the previously described findings from cross-sectional studies. In the first study, single mothers were more likely to experience chronic stress compared with mothers in dual-parent households (McLanahan, 1983). Among single mothers, recently divorced/separated mothers had higher levels of stress compared to mothers who were divorced for 3 or more years (McLanahan, 1983). The second study compared the stress levels of 518 single mothers and 502 married mothers and determined that single mothers experienced significantly more stress than married mothers (Avison, Ali, & Walters, 2007). Furthermore, higher levels of distress among single mothers were associated with greater exposure to stressors, rather than an increased susceptibility or vulnerability to stress compared to married mothers (Avison et al., 2007). These studies emphasize the increased stress exposure among single compared to married mothers and the link between stress and depression among single mothers.

Physical Health

The physical health of single mothers has been studied less frequently than mental health outcomes among this population. Despite the need for more research in this area, a few studies have reported poorer physical health among single mothers compared to married/partnered mothers (Kaplan et al., 2005; Young et al., 2005, 2004). Two large cross-sectional studies reported an increased risk of cardiovascular disease among single mothers (Young et al., 2005, 2004). Young et al. (2004) conducted a cross-sectional study using a nationally representative sample of Canadian mothers (N = 2,184; n = 478 lone mothers). Lone mothers had poorer self-reported health, were more likely to report having multiple chronic conditions, and had an elevated risk of cardiovascular disease (CVD) compared to married/partnered mothers (Young et al., 2004). Similar to the previously described study, results from a large (N = 1,446; n = 623 lone mothers), nationally representative sample of mothers in the United States indicated that lone mothers had poorer self-reported health compared to married/partnered mothers (Young et al., 2005). Lone mothers in this study had elevated risks of hypertension, hypercholesterolemia, and diabetes and were 3 times as likely to have had a CVD event compared to mothers in two-parent families (Young et al., 2005).

In another study, a sample of single mothers with children who were receiving public assistance was compared to a nationally representative sample of women matched for age and race (Kaplan et al., 2005). Single mothers (*n* = 299) were almost 2.5 times more likely to have hypertension and reported a rate of diabetes that was nearly 3 times higher than the comparison group (Kaplan et al.). Furthermore, the body mass index (BMI) of single mothers was 16% higher than the age and race matched sample (Kaplan et al.). Contrary to these previous studies, one study reported a non-significant difference in physical health characteristics of single mothers compared to married/partnered mothers (Lipman et al., 1997). This large (*N* = 1,540; *n* = 288 single mothers), cross-sectional study indicated that there was no difference in the number of chronic conditions or physical disability reported by single and married/partnered mothers (Lipman et al.,).

In addition to increased risk of cardiovascular diseases and diabetes, data from 3,391 women in United States provide information about self-reported health and marital status over time (Williams et al., 2011). Women who were unmarried at the birth of their first child were more likely to describe their health as fair or poor at midlife (age 40) compared to women who had a marital first birth. These results provide evidence for the long-term consequences of single motherhood from a longitudinal study where the union history of participants was monitored for 29 years before assessing health at midlife (Williams et al.).

Quality of life among single mothers

Quality of life is a broad concept that has been defined as “individuals’ perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.” (The WHOQOL Group, 1995, p.1405). Quality of life is subjective, multidimensional, and includes positive and negative dimensions (The WHOQOL Group, 1995). Some evidence among older adults suggests that components of health related quality of life (HRQOL) are more proximal to physical activity than global measures of quality of life (Elavsky et al., 2005; Motl & McAuley, 2010; Stewart & King, 1991), and as such, this study will focus on HRQOL. The Centers for Disease Control and Prevention (CDC) defines health related quality of life as "an individual's or group's perceived physical and mental health over time." (Centers for Disease Control and Prevention, 2000). The measurement of HRQOL has been encouraged as a standard measure of disease burden for comparing outcomes among studies and is important given the established associations between HRQOL and chronic health diseases (e.g., diabetes and hypertension) (Centers for Disease Control and Prevention, 2000, p. 8).

The burdens and negative health consequences of single motherhood are numerous and may contribute to reductions in global quality of life and/or HRQOL among single mothers. Indeed, in a cross-sectional study among single mothers (n = 33), depression, household income, and number of children explained 44.5% of the variance in HRQOL (Landero Hernández, Estrada Aranda, & González Ramírez, 2009). In this same study, single mothers (n = 33) reported lower overall HRQOL compared to mothers in dual-parent families (n = 107) and specifically differed in the social relations sub-domain (Landero Hernández et al., 2009). HRQOL is an important construct to study and as documented in this section, there is very limited information about the HRQOL among single mothers.

Collectively, there is an emergent body of evidence supporting the physical and mental health consequences of single motherhood. Despite this initial evidence, future studies should focus on physical health outcomes, dimensions of mental health beyond depression, and HRQOL among single mothers.

Benefits of Physical Activity

Thus far, this review has detailed the prevalence of single motherhood in the United States and the numerous negative health consequences faced by this group of women. Determining the causal factors associated with these negative health outcomes is beyond the scope of this review. Instead, this section of the review will focus on documenting the potential for physical activity to mitigate some of the negative health consequences that are experienced at higher levels by single mothers. As such, this section of the review presents an analysis of the benefits associated with leading a physically active lifestyle that have implications for the specific diseases experienced by single mothers. This part of the review is intended to be illustrative of the possibility for improving the health of single mothers through physical activity rather than an exhaustive review of the benefits related to physical activity.

Physical Activity, Depression, and Anxiety

The association between physical activity and depression has been demonstrated in numerous studies and summarized in multiple review articles (e.g, Dunn, Trivedi, & O'Neal, 2001; Teychenne, Ball, & Salmon, 2008). Dunn et al. (2001) reviewed 37 studies and found consistent evidence that physical activity was associated with a reduction in depressive symptoms. Similarly, Teychenne et al. (2008) reviewed 67 studies (27 observational and 40 intervention) and the majority of these studies (~84%) showed an inverse relationship between physical activity and depression. These studies further indicated that even low doses of physical activity were associated with a reduced risk of depression (Teychenne et al., 2008). One recent study among a large sample (N = 217,379) of adults in the U.S. is representative of the results from these reviews (Strine et al., 2008). In this cross-sectional study, the prevalence of inactivity among adults who were never depressed, previously depressed, and currently depressed was 20.9%, 23.4%, and 43%, respectively (Strine et al., 2008).

The 2008 Physical Activity Guidelines Advisory Committee Report conducted a comprehensive review of more than 100 studies published after 1995 and provided additional support for the relationship between physical activity and depression. The studies reviewed in this report provide consistent and strong evidence for the reduced risk of depression among active compared to inactive adults. The reduction in risk for active versus inactive adults was ~45% for cross-sectional studies, 25-40% for prospective studies, and 15-25% for prospective studies after controlling for depression risk factors. Importantly, the odds of developing depression were similar for moderate and high levels of physical activity, and there was no conclusive evidence to suggest that changes in physical fitness are necessary to protect against depression (Physical Activity Guidelines Advisory Committee, 2008). Collectively, these studies stress the importance of participating in physical activity to reduce the risk of depression and/or depressive symptoms. In light of these results, it is important to understand factors that are associated with participation in physical activity behavior among single mothers to reduce the likelihood of depression among this population.

Fewer studies have considered the relationship between physical activity and anxiety, but several cross-sectional (Goodwin, 2003; Taylor, Pietrobon, Pan, Huff, & Higgins, 2004) and prospective (Strohle et al., 2007) studies using nationally representative samples have demonstrated a protective effect of physical activity for anxiety disorders and anxiety symptoms. Goodwin (2003) conducted a cross-sectional study with 8,098 participants aged 15 – 54 years old from the National Comorbidity Survey. Results indicated that inactive individuals had twice the rate of generalized anxiety disorder compared to active individuals (4% versus 2%) and nearly twice the rate of panic attack (5.8% versus 3.3%) (Goodwin, 2003). In another cross-sectional study of anxiety among 41,914 participants, inactive participants more frequently reported a greater number of days with anxiety symptoms than active individuals (Taylor et al., 2004). For example, 48% of participants who were meeting physical activity recommendations reported greater than 20 days per month of anxiety symptoms compared with almost 62% of participants who were inactive. Similar relationships existed among participants who reported 10 or 14 days per month with anxiety symptoms (Taylor et al., 2004). These results are supported by findings from a prospective study with a 4-year follow-up period among 2,548 adolescents and young adults (aged 14-24 years) (Strohle et al., 2007). In this study, participants who engaged in regular physical activity or irregular activity compared to inactive individuals had lower incidence of any anxiety disorder (Strohle et al., 2007). Together, these studies demonstrate the consistent relationship that exists between engaging in physical activity reduced anxiety symptoms.

Physical Activity and Self-Esteem

The positive association between physical activity participation and self-esteem has been described in multiple reviews (Fox, 1999; Scully, Kremer, Meade, Graham, & Dudgeon, 1998). Fox (1999) concluded that the relationship between global self-esteem and physical activity is often weak or inconsistent and there is stronger evidence for the positive association between physical self-perceptions and physical activity. Scully et al. (1998) made similar conclusions and further stated that the benefits of physical activity participation might be greatest for adults with low self-esteem. More recently, a meta-analysis including 128 effect sizes from 113 studies concluded that there was a small effect (d = .23) of physical activity or exercise on global self-esteem (Spence, McGannon, & Poon, 2005). Global self-esteem and physical self-perceptions are two constructs that are important to consider among single mothers in the future.

Physical Activity and Stress

A recent review summarized the results from 31 studies with 27 independent datasets regarding the relationship between physical activity, stress, and health outcomes (Gerber & Pühse, 2009). Nearly 70% of the cross-sectional studies provided evidence of a negative association between physical activity and stress and this was generally supported by prospective and longitudinal studies. Overall, 16 out of 31 studies demonstrated the stress buffering effects of physical activity and the authors recommended that future studies should explore the type, intensity, and duration of physical activity necessary for stress reduction (Gerber & Pühse, 2009). As an example, results from one cross-sectional study of 32,229 working adults indicated that adults with the highest level of physical activity were about half as likely to have high levels of stress compared to those who had low levels of physical activity (Aldana, Sutton, Jacobson, & Quirk, 1996). Stronger evidence from a 5-year prospective study of 12,028 randomly selected men and women aged 20 – 79 years supports the negative association between physical activity and level of stress (Schnohr, Kristensen, Prescott, & Scharling, 2005). In this sample, a high level of stress was present among 19% of women who were engaging in low levels of physical activity compared with 4% and 3% of women with high activity and joggers, respectively. Over the 5-year study period, participants who were sedentary and became more physically active had reduced levels of stress, with the reverse occurring for participants who changed from being active to sedentary. Participants who were sedentary at baseline and remained inactive had the highest levels of stress and the greatest decreases in stress occurred when participants increased from low to moderate activity (Schnohr et al., 2005). These studies represent some of the research supporting the benefits of participating in physical activity for stress reduction.

Physical Activity and Cardiovascular Diseases

Several review studies have documented the negative association between physical activity and the risk of diseases of the heart (Oguma & Shinoda-Tagawa, 2004; Penedo & Dahn, 2005; Warburton, Nicol, & Bredin, 2006). Penedo and Dahn (2005) concluded that regular moderate physical activity results in a decreased risk of coronary heart disease. Warburton et al. (2006) underscored the benefits of increased physical activity regardless of one's current level of physical activity and noted that the greatest decreases in risk occur when moving from sedentary to physically active. Oguma and Shinoda-Tagawa (2004) reviewed 30 studies and reported a dose-response relationship between physical activity and coronary heart disease, stroke, and overall cardiovascular disease. Peterson et al. (2012) extended previous research by emphasizing the risk associated with decreasing levels of physical activity over time. In this large study (N = 10,443; n = 5,956 women), women who decreased their physical activity by one level (of four possible levels created for this study) had an increased risk of myocardial infarction, ischemic heart disease, and all-cause mortality compared to women who maintained their level of physical activity (Petersen et al., 2012). For example, women who engaged in light activity and were later classified as sedentary had a 68% increase in risk for myocardial infarction compared to women who maintained light activity (Petersen et al., 2012). These findings might be particularly important to note in the context of decreasing levels of physical activity that have been demonstrated among mothers (Hull et al., 2010).

The 2008 Physical Activity Guidelines Advisory Committee Report summarized the large number of studies that have reported the relationship between physical activity and risk of cardiovascular disease and coronary heart disease. In 13 prospective studies analyzed for this report, women who engaged in high levels or vigorous physical activity compared to low levels of activity had a relative risk of .62 for coronary heart disease. Similarly, the relative risk of cardiovascular disease among high active compared to low active women was .72 (Physical Activity Guidelines Advisory Committee, 2008). Together, these studies highlight the importance of engaging in physical activity to reduce the risk of cardiovascular morbidity and mortality.

Physical Activity and Diabetes

Many studies have explored the association between physical activity and the prevention of type 2 diabetes. Sigal, Kenny, Wasserman, and Castaneda-Sceppa (2004) conducted a review of studies examining the relationship between physical activity and type 2 diabetes and concluded that there was consistent evidence from prospective studies and randomized controlled trials that increased physical activity results in decreased incidence of diabetes. For example, one prospective study of 37,878 women who were followed for an average of 6.9 years indicated that physical activity was an independent predictor of diabetes and participants who were meeting physical activity guidelines were less likely to develop diabetes (Weinstein et al., 2004). One randomized controlled trial provided strong evidence for the decreased risk of diabetes with lifestyle modification (i.e., diet and physical activity) (Knowler et al., 2002). In this intervention, 3,234 participants with impaired glucose tolerance were randomly assigned to one of three groups, placebo, metformin, or lifestyle modification. The incidence of diabetes among the lifestyle modification group was 58% lower than the placebo group and lifestyle modification was significantly more effective than metformin (Knowler et al., 2002). Importantly, a post hoc analysis of the Finnish Diabetes Prevention Study among 487 men and women concluded that physical activity was independently associated with decreased incidence of diabetes (Laaksonen et al., 2005). Participants who engaged in enough moderate-to-vigorous physical activity to meet national recommendations were 44% less likely to develop diabetes than participants who remained sedentary (Laaksonen et al., 2005). These studies clearly demonstrate the importance of engaging in physical activity for reducing the risk of type 2 diabetes.

Single Motherhood and Physical Activity

The many negative health outcomes associated with single motherhood and the potential for improvements in these outcomes with participation in physical activity make understanding physical activity behavior among single mothers of utmost importance. Single mothers report time constraints and pressures that derive from being responsible for all aspects of parenting that are intensified by other household tasks and work responsibilities (Hodgson, Dienhart, & Daly, 2001). These perceived time constraints may contribute to low levels of leisure time for single mothers (Hodgson et al., 2001). Despite these reports, a recent study of time use among parents found no statistically significant difference between the leisure time of single and married mothers (Connelly & Kimmel, 2010). However, in that same study, single mothers spent more time in employment than married mothers and had significantly less leisure time compared with non-mothers (Connelly & Kimmel). Only a few studies have specifically examined the physical activity of single mothers and the results have been inconsistent and limited by the use of self-reported questionnaires. This section of the review provides a detailed description of each of these studies and highlights the need for continued research in this area.

