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The purpose of this study was to explore the effects of a 6-month lifestyle intervention in older adults with hypertension. A secondary data analyses was used from Inter-University Consortium for Political and Social Research (ICPSR) to examine the differences between the intervention and the control groups in the changes in physical activity, blood pressure, and health-related quality of life (HRQOL) in older adults with hypertension, from pre-test (baseline) to post-test (6 months), accounting for stress and social support as mediating variables. This study was a randomized controlled trial with pretest-posttest design. A total of 196 participants were randomly assigned to the intervention group (n=103) and the control group (n=93).

Descriptive statistics and hierarchical multiple regression were used to analyze characteristics of the sample and hypotheses testing. Most participants were women and low income. The results of hierarchical multiple regression analyses revealed that there were no statistically significant differences between the intervention and the control groups on change in physical activity, blood pressure, and HRQOL, but the final regression models were statistically significant. In the final hierarchical regression model, demographic variables (education, gender, race, age, and monthly income), social support at baseline, and intervention vs. control accounted for 18% of the variance in change in social support (R^2=.18, $p < .01$); demographic variables, stress at baseline, and intervention vs. control accounted for 25% of the variance in change in stress (R^2=.25, *p*

< .001). Demographic variables, SF-36 mental component summary (MCS) score at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support accounted for 39% of the variance in change in the SF-36 MCS (R^2=.39, $p < .001$); demographic variables, SF-36 physical component summary (PCS) score at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support accounted for 18% of the variance in change in the SF-36 PCS (R^2=.18, $p < .05$). Demographic variables, systolic blood pressure (SBP) at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support accounted for 36% of the variance in change in SBP (R^2=.36, $p < .001$); demographic variables, diastolic blood pressure (DBP) at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support accounted for 49% of the variance in change in DBP (R^2=.49, $p < .001$). Also, in the last step, demographic variables, physical activity frequency at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support accounted for 33% of the variance in change in physical activity frequency (R^2=.33, $p < .001$).

As many older adults have hypertension, promoting effective hypertension self-management is crucial for older adults. Lifestyle interventions in combination with physical activity interventions are strongly recommended. Also, stress management and social support resources should be provided for older adults with hypertension. Further research should be considered within individual, interpersonal, societal, and cultural factors when developing lifestyle-based interventions for older adults with hypertension.

THE EFFECTIVENESS OF A LIFESTYLE-BASED INTERVENTION ON PHYSICAL ACTIVITY, BLOOD PRESSURE, AND HEALTH-RELATED QUALITY OF LIFE IN OLDER ADULTS WITH HYPERTENSION

by

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APPROVAL PAGE

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CHAPTER I

INTRODUCTION

The older population is growing significantly in the United States and global society. In 2012, the number of Americans age 65 and over was 43.1 million; by 2030, the older population is estimated to be about 20% of the total population and one in 13 will be older than 85 (Centers for Disease Control and Prevention [CDC], 2015; U.S. Census Bureau, 2014). Older adults frequently experience aging-related functional declines and chronic diseases such as hypertension, diabetes, heart disease, and stroke. Successful aging is largely determined by individual lifestyle choices rather than genetic inheritance (CDC, 2015; Chodzko-Zajko, 2014). Lifestyle interventions have been found to promote physical function and mental health in older adults (Carlson et al., 2014; Clark et al., 2012). However, few research studies tested the effects of lifestyle-based interventions in older adults with hypertension. As many older adults are suffering from hypertension, further studies are needed to investigate the effects of lifestyle-based interventions in older adults with hypertension.

Background of the Problem

Hypertension, a significant cause of morbidity and mortality, is one of the leading risk factors for stroke and cardiovascular diseases. Overall, one in three adults, an estimated 68 million adults, has hypertension in the United Stated and less than half have high blood pressure under control (CDC, 2012). In 2008, 43.9% of male deaths and56.1% female deaths were from hypertension (Kochanek, Xu, Murphy, Miniño, & Kung, 2011). From 2000 to 2010, the death rate resulting from high blood pressure increased 16% (American Heart Association [AHA], 2014). The estimated direct and indirect cost of hypertension annually in health care services is $131 billion (CDC, 2012); the estimated cost of high blood pressure could increase to $274 billion by 2030 (AHA, 2014).

Hypertension is more prevalent among older adults than young adults. From 2007 to 2010, among those 45 to 54 years of age, the prevalence of hypertension was 35.9%; among those 65 to 74 years of age, the prevalence of hypertension was 67.4% and prevalence was 76.1% in older adults ≥ 75 years of age. From 2007 to 2010, 84% of adults ≥ 60 years of age were aware of their high blood pressure and 80.4% self-reported that they were taking antihypertensive medication (AHA, 2014). However, the percentage of adults ≥ 60 years of age that took medication but still had uncontrolled hypertension was 46.7%. Older women had a higher prevalence of hypertension and a higher rate of uncontrolled hypertension than older men (AHA, 2014; CDC, 2015). From 2009 to 2012, 68.4% of older men had hypertension and 42.9% reported uncontrolled hypertension; 73% of older women had hypertension and 51.6% reported uncontrolled hypertension (CDC, 2015). Hence, high prevalence and poor control of high blood pressure remain critical issues for older Americans.

Significance of the Problem

Hypertension is one of the major causes of illness and death in the United States (AHA, 2014). As many older Americans have uncontrolled high blood pressure, it is important to promote effective interventions with better control of hypertension for older adults, especially for older women (CDC, 2012). Lifestyle-based interventions are highly recommended for older adults (Clark et al., 2012; Jackson et al., 2009; Rippe, 2013). However, few studies assessed the effects of lifestyle-based interventions on physical activity and blood pressure in older adults with hypertension over time. Also, the impact of lifestyle interventions on health-related quality of life in this population remains unclear.

The purpose of this study was to examine the effects of a lifestyle-based intervention on health-related quality of life, blood pressure, and physical activity in older adults with hypertension between the control and experimental groups, accounting for stress and social support as mediating variables. This study is significant for nursing because it is likely to advance the scientific knowledge and nursing interventions with hypertension. Most important, the study has the potential to reduce the risk of stroke and cardiovascular disease in older Americans with hypertension and improve their overall health outcomes.

Statement of the Problem

Current literature demonstrates that regular physical activity is an effective way to improve physical health and mental well-being in older populations (Chapman et al., 2013; Etnier & Karper, 2014; Rahl, 2010). However, older adults in the United States engage in less physical activity than young adults (CDC, 2014a). Studies have showed that psychosocial factors such as stress and social support can impact older adults' lifestyle and physical activity behavior (Carlson et al., 2012; Fernandez et al., 2014; Taylor-Piliae et al., 2010; Yoshiuchi et al., 2010). However, based on existing literature, few studies have included a measure of both stress and social support in current research (Carlson et al., 2012; Fernandez, Montenegro, Knoll, & Schwarzer, 2014; Hamer, 2012; Kwag, Martin, Russell, Franke, & Kohut, 2011; Paukert et al., 2010; Rimmele et al., 2009; Warner, Ziegelmann, Schüz, Wurm, & Schwarzer, 2011). Also, there is limited research to examine the relationship between stress and physical activity in older adults, particularly for perceived stress.

Studies have showed that lifestyle interventions can promote and improve older adults' physical function and mental health (Clark et al., 2012; Jackson, Carlson, Mandel, Zemke, & Clark, 1998; Jackson et al., 2009; Rejeski, Mihalko, Ambrosius, Bearon, & McClelland, 2011). However, few sources of literature address the effects of lifestyle-based interventions on blood pressure, health-related quality of life, and physical activity in older adults. Moreover, aging is a multi-faceted process in which a variety of factors interact (e.g., sedentary lifestyles and physical inactivity) and is associated with reduced functional capacity and chronic diseases. Many older adults have hypertension, but there has been few studies conducted to investigate the effectiveness of lifestyle-based interventions in older adults with hypertension.

Assumptions

The conceptual framework of the study was based on the social cognitive theory (SCT). The SCT considers individual uniqueness and offers a comprehensive framework for understanding behavior change of individuals (Glanz, Rimer, & Viswanath, 2008; Simons-Morton, McLeroy, & Wendel, 2012). One of the unique features of the SCT is the emphasis on the relationship between person, environment, and behavior (Simons-Morton et al., 2012). The current study assumes that there is a relationship between person (e.g., stress), environment (e.g., social support), and behavior (e.g., physical activity). Individual characteristics may determine stress (person) and social support (environment), and can impact on physical activity (behavior). Lifestyle-based interventions would improve changes in stress (person), social support (environment), and physical activity (behavior).

Research Hypotheses

The purpose of this study was to test the effects of a 6-month lifestyle-based intervention on blood pressure, physical activity, and health-related quality of life (HRQOL) in older American adults with hypertension, accounting for stress and social support as mediating variables. After receiving a 6-month lifestyle-based intervention, the intervention group will have significant improvement in person (stress), environment (social support), and outcomes (physical activity behavior, blood pressure, and HRQOL) in older adults with hypertension from pre-test (baseline) to post-test (6 months) compared to the control group:

Hypothesis 1: There will be a significant improvement in stress and social support.

Hypothesis 2: There will be a significant improvement in HRQOL, blood pressure, and physical activity frequency.

Conceptual Definitions

In this study, conceptual definitions are described below.

1. Older adults with hypertension: Older adults are defined as adults who are age 60 and over (World Health Organization [WHO], 2015). High blood pressure is defined as SBP≥ 140mmHg or DBP≥90mmHg, or taking antihypertensive medicine (AHA, 2014). In this study, older adults with hypertension are defined as older adults who self–report taking antihypertensive medicine.
2. Demographic factors: Personal characteristics may affect perceived stress and social support, and can influence health behavior. Demographic factors are defined as individual characteristics such as gender, ethnicity, educational level, and socioeconomic status.
3. Person: The term *person* refers to an individual with unique personality, personal values, past experiences, and learned behavior (Glanz et al., 2008; Simons-Morton et al., 2012). What a person thinks, feels, believes, and perceives may impact on her/his actions (Bandura, 1985).

4. Environment: Environment refers to external social context and physical milieu with stimulants and reinforcements (Glanz et al., 2008; Simons-Morton et al., 2012).
5. Behavior: Behavior represents responses to stimulants to accomplish immediate and long-term goals (Glanz et al., 2008; Simons-Morton et al., 2012). For this study, behavior refers to participation in physical activity.
6. Physical activity: Physical activity refers to "a behavior that is any bodily movement produced by the contraction of skeletal muscles that substantially increases energy expenditure" (Ehrman & American College of Sports Medicine, 2010, p.166). In this study, physical activity refers to physical activity frequency. Physical activity frequency is defined as the amount of time that participants spent on physical activity during the last few months (Clark, 2012).
7. Health-related quality of life: The term of health-related quality of life is defined as a subjective and multi-dimensional concept which is related to physical, mental, emotional, and social functioning (Office of Disease Prevention and Health Promotion, 2015a).
8. Stress: Stress is defined as the brain's response to any change and demand (National Institute of Mental Health, 2015). Stress can be real or perceived, acute or chronic, as well as positive or negative.
9. Social support: Social support is defined as "those activities performed by one individual that assist another person toward a desired goal" (Orsega-Smith, Payne, Mowen, Ho, & Godbey, 2007, p. 709).

Summary

Studies have shown that physical activity and active lifestyles can reduce functional decline and promote health and well-being for older adults (Bennett et al., 2005; Etnier & Karper, 2014; Jackson et al., 2009; Klumb & Maier, 2007). However, in 2012, merely 28.6% of older adults engaged in regular physical activity that met the federal physical activity guidelines (Office of Disease Prevention and Health Promotion, 2013). As many older adults have inactive lifestyles, a lifestyle-based intervention is essential for promoting older adults' health and reducing functional declines for elders.

Blood pressure is the most important predictor of cardiovascular diseases, such as stroke and heart attack (AHA, 2014). Also, it is known worldwide, high blood pressure can be controlled if an effective intervention is undertaken (CDC, 2012). However, hypertension is poorly controlled by older Americans (AHA, 2014; CDC, 2012). As many older adults have uncontrolled hypertension in the United States, promoting active lifestyles and physical activity among older adults with hypertension is a national public health priority.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

By the year 2050, the number of persons aged 65 and over will reach nearly 89 million in the United States (CDC, 2013). Also, older adults aged 85 and older will be the fastest-growing population. Nearly 50% of adults aged 65 and over have either mild limitation with mobility or severe physical disability (Ip et al., 2013; Shumway-Cook, Ciol, Yorkston, Hoffman, & Chan, 2005). Clearly, promoting older adults' physical functions and maintaining their mobility and independence as long as possible are public health priority.

Current research clearly indicates that participation in a regular exercise program is an effective way to reduce and prevent a number of the functional declines associated with aging (Brinke et al., 2015; Chapman et al., 2013; Etnier & Karper, 2014; Rahl, 2010). Inactive and sedentary lifestyles can impact older adults' physical functions and well-being (Chodzko-Zajko, 2014; Matthews et al., 2012; Rahl, 2010). However, the average older adult spent nearly 60% or more than 9 hours of each day in sedentary behavior (Matthews et al., 2008; Matthews et al., 2012). Hence, lifestyle-based interventions such as physical activity interventions are critically important in promoting physical health, mental well-being, functional capacity, health-related quality of life, and independence for older adults.

One of the goals of Healthy People 2020 is to promote that at least 47.9 % of adults engage in moderate-intensity aerobic physical activity for 150 minutes per week, or 75 minutes per week of vigorous-intensity aerobic physical activity, or an equivalent combination (Office of Disease Prevention and Health Promotion, 2015b). Also, the objective of Healthy People 2020 on physical activity is to target at least 20.1% of adults meeting the federal physical activity guidelines for 150 minutes/week of moderate-intensity aerobic physical activity or 75 minutes/week of vigorous intensity, or an equivalent combination, and for muscle-strengthening activity on 2 or more days per week (Office of Disease Prevention and Health Promotion, 2015b). However, in 2012, the percentages of adults engaging in regular physical activity that met the federal physical activity guidelines were 24.2% among those aged 25-44 years, 18.2% among those aged 45-54 years, 16.0% among those aged 55-64 years, 14.8% among those aged 65-74 years, 9.1% among those aged 75-84 years, and only 4.7% among those aged 85 years and over (Office of Disease Prevention and Health Promotion, 2013). Obviously, these national statistics indicate that older adults have lower participation rates of regular physical activity than young adults.

Conceptual Framework

Social cognitive theory (SCT) was used as a conceptual framework for this study. The SCT is one of the most frequently used and robust health behavior theories (McAlister, Perry, & Parcel, 2008; Olander et al., 2013; Plotnikoff, Lippke, Courneya, Birkett, & Sigal, 2008). Social cognitive theory, an interpersonal-level behavior theory, was developed in 1986 by Albert Bandura. It stems from the social learning theory (SLT) and consolidates concepts and processes from behavioral, cognitive, and emotional models/theories. The SCT is one of most commonly used theoretical models on physical activity behavior in older adults. It is very useful in predicting physical activity behavior with older adults (Umstattd & Hallam, 2007; White, Wójcicki, & McAuley; 2012).