Although relatively few studies have explored physical activity levels among single mothers, a recent review described consistent evidence supporting a negative association between parenthood and physical activity that seemed to be stronger among mothers than fathers (Bellows-Riecken & Rhodes, 2008). The majority of studies (11 of 14) included in this review of parenthood and physical activity, supported the conclusion that parents were less physically active than non-parents ($d = .41$). This study further highlighted inconsistencies among results from studies examining the impact of single parenthood on physical activity and noted the reliance on self-reported measures of physical activity (Bellows-Riecken & Rhodes). More recently, a prospective study of the impact of marriage and parenthood on physical activity provided further evidence that motherhood is associated with decreased physical activity (Hull et al., 2010). At baseline, mothers had significantly lower physical activity compared with fathers (4.0 versus 7.7 hours per week), and women who had a child during the 2-year period reduced physical activity by ~2.5 hours per week. Results from this study further indicated that marriage did not have a significant impact on physical activity. Unfortunately, results from this study did not specifically analyze the impact of single motherhood on levels of physical activity (Hull et al., 2010).

The following two longitudinal studies provide emerging support for the relationship between single motherhood and physical inactivity. The first evidence of a possible association between single motherhood and inactivity was provided in a large ($N = 8,545$), longitudinal study of physical activity among a sample of young women (aged 18 – 23 years at baseline) from Australia (Bell & Lee, 2005). Among women in this study, being a mother was associated with physical inactivity at baseline and with decreased physical activity after a 4-year follow-up period. This study further reported an increased risk of inactivity for women who married and had children compared to women who were single and childless. Although this study did not specifically examine the physical activity levels of women who were unmarried with children, an

“Other” category of women that likely included single mothers had an increased risk of inactivity compared to single childless women (Bell & Lee, 2005). This observation was confirmed when Brown and Trost (2003) conducted a study of life transitions associated with physical inactivity among the same sample of women (*N* = 7,281). During the 4-year follow-up period, getting married, having a child, and becoming a single mother were associated with physical inactivity (Brown & Trost, 2003). At follow-up, almost 51% of the single mothers were inactive compared to 44% of women who were not single mothers. Two strengths of these studies were large samples sizes and use of longitudinal designs. Despite these strengths, information about the level of physical activity among single mothers from these studies is limited by the use of different physical activity questionnaires at baseline and follow-up and dichotomizing the sample into “active” and “inactive” groups. In spite of these weaknesses, these studies provide some initial evidence that single motherhood might be associated with physical inactivity.

Building on the aforementioned findings, two cross-sectional studies of lone motherhood and physical activity reported either no difference in physical activity between single and partnered mothers (Young et al., 2004) or an increased likelihood of physical activity participation for lone mothers compared to partnered mothers (Young et al., 2005). Results from the first study indicated that there was no significant difference between the physical activity of lone mothers (*n* = 478) and partnered mothers (*n* = 1,706), although the prevalence of inactivity was high among both lone and partnered mothers, 54.7% and 58.6%, respectively (Young et al., 2004). In another large sample (*N* = 1,446; *n* = 623 lone mothers), only 35.8% of lone mothers and 29.9% of partnered mothers participated in at least 30 minutes of physical activity on most days per week during the previous month (Young et al., 2005). These two studies provide conflicting results about the relationship between single motherhood and physical activity using data from large samples of women, but conclusions are limited by self-reported data and dichotomized physical activity groups similar to previous studies. Thus far, the studies presented support the relationship between motherhood and physical inactivity, but do little to clarify the relationship between single motherhood and physical activity.

To overcome some of the weaknesses of previous studies, one small (*N*=66) pilot study compared the physical activity of equal-sized groups of single mothers, married mothers, and non-mothers using self-reported and objective measures of physical activity (Dlugonski & Motl, 2013). In general, results from this study indicated that married mothers and non-mothers had similar levels of physical activity and both groups were more active than single mothers. Single mothers were the only group of women who were not meeting national guidelines for physical activity and engaged in significantly fewer minutes of accelerometer measured moderate-to-vigorous physical activity compared to non-mothers (d = .93) (Dlugonski & Motl). Further, single mothers reported significantly less physical activity compared to married mothers (d = .87) and non-mothers (d = 1.02) using the Godin Leisure-Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985). This study was the first to directly compare the physical activity of single mothers to married mothers and non-mothers using a comprehensive assessment of physical activity. Findings from this pilot study, considered alongside results from a large cross-sectional study (Brown & Trost, 2003), provide some evidence for the association between single motherhood and physical inactivity. Despite this evidence, the relationship between single motherhood and physical activity is still unclear and there is an existing need to examine the levels and patterns of physical activity among large samples of single mothers using self-report and objective measures of physical activity.

Social Cognitive Theory and Physical Activity

Theoretical models are important for understanding, predicting, and changing behaviors. Social cognitive theory (SCT; Bandura, 1986, 2004) is one commonly used approach for understanding physical activity behavior that might help to explain the relationship between single motherhood and physical activity. SCT is particularly relevant for explaining the physical activity of single mothers because it takes into consideration personal as well as structural, environmental, and behavioral factors that may impact behavior. Indeed, Bandura (1999) specifically mentioned family structure as one factor that may influence personal efficacy, goal setting, and self-regulation (p. 24). Furthermore, SCT is ideal for use among single mothers and other populations because goes beyond the explanation and prediction of behavior and provides information about how to change behavior that will be useful in the design of future physical activity interventions. This section of the review details the main components of SCT, the use of SCT constructs to predict physical activity, and the potential for using a social cognitive approach to study the physical activity of single mothers.

Core constructs of social cognitive theory

SCT considers the influences of behavioral, individual, and environmental factors that are interdependent and interact to predict, explain, and change behavior. Reciprocal determinism, the bidirectional interactions that occur between person, behavior, and environment, is a main underlying concept in this theory (Bandura, 1999). For example, individuals are impacted by the environment, but also have the ability to shape and actively create their environment. Thus, human behavior is determined by the interactions between behavioral, personal, and environmental influences.

The central construct in SCT is self-efficacy or one's confidence in their ability to carry out a specific course of action in spite of barriers. Bandura (1977) outlined four specific sources of efficacy information that include performance accomplishments, vicarious experiences, verbal persuasion, and emotional arousal. The most salient sources of efficacy information are performance accomplishments, or mastery experiences. In these experiences, personal efficacy is enhanced through repeated successes with the behavior of interest (Bandura, 1977). Similarly, watching others successfully perform a behavior (i.e., vicarious experiences) may also increase self-efficacy. This source of efficacy information is weaker and more variable than mastery experiences because it depends on successful modeling by others. Encouragement and support from others, or verbal persuasion, is the third source of efficacy information. The final source of efficacy information involves the interpretation of emotional and physiological states. The interpretation of certain physiological or emotional states may enhance or undermine feelings of confidence. When these sources of efficacy information result in high self-efficacy, individuals will engage in more types of behaviors, expend more effort to reach goals, and persist longer in a behavior compared to those with low self-efficacy (Bandura, 1999). In Bandura's (1999) words, personal efficacy beliefs are "the foundation of human agency" (p. 28) and as such, represent the central component of this theory.

In addition to self-efficacy, the main components of SCT include outcome expectations, self-regulation, and sociostructural factors (i.e., facilitators and impediments). Bandura (2004) proposed that outcome expectations, one's expectations about the results of a particular behavior can be divided into three different categories. These include social (e.g., improved social status), self-evaluative (e.g., improved mood), and physical (e.g., improved strength) outcome expectations. Self-regulation is the process by which individuals control their own behavior and can include self-monitoring, goal setting, and planning. Facilitators and impediments, factors that assist or deter one from working towards goals and ultimately engaging in a behavior, are the final constructs included in SCT. Bandura (2004) detailed the specific relationships among SCT constructs such that self-efficacy has a direct effect on behavior and works indirectly through outcome expectations, self-regulation, and sociostructural factors. Thus, an individual with high self-efficacy would be expected to have more positive outcome expectations, greater use of self-regulatory strategies, and fewer perceived barriers that all positively influence behavior.

Based on the previously described relationships among theory constructs, it would be expected that a single mother with low self-efficacy for engaging in physical activity would have more negative outcome expectations, more barriers and fewer facilitators, and use goal setting and self-monitoring strategies less frequently for engaging in physical activity. The following hypothetical example highlights the utility of SCT for explaining and changing physical activity behavior specifically among single mothers. Imagine a single mother who is working full-time, feels guilty leaving her child to engage in physical activity, and does not believe that being physically active will result in helping her reach her health goal of losing weight. Now imagine that this same single mother has a coworker who invites her for a walk during a lunch break. After these initial successes, the single mother reframes her thoughts about the importance of physical activity for her own health and sets a goal to walk with her child in a stroller for 30 minutes every weekday after dinner. She also begins wearing a pedometer to track her steps, and becomes educated on the importance of physical activity for weight maintenance. Based on SCT, these seemingly simple and teachable changes, although they can be difficult to make, would be expected to result in increased physical activity. This is just one example that illustrates how SCT can be used for understanding and promoting physical activity among single mothers.

Prospective studies of physical activity using SCT

SCT is one of the most frequently used theories to promote lifestyle behavior change (Glanz & Bishop, 2010) and has been used to explain physical activity behavior in a wide range of populations including college students (Rovniak et al., 2002), older women (McAuley et al., 2009), individuals who have type 1 and type 2 diabetes (Plotnikoff et al., 2008) and persons with multiple sclerosis (Suh et al., 2011). Despite the popularity of SCT for explaining, predicting, and changing physical activity behavior, only a few studies have tested the entire theory using prospective designs. Several studies are provided here as examples.

Rovniak et al. (2002) used SCT to predict the physical activity of 277 undergraduate students in an 8-week prospective study. Social support, self-efficacy, outcome expectations, and self-regulation were measured at baseline and self-reported physical activity was measured at follow-up. Results indicated that the direct relationship between self-efficacy and physical activity was small and non-significant. Self-efficacy operated indirectly through self-regulation and self-regulation was the only direct predictor of physical activity. The overall model explained 55% of the variance in physical activity at 8 weeks and supported the use of SCT variables for explaining the physical activity of young adults (Rovniak et al., 2002).

Plotnikoff, Lippke, Courneya, Birkett, and Sigal (2008) tested SCT constructs as predictors of self-reported physical activity among a large sample of adults with type 1 or 2 diabetes (N = 1,717). This study used a longer (i.e., 6-month), prospective design to explain self-reported physical activity measured by the Godin Leisure-Time Exercise Questionnaire (GLTEQ). Contrary to the previous study (Rovniak et al., 2002), self-efficacy was a direct predictor of physical activity behavior at 6 months. Self-efficacy was also significantly associated with outcome expectations, goal setting, and impediments/facilitators. Further, goal setting was directly associated with physical activity at follow-up. Overall, self-efficacy explained 52% and 59% of the variance in goal setting and 14% and 9% of the variance in physical activity among participants with type 1 and 2 diabetes, respectively. This study offered support for using SCT to predict physical activity behavior among a population of persons with a chronic health condition.

A third longitudinal study of the utility of SCT for predicting physical activity measured self-reported physical activity among older women ($N = 217$) who were followed for 24 months after participating in a physical activity intervention (McAuley et al., 2009). Self-efficacy, outcome expectations, and functional limitations were also measured during this two-year period. Results indicated that physical activity declined over the 2-year follow-up period and changes in self-efficacy were not directly associated with these declines. Rather, self-efficacy was indirectly associated with change in physical activity through functional limitations among this sample of older women. These findings provided partial support for the relationships among variables within SCT, but this study did not measure self-regulation and thus, cannot provide support for the full theoretical model.

Suh, Weikert, Dlugonski, Balantrapu, and Motl (2011) conducted a longitudinal study over an 18-month period among 218 adults with multiple sclerosis to examine SCT constructs as predictors of physical activity behavior. Self-reported physical activity, self-efficacy, outcome expectations, functional limitations, and goal setting were measured at baseline and 18 months. At baseline, self-efficacy was not directly associated with physical activity, but interestingly, change in self-efficacy was directly related to change in physical activity over an 18-month period. Change in self-efficacy was also indirectly associated with change in physical activity through an increase in goal setting. Change in self-efficacy was further associated with change in outcome expectations and impediments, but these constructs were not significantly associated with change in physical activity. Similar to previous studies, these results partially support the use of SCT and highlight the importance of considering the theory constructs in the context of different target populations.

Most recently, White, Wojcicki, and McAuley (2012) conducted an 18-month prospective study of SCT influences on physical activity among 321 middle aged and older adults. At baseline, self-efficacy was directly related to physical activity, outcome expectations, goals, and impediments, consistent with the model proposed by Bandura (2004). Similarly, at follow-up, changes in self-efficacy were related to changes in physical activity, outcome expectations, goals, and impediments. Interestingly, goal setting was not associated with physical activity at baseline or follow-up and the only significant indirect pathway between changes in self-efficacy and changes physical activity at follow-up was through changes in physical outcome expectations. Despite some inconsistencies with the model specified by Bandura (2004), the overall SCT model in this study accounted for 40% of the variance in physical activity at follow-up (White et al., 2012). Although these prospective studies partially support the use of SCT to explain and predict physical activity behavior, more research should be conducted on the full SCT model to determine its utility within additional target populations, including single mothers.

Single mothers and SCT

SCT has not yet been used to explain, predict, or change physical activity behavior among single mothers. Nevertheless, a recent review identified self-efficacy as a theory-based construct that can be used to explain depression among single mothers and emphasized SCT as one theoretical approach for promoting health among this group of women (Atkins, 2010). Given this recommendation and the previously described research that predicted physical activity using SCT in multiple populations, it is likely that SCT provides a useful framework for examining the physical activity of single mothers. Findings from a qualitative study that explored health-promoting behaviors among lone mothers (Higgins, Young, Cunningham, & Naylor, 2006) seem to provide additional support for the use of SCT among this population. Women (*n* = 38) in this study reported many barriers (e.g., lack of resources, stress) to engaging in health behaviors, felt they had little ability to make changes in their lives (i.e., low self-efficacy) and described a lack of social support for physical activity (Higgins et al., 2006). The authors' analysis was not grounded in SCT, but participant responses seem to align well with the main constructs in SCT that should be explored in future studies. In another qualitative study of physical activity experiences among working mothers (many of whom were single mothers), mothers of young children and single mothers reported the most barriers and least ability to manage those barriers (Dixon, 2009). Again, the authors did not use SCT to guide the analysis, but SCT seems well suited to explain participant beliefs about physical activity. The barriers (e.g., lack of time and resources, perceived stress) reported by single mothers in these studies will be considered as impediments within the SCT model used in this study.