The SCT assumes that behavior change occurs in a social environment within a dynamic, ongoing, and reciprocal interaction of the person, environment, and behavior. Reciprocal determinism, triadic reciprocity, is the central concept of the SCT. Reciprocal determinism represents a self-regulatory feedback loop (Glanz et al., 2008; Simons-Morton et al., 2012). It refers to the dynamic and reciprocal interaction of person (individual with personality, experiences, and learned behavior), environment (external social context and physical milieu with stimuli and reinforcements), and behavior (responses to stimuli to achieve immediate and long-term goals). Overall, the SCT provides comprehensive perspectives and a broader model of behavior change and maintenance. In this study, applying the SCT as the conceptual framework to examine older adults' physical activity behavior, a relationship can be assumed between person (e.g., stress), environment (e.g., social support), and behavior (e.g., physical activity).

Components of Conceptual Framework

The conceptual framework guiding this study was derived from the social cognitive theory and literature review. Figure 1 shows the components of the conceptual framework in this study. Demographic factors (participants' characteristics), independent variables, include age, race, gender, income, and educational level. The outcome (dependent) variables including physical activity (behavior), blood pressure, and health-related quality of life are targeted by the intervention. As indicated in Figure 1, stress (person) and social support (environment) are also targeted by the intervention.

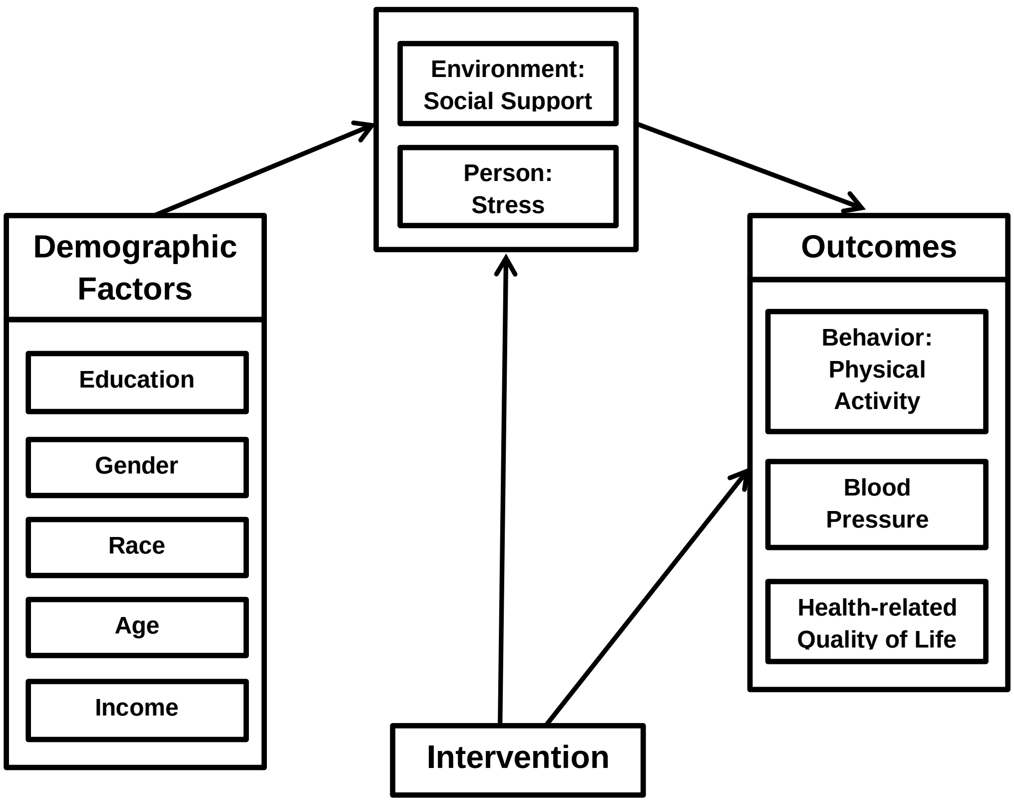

Figure 1. Conceptual Framework of the Lifestyle-Based Intervention Study.

Physical Activity

Physical activity is defined as "a behavior that is any bodily movement produced by the contraction of skeletal muscles that substantially increases energy expenditure" (Ehrman & American College of Sports Medicine, 2010, p.166). Four major components of physical activity include aerobic exercise (endurance exercise), resistance exercise (strength training), flexibility training (stretching, range-of-motion exercise), and balance exercise. Overall, most physical activity programs for older adults are based on the FITT principle: frequency, intensity, time (duration), and type of exercise (American College of Sports Medicine, Thompson, Gordon, & Pescatello, 2010; Chodzko-Zajko, 2014; Rahl, 2010). Frequency of physical activity refers to how many days the elder takes part in physical activity per week. Intensity of physical activity means what level the elder perceives exertion during a physical activity session. Time of physical activity represents how long the elder spends in physical activity. Basically, the recommended duration of physical activity for older adults varies in the intensity of physical activity. Type of exercise refers to mode of physical activity. Walking is one of the most popular types of physical activity among older adults (Chodzko-Zajko, 2014; Rahl, 2010).

Regular physical activity is essential to healthy aging. The National Institute on Aging (2011) strongly recommends endurance exercise (e.g., walking), strength training (e.g., lifting weights), flexibility exercise (e.g., shoulder and upper arm stretch), and balance exercise (e.g., Tai Chi) for older adults. Federal physical activity guidelines highly recommend moderate-intensity aerobic physical activity for at least 150 minutes every week or vigorous-intensity aerobic physical activity for at least 75 minutes every week, or an equivalent combination for older adults (CDC, 2014a; Office of Disease Prevention and Health Promotion, 2008). According to the Borg Scale (Rating of Perceived Exertion, RPE), a 10-point scale, moderate-intensity physical activity refers to perceived exertion level of 5 to 6, whereas vigorous-intensity physical activity is a 7 to 8 on this scale (American College of Sports Medicine et al., 2010; CDC, 2014a). In addition, older adults are suggested to work on all major muscle groups for two or more days per week based on the federal physical activity guidelines (CDC, 2014a; Office of Disease Prevention and Health Promotion, 2008). Major muscle groups include arms, shoulders, chest, abdomen, back, hips, and legs. Basically, a physical activity session for older adults should include the warm-up and cool-down for 5 to 10 minutes, moderate-intensity physical activity or vigorous-intensity physical activity for 20 to 60 minutes, and flexibility exercises for 10 minutes (CDC, 2014a; Chodzko-Zajko, 2014).

Health Benefits of Physical Activity

Regular physical activity is highly recommended for older adults. The benefits of regular physical activity for older adults include increasing aerobic capacity, reducing cardiovascular disease risk factors, changing in body composition, improving insulin sensitivity and increasing glucose transporters in muscle, preventing the risk for osteoporosis, improving brain health, mental well-being, and physical fitness (Bherer, Erickson, & Liu-Ambrose, 2013; Brinke et al., 2015; Chapman et al., 2013; Etnier & Karper, 2014; Rahl, 2010). Also, Centers for Disease Control and Prevention (2011) has indicated numerous health benefits of physical activity for older adults, such as maintaining healthy weight, reducing the risk of chronic diseases (e.g., hypertension and type 2 Diabetes), lowering the risk of some cancers (e.g., colon and breast cancer), building strong and healthy bones and muscles, enhancing one's ability to do daily activities, preventing falls, improving mental health and mood, and increasing one's chances of living longer.

Maximal oxygen uptake (VO_{2max}) is characterized as the maximum oxygen consumption during maximal physical effort (American College of Sports Medicine et al., 2010; Rahl, 2010). VO_{2max} declines with age and decreases nearly 5 to 15% per decade beginning at 25-30 years of age (Chodzko-Zajko, 2014; Rahl, 2010). However, older adults who engage in regular aerobic endurance exercise can increase 10% to 30% VO_{2max}. In addition, older adults can improve their blood pressure and body composition with exercise training. Studies indicated that aerobic exercise training reduced resting blood pressure in hypertensive older persons (American College of Sports Medicine et al., 2010; Chiang & Sun, 2009; Gallagher et al., 2012; Rahl, 2010; Wellman, Kamp, Kirk-Sanchez, & Johnson, 2007). Also, regular physical activity can significantly reduce total percent of body fat in older adults (Etnier & Karper, 2014; Kay & Fiatarone Singh, 2006; Rahl, 2010). All in all, regular physical activity results in reducing heart disease risk and improving cardiovascular function in older adults.

Additional benefits of physical activity involve improved bone health and cognitive function. Studies have found that regular physical activity can contribute to reduce the risk for osteoporosis and falling and improve postural stability in older adults (Etnier & Karper, 2014; Park et al., 2006; Rahl, 2010; Taylor et al., 2004; Yorston, Kolt, & Rosenkranz, 2012). These benefits associated with regular physical activity can contribute to an active and independent lifestyle and significantly improve functional capacity for older adults. Nearly one in nine people age 65 and older has Alzheimer's disease in the United States (Alzheimer's Association, 2014). Studies revealed that regular physical activity improved older adults' memory, cognitive function, and brain health (Alzheimer's Disease International, 2014; Bherer et al., 2013; Brinke et al., 2015; Chapman et al., 2013; Etnier & Karper, 2014; Rahl, 2010). A 6-month randomized controlled trial was conducted by Brinke et al. (2015); the result indicated that regular aerobic exercise significantly increased left, right, and total hippocampal volumes in older women with probable mild cognitive impairment. Similarly, Chapman et al. (2013) examined the effect of a 3-month randomized controlled trial on brain function in older adults. The result has demonstrated that short-term aerobic exercise training can improve cognitive function, brain health, and cardiovascular fitness for sedentary elders. In short, regular physical activity has significant positive effects on memory and learning, cerebral blood volume, perfusion of the hippocampus, and cognitive performance (Brinke et al., 2015; Chapman et al., 2013; Erickson et al., 2011; Taylor et al., 2004).

Factors Influencing Physical Activity Participation

Some factors may influence the engagement in regular physical activity for older adults. For example, the enjoyment of physical activity, encouragement of family and friends, and positive beliefs on the benefits of physical activity are critical factors to promote regular physical activity for older adults (Ginis et al., 2006; Lee, Avis, & Arthur, 2007; Rahl, 2010; Taylor et al., 2004). Conversely, lack of time and transportation, weather conditions, safety issues, poor health status, and economic difficulties are barriers for regular physical activity among older adults (Ginis et al., 2006; Rahl, 2010; Taylor et al., 2008). In addition, cultural health beliefs may play an important role in engaging physical activity. For instance, some older Chinese Americans believe that moderate or vigorous physical activity is not appropriate for older people (Li, Stewart, Stotts, & Froelicher, 2006; Taylor et al., 2008). Race, gender, income, and educational level also appear to impact regular physical activity participation (Office of Disease Prevention and Health Promotion, 2013; Rahl, 2010). Overall, African Americans and Hispanics are less likely to meet the federal physical activity guidelines than Caucasians (Office of Disease Prevention and Health Promotion, 2013). Women have a lower rate of meeting the federal physical activity guidelines than men. The percentages of adults who meet the federal physical activity guidelines increase as income and educational level increase. All in all, these results imply that social disparities may exist in physical activity participation for older adults.

Relationship between Stress and Physical Activity

There is no universal conclusion on the definition of stress (Stults-Kolehmainen & Sinha, 2014). National Institute of Mental Health (2015) defines stress as the brain's response to any change and demand. McEwen (2007) pointed out that stress is used to express experiences that are challenging physiologically and emotionally. Stress can be real or perceived, acute or chronic, as well as positive or negative. Lazarus and Folkman (1984) asserted that perceived stress represents appraisals of person-environment interactions that may impact health behaviors, emotional well-being, biological processes, and physical health outcomes. Studies have shown that chronic stress may cause serious health problems and decline physical functions, such as cardiovascular disease, high blood pressure, diabetes, depression, immune system impairments, and other stress-related illnesses (Dhabhar, 2014; Kivimaki et al., 2002; McVicar, Ravalier, & Greenwood, 2014; Schetter & Dolbier, 2011; Stults-Kolehmainen & Sinha, 2014; Vitlic, Lord, & Phillips, 2014; Webb & Beckstead, 2002) . Long-term stress can damage brain cells, leading to dementia, cognitive dysfunction, or mental disorders (Sandi, 2004; Stults-Kolehmainen & Sinha, 2014).

Older adults are more vulnerable to physical and psychosocial stressors (Hamer, 2012; Rimmele et al., 2009; Rueggeberg, Wrosch, & Miller, 2012). For older adults, physical stressors can come from chronic illness, disability, chronic pain, cognitive changes, or aging-related physical impairments (Rueggeberg et al., 2012). Psychosocial stressors in older adults may involve financial concerns, retirement, change in living situation, family problems, caring for a spouse with Alzheimer's disease or serious illness, or the loss of a spouse (Rimmele et al., 2009; Yoshiuchi et al., 2010). Some types of stressors are chronic and long term and can stimulate neurophysiological systems in response to stress. Over time, stress can negatively impact physical and mental health on older adults (Rimmele et al., 2009; Taylor-Piliae et al., 2010).

Studies have indicated that engaging in physical activity is correlated to be more biologically resilient to psychosocial stressors for older adults (Atlantis, Chow, Kirby, & Singh, 2004; Hamer, 2012; Rimmele et al., 2009; Rueggeberg et al., 2012). For example, in a 4-year longitudinal study of community-dwelling older adults testing the long-term effect of physical activity on perceived stress and physical health, the result indicated that older adults who frequently engaged in physical activity significantly decreased high levels of perceived stress and improved physical health (Rueggeberg et al., 2012). These findings suggest that physical activity is an effective way to reduce stress level and promote physical health. In addition, stress levels are negatively associated with physical activity levels (Taylor-Piliae et al., 2010; Yoshiuchi et al., 2010). Taylor-Piliae et al. (2010) conducted a study to examine psychological factors and physical activity levels in older adults; the result showed that lower levels of stress were significantly associated with higher levels of physical activity. Similarly, Yoshiuchi et al. (2010) investigated the relationship between stressful life events and habitual physical activity in older adults. The result revealed that stressful life events were significantly associated with a low level of habitual physical activity. For instance, older adults who are experiencing stressful life events such as the death of their spouses may decrease physical activity. In short, these studies have revealed that there is a reciprocal relationship between stress and physical activity (Stults-Kolehmainen & Sinha, 2014). Physical activity can decrease perceived stress, relieve stress symptoms, and prevent stress-related illnesses. Conversely, high levels of perceived stress may contribute to negatively impact physical activity participation. In other words, stress may impair healthy lifestyle practices and decrease physical activity (Hamer, 2012).

Relationship between Social Support and Physical Activity

The definition of social support varies greatly (Molloy, Dixon, Hamer, & Sniehotta, 2010; Nezu, Nezu, Geller, & Weiner, 2013; Orsega-Smith et al., 2007). Orsega-Smith et al. (2007) defined social support as “those activities performed by one individual that assist another person toward a desired goal" (p. 709). Fernandez et al. (2014) asserted that social support can impact the cognitive appraisal of stressful circumstances and promotes coping. Basically, social support refers to social relationships, resources, and interactions including perceived support and received support (Fernandez et al., 2014; Molloy et al., 2010; Nezu et al., 2013). Perceived support means the perception of relationships and supports the individual can access and potential available in case of need. Received support involves actual supportive behaviors or specific instances of actual support. There are two types of received support: positive support and negative support (Nezu et al., 2013). Positive support represents the individual receives beneficial or affirmative support. Conversely, negative support refers to the individual receives unsupportive or adverse support. Social support can also be characterized as non-directive support (reflective listening) or directive support (providing directions or recommendations) (Harber, Schneider, Everard, & Fisher, 2005).