Cognitive behavioral approach to behavior change

Understanding the social cognitive determinants of physical activity among single mothers is important for the development of future behavioral interventions designed to increase physical activity and improve health among this group of women. Stress and depression are two health outcomes that are prevalent among single mothers and important to consider in the context of such behavioral interventions. One randomized controlled trial aimed to reduce negative thinking, chronic stressors, and depressive symptoms among 136 low-income mothers with children between 2 and 6 years old (Peden, Rayens, Hall, & Grant, 2005). The authors used a 4-6 week group-based cognitive behavioral intervention to teach participants the skills necessary to regulate their own negative thoughts and feelings. After 6 weeks, the experimental group had significantly fewer stressors and decreased depressive symptoms that persisted through a 6-month follow up (Peden et al., 2005). This study highlights the potential to manipulate stress and depression in the context of an intervention and opens the door for future interventions with the goal of decreasing stress and depression among single mothers. Given the relationships between stress and depression with physical activity, such interventions might use a social cognitive approach to increase physical activity among single mothers and this further underscores the importance of identifying social cognitive correlates of physical activity behavior among this group of women.

SCT has been applied in many different populations to explain and predict physical activity behavior and may be a useful framework for exploring physical activity among single mothers. A better understanding of the factors associated with physical activity among single mothers from a SCT perspective is the first step towards designing interventions to promote physical activity among this group of women that may yield positive health outcomes and enhance overall well-being.

The Present Study

Single motherhood has been associated with negative health consequences, including an increased risk of cardiovascular disease, depression, and reduced HRQOL and as such, represents a public health challenge. Physical activity is one modifiable health behavior that has the potential to ameliorate some of these negative health outcomes to improve the overall well-being of single mothers. A few studies have demonstrated a relationship between single motherhood and inactivity (Brown & Trost, 2003; Dlugonski & Motl, 2013). However, there is an existing need to study physical activity among single mothers given the well-known benefits associated with engaging in physical activity.

This study contributed to the body of literature exploring the physical activity of single mothers that to date, has not examined the correlates and consequences of physical activity among this group of women. This study examined the associations between physical activity and health consequences, including cardiovascular disease risk, depression, anxiety, stress, physical self-perception, and HRQOL among single mothers. These associations are well documented among other populations but have not been studied among single mothers. Associations among physical activity and positive health outcomes for single mothers highlight the importance of promoting physical activity as one approach for enhancing overall health among this group of women.

Social cognitive theory offers one framework for understanding physical activity that has been useful among other populations and this study was the first to explore SCT constructs as correlates of physical activity behavior among single mothers. These theoretical constructs might be important for understanding and identifying factors associated with physical activity among single mothers as a first step towards developing effective behavioral interventions.

CHAPTER 3: METHODS

Participants

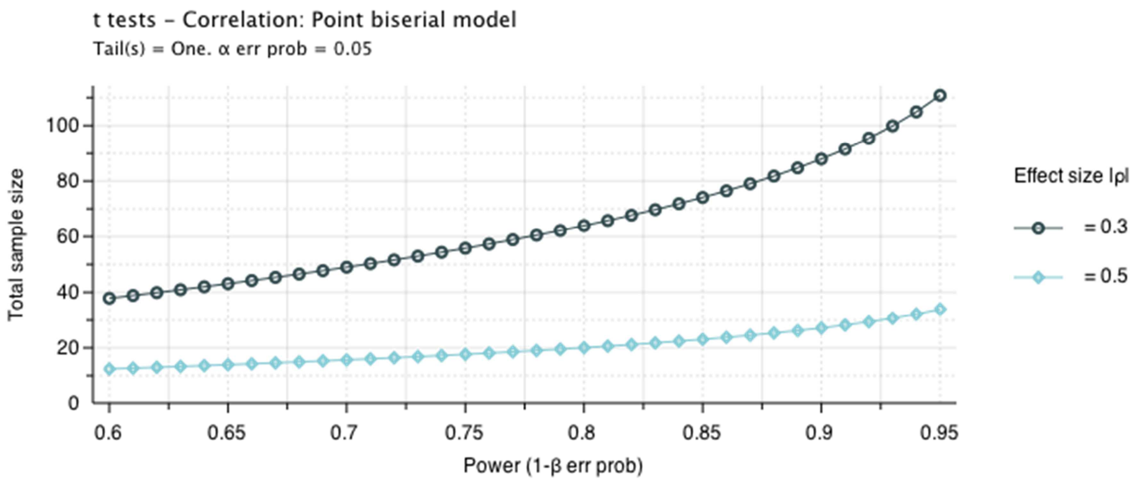
Sample

Women were recruited whom met the following inclusion criteria: a) 18 - 50 years of age; b) not currently pregnant; c) being a single mother (i.e., never married, separated/divorced or widow; not currently living with a partner; at least one child under the age of 5 living in the household); d) willingness to wear an accelerometer for 7 full days and complete two questionnaire packets.

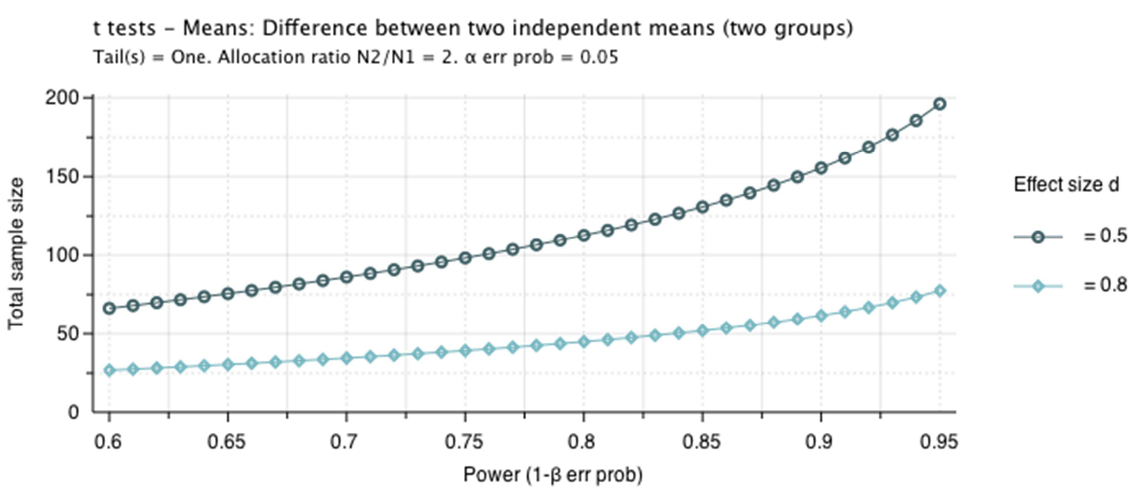
Single mothers with young children were selected as the target group for this study because evidence suggests that mothers with young children engage in less physical activity than mothers with older children (Bellows-Riecken & Rhodes, 2008). Furthermore, caring for a child under 5 years old is more demanding on the mother's time (Nomaguchi & Bianchi, 2004) and may represent a critical period to understand the correlates and consequences of physical activity.

Power Analysis

Two a priori power analyses were conducted to determine an appropriate sample size for testing each study hypothesis. The first power analysis was used to estimate the sample size necessary to test for correlations among physical activity, social cognitive theory constructs, and health consequences. The results of this analysis suggested that 64 subjects were necessary to detect a statistically significant correlation of .3, assuming one-tailed $\alpha = .05$, and 80% power. These results are illustrated in the power curve below:



The second a priori power analysis was conducted to estimate the sample size needed to detect differences in health consequences between participants in dichotomous physical activity groups (i.e., meeting or not meeting national recommendations for moderate-to-vigorous physical activity). Using independent t-tests with 1-tailed $\alpha = .05$ and an allocation ratio of 2, the analysis indicated that ~100 subjects were necessary to detect a minimum effect size of .5 with 80% power. This is illustrated in the curve below:



The results from these power analyses indicate that a sample size of 100 would yield >90% power to detect correlations of .3 between social cognitive theory constructs and health outcomes with physical activity and ~80% power to detect an effect size of .5 for comparisons of health consequences between groups dichotomized for physical activity.

Measures

Demographic Characteristics

Participant characteristics were measured using a demographic scale that was developed and used for a previous pilot study (Dlugonski & Motl, 2013). This scale included questions to obtain information about age, height and weight, number and age of children, employment, education, and income among other variables of interest.

Physical activity

Objectively measured physical activity. The ActiGraph model 7164 accelerometer (ActiGraph Corporation, Pensacola, Florida) was used as an objective measure of physical activity over a 7-day period of usual activity. The single, vertical axis piezoelectric bender element within the accelerometer generates an electrical signal proportional to the force acting on it that is converted to activity or step counts for a pre-determined period of time (i.e., 1 minute in the current study). This signal is then stored in random access memory within the device until the device is downloaded. Data from the accelerometer were downloaded and processed using ActiLife 5 software to yield average daily step and activity counts, average minutes per day spent in moderate-to-vigorous physical activity (MVPA; ≥ 1952 counts per minute), and average daily sedentary time (< 100 counts per minute) using cut points based on the Freedson equation (Freedson, Melanson, & Sirard, 1998).

Self-reported physical activity. The Godin Leisure-Time Exercise Questionnaire (Godin & Shephard, 1985) and the long-form International Physical Activity Questionnaire (Craig et al., 2003) were used as self-reported measures of current physical activity. The GLTEQ is a widely used 4-item questionnaire that measures leisure-time physical activity during a usual 7-day period. Only the first three items measuring strenuous, moderate, and mild exercise during free time were used in the current study. The final item that was excluded from the analysis asked participants to report the number of times per week that they engaged in physical activity long enough to work up a sweat. Total leisure activity scores for the GLTEQ were calculated by multiplying the weekly frequency scores by metabolic equivalents of 9, 5, and 3 for strenuous, moderate, and mild activity, respectively and then summing all categories. Based on these calculations, total activity scores can range from 0 – 119. An additional GLTEQ MVPA score was calculated using only the moderate and strenuous questions resulting in a score that can range from 0 – 98 (Godin, 2011). A GLTEQ MVPA score of 24 units has been suggested as a cut point for accruing substantial benefits from physical activity (Godin, 2011).

The 27-item, long form of the IPAQ was used to measure health-related physical activity during the previous 7-day period. Participants reported the number of days per week and average number of minutes per day that they engaged in moderate-intensity, vigorous-intensity, and walking activities in four separate domains (i.e., work, active transportation, domestic chores and gardening, and leisure-time). Minutes per day spent in each of these categories and domains were calculated by multiplying the frequency and duration of each activity to yield total weekly minutes of each activity. Next, all activities within a category were summed, and then dividing by 7 days to yield average minutes per day in each category or domain. Average MET-minutes per day were calculated by multiplying moderate, vigorous, and walking activities by the associated metabolic equivalent values of 4, 8, and 3.3. The IPAQ total time variables for walking, moderate, and vigorous activities were truncated to 180 minutes based on instructions in the IPAQ scoring protocol (“Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire,” 2005). Cases exceeding 960 minutes (16 hours) of summed walking, moderate, and vigorous activities were excluded from the analyses as suggested in the guidelines for scoring this questionnaire.

Social Cognitive Theory Constructs

Self-efficacy. The Exercise Self-Efficacy Questionnaire (McAuley, Lox, & Duncan, 1993) was used to measure self-efficacy for meeting nationally recommended physical activity guidelines (i.e., 150 minutes per week of MVPA). Participants were asked to rate their confidence in their ability to engage in 30 minutes of moderate intensity activity (similar to a brisk walk) on most days of the week over the next 1 to 6 months. Responses for each item ranged from 0 (Not confident at all) to 10 (Completely confident) and were summed, divided by 6, and then multiplied by 10 to achieve the final score. Acceptable internal consistency ($\alpha > .85$) has been demonstrated in previous research (McAuley et al., 1993). The internal consistency in this study was .99.

Exercise Barriers. The Exercise Barriers Scale (Sechrist, Walker, & Pender, 1987) was used to measure perceived barriers for physical activity. The original scale consists of 14 items rated on a 4-point scale that ranges from “strongly agree (4)” to “strongly disagree (1)”. Example items include, “It costs too much to exercise” and “Exercise takes too much time from my family responsibilities”. Two additional items were added to the original scale to capture salient barriers that have been reported by single mothers in previous studies. The updated scale consisted of the 14 original items and the following two additional items, “I don’t have anyone to watch my child(ren) while I exercise." and "I feel guilty leaving my child(ren) with someone else while I exercise." Scores are summed to yield a total score on the updated questionnaire that can range from 16 – 64 with higher values indicative of more perceived barriers to physical activity. One of the questions on the original scale, "My spouse or significant other does not encourage exercise", was excluded from the summary score because most participants left this item blank or indicated that this item was not applicable. This resulted in a score that could range from 15 – 60. The original scale has previously demonstrated internal consistency (Sechrist et al., 1987) and the internal consistency in the present study with the additional items was .86.

Social Support. Perceived social support for physical activity from family and friends was measured with the Social Support and Exercise Survey (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). For each of the 13 items, participants were asked to report how often family and friends have provided the type of support listed during the previous 3 months, using a scale of 1 (none) to 5 (very often). One example item is, "During the past three months my family or friends helped plan activities around my exercise". The original instructions for this scale were modified slightly to encourage single mothers in this study to report perceived support from their family members generally instead of only reporting the level of support from family members who were living in the household. Ten of the 13 items from each scale were summed to yield separate scores for Family Participation and Friend Participation that can range from 10 - 50, with higher scores indicating more support from family and/or friends. The remaining 3 items on each scale that can be used to calculate a Family and Friend Rewards and Punishment subscale were not used in this study. Items on this survey were initially developed from in-depth interviews with a sample of parents who were mostly women (Sallis et al., 1987). Internal consistency values in the present study for social support from family (α = .87) and friends (α = .92) were acceptable.

Outcome Expectations. The Multidimensional Outcome Expectations for Exercise Scale (Wojcicki, White, & McAuley, 2009) was used to measure the physical, social, and self-evaluative domains of outcome expectations for physical activity. This 15-item scale assesses these three domains of outcome expectations for physical activity on a scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), with 3 representing a neutral response. Total summed scores for each domain can range from 6 – 30, 4 – 20, and 5 – 25 for physical, social, and self-evaluative, respectively. Higher scores indicate more positive outcome expectations for physical activity. All three scales have demonstrated internal consistency > .80 (Wojcicki et al., 2009). Similarly, internal consistency values for physical (α = .75), social (α = .76), and self-evaluative (α = .83) subscales in the present study were all above the criterion of .70 (Altman & Bland, 1997)

Self-regulation. Self-regulation was measured using the Exercise Goal Setting (EGS) and Exercise Planning and Scheduling (EPS) Scales (Rovniak et al., 2002). Both scales have 10 items and are rated on a 5-point scale ranging from "does not describe (1)" to "describes moderately (3)" to "describes completely (5)". Sample items from the EGS and EPS scales, respectively, include, "I often set exercising goals" and "I schedule exercise at specific times each week". After reverse scoring negatively worded items, item responses were summed to yield a total score for each scale that can range from 10 – 50, with higher scores indicating more frequent use of self-regulatory strategies for engaging in exercise. The EGS and EPS scales have evidence of internal consistency, α = .87, .89, respectively. The EGS and EPS demonstrated acceptable internal consistency levels in the present study of α = .89 and .74, respectively.

Health Outcomes

Anxiety and Depression. The Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) was used to measure symptoms of anxiety and depression. Participants rated the frequency of anxiety (7-item subscale) and depression (7-item subscale) symptoms on a scale from 3 (Most of the time) to 0 (Not at all). After reverse scoring the positively worded items, a total score was calculated by summing the 7-items in each subscale that can range from 0 – 21. Sample anxiety items include, "Worrying thoughts go through my mind" and "I feel restless as if I have to be on the move", and sample depression items include, "I still enjoy the things I used to enjoy" and "I have lost interest in my appearance". Both scales have demonstrated reliability and internal consistency among clinical samples and adults in the general population (Bjelland, Dahl, Haug, & Neckelmann, 2002). In the present study, internal consistency values for anxiety ($\alpha = .67$) and depression ($\alpha = .71$) subscales were acceptable.

Cardiovascular Disease Comorbidities. Self-reported cardiovascular disease symptoms and comorbid conditions were assessed using a questionnaire that was developed based on American College of Sports Medicine guidelines for measuring signs and symptoms associated with cardiovascular disease (Motl, Fernhall, McAuley, & Cutter, 2011). The first nine items of this questionnaire measure cardiovascular disease symptoms (e.g., pain in the chest, unusual dizziness, shortness of breath, ankle swelling) and the final three items measure the presence of other conditions associated with increased risk of cardiovascular disease (i.e., diabetes, elevated cholesterol levels, and hypertension). Participants were asked to respond 'yes' or 'no' to each of the 12 items to indicate the presence or absence of the symptom or condition. A summed score was calculated that can range from 0 – 12, with higher scores indicating greater risk of cardiovascular disease. This scale has demonstrated good internal consistency ($\alpha = .74$) in a previous sample of persons with multiple sclerosis (Motl et al., 2011) and in the present study (α = .68).

Physical Self-Concept. The Physical Self-Perception Profile (Fox & Corbin, 1989) was used to measure the physical domain of self-esteem. This self-report scale has a total of 30 items split into 5 subdomains including perceived sport competence, body attractiveness, physical strength, physical condition, and a global perception of overall physical competence. Positively worded items were reverse scored and then subscales were summed to yield scores that can range from 6 – 24, with higher scores indicating more positive physical self-concept (Fox & Corbin, 1989). This scale initially demonstrated validity and reliability among undergraduate students (Fox & Corbin, 1989) and has since been validated in a sample of 216 adult women (M_{age} = 38 years) (Sonstroem, Harlow, & Josephs, 1994). More recently this scale was used to measure physical self-concept in a sample of mothers and daughters who were participating in a SCT intervention to increase physical activity (Ransdell, Dratt, Kennedy, O'Neill, & DeVoe, 2001). The internal consistency values for the condition (α = .89), body (α = .91), sport (α = .88), strength (α = .90), and perceived self-worth (α = .88) subscales were above the criterion of .70.

Stress. Perceived stress was conceptualized in this study as health outcome that may be associated with physical activity and also as a potential barrier to physical activity participation. Perceived stress was assessed using the 14-item Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983). Questions on this survey are rated from 0 (Never) to 4 (Very Often) and include, "In the last month, how often have you felt nervous and "stressed"?" and "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?". Positively worded items were reverse scored and then all items were summed to create a total score that can range from 0 – 56. Higher scores on this scale indicate more frequent perceived stress. This scale has evidence of internal consistency and reliability (Cohen et al., 1983). This scale demonstrated good internal consistency ($\alpha = .84$) in the present study.

Health Related Quality of Life. The SF-12 Health Survey was used as a measure of HRQOL. Scores on this survey are converted to a 0 to 100 scale with higher scores indicating more positive HRQOL. Example items include "In general, would you say your health is excellent, very good, good, fair or poor?" and "Thinking about the past four weeks, have you accomplished less than you would like as a result of your physical health?". This shortened version of the SF-36 provides an overall measure of perceived health status and correlates well with the SF-36 (Ware, Kosinski, & Keller, 1996).

Procedures

Participants were recruited from multiple sources, including an electronic advertisement distributed to all university faculty and staff via a weekly newsletter, flyers posted in local day cares, churches, public health office, and libraries. Participants were further recruited through direct mail postcards sent to approximately 3,000 single mothers in the local region. These local sources targeted the approximately 8,000 single mothers who were living in Champaign County (US Census Bureau, Table DP02). Finally, single mothers were recruited through a Facebook page created for this project and study information posted on websites and blogs that focus on single motherhood. Interested individuals were screened over the phone for inclusion/exclusion criteria. If qualified, participants received an informed consent document and were asked to return the signed document through electronic mail, postal mail, or fax.

Once informed consent was received, participants were mailed a study packet that included: an accelerometer, an accelerometer log sheet, instructions for wearing the accelerometer, and two questionnaire packets. Participants were asked to first, complete questionnaire packet #1 that included SCT measures. Second, participants were instructed to wear the accelerometer for 7 full days, during all waking hours, except while engaging in water activities. To conclude, participants were asked to complete questionnaire packet #2 with physical activity and health outcomes measures. Participants received $25 for participation in this study after returning all materials.

Participants received a phone call or email to check that the packet had been received and to answer any questions the participant had about completing the questionnaires or wearing the accelerometer. Participants were also provided with phone and email reminders to return study materials based on their expected date of completion. Upon receipt of study materials, questionnaires were checked for completeness and participants were contacted to obtain any missing data within one week of receiving the materials.

Data Analysis

Data were analyzed using SPSS Version 21.0 (IBM Corp., Armonk, NY). An initial distributional analysis was conducted to detect violations of normality, identify potential outliers, and assess skewness and kurtosis. Descriptive statistics were calculated for physical activity, social cognitive theory, and health outcome variables.

For specific aim #1, bivariate correlation analyses using Pearson product-moment correlation coefficients were used to examine relationships between physical activity and SCT constructs. SCT constructs were then entered into a hierarchical multiple linear regression analysis to test the SCT model, including the direct and indirect relationships between self-efficacy and self-reported and objective measures of physical activity. Self-efficacy was entered into these analyses in step 1, with outcome expectations, goals, social support, planning, and barriers (overall and stress) entered in step 2.

For specific aim #2, the sample was divided into dichotomous physical activity categories (i.e., women who were meeting or not meeting national guidelines for physical activity of 30 or more minutes per day of MVPA) based on minutes spent in MVPA from the accelerometer. One-way multivariate analysis of variance (MANOVA) tests were used to compare the health outcome variables between dichotomized physical activity groups. Pearson product moment correlation coefficients were conducted to further describe the relationships among measures of physical activity and health outcomes.

Finally, for specific aim #3, an exploratory analysis, was conducted by first dividing the sample into dichotomized race, education, and income groups. Second, the correlation coefficients between SCT constructs and physical activity were calculated for each of these dichotomized groups and were then compared using Fisher's *z*-statistics and associated *p*-values. Finally, two-way MANOVAs were conducted to check for interactions between dichotomized physical activity groups (i.e., meeting versus not meeting guidelines) and dichotomized race, education, and income groups on health outcomes.

CHAPTER 4: RESULTS

Participant Characteristics

There were 195 women who expressed interest in this study and received a description of the study protocol via phone, email, or a Facebook message. After receiving the study description, 3 women were no longer interested in participating and 42 were unable to be reached for screening after multiple attempts. Of the 150 women who underwent screening for enrollment, 30 were disqualified (*n* = 24, no child < 5 years), 17 never returned the informed consent document, and 103 were formally enrolled in the study (i.e., provided signed informed consent). Of these 103 participants, ~22% (*n* = 23) were recruited from local sources (i.e., daycares, libraries, public assistance office, etc.), ~12% (*n* = 12) from direct mail postcards, and ~66% (*n* = 68) from Facebook and other online sources. Three participants dropped out after receiving study materials and 6 did not return study materials and were unable to be reached after several attempts, resulting in a final sample for data analysis of 94 single mothers with young children who provided usable data.

Single mothers in this study were aged 32.6 ± 7.2 years, mostly Caucasian (*n* = 66; 71.7%) and employed (*n* = 79; 85.9%). Participants had varied levels of education ranging from women without a college degree (*n* = 39; 42.4%) to women who held a post-graduate degree (*n* = 24; 26.1%). Roughly half of the sample had an annual household income level below $40,000 (*n* = 54; 58.7%). Most participants in this study had never been married (*n* = 63; 68.5%) and had only one child (*n* = 57; 62.0%). Complete demographic characteristics are included in Table 1.

Descriptive statistics and Compliance

Descriptive statistics for self-reported and objectively measured physical activity are included in Table 2. Most participants completed the GLTEQ (n = 90) and IPAQ (n = 89) questionnaires. The IPAQ total time variables for walking, moderate, and vigorous activities were truncated to 180 minutes based on instructions in the IPAQ scoring protocol ("Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire," 2005). There were 76 participants who provided valid accelerometer data (i.e., at least 10 hours of wear time per day on at least 1 day) and were included in the analysis. The 18 missing accelerometer cases were due to insufficient wear time (n = 17) and a lost device in mail (n = 1). Over 90% of the women who wore the accelerometer provided at least 3 days of valid data. The percentage of participants who provided accelerometer data with 7, 6, 5, 4, 3, 2, and 1 day of valid accelerometer data were 35.5%, 18.4%, 15.8%, 13.2%, 9.2%, 3.9%, and 3.9%, respectively.

The average GLTEQ score in the present study was 26.4 ± 21.4 units. Recently, a cut point of 24 units of moderate or strenuous activity from the GLTEQ was equated with achieving health benefits from physical activity (Godin, 2011). Based on this criterion, only ~32% of the participants in the current sample were sufficiently active to achieve health benefits from engaging in physical activity.

For the IPAQ, participants reported engaging in walking, moderate, and vigorous activities for 41.9 ± 50.4, 73.5 ± 62.7, and 16.8 ± 32.1 minutes per day, respectively, during the previous 7-day period. On average, participants reported 14.0 ± 30.5, 39.8 ± 66.4, 53.4 ± 54.0, and 21.5 ± 25.1 minutes of physical activity per day in transportation, job-related, domestic/garden, and leisure-time physical activities. Compared to a large (n = 537) sample of Swedish women (Hagstromer, Ainsworth, Oja, & Sjostrom, 2010), single mothers in this study engaged in slightly higher levels of moderate activities, similar levels of vigorous intensity activities, and reported fewer minutes of sitting per day. Total MET-minutes per day among women in the current sample (566.2 ± 522.0) were calculated based on MET values of 3.3, 4, and 8 for walking, moderate, and vigorous activities, respectively. Single mothers in the current study reported approximately 50 MET-minutes per day less than the Swedish women in the comparison sample (Hagstromer et al., 2010). Single mothers in this study reported 924.8 ± 787.7 weekly minutes of activity. This value is lower than two large samples of adults that included men and women from Seattle (*N* = 1287; 1086.8 ± 765.3) and Baltimore (*N* = 912; 1115.1 ± 811.9) (Van Dyck et al., 2012).

Based on minutes spent in MVPA from the accelerometer, only 23.7% (*n* = 18) of the women in this study who provided accelerometer data were meeting national physical activity guidelines. This is slightly less than the proportion of the sample that was achieving recommended levels of activity using the GLTEQ cut-point score of 24 units of moderate and/or strenuous activity. On average, single mothers in the current study engaged in 20.2 ± 17.8 minutes per day of MVPA. This is consistent with accelerometer-measured minutes of MVPA of mothers (married and unmarried) with young children from a recent study (22.9 ± 3.4) (Candelaria et al., 2012) and with average daily accelerometer minutes of MVPA of single mothers from a previous pilot study (21.6 ± 20.1) (Dlugonski & Motl, 2013). Single mothers in the present study averaged 9,251 ± 3,215 steps per day and spent approximately 502 ± 115 minutes per day in sedentary activities based on the criterion of <100 accelerometer counts per minute. The average steps per day for the current sample could be categorized as 'somewhat active' (7500 – 9999 steps per day) and are approaching a classification of 'active' (10,000 – 12,499 steps per day) according to step count guidelines proposed in previous research (Tudor-

Locke & Bassett, 2004). The accelerometer measured sedentary time for single mothers in the current study (502 minutes) was slightly higher than the sedentary time (457 minutes) for a large sample of Swedish women (n = 537) (Hagstromer et al., 2010).

Specific Aim #1: Social Cognitive Theory (SCT) and Physical Activity

Correlations among SCT constructs and self-reported physical activity

Descriptive statistics for all SCT constructs are included in Table 3. Pearson product moment correlations with one-tailed tests of significance indicated that self-efficacy (r = .34, p = .001), goal setting (r = .30, p = .002), planning (r = .46, p = .001), and social support from friends (r = .22, p = .018) were significantly and positively associated with GLTEQ scores. Overall barriers (r = – .23, p = .017) had a statistically significant negative association with GLTEQ scores. Single mothers who reported higher levels physical activity during their leisure time over the previous 7-day period generally reported higher self-efficacy, more frequent use of self-regulatory strategies (i.e., goal setting and planning), higher levels of social support from friends, and fewer overall barriers. All statistically significant associations between GLTEQ scores and SCT constructs were small to moderate in magnitude except for the relationship with planning that was moderate to large based on Cohen’s guidelines of .1, .3, and .5 for small, moderate, and large (Cohen, 1992).

A natural log transformation was performed on IPAQ scores prior to conducting correlation and regression analyses due to the skewed distribution of IPAQ scores. After transformation, IPAQ scores approximated a normal distribution. The Pearson correlations between transformed IPAQ scores and SCT variables were nearly identical to Spearman’s correlations between untransformed IPAQ scores and SCT variables. For example, the relationships between untransformed IPAQ scores and self-efficacy (ρ = .220) and between transformed IPAQ scores and self-efficacy (r = .224) were similar. Pearson's correlations with one-tailed tests of significance between SCT constructs and average daily MET-minutes of activity from the IPAQ were small-to-moderate in magnitude. Self-efficacy (r = .22, p = .017), social (r = .25, p = .008) and self-evaluative (r = .25, p = .009) outcome expectations, and planning (r = .25, p = .009) were significantly and positively associated with average daily IPAQ MET minutes of activity. Barriers had a significant negative correlation (r = – .32, p = .001) with daily IPAQ MET minutes and the correlation between IPAQ MET minutes per day and goal setting approached significance (r = .16, p = .071). All correlation coefficients among SCT variables and self-reported physical activity are included in Table 4.

Correlations among SCT constructs and objectively measured physical activity

Accelerometer minutes spent in moderate-to-vigorous physical activity (MVPA) were significantly associated with self-efficacy (r = .30, p = .005), social (r = .27, p = .01) and self-evaluative (r = .21, p = .036) outcome expectations, planning (r = .27, p = .009), and barriers (r = – .29, p = .006). The correlation between MVPA and goal setting approached statistical significance (r = .18, p = .060). The significant correlations among SCT constructs and accelerometer MVPA were small to moderate in magnitude.