Overall, social support can be divided into two main categories: structural and functional support (Nezu et al., 2013). Structural support refers to social supportive networks, such as marital status, friendship, frequency of interpersonal contact, memberships in groups or communities, and number of contacts. Functional support represents supportive behaviors offered by one's social networks. For example, functional support in physical activity for older adults may involve informational support (e.g., providing information about physical activity), instrumental support (e.g., driving a friend to a physical activity class), emotional support (e.g., calling and listening a friend to know how his/her physical activity is going), and appraisal support (e.g., providing encouragement for maintaining physical activity) (Berkman, 1995; Nezu et al., 2013; Orsega-Smith et al., 2007).

Social support has been linked to health outcomes (Kwag et al., 2011; Nezu et al., 2013; Orsega-Smith et al., 2007). In other words, social networks and interactions have been found to impact physical health and psychological well-being. Numerous studies have indicated that higher social support is associated with better cardiovascular, endocrine, and immune functions in older adults (Nezu et al., 2013; Paukert et al., 2010). In addition, social support can promote mental health in older adults. A study was conducted by Kwag et al. (2011) to investigate how social support impacts fatigue, loneliness, and depression among older adults. The result showed that higher social support was significantly associated with lower levels of fatigue and loneliness. Similarly, Paukert et al. (2010) conducted a randomized clinical trial to test the role of social support on depressive and anxiety symptoms in older adults. The finding of this study indicated that higher social support was significantly associated with higher positive affect and decreased depressive symptoms. In short, these studies imply social support may predict physical health and mental well-being in older adults.

Studies have indicated that social support is considered to impact physical activity in older adults (Carlson et al., 2012; Fernandez et al., 2014; Kwag et al., 2011; Orsega-Smith et al., 2007; Paukert et al., 2010; Sasidharan, Payne, Orsega-Smith, & Godbey, 2006; Warner et al., 2011). In a longitudinal study, Fernandez et al. (2014) examined the relationship between social support and physical activity changes in older adults; the results showed the relevance of social support as a moderator in physical activity changes. In addition, social support provided by family and friends may play a critical role in affecting physical activity participation in older adults. Sasidharan et al. (2006) investigated the influence of social support for leisure on physical activity in older adults. The result of this study indicated that support from friends significantly increased physical activity participation among older adults. Similarly, Orsega-Smith and colleagues (2007) tested the role of social support in physical activity among older adults. Results of this study demonstrated that social support from friends was positively related to physical activity in older adults. All in all, these studies have shown that social support may predict physical activity initiation and maintenance.

Health-Related Quality of Life (HRQOL)

The World Health Organization (WHO) has emphasized the importance of assessing and promoting people's quality of life (World Health Organization, 2005). It is referred to as health-related quality of life (HRQOL) when quality of life is considered in the health-related context. One of goals of Healthy People 2020 is promoting health-related quality of life and well-being across all life stages (Office of Disease Prevention and Health Promotion, 2015a). The term of health-related quality of life is frequently used to measure the effects of interventions and treatments on health benefits in older adults. Overall, HRQOL is a subjective and multi-dimensional concept which is related to physical, mental, emotional, and social functioning (Office of Disease Prevention and Health Promotion, 2015a).

Factors that influence health-related quality of life (HRQOL) among older adults include race, medical care costs, physical activity, and smoking (Hu, 2007; Skarupski et al., 2007; Thompson, Zack, Krahn, Andresen, & Barile, 2012). Thompson and colleagues (2012) recommended that lowering medical care cost, increasing physical activity, and decreasing smoking behavior can improve HRQOL in older adults. In addition, older adults' mobility may predict HRQOL (Groessl et al., 2007; Moriarty, Zack, Kobau, 2003). Groessl et al. (2007) found that older adults with impaired mobility or functional limitations had reduced HRQOL. Moreover, racial differences exist in health-related quality of life among older adults. Older White Americans have better HRQOL than older Africa Americans (Skarupski et al., 2007). Also, the black-white differences in HRQOL tend to increase with age; the black-white differences in HRQOL are greater in older women than older men.

Significantly, geographical variations and regional differences exist in HRQOL of older Americans(Kachan et al., 2014). Kachan and colleagues (2014) analyzed pooled data from 1997 through 2010 from the National Health Interview Survey for older Americans aged 65 or older. Results showed that older residents of Alaska, Alabama, Arkansas, Mississippi, and West Virginia had the lowest mean HRQOL scores; older residents of Arizona, Delaware, Nevada, New Hampshire, and Vermont had the highest HRQOL scores. Lastly, HRQOL varies significantly by sex, education, and annual household income in older adults. Older adults with less than a high school education or lower annual household income are particularly vulnerable to reduced HRQOL (Hu, 2007; Keyes et al., 2005; Moriarty et al., 2003). On average, older men have higher level of HRQOL than older women. All in all, these findings indicate that sex, race, education, geographical variations, functional limitations, health behaviors, and annual household income may impact older adults' HRQOL. It implies that social disparities may exist in HRQOL of older adults.

Relationship between Stress and Health-Related Quality of Life

Studies have indicated stress negatively impacts physical health and mental well-being (Ames, Jones, Howe, & Brantley, 2001; Charles, Piazza, Mogle, Sliwinski, & Almeida, 2013; Kulmala et al, 2013). Older adults can be more vulnerable to stressful life events. It is critically important to examine the influence of stress and its relation to HRQOL in older adults. However, there is little research in this area. Nevertheless, Ames et al. (2001) tested the impact of stress on HRQOL in 183 middle-aged and older adults. Results revealed that major and minor stress both significantly predicted HRQOL. In addition, Gerber (2012) examined the relations of perceived stress and social support to HRQOL in 137 community-dwelling older adults. The finding indicated that perceived stress was not significantly associated with physical HRQOL. However, higher perceived stress was significantly associated with poorer mental HRQOL. Also, there was significantly interaction between perceived stress and social support on mental HRQOL. In Frias and Whyne's (2015) study, they tested the relationship between stress and HRQOL in 134 community-dwelling older adults. The result indicated that stress was negatively associated with HRQOL. All in all, these findings suggest that stress may impact and predict HRQOL in older adults.

Relationship between Social Support and Health-Related Quality of Life

Overall health can be influenced by multiple factors, including one's physical functions, health behaviors, and psychological and social well-being. Previous studies have demonstrated an association between increased levels of social support and reduced risk for physical disease and mental illness (Kwag et al., 2011; Nezu et al., 2013; Orsega-Smith et al., 2007). Truly, social support plays an important role in maintaining physical health and mental well-being, and promoting health-related quality of life (HRQOL) (Achat et al., 1998; Gallegos-Carrillo et al., 2009; Keyes et al., 2005). Keyes et al. (2005) examined the relationship between social support and HRQOL in community-dwelling older adults. The results revealed that there was an association between perceived social support and HRQOL in older adults. Higher levels of perceived social support were significantly associated with higher levels of HRQOL.

The findings of Keyes et al.'s (2005) study indicated that HRQOL varied significantly by characteristics of social support. Older adults visited friends or relatives at least several times per week had higher levels of HRQOL than those who almost never visited friends or relatives in the past month. Older adults who reported having three or more friends for emotional support reported higher levels of HRQOL than those with no close friends for emotional support. Additionally, older adults who perceived no help available had lower levels of HRQOL than those who perceived help was available. However, there was no significant difference in HRQOL between older adults who lived alone and those who lived with one or more persons.