Similar to accelerometer derived MVPA, accelerometer activity counts were significantly positively associated with social (r = .30, p = .005) and self-evaluative (r = .26, p = .013) outcome expectations and negatively correlated with barriers (r = –.32, p = .003). The associations between activity counts with self-efficacy (r = .16, p = .079) and planning (r = .19, p = .054) approached statistical significance. Step counts from the accelerometer had a statistically significant and negative association with barriers (r = –.31, p = .003). There were statistically significant positive correlations between accelerometer step counts per day and social (*r* = .25, *p* = .015) and self-evaluative (*r* = .21, *p* = .034) outcome expectations. The association between step counts and self-efficacy (*r* = .18, *p* = .066) only approached significance. The bivariate correlations among SCT constructs and objectively measured physical activity outcomes were generally small-to-moderate in magnitude. Correlation coefficients among SCT variables and objectively measured physical activity are included in Table 5.

Hierarchical linear regression

In three separate regression analyses, GLTEQ scores, IPAQ MET minutes per day, and accelerometer MVPA minutes were regressed on self-efficacy in step 1 and all remaining SCT constructs in step 2 (i.e., physical, social, and self-evaluative outcome expectations, goal setting, planning, social support from friends and family, stress, and barriers). For GLTEQ scores, results indicated that both model 1 (only including self-efficacy) (*F* = 11.54, *p* = .001) and model 2 (including all SCT constructs) (*F* = 2.65, *p* = .008) were statistically significant. Model 1 explained ~12% of the variance in GLTEQ scores (Adjusted R^2 = .117), whereas model 2 explained ~16% of the variance in GLTEQ scores (Adjusted R^2 = .158). In model 1, self-efficacy had a statistically significant association with GLTEQ scores (ß = .34, *p* = .001). When all SCT constructs were included in model 2, only planning (ß = .39, *p* = .01) was a statistically significant predictor of GLTEQ scores.

For IPAQ MET minutes per day, using transformed IPAQ scores, model 1 (*F* = 4.59, *p* = .035) was statistically significant, whereas model 2 was not statistically significant (*F* = 1.69, *p* = .098). Model 1 explained ~ 4% (Adjusted R^2 = .039) of the variance in IPAQ MET minutes per day. Finally, regression results for accelerometer MVPA minutes indicated that model 1 (*F* = 6.97, *p* = .010) but not model 2 (*F* = 1.47, *p* = .170) was statistically significant. Model 1 explained approximately 8% of the variance in accelerometer derived minutes spent in MVPA (Adjusted R^2 = .075). In this model, self-efficacy was a statistically significant predictor of minutes spent in MVPA (ß = .30, p = .010).

Additional hierarchical analyses for each physical activity measure were conducted entering only the SCT variables with significant correlations into the model. This did not significantly change the outcomes and as such, these analyses are not presented.

Specific Aim #2: Health Outcomes and Physical Activity

The sample was divided into two groups using minutes spent in MVPA from the accelerometer to identify women who were meeting versus not meeting public health guidelines for physical activity. Women who engaged in an average of 30 or more minutes of MVPA per day were classified as 'meeting guidelines' whereas women who participated in less than 30 minutes of MVPA, on average, were classified as 'not meeting guidelines'. Based on this definition, 76% (n = 58) of the single mothers in this study who provided valid accelerometer data were not meeting public health guidelines for physical activity. Participants meeting public health guidelines for physical activity engaged in an average of 43.1 ± 11.4 minutes of MVPA compared to 13.1 ± 9.1 minutes of MVPA for those who were not meeting the guidelines. GLTEQ scores for women classified as meeting guidelines were 36.7 ± 18.7 compared to 20.7 ± 18.1 for women who were not meeting guidelines and IPAQ MET minutes per day were 761.6 ± 574.8 and 559.6 ± 541.8, respectively.

Multivariate Analysis of Variance (MANOVA) Results

Descriptive statistics for health outcomes among the overall sample and for dichotomized MVPA groups are presented in Table 6. There were 76 participants who provided valid accelerometer data and were subsequently classified into dichotomized physical activity groups of meeting versus not meeting physical activity guidelines. There were no significant differences between dichotomized MVPA groups for age, race, education, income, number of children, or BMI. A one-way MANOVA was conducted to compare MVPA group differences in health outcomes including cardiovascular disease, anxiety, depression, stress, physical self-perception, and health-related quality of life. The overall MANOVA for meeting guidelines was significant [F (11,63) = 3.62, p = .001, η^2 = .39]. Univariate tests indicated that the PSPP condition subscale was the only health outcome that significantly differed between MVPA groups [F(1,73) = 16.06, p = .001, η^2 = .18]. Participants who were meeting physical activity guidelines reported a more positive perception of their physical condition compared to participants who were not achieving recommended levels of MVPA.

Correlations between physical activity and health outcomes

Correlation analyses were conducted among physical activity measures and health outcomes to better understand these associations given the small percentage of women in the final sample who were meeting public health guidelines for physical activity based on accelerometer-derived MVPA minutes. For self-reported physical activity measures, bivariate correlations indicated that GLTEQ scores were significantly associated with PSPP sport (r = .23, p = .015), condition (r = .50, p = .001), strength (r = .29, p = .003), and physical self-worth subscales (r = .22, p = .018). The association between GLTEQ and SF-12 mental component scores (r = .16, p = .074) approached significance. Using transformed data, IPAQ MET minutes per day were significantly associated with depression (r = −.18, p = .045), and PSPP condition (r =.33, p = .001), body (r = .22, p = .019), strength (r = .23, p = .015), and overall perceived self-worth (r = .28, p = .005) physical self-perception subscales. The association between IPAQ MET minutes per day and stress (*r* = −.14, *p* = .096) approached statistical significance. The full correlation matrix for self-reported physical activity with health outcome variables is provided in Table 7.

For objectively measured physical activity, minutes of MVPA were significantly associated with physical self-perception condition (*r* = .39, *p* = .001) and strength (*r* = .19, *p* = .049) subscales. The correlations between MVPA and CVD symptoms (*r* = −.17, *p* = .074) and SF-12 physical component scores (*r* = .15, *p* = .094) approached statistical significance. Accelerometer activity counts were significantly associated with CVD symptoms (*r* = −.24, *p* = .018) and PSPP condition subscale scores (*r* = .35, *p* = .001). Similarly, accelerometer step counts were significantly associated with CVD symptoms (*r* = −.25, *p* = .015) and PSPP condition subscale scores (*r* = .25, *p* = .015). The full correlation matrix for objectively measured physical activity with health outcome variables is provided in Table 8.

Specific Aim #3 (Exploratory): Physical Activity Correlates and Consequences by Social Demographic Factors

Fisher's *z*-statistics were calculated to compare correlations between physical activity (i.e., accelerometer MVPA minutes, GLTEQ scores, and IPAQ MET minutes per day scores) and SCT variables for dichotomized race, education, and income groups. There were only a few statistically significant differences among these correlations for race, education, or income groups and these differences were not consistent across all measures of physical activity. The correlations between GLTEQ scores and overall outcome expectations differed for white (*r* = .31) versus non-white (*r* = −.20) participants (*z* = 2.11, *p* = .04). Correlations between GLTEQ scores and barriers differed by participants without a college degree (*r* = .06) compared to women with a college degree (*r* = −.42) (*z* = 2.27, *p* = .02). The relationship between MVPA minutes and planning differed by education level (*z* = −2.26, *p* = .02). There was a stronger association between MVPA minutes and planning for single mothers with a college degree (*r* = −.08) compared to single mothers without a college degree (*r* = .44). Correlation coefficients between accelerometer GLTEQ minutes and SCT variables by demographic group along with associated *z*-statistics and *p*-values are presented in Table 9 as an example of the correlation coefficient comparisons.

A series of two-way MANOVAs were conducted to examine differences in health outcomes based on physical activity and demographic characteristic groups. Health outcomes of interest for this specific aim included CVD symptoms, anxiety, depression, stress, PSPP physical self-worth subscale, and SF-12 physical and mental component subscales. The first two-way MANOVA compared health outcomes by MVPA groups (i.e., meeting versus not meeting physical activity guidelines) and dichotomized racial groups (i.e., white versus non-white). The second and third two-way MANOVAs again compared health outcomes by MVPA groups with income (i.e., <$40,000 versus >$40,000) and education groups (i.e., less than college degree versus college degree), respectively. The final two-way MANOVA compared health outcomes by MVPA and age (≤ 33 years versus > 33 years). There were no statistically significant interactions between meeting versus not meeting physical activity guidelines and race [F (7, 65) = .63, p = .729, η^2 = .064], education [F (7, 65) = 1.04, p = .413, η^2 = .101], income [F (7, 65) = .86, p = .588, η^2 = .080], or age [F (7, 65) = .53, p = .810, η^2 = .054] groups for health outcomes.

CHAPTER 5: DISCUSSION

General Overview

Some evidence suggests that single motherhood is associated with negative health consequences such as symptoms of CVD (Young et al., 2005, 2004), stress (Cairney et al., 2003), and symptoms of depression (Peden et al., 2004; Turner, 2006). Participation in physical activity might be important for mitigating or reducing the risks of these negative health consequences. Yet, previous evidence suggests that becoming a single mother is associated with less physical activity (Brown & Trost, 2003) and that single mothers may not be meeting national recommendations for physical activity (Dlugonski & Motl, 2013). The two primary aims of this study were: (a) to use social cognitive theory (SCT) to explain variation in physical activity behavior and (b) to examine the relationships between physical activity participation and health outcomes among single mothers with young children.

Overall, the primary results from this study indicate that most single mothers with young children were not meeting national guidelines for MVPA and that some SCT constructs were useful for explaining physical activity behavior among single mothers with children under 5 years old. Although less conclusive, this study provided initial support for the association between health outcomes and physical activity among this group of women. The identification of SCT constructs that are related to physical activity participation and the associated health consequences among single mothers is an important first step towards designing an intervention to increase physical activity that is relevant and suitable for this particular group of women.

Physical Activity Levels and National Physical Activity Recommendations

Multiple self-report and objective measures were used to assess physical activity in an effort to provide a comprehensive description of physical activity participation among this sample of single mothers with young children. Of particular importance was capturing both leisure and non-leisure time physical activity among this group of women who might have limited time for discretionary pursuits. Overall, single mothers in this study reported low levels of leisure-time physical activity behavior. This is supported by low GLTEQ scores (~26 units; range 0 – 119) and slightly more than 20 minutes of leisure-time physical activity reported per day on the IPAQ compared to ~53 minutes of domestic-related activities and ~40 minutes of job-related activities. This finding has important implications for understanding and promoting physical activity among single mothers. Most single mothers in this study were employed in addition to caring for their child(ren) and thus, may have limited opportunities for engaging in leisure-time physical activity. As such, promoting lifestyle physical activity or encouraging short (~10 minutes) instead of longer bouts of activity may make achieving at least 30 minutes of MVPA per day seem like a more realistic or feasible goal for single mothers.

The majority of mothers in this study (~76%) were not meeting public health guidelines for physical activity. However, on average, women in this study were participating in approximately 20 minutes of MVPA per day. Therefore, a small increase in MVPA of approximately 10 minutes per day might improve the likelihood of attaining health benefits from engaging in physical activity. This is a promising point to consider for intervention because an extra 10 minutes per day, on average, might seem like a manageable target for busy single mothers.

In general, the relationships among social cognitive theory constructs with self-reported and objective measures of physical activity were small-to-moderate in magnitude. Excluding physical outcome expectations and social support from family, all SCT constructs demonstrated at least one statistically significant association with physical activity. Overall, this study provided some support for using SCT to explain variation in the physical activity behavior of single mothers with young children.

Self-efficacy

Self-efficacy had a consistent relationship with physical activity across both self-report measures of physical activity and objectively measured minutes spent in MVPA. These relationships were moderate in magnitude. This finding is consistent with SCT such that women who were currently engaging in higher levels of physical activity were more confident in their ability to meet recommended levels of physical activity in the future. On average, single mothers in this study were ~60% confident in their ability to participate in a cumulative total of 30 or more minutes of moderate to vigorous physical activity on most days of the week over the next 6 months. This level of efficacy is similar with exercise self-efficacy levels reported by a previous sample of mostly female middle aged adults (N = 321) who were ~66% confident in their ability to engage in moderate exercise for 30 or more minutes on 5 days of the week over the next 3 months (White et al., 2012). Interestingly, self-efficacy had the strongest association with GLTEQ scores, the one physical activity measure that included only leisure-time physical activities. This might suggest that single mothers who were participating in higher levels of leisure-time physical activity had increased levels of confidence in their ability to be physically active in the future.

Outcome-expectations

Physical outcome expectations were not associated with self-reported or objectively measured physical activity in this study. This is likely due to a lack of variation in physical outcome beliefs about engaging in physical activity. The possible range of physical outcome expectation scores is 6 – 30, but the actual range of scores in this study was 21 – 30. These high scores indicate that participants had positive physical outcome expectations for physical activity regardless of their level of activity. The average physical outcome expectations score in this study (27.8 ± 2.3) is consistent with results from the aforementioned longitudinal study among middle aged adults (26.4 ± 2.60) (White et al., 2012). These high levels of physical outcome expectations are not surprising given the well-known and often promoted physical benefits of engaging in physical activity.

Social and self-evaluative outcome expectations for physical activity were associated with all measures of physical activity except GLTEQ scores and were all small to moderate in magnitude. Similar to physical outcome expectation scores, social and self-evaluative expectation scores were nearly identical to scores from the previously described large sample of middle-aged adults (White et al., 2012). Future studies might explore the potential of focusing on these social and self-evaluative motives among single mothers to promote participation in physical activity in addition to the commonly touted physical outcomes.

Barriers and Facilitators

Barriers were the only SCT construct that had statistically significant and moderate correlations with all self-reported and objective measures of physical activity. This seemingly emphasizes the importance of barriers for physical activity participation among single mothers with young children. Participants in this study had an average barriers score of 32.8 (possible range 15 – 60) and this is similar to the barriers score of 35.8 (possible range 14 – 56) reported by a sample (*n* = 52) of mothers who were part of a physical activity intervention study (Fahrenwald, Atwood, Walker, Johnson, & Berg, 2004). Based on the associations among barriers and physical activity participation, teaching single mothers skills related to the management of barriers to physical activity may be an important component of an intervention designed to increase physical activity.

Single mothers in this study reported low levels of social support from family and friends, 15.9 and 19.5 (range 10 – 50), respectively. The support from family reported by participants in the current study was even lower than support reported by mothers who were enrolled in the aforementioned physical activity intervention (21.95) (Fahrenwald et al., 2004). However, support from friends reported by single mothers in this study (19.5), although low, was slightly higher than pre-intervention levels of friend support reported by mothers in the previously mentioned trial (17.3) (Fahrenwald et al., 2004).