Gallegos-Carrillo et al. (2009) tested how social network is related to HRQOL. The results showed that older adults with a larger social network of close friends and relatives were significantly associated with better HRQOL. However, older adults who lived alone were not significantly associated with HRQOL. Moreover, Gerber (2012) examined the relations of social support to HRQOL in community-dwelling older adults. Results indicated that social support was not significantly associated with physical HRQOL, but lower levels of social support were significantly associated with lower levels of mental HRQOL. In Sherman et al.'s (2006) study, the results also concluded that social support significantly predicted psychosocial HRQOL, but did not predict physical HRQOL. In short, these studies imply that social support plays an important role in predicting mental or psychosocial HRQOL.

Lifestyle-Based Intervention Studies

The aging population represents greater long-term health care challenges than ever seen before by health care providers, family caregivers, and older adults themselves (Groessl et al., 2007; Rippe, 2013; Wu, Chi, Plassman, & Guo, 2010). Older adults now have an extended life span, but many older adults face multiple chronic diseases such as hypertension, diabetes, cardiovascular diseases, and pulmonary diseases. Such older adults often have impairments in physical function and mental well-being, resulting in dependence, functional decline, and reduced health-related quality of life (Groessl et al., 2007; Rahl, 2010). Sedentary or inactive lifestyle is one of the major risk factors for chronic diseases and functional limitations among older adults (Chodzko-Zajko, 2014; Rahl, 2010). Also, healthy aging is largely determined by one’s lifestyle choices. Hence, lifestyle modification and lifestyle-based interventions are strongly recommended for older adults including regular physical activity, a healthy dietary pattern, stress management, and active social relationships (Chodzko-Zajko, 2014; Office of Disease Prevention and Health Promotion, 2013; Rippe, 2013).

One of the primary goals of lifestyle-based interventions is to help older adults in developing and adopting an active, meaningful, and healthy lifestyle for successful aging that is sustainable and maintainable for their daily routines (Clark et al., 2012; Fielding et al., 2011; Jackson et al., 2009; Marsh et al., 2013; Rejeski et al., 2005; Rejeski et al., 2011). In a review of lifestyle interventions in older adults, results have showed that lifestyle-based interventions may target single lifestyle behavior (e.g., physical activity), two lifestyle behaviors (e.g., physical activity and dietary behaviors), or multiple lifestyle behaviors (e.g., physical activity, dietary behavior, and social relationships) (Fielding et al., 2011; Hageman, Pullen, Hertzog, & Boeckner, 2014; Rejeski et al., 2011). Social cognitive theory is frequently used in theory-based lifestyle intervention studies in older adults (Fielding et al., 2011). Overall, physical activity intervention, physical activity in combination with dietary behavior change interventions, and multiple-behavior lifestyle interventions are commonly used in lifestyle-based programs among older adults (Clark et al., 2012; Fielding et al., 2011; Hageman et al., 2014; Jackson et al., 2009; Marsh et al., 2013; Rejeski et al., 2011). Components, modes, and doses of physical activity interventions, physical activity in combination with dietary behavior change interventions, and multiple-behavior lifestyle interventions are described as below.

Physical Activity Interventions

The physical activity intervention focuses on promoting older adults' physical activity behavior. Basically, a physical activity intervention may encompass aerobic, strength, flexibility, or/and balance training (Fielding et al., 2011; Hageman et al., 2014; Marsh et al., 2013; Rejeski et al., 2011). Also, walking is the most commonly used physical activity intervention. For example, in the Lifestyle Interventions and Independence for Elders (LIFE) Study, Fielding et al. (2011) designed a supervised moderate-intensity physical activity program in sedentary older adults to evaluate the long-term effects of a physical activity intervention on preventing or reducing mobility disability. In the LIFE study, physical activity interventions include aerobic, strength, flexibility, and balance training. Each intervention session was preceded by a warm-up and followed by a cool-down period. Overall, this physical activity intervention was based on social cognitive theory and federal physical activity guidelines.

Mode of delivery comprises three areas: medium, format, and approach (Sidani & Braden, 2011). Written and verbal media are frequently used in physical activity interventions, including booklets, phone call reminders, individual counseling sessions, and group meetings (Fielding et al., 2011; Hageman et al., 2014; Marsh et al., 2013; Rejeski et al., 2011). Also, two commonly used approaches in the physical activity intervention to increase physical activity are group-based and home-based interventions. In addition, the dose of intervention consists of purity, amount, frequency, and duration (Sidani & Braden, 2011). Purity reflects concentration of the intervention. Amount, frequency, and duration represent exposure to the intervention (Sidani & Braden, 2011).

For example, Rejeski et al. (2011) conducted the Cooperative Lifestyle Intervention Program, an 18-month physical activity intervention included three 90-minute group meetings and one 30-minute individual counseling session per month during the first six months; one group meeting and a telephone contact were provided during the 7-18 months. Overall, doses of physical activity interventions are based on federal physical activity guidelines for older adults (e.g., 30-minute moderate-intensity aerobic physical activity for at least 5 days per week). In order to change and maintain older adults' health behavior, most physical activity interventions in older adults were long-term programs which were followed for an average of 1 – 2.7 years (Fielding et al., 2011; Hageman et al., 2014; Marsh et al., 2013; Pahor et al, 2014; Rejeski et al., 2011).

Physical Activity in Combination with Dietary Behavior Change Interventions

Physical activity in combination with dietary behavior change interventions include the physical activity intervention described previously, but also in combination with dietary interventions. The goal of physical activity in combination with dietary interventions (PA + dietary interventions) in older adults is to achieve and maintain a healthy weight and regular physical activity (Hageman et al., 2014; Rejeski et al., 2011). In a review of lifestyle-based interventions, results showed that recommendations for healthy eating were based on federal dietary guidelines for Americans or the Dietary Approaches to Stop Hypertension (DASH) guideline (Hageman et al., 2014; Rejeski et al., 2011). Modes of delivery involved Internet-based, print-mailed delivery, phone contacts, individual counseling sessions, and group meetings (Fielding et al., 2011; Hageman et al., 2014; Rejeski et al., 2011).

Doses of PA + dietary interventions vary in different lifestyle-based programs. For instance, Rejeski et al. (2011) conducted an 18-month weight loss in combination with physical activity intervention. This intervention involved one 30-minute individual counseling meeting and three 90-minute group sessions every month during the first six months; one group meeting and a telephone contact were offered during the 7-18 months. In the Wellness for Women Study, Hageman et al. (2014) designed a 12-month physical activity intervention in combination with DASH eating plan for midlife and older women with prehypertension. Web-based and print-mailed interventions included two 2-hour counseling meetings, strength-training video, five phone goal-setting sessions, and 16 web-based or print-mailed newsletters. Overall, in order to shape and maintain older adults' physical activity and dietary behaviors, most of PA + dietary programs were long-term interventions which delivered and followed for average of 1.5 – 2 years (Fielding et al., 2011; Hageman et al., 2014; Rejeski et al., 2011).

Multiple-Behavior Lifestyle Interventions

Lifestyle-based programs in older adults may involve multiple lifestyle-related behaviors such as physical activity, dietary behavior, cultural awareness, and social relationships. The objective of multiple-behavior lifestyle interventions in older adults is to achieve successful aging, and initiate and maintain a healthy lifestyle that involve multiple health behavior changes (Clark et al., 2012; Fielding et al., 2011; Jackson et al., 2009; Rejeski et al., 2011). In a review of multiple-behavior lifestyle interventions, modes of delivery involved printed materials, phone contacts, individual counseling sessions, group meetings, and community outings (Clark et al., 2012; Jackson et al., 2009; Rejeski et al., 2011). Also, home-based and community-based interventions were most commonly employed in multiple-behavior lifestyle-based programs.