Social support was not consistently associated with physical activity among this sample. However, the present study used a measure of social support that captured the level and not the type of social support for physical activity among single mothers. Future studies should consider exploring the types of social support that are associated with physical activity among single mothers. For example, future research might use the Social Provisions Scale (Cutrona & Russell, 1987) to measure specific forms of social support/provisions, including attachment, guidance (advice or information), and social integration. Developing a more specific understanding of the social support needs of single mothers would inform the design of future interventions to promote physical activity among this group of women.

Self-regulatory Strategies

Goal setting was only associated with GLTEQ scores, whereas planning was consistently associated with self-reported and objective measures of physical activity among this sample of single mothers. Despite the slightly more consistent relationships among planning and physical activity compared to goal setting, participants reported similar mean levels of goal setting (26.1 ± 9.1) and planning (21.8 ± 6.6). This suggests that both of these self-regulatory strategies might be useful for promoting physical activity behavior among single mothers. Planning for physical activity might be of particular importance for this group of women because of time constraints due to work and childcare responsibilities.

Comparison between Self-report and Objective Measures of Physical Activity

The correlation coefficients between physical activity and SCT variables were generally stronger for self-reported compared to objectively measured physical activity. Low to moderate associations, similar to those in the current study, between these two types of physical activity measures are common and a previous review highlighted the trend for higher estimates of physical activity from self-reported physical activity measures compared to accelerometry (Prince et al., 2008). There are several plausible explanations for the differential relationships between self-reported physical activity and accelerometer measured MVPA with SCT constructs.

First, self-report measures of physical activity might be subject to over reporting. Similarly, previous studies have highlighted the overestimation of self-efficacy (McAuley, et al., 2011) and it is possible that other SCT variables may also be overestimated. These overestimations could result in stronger correlations among physical activity and SCT variables for self-reported compared to objectively measured physical activity. Secondly, it is possible that participants provided socially desirable responses for physical activity (i.e., higher physical activity scores). Although speculative, single mothers might be even more likely than others to report positive health behaviors as a small way to counteract the overwhelmingly negative view of single mothers in society. A third explanation for the discrepancy between self-reported and objective measures of physical activity is that the slightly smaller sample size for objective compared to self-reported physical activity may have resulted in a weaker relationships among SCT constructs. The differences that exist by type of physical activity measure emphasize the importance of including multiple measures of physical activity in future studies.

Physical Activity and Health Outcomes

Results from this study provided initial evidence for the association between health outcomes and physical activity although these relationships were less consistent than those demonstrated among physical activity outcomes and SCT constructs. Specifically, health outcomes measured in this study were associated with self-reported physical activity but generally not related to objectively-measured physical activity. Symptoms of cardiovascular disease comorbidities, anxiety, stress, and health-related quality of life were not associated with self-reported or objectively measured physical activity outcomes.

Overall, the current sample of single mothers had low levels of physical activity, but health outcome scores that were consistent with normative values (i.e., a relatively healthy sample). The health of the current sample might be partially due to the young age of participants (~33 years old). Participants reported a range of 0 to 6 CVD comorbidities, but more than 75% of the sample reported zero or one CVD symptom or condition. Similarly, only ~10% of participants in this study had anxiety and depression scores that were above the cutoff point for identifying disturbances from normal (i.e., anxiety or depression subscale score of 11 or higher).

Stress levels in this study were consistent with normative data from a large sample of women (Cohen & Janicki-Deverts, 2012). Physical component scores from the SF-12 (51.5) in the current sample were consistent with physical (47.9) component scores from a large sample of women in the United States (n = 129) (Johnson & Coons, 1998). Mental component scores for participants in the present study (40.3) were lower (i.e., less favorable) than mental SF-12 component scores in the previously mentioned study (50.5) (Johnson & Coons, 1998). For the physical self-perception profiles, it is not surprising that the physical condition subscale was the most consistently associated health outcome with self-reported and objectively measured physical activity. It seems logical that one's perception of physical condition or fitness would be more positive with higher levels of physical activity participation. The relatively healthy nature of the current sample may have limited or attenuated some of the associations among physical activity outcomes for this sample of single mothers with young children.

Despite the relatively healthy sample in this study, self-reported physical activity was significantly related to depressive symptoms and each of the physical self-perception profile subscales. There were statistically significant associations between accelerometer MVPA and the physical condition and strength subscales of the PSPP. Although the correlations among health outcomes and physical activity were small or non-significant in the present study, these results are comparable to findings from previous studies with much larger samples. By converting the correlation coefficients from the present study to relative risk (RR) scores, it is possible to contextualize the present results within the broader literature. For example, the correlation between depression and physical activity in the current study ranged from −.04 to −.18 and a correlation of −.2 corresponds with a RR of .60 (Ferguson, 1966). This RR is consistent with the 30 – 40% lower risk for active compared to inactive individuals that was described in a recent report (Physical Activity Guidelines Advisory Committee, 2008). Similarly, the correlations among CVD comorbidities and physical activity ranged from −.10 to −.17 and these correspond to a RR of .65 to .77. These risk values are similar to the 20 – 30% risk reduction in CHD or CVD morbidity or mortality for active compared to inactive individuals that was summarized in a previous report (Physical Activity Guidelines Advisory Committee, 2008). In light of these comparisons, the findings from this study, although small in magnitude or non-significant, are consistent with results from large epidemiological studies.

Physical Activity and Social Demographic Factors

There were only a few differences in the relationships between SCT constructs and physical activity by social demographic characteristics in this study. These differences were not consistent across all measures of physical activity, but might highlight areas for future researchers to explore. This study did not demonstrate any interactions between physical activity and social demographic factors (i.e., race, education, income, and age) for health outcomes. However, the present sample was not large enough to make definitive conclusions about the combined impact of physical activity and other social demographic characteristics on health outcomes among single mothers. Future studies with larger samples should take these important factors into consideration as there might be differential relationships between physical activity and health outcomes based on racial identity, or between low and high education or income groups.

Strengths and Limitations

This study was the first to examine a wide-ranging set of correlates and consequences associated with physical activity among single mothers with young children. Understanding the correlates associated with physical activity participation is integral for designing and testing behavioral interventions to increase physical activity that are specifically tailored to meet the needs of single mothers. This study provided a foundation for beginning to understand the relationships between physical activity and health outcomes among single mothers. It is critical that we strive to understand the health consequences of being a single mother and perhaps more importantly, identify modifiable factors that have the potential to improve the health and well-being of women in this population. This study was a first step towards identifying these factors and the associated health consequences.

Despite these strengths, there were several limitations to this study. First, the cross-sectional study design limited conclusions about directionality of the relationships among constructs and the impact of time on these relationships. Secondly, the conclusions from this study would have been strengthened with random selection of participants. However, random sampling is difficult to achieve outside of large national datasets and these samples often include only a few limited questions about physical activity. It is possible that women who volunteered to participate in this study were somehow different from the general population of single mothers. For example, single mothers in this study might have been healthier or had a stronger interest in physical activity or health compared to women who chose not to participate. Similarly, single mothers who volunteered to participate but did not return the informed consent document or study materials might have meaningful differences when compared to women who completed all study procedures. Thus, these results may not be generalizable to all single mothers with young children. However, participants in this study represented a range of educational, income, and racial backgrounds that provided important diversity among sample participants. The relatively small sample size in this study limited comparisons of the physical activity and health of single mothers based on social demographic characteristics such as race, education, and income. Finally, the small number of women who were meeting physical activity guidelines further limited conclusions that could be drawn about differences in health outcomes by physical activity levels in this study.

Future Directions and Considerations

This study extended the body of literature on physical activity among single mothers by providing a more comprehensive description of the physical activity level of single mothers as well as the correlates and consequences of this health behavior. Given the rates of inactivity among single mothers and the potential benefits associated with engaging in physical activity, this is a group would likely benefit from further study. There are several potential avenues for future research that would continue to move this body of literature forward.

Future studies might use a longitudinal research design to examine changes in correlates and consequences of physical activity over time with naturally occurring changes in activity levels. This study design would further allow researchers to increase knowledge about the long-term health effects of single motherhood that might accrue over time and the impact that physical activity has on these health outcomes. Single motherhood might have cumulative effects on health that cannot be explored through a cross-sectional analysis. Thus, a longitudinal study would be a logical next step to enhance knowledge about health and physical activity among this social demographic group.

Another direction for future research might be using social cognitive theory constructs to design a physical activity intervention for single mothers. In combination with the results from this study, learning about physical activity from the perspective of single mothers with young children through focus groups and/or interviews would be helpful for designing a physical activity intervention. Such an intervention might include enhancing efficacy beliefs through social modeling (i.e., testimonials from single mothers who are physically active) and providing opportunities for single mothers to have successful physical activity experiences. This intervention might also teach single mothers how to use self-regulatory strategies such as goal setting and planning to increase physical activity and encourage women to develop their social support networks for being physically active. Single mothers in the present study had low levels of moderate-to-vigorous activity during leisure time and this might be due to limited time for leisure activities in general. As such, it may be advantageous to promote short bouts (~10 minutes) of lifestyle physical activity instead of longer (e.g., 30 minutes), more structured exercise in the context of a behavior intervention to increase physical activity among single mothers.

Finally, other health behaviors such as smoking, alcohol use, and food choices might also play a role in health outcomes among single mothers. Future studies might consider exploring the contributions of a wider range of health behaviors on health outcomes among this group of women. It is possible that the negative health consequences of single motherhood are associated with a reduction in self-care behaviors in general, rather than only physical activity. Indeed, previous studies among mothers have described an ‘ethic of care’ among mothers (Miller & Brown, 2005) and it is conceivable that this feeling may be intensified for single mothers who are often the sole or primary care providers for the family. Other health behaviors might be important in the context of attempting to explain and ultimately improve the health of single mothers with young children.

On a more practical level, future studies might consider finding novel ways to recruit and retain single mothers in the context of physical activity research studies. Despite using several methods for recruitment, it was quite difficult to find a large group of single mothers who were willing and able to participate in the present study. Although there are some logistical challenges of working with single mothers that became apparent in the process of completing this study, the level of inactivity and the potential for associated negative health consequences demands continued research on physical activity among this group of women.

Conclusions

Overall, this study established the prevalence of inactivity among single mothers with young children and identified potential social cognitive theory constructs as targets for behavioral interventions. Additionally, this study provided initial support for the health benefits of engaging in physical activity among single mothers. Ultimately, the knowledge gained from this study will be useful for designing future studies and testing interventions to increase physical activity among single mothers with young children. This may help to mitigate some of the negative health consequences associated with single motherhood.

CHAPTER 6: REFERENCES

Aldana, S. G., Sutton, L. D., Jacobson, B. H., & Quirk, M. G. (1996). Relationships between leisure time physical activity and perceived stress. *Perceptual and Motor Skills*, *82*(1), 315–321.

Altman, D. G., & Bland, J. M. (1997). Cronbach's alpha. *British Medical Journal*, *314*(7080), 572.

Atkins, R. (2010). Self-efficacy and the promotion of health for depressed single mothers. *Mental Health in Family Medicine*, *7*(3), 155–168.

Avison, W. R., Ali, J., & Walters, D. (2007). Family structure, stress, and psychological distress: A demonstration of the impact of differential exposure. *Journal of Health and Social Behavior*, *48*(3), 301–317.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Pscyhological Review*, *84*(2), 191–215.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall, Inc.

Bandura, A. (1999). Social cognitive theory: An agentic perspective. *Asian Journal of Social Psychology*, *2*, 21–41.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behavior*, *31*(2), 143–164.

Bell, S., & Lee, C. (2005). Emerging adulthood and patterns of physical activity among young Australian women. *International Journal of Behavioral Medicine, 12*(4), 227–235.

Bellows-Riecken, K. H., & Rhodes, R. E. (2008). A birth of inactivity? A review of physical activity and parenthood. *Preventive Medicine, 46*(2), 99–110.

Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale-An updated literature review. *Journal of Psychosomatic Research*, *52*(2), 69–78.

Brown, G. W., & Moran, P. M. (1997). Single mothers, poverty and depression. *Psychological Medicine*, *27*(1), 21–33.

Brown, W. J., & Trost, S. G. (2003). Life transitions and changing physical activity patterns in young women. *American Journal of Preventive Medicine*, *25*(2), 140–143.

Cairney, J., Boyle, M., Offord, D. R., & Racine, Y. (2003). Stress, social support and depression in single and married mothers. *Social Psychiatry and Psychiatric Epidemiology*, *38*(8), 442–449.

Cairney, J., & Wade, T. J. (2002). Single parent mothers and mental health care service use. *Social Psychiatry and Psychiatric Epidemiology*, *37*(5), 236–242.

Candelaria, J., Sallis, J., Conway, T., Saelens, B., Frank, L., & Slymen, D. (2012). Differences in physical activity among adults in households with and without children. *Journal of Physical Activity & Health*, *9*(7), 985–995.

Centers for Disease Control and Prevention. (2000). *Measuring healthy days*. Atlanta, Georgia: CDC.

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155–159.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*(4), 385–396.

Cohen, S., & Janicki-Deverts, D. (2012). Who's stressed? Distributions of psychological stress in the United States in probability samples from 1983, 2006, and 2009. *Journal of Applied Social Psychology*, *42*(6), 1320–1334.

Connelly, R., & Kimmel, J. (2010). *The time use of mothers in the United States at the beginning of the 21st century*. Kalamazoo, MI: W.E. Upjohn Institute for Employment Research.

Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., … Oja, P. (2003). International Physical Activity Questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise*, *195*(9131/03), 3508–1381.

Crosier, T., Butterworth, P., & Rodgers, B. (2007). Mental health problems among single and partnered mothers. *Social Psychiatry and Psychiatric Epidemiology*, *42*(1), 6–13.

Cutrona, C. E. & Russell, D. W. (1987). The provisions of social relationships and adaptation to stress. *Advances in Personal Relationships*, 1, 37–67.

Demo, D. H., & Acock, A. C. (1996). Singlehood, marriage, and remarriage: The effects of family structure and family relationships on mothers' well-being. *Journal of Family Issues*, *17*(3), 388–407.

Dixon, M. A. (2009). From their perspective: A qualitative examination of physical activity and sport programming for working mothers. *Sport Management Review*, *12*(1), 34–48.

Dlugonski, D., & Motl, R. W. (2013). Marital status and motherhood: Implications for physical activity. *Women & Health*, *53*(2), 203–215.

Dunn, A. l., Trivedi, M. H., & O'Neal, H. A. (2001). Physical activity dose-response effects on outcomes of depression and anxiety. *Medicine & Science in Sports & Exercise, 33*(6 Suppl), S587–S597.

Elavsky, S., McAuley, E., Motl, R. W., Konopack, J. F., Marquez, D. X., Hu, L., … Diener, E. (2005). Physical activity enhances long-term quality of life in older adults: Efficacy, esteem, and affective influences. *Annals of Behavioral Medicine*, *30*(2), 138–145.

Elfhag, K., & Rasmussen, F. (2008). Food consumption, eating behaviour and self-esteem among single v. married and cohabiting mothers and their 12-year-old children. *Public Health Nutrition*, *11*(9), 934–939.

Fahrenwald, N. L., Atwood, J. R., Walker, S. N., Johnson, D. R., & Berg, K. (2004). A randomized pilot test of “Moms on the Move”: A physical activity intervention for WIC mothers. *Annals of Behavioral Medicine*, *27*(2), 82–90.

Ferguson, G. A. (1966). *Statistical analysis in psychology & education.* New York, NY: McGraw-Hill, pp. 244.

Fox, K. R. (1999). The influence of physical activity on mental well-being. *Public Health Nutrition*, *2*(3a), 411–418.

Fox, K. R., & Corbin, C. B. (1989). The physical self-perception profile: Development and preliminary validation. *Journal of Sport & Exercise Psychology*, *11*(4), 408–430.

Freedson, P. S., Melanson, E., & Sirard, J. (1998). Calibration of the Computer Science and Applications, Inc. accelerometer. *Medicine & Science in Sports & Exercise*, *30*(5), 777–781.

Gerber, M., & Pühse, U. (2009). Review article: Do exercise and fitness protect against stress-induced health complaints? A review of the literature. *Scandinavian Journal of Public Health, 37*(8), 801–819.

Glanz, K., & Bishop, D. B. (2010). The role of behavioral science theory in development and implementation of public health interventions. *Annual Review of Public Health*, *31*(1), 399–418.

Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Sciences, 10*(3), 141–146.

Godin, G. (2011). The Godin-Shephard leisure-time physical activity questionnaire. *The Health & Fitness Journal of Canada*, *4*(1), 18–22.

Goodwin, R. D. (2003). Association between physical activity and mental disorders among adults in the United States. *Preventive Medicine*, *36*(6), 698–703.

Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire. (2005, November). Retrieved from http://www.ipaq.ki.se/scoring.pdf

Hagstromer, M., Ainsworth, B. E., Oja, P., & Sjostrom, M. (2010). Comparison of a subjective and an objective measure of physical activity in a population sample. *Journal of Physical Activity & Health*, *7*(4), 541–550.

Higgins, J. W., Young, L., Cunningham, S., & Naylor, P.-J. (2006). Out of the mainstream: Low-income, lone mothers' life experiences and perspectives on heart health. *Health Promotion Practice*, *7*(2), 221–233.

Hodgson, J., Dienhart, A., & Daly, K. (2001). Time juggling: Single mothers' experience of time-press following divorce. *Journal of Divorce & Remarriage*, *35*(1/2), 1–28.

Hull, E. E., Rofey, D. L., Robertson, R. J., Nagle, E. F., Otto, A. D., & Aaron, D. J. (2010). Influence of marriage and parenthood on physical activity: A 2-year prospective analysis. *Journal of Physical Activity & Health*, *7*(5), 577–583.

Jayakody, R., & Stauffer, D. (2002). Mental health problems among single mothers: Implications for work and welfare reform. *Journal of Social Issues*, *56*(4), 617–634.

Johnson, J. A., & Coons, S. J. (1998). Comparison of the EQ-5D and SF-12 in an adult US sample. *Quality of Life Research, 7*(2), 155–166.

Kaplan, G. A., Siefert, K., Ranjit, N., Raghunathan, T. E., Young, E. A., Tran, D., … Tolman, R. (2005). The health of poor women under welfare reform. *American Journal of Public Health*, *95*(7), 1252–1258.

Knowler, W. C., Barrett-Connor, E., Fowler, S. E., Hamman, R. F., Lachin, J. M., Walker, E. A., & Nathan, D. M. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *The New England Journal of Medicine*, *346*(6), 393–403.

Kreider, R. M., & Ellis, R. (2011). *Living arrangements of children: 2009.* Washington, DC: US Census Bureau.

Laaksonen, D. E., Lindström, J., Lakka, T. A., Eriksson, J. G., Niskanen, L., Wikström, K., … Valle, T. T. (2005). Physical activity in the prevention of type 2 diabetes the Finnish Diabetes Prevention Study. *Diabetes*, *54*(1), 158–165.

Landero Hernández, R., Estrada Aranda, B., & González Ramírez, M. T. (2009). Depression and quality of life for women in single-parent and nuclear families. *Spanish Journal of Psychology*, *12*(1), 171–183.

Lipman, E. L., Offord, D. R., & Boyle, M. H. (1997). Single mothers in Ontario: Sociodemographic, physical and mental health characteristics. *Canadian Medical Association Journal*, *156*(5), 639–645.

Martin, J. A., Hamilton, B. E., Ventura, S. J., Osterman, M. J. K., Wilson, E. C., & Mathews, T. J. (2012). *Births: Final data for 2010* (Vol. 61). Hyattsville, MD: National Center for Health Statistics.

Mather, M. (2010). US children in single-mother families. *PRB Data Brief*. Retrieved from http://prb.org/Publications/PolicyBriefs/singlemotherfamilies.aspx?e=1

McAuley, E., Hall, K. S., Motl, R. W., White, S. M., Wójcicki, T. R., Hu, L., & Doerksen, S. E. (2009). Trajectory of declines in physical activity in community-dwelling older women: Social cognitive influences. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *64B*(5), 543–550.

McAuley, E., Lox, C., & Duncan, T. E. (1993). Long-term maintenance of exercise, self-efficacy, and physiological change in older adults. *Journal of Gerontology*, *48*(4), 218–224.

McAuley, E., Mailey, E. L., Mullen, S. P., Szabo, A. N., Wojcicki, T. R., White, S. M., …Kramer, A. F. (2011). Growth trajectories of exercise self-efficacy in older adults: Influence of measures and initial status. *Health Psychology*, *30*(1), 75–83.

McLanahan, S. S. (1983). Family structure and stress: A longitudinal comparison of two-parent and female-headed families. *Journal of Marriage and Family*, *45*(2), 347–357.

Miller, Y. D., & Brown, W. J. (2005). Determinants of active leisure for women with young children—an "ethic of care" prevails. *Leisure Sciences*, *27*(5), 405–420.

Motl, R. W., Fernhall, B., McAuley, E., & Cutter, G. (2011). Physical activity and self-reported cardiovascular comorbidities in persons with multiple sclerosis: Evidence from a cross-sectional analysis. *Neuroepidemiology*, *36*(3), 183–191.

Motl, R. W., & McAuley, E. (2010). Physical activity, disability, and quality of life in older adults. *Physical Medicine and Rehabilitation Clinics of North America*, *21*(2), 299–308.

Nomaguchi, K. M., & Bianchi, S. M. (2004). Exercise time: Gender differences in the effects of marriage, parenthood, and employment. *Journal of Marriage and Family*, *66*(2), 413–430.

Oguma, Y., & Shinoda-Tagawa, T. (2004). Physical activity decreases cardiovascular disease risk in women: Review and meta-analysis. *American Journal of Preventive Medicine, 26*(5), 407–418.

Olson, S. L., & Banyard, V. (1993). “Stop the world so I can get off for a while”: Sources of daily stress in the lives of low-income single mothers of young children. *Family Relations*, *42*(1), 50–56.

Peden, A. R., Rayens, M. K., Hall, L. A., & Grant, E. (2004). Negative thinking and the mental health of low-income single mothers. *Journal of Nursing Scholarship*, *36*(4), 337–344.

Peden, A. R., Rayens, M. K., Hall, L. A., & Grant, E. (2005). Testing an intervention to reduce negative thinking, depressive symptoms, and chronic stressors in low-income single mothers. *Journal of Nursing Scholarship*, *37*(3), 268–274.

Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: A review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry*, *18*(2), 189–193.

Petersen, C. B., Grønbæk, M., Helge, J. W., Thygesen, L. C., Schnohr, P., & Tolstrup, J. S. (2012). Changes in physical activity in leisure time and the risk of myocardial infarction, ischemic heart disease, and all-cause mortality. *European Journal of Epidemiology*, *27*(2), 91–99.

Physical Activity Guidelines Advisory Committee. (2008). *Physical activity guidelines advisory committee report*. Washington, DC: U.S. Department of Health and Human Services.

Plotnikoff, R. C., Lippke, S., Courneya, K. S., Birkett, N., & Sigal, R. J. (2008). Physical activity and social cognitive theory: A test in a population sample of adults with type 1 or type 2 diabetes. *Applied Psychology*, *57*(4), 628–643.

Prince, S. A., Adamo, K. B., Hamel, M. E., Hardt, J., Gorber, S. C., & Tremblay, M. (2008). A comparison of direct versus self-report measures for assessing physical activity in adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity, 5*(56).

Ransdell, L. B., Dratt, J., Kennedy, C., O'Neill, S., & DeVoe, D. (2001). Daughters and Mothers Exercising Together (DAMET): A 12-week pilot project designed to improve physical self-perception and increase recreational physical activity. *Women & Health*, *33*(3-4), 113–129.

Rosenberg, M. (1989). *Society and the adolescent self-image (rev. ed.)*. Middletown, CT: Wesleyan University Press.

Rovniak, L. S., Anderson, E. S., Winett, R. A., & Stephens, R. S. (2002). Social cognitive determinants of physical activity in young adults: A prospective structural equation analysis. *Annals of Behavioral Medicine*, *24*(2), 149–156.

Sallis, J. F., Grossman, R. M., Pinski, R. B., Patterson, T. L., & Nader, P. R. (1987). The development of scales to measure social support for diet and exercise behaviors. *Preventive Medicine*, *16*(6), 825–836.

Schnohr, P., Kristensen, T. S., Prescott, E., & Scharling, H. (2005). Stress and life dissatisfaction are inversely associated with jogging and other types of physical activity in leisure time—The Copenhagen City Heart Study. *Scandinavian Journal of Medicine & Science in Sports*, *15*(2), 107–112.

Scully, D., Kremer, J., Meade, M. M., Graham, R., & Dudgeon, K. (1998). Physical exercise and psychological well being: A critical review. *British Journal of Sports Medicine*, *32*(2), 111–120.

Sechrist, K. R., Walker, S. N., & Pender, N. J. (1987). Development and psychometric evaluation of the Exercise Benefits/Barriers Scale. *Research in Nursing & Health, 10*, 357 – 365.

Sigal, R. J., Kenny, G. P., Wasserman, D. H., & Castaneda-Sceppa, C. (2004). Physical activity/exercise and type 2 diabetes. *Diabetes Care*, *27*(10), 2518–2539.

Sonstroem, R. J., Harlow, L. L., & Josephs, L. (1994). Exercise and self-esteem: Validity of model expansion and exercise associations. *Journal of Sport & Exercise Psychology*, *16*(1), 29 – 42.

Spence, J. C., McGannon, K. R., & Poon, P. (2005). The effect of exercise on global self-esteem: A quantitative review. *Journal of Sport & Exercise Psychology*, *27*(3), 311–334.

Stewart, A. L., & King, A. C. (1991). Evaluating the efficacy of physical activity for influencing quality-of-life outcomes in older adults. *Annals of Behavioral Medicine*, *13*(3), 108–116.

Strine, T. W., Mokdad, A. H., Dube, S. R., Balluz, L. S., Gonzalez, O., Berry, J. T., … Kroenke, K. (2008). The association of depression and anxiety with obesity and unhealthy behaviors among community-dwelling US adults. *General Hospital Psychiatry*, *30*(2), 127–137.

Strohle, A., Hofler, M., Pfister, H., Muller, A. G., Hoyer, J. U. R., Wittchen, H. U., & Lieb, R. (2007). Physical activity and prevalence and incidence of mental disorders in adolescents and young adults. *Psychological Medicine*, *37*(11), 1657–1666.

Suh, Y., Weikert, M., Dlugonski, D., Balantrapu, S., & Motl, R. W. (2011). Social cognitive variables as correlates of physical activity in persons with multiple sclerosis: Findings from a longitudinal, observational study. *Behavioral Medicine*, *37*(3), 87–94.

Taylor, M. K., Pietrobon, R., Pan, D., Huff, M., & Higgins, L. D. (2004). Healthy People 2010 physical activity guidelines and psychological symptoms: Evidence from a large nationwide database. *Journal of Physical Activity & Health*, *1*, 114–130.

Teychenne, M., Ball, K., & Salmon, J. (2008). Physical activity and likelihood of depression in adults: A review. *Preventive Medicine*, *46*(5), 397–411.

The WHOQOL Group. (1995). The World Health Organization quality of life assessment (WHOQOL): Position paper from the World Health Organization. *Social Science & Medicine*, *41*(10), 1403–1409.

Thornton, A., & Young-DeMarco, L. (2001). Four decades of trends in attitudes toward family issues in the United States: The 1960s through the 1990s. *Journal of Marriage and Family*, *63*(4), 1009–1037.

Tudor-Locke, C., & Bassett, D. R., Jr. (2004). How many steps/day are enough? Preliminary pedometer indices for public health. *Sports Medicine*, *34*(1), 1–8.

Turner, H. A. (2006). Stress, social resources, and depression among never-married and divorced rural mothers. *Rural Sociology*, *71*(3), 479–504.

Turner, H. A. (2007). The significance of employment for chronic stress and psychological distress among rural single mothers. *American Journal of Community Psychology*, *40*(3-4), 181–193.

U.S. Census Bureau. *Table DP02.Selected social characteristics in the United States.* 2007 – 2011 American Community Survey. http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk

U.S. Census Bureau. (2011). *Table FM-2. All parent/child situations: 1970 to Present*. Current Population Survey, March and Annual Social and Economic Supplements.

Van Dyck, D., Cerin, E., Conway, T. L., De Bourdeaudhuij, I., Owen, N., Kerr, J., … Sallis, J. F. (2012). Associations between perceived neighborhood environmental attributes and adults' sedentary behavior: Findings from the USA, Australia and Belgium. *Social Science & Medicine*, *74*(9), 1375–1384.

Ventura, S. J. (2009). Changing patterns of nonmarital childbearing in the United States. *National Center for Health Statistics Data Brief*, (18), 1 – 8.

Wade, T. J., & Cairney, J. (2000). Major depressive disorder and marital transition among mothers: Results from a national panel study. *The Journal of Nervous and Mental Disease*, *188*(11), 741–750.

Wang, J. L. (2004). The difference between single and married mothers in the 12-month prevalence of major depressive syndrome, associated factors and mental health service utilization. *Social Psychiatry and Psychiatric Epidemiology*, *39*(1), 26–32.

Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2006). Health benefits of physical activity: The evidence. *Canadian Medical Association Journal*, *174*(6), 801–809.

Ware Jr., J. E., Kosinski, M., & Keller, S. D. (1996). A 12-Item Short-Form Health Survey: construction of scales and preliminary tests of reliability and validity. *Medical Care*, *34*(3), 220–233.

Weinstein, A. R., Sesso, H. D., Lee, I. M., Cook, N. R., Manson, J. E., Buring, J. E., & Gaziano, J. M. (2004). Relationship of physical activity vs body mass index with type 2 diabetes in women. *The Journal of the American Medical Association*, *292*(10), 1188–1194.

White, S. M., Wojcicki, T. R., & McAuley, E. (2012). Social cognitive influences on physical activity behavior in middle-aged and older adults. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences*, *67*(1), 18–26.