Elements and doses of multiple-behavior lifestyle interventions vary in different lifestyle-based programs. For example, Clark et al. (2012) conducted a 6-month lifestyle intervention in promoting the well-being of independently living older adults, elements of the lifestyle intervention including goal setting, daily activity, social relationship, cultural awareness, transportation utilization, time use and energy conservation, home and community safety, and changing routines and habits. This intervention involved a 2-hour small group sessions weekly, ten 1-hour individual sessions, and community outings monthly. Overall, most multiple-behavior lifestyle programs were long-term interventions which delivered and followed for an average of 1.5 – 2.7 years in order to initiate and maintain older adults' healthy lifestyles (Clark et al., 2012; Fielding et al., 2011; Jackson et al., 2009; Rejeski et al., 2011).

Effects of Lifestyle-Based Interventions

Lifestyle-based interventions have been found to promote physical health and psychosocial well-being in older adults (Clark et al., 2012; Espeland et al., 2007; Fielding et al., 2011; Ip et al., 2013; Jackson et al., 2009; Liu et al., 2013; Marsh et al., 2013; Matthews et al.,2011; Pahor et al, 2014; Picarsic et al., 2008; Teri et al., 2011; Williamson et al., 2009). Clark et al. (2012) conducted a 6-month lifestyle intervention in community-dwelling older adults; results of this study indicated that the intervention group (received multiple-behavior lifestyle interventions) had significantly greater improvements in vitality, bodily pain, social functioning, mental health, life satisfaction, and depressive symptomatology than the control group (did not receive interventions). Ip et al. (2013) examined the effectiveness of a one-year lifestyle intervention on physical function among older adults aged 70-89. A total of 424 older adults were randomly assigned to the experimental group (a physical activity program) and the control group (a successful aging education program). The results showed that the experimental group was more likely to regain and maintain physical functioning than the control group. Also, the experimental group was less likely to reduce physical functioning when compared with the control group. In short, lifestyle-based interventions may promote health-related quality of life and reduce physical limitations in older adults.

Studies have revealed that lifestyle-based interventions can improve prehypertension and weight management in older adults (Hageman et al., 2014; Rejeski et al., 2011). Hageman et al. (2014) designed a community-based clinical trial to test the effect of a 12-month lifestyle intervention in midlife and older women with prehypertension. A total of 289 participants were randomly assigned to three groups: standard advice group (the control group), web-based lifestyle intervention group, and print-mailed lifestyle intervention group. The results of this study showed that two intervention groups had significantly greater improvements in waist circumference, saturated fat, daily servings of fruit and vegetables, and low fat dairy than the control group. Also, the web-based intervention group had significantly greater reduction in systolic blood pressure and greater improvements in VO_2max when compared with the control group. Similarly, in Rejeski et al.'s (2011) study, a randomized controlled trial was conducted to test the effects of a 6-month lifestyle intervention on eating behavior and weight loss in older, obese adults. A total of 288 older adults were randomly assigned to three groups: physical activity group (PA), weight loss in combination with physical activity group (WL+PA), and successful aging health education group (SA). Results of this study showed that WL+PA group had significantly greater improvements on weight management than PA group and SA group. All in all, these studies suggest that lifestyle-based interventions play a critical role to initiate and maintain older adults' healthy lifestyles for healthy aging.

Cultural Relevance

Health disparities exist among racial and ethnic disadvantaged populations in the United States. For example, older Hispanic and African Americans are less likely to report good to excellent health status than White Americans (Smedley, Stith, & Nelson, 2004). Also, older African American and older Hispanic Americans are more likely to report functional limitations than White Americans. In addition, culture establishes norms, values, and beliefs for health behavior (Simons-Morton et al., 2012). Truly, many health problems stem from culture, family, and neighborhood. Notably, almost every aspect of well-being and quality of life with older adults can be affected by race, ethnicity, and culture. Hence, it is crucial to deliver ethnically and culturally tailored interventions for older minorities.

Given the critical need to reduce racial and ethnic health disparities among older adults, the research participation of older ethnic minorities in intervention studies is essential. As the diversity of racial and ethnic elders in the United States increases, critical to lifestyle-based intervention research is the ability to conduct studies on the sample adequately representative of older Americans under investigation to achieve sufficient generalizability. However, the recruitment of older adults into intervention research is challenging and difficult, especially among older minorities (Carlson et al., 2014; Moreno-John et al., 2004; Sidani & Braden, 2011; Stahl & Vasquez, 2004). Possible reasons for the low participation of ethnical minority elders in intervention research include mistrust of the research community, language and health literacy barriers, fear of deportation, lack of transportations, and the social isolation.

It is critical to deliver culturally linguistic sensitive interventions for older Americans, but a one-size-fits-all approach does not work for all ethnically diverse elders. For instance, a recruitment that approach works well for a Chinese American community may fail in a Hispanic American community. Nevertheless, there are two strategies for delivering culturally linguistic sensitive interventions for older adults: training researchers on cultural competence, and providing bilingual health education materials and forms to older adults whose first language is not English. Additionally, Moreno-John et al. (2004) recommended four strategies for enhancing research participation among ethnical older minorities: building a trust relationship with community members/community-based organizations, applying participatory approaches to research, targeting the special events of ethnic elders, and training and presenting the findings on designing studies with ethnical older adults. Finally, culturally tailored strategies to promote recruitment among ethnic elders including employing recruiters who can deliver culturally linguistic sensitive interventions, using translated flyers and brochures, employment of pictures of ethnic elders in posters, performing the consent process in a small group to facilitate the enrollment, and maintaining a trust relationship with community members/community centers by sharing research findings are strongly recommended for lifestyle-based intervention research in older minorities (Carlson et al., 2014; Moreno-John et al., 2004).

Summary

Current literature indicates that the effectiveness of lifestyle-based interventions in older adults is an ongoing discussion. In other words, further studies are needed to investigate the effects of lifestyle interventions in older adults with chronic diseases. Lifestyle-based interventions such as physical activity interventions are the cornerstone of health promotion programs for older adults. Lifestyle-based interventions have numerous benefits and low costs for promoting older adults' health. As the older population is growing significantly and many older adults have hypertension, further research with rigorous methodological designations is needed to define the effectiveness of lifestyle-based interventions for older adults with hypertension.

CHAPTER III

METHODOLOGY

Introduction

The current study used a secondary dataset from the Well Elderly 2 Study (Clark, 2012) to examine the effects of a 6-month lifestyle intervention in older adults with hypertension. In this study, a two-group randomized controlled trail with pretest-posttest design was used to test the differences between the intervention group (received a 6-month intervention) and the control group (did not receive a 6-month intervention) on physical activity, blood pressure, and health-related quality of life from pre-test (baseline) to post-test (6 months) in older adults with hypertension.

The Original Study (Well Elderly 2 Study)

Design

The Well Elderly 2 Study was funded by the National Institute on Aging (R01 AG021108). The purpose of the study was to examine the effectiveness and cost-effectiveness of a 6-month lifestyle-based intervention in older adults in California (Clark, 2012; Clark et al., 2012). The study was a two-group randomized controlled trail using crossover design with pre-test, post-test (6 months), and one-year follow up. All participants were randomly assigned into two groups: the control group (did not participate in the intervention program) and the intervention group (participated in the intervention program). Neither the interveners nor the intervention group were blind to the intervention, but both the interveners and the participants were blind to the study design.