Williams, K., Sassler, S., Frech, A., Addo, F., & Cooksey, E. (2011). Nonmarital childbearing, union history, and women's health at midlife. *American Sociological Review*, *76*(3), 465–486.

Wojcicki, T. R., White, S. M., & McAuley, E. (2009). Assessing outcome expectations in older adults: The Multidimensional Outcome Expectations for Exercise Scale. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *64B*(1), 33–40.

Young, L. E., Cunningham, S. L., & Buist, D. S. M. (2005). Lone mothers are at higher risk for cardiovascular disease compared with partnered mothers. Data from the National Health and Nutrition Examination Survey III (NHANES III). *Health Care for Women International*, *26*(7), 604–621.

Young, L. E., James, A. D., & Cunningham, S. L. (2004). Lone motherhood and risk for cardiovascular disease: The National Population Health Survey (NPHS), 1998-99. *Canadian Journal of Public Health*, *95*(5), 329–335.

Zigmond, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, *67*(6), 361–370.

CHAPTER 7: TABLES

Table 1. Participant demographic characteristics (*N* = 92)*

Variable	Categories	Mean (SD)/Frequency (%)
Age, *years*		32.6 (7.2)
BMI, *kg/m²*		29.7 (7.1)
	Normal weight (< 25.0)	28 (32.2%)
	Overweight (25 – 29.9)	21 (24.1%)
	Obese (≥ 30)	38 (43.7%)
No. of children, *median (range)*		1 (1 – 4)
Age of youngest child, *years*		2.5 (1.3)
Employment	Employed	79 (85.9%)
	Unemployed	13 (14.1%)
Education	Less than college degree	39 (42.4%)
	College degree	29 (31.5%)
	Post-graduate degree	24 (26.1%)
Annual household income	< $40,000	54 (58.7%)
	> $40,000	38 (41.3%)
Race	Caucasian	66 (71.7%)
	Black/African American	15 (16.3%)
	Other	11 (11.9%)

*Two participants did not provide demographic information; Percentages calculated based on number of participants who provided demographic data.
Note. BMI = body mass index

Table 2. Descriptive statistics for self-reported and objectively measured physical activity

Measure	Mean (SD)
Self-reported physical activity	
GLTEQ (Range; 0 – 119)	26.4 (21.4)
GLTEQ (Range; 0 – 98)	17.1 (17.2)
IPAQ MET minutes per day	566.2 (522.0)
IPAQ walking activity minutes per day	41.9 (50.4)
IPAQ moderate activity minutes per day	73.5 (62.7)
IPAQ vigorous activity minutes per day	16.8 (32.1)
IPAQ, sitting minutes per day	378.8 (169.8)
Objective physical activity	
MVPA, *minutes*	20.2 (16.0)
Activity Counts, *counts per day*	271,900 (120,205)
Step Counts, *steps per day*	9,251 (3,215)

Note. GLTEQ = Godin Leisure Time Exercise Questionnaire; IPAQ = International Physical Activity Questionnaire; MET = metabolic equivalent; MVPA = moderate to vigorous physical activity

Table 3. Descriptive statistics and Cronbach alpha values for SCT questionnaires

Measure	Possible Range	Mean (SD)
EXSE	0 – 100	60.3 (33.9)
MOEES Physical	6 – 30	27.8 (2.3)
MOEES Social	4 – 20	12.8 (3.1)
MOEES Self-Evaluative	5 – 25	22.1 (2.7)
EGS	10 – 50	26.1 (9.1)
EPS	10 – 50	21.8 (6.6)
EBS	15 – 60	32.8 (7.8)
PSS-14	0 – 56	23.6 (7.5)
SSES Family	10 – 50	15.9 (6.6)
SSES Friends	10 – 50	19.5 (9.4)

Note. EXSE = Exercise Self-Efficacy Questionnaire; MOEES = Multidimensional Outcome Expectations for Exercise Scale; EGS = Exercise Goal Setting Scale; EPS = Exercise Planning Scale; EBS = Exercise Barriers Scale; PSS-14 = 14-item Perceived Stress Scale; SSES = Social Support for Exercise Scale

Table 4. Correlation coefficients among self-reported physical activity and SCT measures

	GLTEQ	IPAQ[a]	EXSE	MOEES Phys	MOEES Social	MOEES Self	EBS	SS_Fam	SS_Fri	EGS	EPS
GLTEQ	–										
IPAQ[a]	.381**	–									
EXSE	.342**	.224*	–								
MOEES_Phys	.013	.099	.120	–							
MOEES_Social	.167	.254**	.246**	.226*	–						
MOEES_Self	.117	.250**	.184*	.570**	.539**	–					
EBS	-.225*	-.315**	-.383**	-.067	-.244**	-.106	–				
SS_Fam	.142	.127	.187*	-.040	.137	.058	-.339**	–			
SS_Fri	.222*	.021	.201*	-.044	.229*	-.001	-.098	.256**	–		
EGS	.302**	.157	.249**	-.090	.352**	.161	-.316**	.435**	.343**	–	
EPS	.457**	.252**	.440**	-.035	.231*	.100	-.481**	.301**	.214*	.608**	–

[a]IPAQ correlations used natural log transformed IPAQ scores
**Correlation is significant at the 0.01 level with one-tailed test of significance
*Correlation is significant at the 0.05 level with one-tailed test of significance

Note. GLTEQ = Godin Leisure Time Exercise Questionnaire; IPAQ = International Physical Activity Questionnaire, average daily MET minutes of activity; MVPA = moderate to vigorous physical activity; EXSE = Exercise Self-Efficacy Questionnaire; MOEES = Multidimensional Outcome Expectations for Exercise Scale; EBS = Exercise Barriers Scale; SS_Fam/SS_Fri = Social Support for Exercise from Family and Friends; EGS = Exercise Goal Setting Scale; EPS = Exercise Planning Scale

Table 5. Correlation coefficients among objective physical activity and SCT measures

	MVPA	ACT CT	STEP CT	EXSE	MOEES Phys	MOEES Social	MOEES Self	EBS	SS_Fam	SS_Fri	EGS	EPS
MVPA	–											
ACT CT	.736**	–										
STEP CT	.689**	.860**	–									
EXSE	.295**	.164	.175	–								
MOEES_Phys	.144	.114	.093	.120	–							
MOEES_Social	.267*	.298**	.252*	.246**	.226*	–						
MOEES_Self	.208*	.256*	.212*	.184*	.570**	.539**	–					
EBS	-.291**	-.315**	-.314**	-.383**	-.067	-.244**	-.106	–				
SS_Fam	.026	.062	.011	.187*	-.040	.137	.058	-.339**	–			
SS_Fri	.028	.082	-.059	.201*	-.044	.229*	-.001	-.098	.256**	–		
EGS	.181	.103	.031	.249**	-.090	.352**	.161	-.316**	.435**	.343**	–	
EPS	.271**	.188	.129	.440**	-.035	.231*	.100	-.481**	.301**	.214*	.608**	–

**Correlation is significant at the 0.01 level with one-tailed test of significance
*Correlation is significant at the 0.05 level with one-tailed test of significance

Note. MVPA = moderate to vigorous physical activity; ACT CT = Accelerometer activity counts; STEP CT = Accelerometer step counts; EXSE = Exercise Self-Efficacy Questionnaire; MOEES = Multidimensional Outcome Expectations for Exercise Scale; EBS = Exercise Barriers Scale; SS_Fam/SS_Fri = Social Support for Exercise from Family and Friends; EGS = Exercise Goal Setting Scale; EPS = Exercise Planning Scale

Table 6. Descriptive statistics for the overall sample and subsamples of women meeting (*n* = 18) and not meeting (*n* = 58) physical activity guidelines and Cronbach alpha values for health outcome questionnaires

Measure	Overall Mean (SD)	Not meeting guidelines Mean (SD)	Meeting guidelines Mean (SD)
CVD	0.9 (1.4)	1.0 (1.5)	0.5 (1.5)
HADS Anxiety	6.9 (3.1)	6.7 (3.2)	6.7 (3.1)
HADS Depression	5.2 (3.4)	5.2 (3.1)	4.6 (4.0)
PSS-14	23.6 (7.5)	22.9 (7.2)	23.4 (7.4)
PSPP Sport	12.1 (3.9)	12.3 (3.9)	12.3 (3.5)
PSPP Condition	12.7 (4.0)	12.0 (3.8)	15.9 (3.3)
PSPP Body	12.2 (4.3)	13.0 (4.4)	11.5 (3.0)
PSPP Strength	14.2 (3.1)	14.4 (3.4)	14.4 (4.4)
PSPP PSW	11.4 (3.1)	11.7 (3.2)	12.1 (2.9)
SF-12 MCS	40.3 (10.1)	41.0 (9.9)	41.4 (9.6)
SF-12 PCS	51.5 (7.3)	50.7 (7.4)	52.6 (6.3)

Note. CVD = Cardiovascular disease comorbidities scale; HADS Anxiety/Depression = Hospital Anxiety and Depression subscales; PSS-14 = 14-item Perceived Stress Scale; PSPP = Physical Self-Perception Profile sport, physical condition, body, strength, and perceived self-worth subscales; SF-12 MCS/PCS = short form health survey mental and physical component summary scores

Table 7. Correlation coefficients among self-reported physical activity and health outcome measures

	GLTEQ	IPAQ[a]	CVD	HADS_A	HADS_ D	PSS-14	PSPP Sport	PSPP Cond	PSPP Body	PSPP Strength	PSPP PSW	SF-12 MCS	SF-12 PCS
GLTEQ	–												
IPAQ[a]	.381**	–											
CVD	-.136	-.098	–										
HADS_A	.106	.008	.281**	–									
HADS_D	-.130	-.180*	.225*	.476**	–								
PSS	-.069	-.140	.269**	.688**	.564**	–							
PSPP Sport	.229*	.145	.052	-.143	-.166	-.169	–						
PSPP Condition	.502**	.332**	-.225*	-.177*	-.312**	-.312**	.368**	–					
PSPP Body	.078	.221*	.027	-.132	-.194*	-.202*	.235*	.431**	–				
PSPP Strength	.287**	.231*	-.208*	-.206*	-.189*	-.271**	.477**	.438**	.234*	–			
PSPP PSW	.222*	.275**	-.116	-.118	-.237*	-.226*	.389**	.580**	.705**	.434**	–		
SF-12 MCS	.155	.118	-.324**	-.512**	-.547**	-.669**	.192*	.385**	.236*	.225*	.432**	–	
SF-12 PCS	.135	-.110	-.287**	.242*	.028	.225*	-.133	.032	-.116	.053	-.068	-.347**	–

[a]IPAQ correlations used natural log transformed IPAQ scores
**Correlation is significant at the 0.01 level with one-tailed test of significance;
*Correlation is significant at the 0.05 level with one-tailed test of significance

Note. GLTEQ = Godin Leisure Time Exercise Questionnaire; IPAQ = International Physical Activity Questionnaire, average daily MET minutes of activity; CVD = Cardiovascular disease comorbidities scale; HADS_A, HADS_D= Hospital Anxiety and Depression subscales; PSS = 14-item Perceived Stress Scale; PSPP = Physical Self-Perception Profile sport, physical condition, body, strength, and perceived self-worth subscales; SF-12 MCS/PCS = short form health survey mental and physical component summary scores

Table 8. Correlation coefficients among objective physical activity and health outcome measures

	MVPA	ACT CT	STEP CT	CVD	HADS _A	HADS _ D	PSS-14	PSPP Sport	PSPP Cond	PSPP Body	PSPP Strength	PSPP PSW	SF-12 MCS	SF-12 PCS
MVPA	–													
ACT CT	.736**	–												
STEP CT	.689**	.860**	–											
CVD	-.168	-.242*	-.250*	–										
HADS_A	-.054	-.072	.000	.281**	–									
HADS_D	-.027	-.107	.019	.225*	.476**	–								
PSS	-.060	-.105	-.033	.269**	.688**	.564**	–							
PSPP Sport	.059	.074	.031	.052	-.143	-.166	-.169	–						
PSPP Condition	.394**	.351**	.250*	-.225*	-.177*	-.312**	-.312**	.368**	–					
PSPP Body	-.083	-.063	-.043	.027	-.132	-.194*	-.202*	.235*	.431**	–				
PSPP Strength	.193*	.145	.088	-.208*	-.206*	-.189*	-.271**	.477**	.438**	.234*	–			
PSPP PSW	.043	.125	.127	-.116	-.118	-.237*	-.226*	.389**	.580**	.705**	.434**	–		
SF-12 MCS	.034	.046	-.002	-.324**	-.512**	-.547**	-.669**	.192*	.385**	.236*	.225*	.432**	–	
SF-12 PCS	.154	.148	.162	-.287**	.242*	.028	.225*	-.133	.032	-.116	.053	-.068	-.347**	–

**Correlation is significant at the 0.01 level with one-tailed test of significance

*Correlation is significant at the 0.05 level with one-tailed test of significance

Note. MVPA = moderate to vigorous physical activity; ACT CT = Accelerometer activity counts; STEP CT = Accelerometer step counts; CVD = Cardiovascular disease comorbidities scale; HADS_A, HADS_D= Hospital Anxiety and Depression subscales; PSS = 14-item Perceived Stress Scale; PSPP = Physical Self-Perception Profile sport, physical condition, body, strength, and perceived self-worth subscales; SF-12 MCS/PCS = short form health survey mental and physical component summary scores

Table 9. Correlation coefficients between GLTEQ and SCT variables by demographic groups and Fisher's *z*-statistic

	Race				Education				Annual Household Income			
	White (n = 65)	Non-White (n = 25)	*z*	*p*	No college (n = 36)	College (n = 53)	*z*	*p*	< $40K (n = 51)	> $40K (n = 38)	*z*	*p*
EXSE	0.39	0.16	1.01	0.31	0.19	0.44	-1.25	0.21	0.30	0.37	-0.38	0.71
MOEES	0.31	-0.20	2.11	0.04	0.05	0.24	-0.85	0.39	0.00	0.42	-2.00	0.05
EBS	-0.23	-0.17	-0.27	0.78	0.06	-0.42	2.27	0.02	-0.10	-0.43	1.60	0.11
SS_FAM	0.21	0.24	-0.11	0.91	0.15	0.28	-0.60	0.55	0.24	0.21	0.12	0.90
SS_FRI	0.05	0.27	-0.93	0.35	0.02	0.23	-0.96	0.34	0.06	0.27	-0.97	0.33
EGS	0.31	0.25	0.24	0.81	0.23	0.36	-0.62	0.53	0.20	0.42	-1.06	0.29
EPS	0.47	0.43	0.20	0.84	0.29	0.61	-1.85	0.06	0.34	0.65	-1.90	0.06

Note. GLTEQ = Godin Leisure Time Exercise Questionnaire; SCT = social cognitive theory; EXSE = Exercise Self-Efficacy Questionnaire; MOEES = Multidimensional Outcome Expectations for Exercise Scale Overall; EBS = Exercise Barriers Scale; SS_Fam, SS_Fri = Social Support for Exercise from Family and Friends; EGS = Exercise Goal Setting Scale; EPS = Exercise Planning Scale