Sample / Setting

In the Well Elderly 2 Study, a convenience sample was recruited from the urban Los Angeles area in California (Clark, 2012; Clark et al., 2012; Jackson et al., 2009). The target population was independent-living older Americans who spoke either English or Spanish. Participants were excluded from the study if they had cognitive impairment such as signs of psychosis or dementia, were not able to complete the assessment battery. Prior to the start of the study, power analysis and sample size calculations for effect sizes in a test for differences between two groups, an alpha level of 0.05, a one-tailed test, an effect size of 0.32, a 10% attrition rate, and a power of 0.93, 220 participants in each group were estimated (Clark et al., 2012).

There were 460 independent-living, older adults aged 60-95 enrolled in the Well Elderly 2 Study. Participants were ethnically diverse, including White (36.6%), African American (33.6%), Hispanic (21.1%), Asian (4.3%), and other (4.3%) (Clark et al., 2012). Two hundred and thirty-two out of 460 participants were randomly assigned to the intervention group, and 228 participants were randomly assigned to the control group. The intervention group and the control group were selected from 21 different community-based sites in the greater Los Angeles metropolitan area (Clark, 2012; Clark et al., 2012;

Jackson et al., 2009). These community-based sites included one graduated care retirement community, nine senior activity centers, and 11 senior housing residences.

Human Subject Protection

The Well Elderly 2 Study was approved by the Institutional Review Board at the University of Southern California and complied with the principles of the Declaration of Helsinki (Carlson et al., 2014; Clark et al., 2012). Also, a data safety board regular reviewed quality of the study and monitored the rights and safety of participants. All participants completed informed consents prior to enrolling the study. Each participant was given detailed information about the study and the study requirements were fully explained to all participants by the research project manager or her assistants.

To compensate participants' efforts, time, and willingness to participate in the study, each participant received a US$20 stipend for each assessment session (Carlson et al., 2014; Clark et al., 2012). At the end of the study (the last assessment session), participants received a US$40 stipend. Based on ethical considerations, a delayed intervention was offered to the control group during the second 6-month stage.

Recruitment / Retention

In the Well Elderly 2 Study, the sample was recruited from 21 community-based locations in California (Clark, 2012; Clark et al., 2012; Jackson et al., 2009). Recruitment strategies involved using posters, flyers, presentations, sign-up booths in a variety of communities. In addition, approaches to promote recruitment among older Hispanic adults involved employing recruiters who spoke Spanish and were culturally sensitive, using Spanish recruitment materials, and photos of older Hispanic Americans were used in recruitment posters and flyers.

Recruitment included two successive cohorts. Cohort 1 (n= 205) enrolled into the program between November 2004 and June 2005; Cohort 2 (n= 255) enrolled into the program between March 2005 and August 2006 (Carlson et al., 2014; Clark et al., 2012). Key retention strategies involved reducing the turnover rate among the research staffs to enhance participants' comfort level and trust relationship to the study, frequently contacted participants by phones, reminder letters, or visits, and individual and group assessment sessions were made flexible and available at each study site.

Data Collection

Prior to data collection at baseline, the process of informed consent was completed by participants (Clark et al., 2012; Jackson et al., 2009). Data were collected at 4-5 time points (6-month intervals) across 1.5-2 years. Assessments included demographic survey (pre-test only), questionnaires, cognitive tests, and measurements of blood pressure and stress-related biomarkers. Data were collected by participants' self-reports in small groups (4 - 29 participants) in meeting rooms of the 21 intervention sites (Clark et al., 2012). Well-trained research assistants were available to assist participants in completing the assessment battery. The cognitive tests were measured individually in a private room/area. Both intervention and control groups were assessed in the same sessions. All research assistants were blind to the participants' assignments. In order to prevent testing order effects, the questionnaire packages included six orders of questionnaire measures. All data quality control and statistical analyses were managed by the data analysis center.

Measures / Instruments

In the Well Elderly 2 Study, the demographic form, an investigator-designed instrument, included demographic and research-related items, such as sex, age, and race. The version 2 of the 36-item Short-Form Health Survey (SF-36v2) was measured on health-related quality of life (Garratt, Ruta, Abdalla, & Russell, 1996; Holt, Muntner, Joyce, Webber, & Krousel-Wood, 2010; Ware, 2013; Ware & Sherbourne, 1992). The word list procedure designed by the Consortium to Establish a Registry of Alzheimer's Disease was used to assess participants' cognitive status. The Digit Symbol Substitution Task of the Weschler Adult Intelligence Scale was used to assess psychomotor speed. Median reaction time on a widely used computer-based visual search task was employed to examine selective attention (Clark, 2012; Clark et al., 2012; Jackson et al., 2009).

The Center for Epidemiologic Studies Depression (CES-D) Scale was measured for assessing depressive symptoms. The Life Satisfaction Index-Z (LSI-Z) was employed to test life satisfaction. Participants were also assessed on the stress level (Perceived Stress Scale and Overall Stress Likert Scale), healthy activity (Meaningful Activity Participation Assessment), and social support (Interpersonal Support Evaluation List and Lubben Social Network Scale) (Clark, 2012). Spanish versions of the questionnaires were available for older Hispanic adults.

Lifestyle-Based Intervention

The goal of the lifestyle-based intervention in the Well Elderly 2 Study was to help older adults in developing a healthy lifestyle that is sustainable and maintainable with respect to individual needs and progress for every day (Clark, 2012; Clark et al., 2012; Jackson et al., 2009). A 6-month lifestyle-based intervention was led by occupational therapists for the intervention group in the first six months of their participation. The control group was received a delay intervention during the second six-month phase. Based on ethnic and cultural considerations, the culturally and linguistically adapted intervention was delivered to older Hispanic participants.

The format of the intervention included weekly 2-hour group meetings (6 - 8 participants), 10 individual 1- hour sessions in homes or community settings, and monthly community outings (Carlson et al., 2014; Clark et al., 2012). The goal of individual sessions was to help each participant develop the personally customized intervention for health-related behavior and healthy lifestyles. Overall, key elements of the intervention contained identifying and implementing of practical and maintainable activity-related change, developing plans and strategies to overcome obstacles to promote activity-related change, and participation and repetition of selected activities to everyday schedule (Clark et al., 2012; Jackson et al., 2009). The modular content of the intervention comprised impact of everyday activity on health, time use and energy conservation, transportation utilization, home and community safety, social relationship, cultural awareness, goal setting, and changing routines and habits.

Treatment Fidelity

The Treatment Fidelity Workgroup of the NIH Behavior Change Consortium indicated that researchers should address and improve treatment fidelity in study design and intervention delivery (Bellg et al., 2004). Treatment fidelity refers to the credibility, reliability and validity of intervention delivery and implementation in intervention programs (Bellg et al., 2004; Sidani & Braden, 2011). In order to successfully translate the intervention into clinical practice, researchers and interventionists must accurately follow the intervention manual and assure the intervention is fully implemented. In other words, the degree of intervention fidelity can impact the outcomes of intervention programs and conclusions in the effects of the intervention (Borrelli, 2011; Breitenstein et al., 2010; Frank, Coviak, Healy, Belza, & Casado, 2008; Horner, 2012; Neff, 2011). Hence, assessing and monitoring the degree of intervention fidelity in research design and intervention implementation are critically important.

In the Well Elderly 2 study, a multidisciplinary research team included a nursing scientist, a gerontologist, two occupational therapy scientists, a biostatistician, a biopsychologist, a cognitive psychologist, a social psychologist, and a psychometrician (Jackson et al., 2009). Research staff were employed for the study including one project manager, an assistant project manager, one project physician, two recruiters, four occupational therapists, four research assistants, one database manager, and a data analyst. All interventionists had completed a 40 hours training course on the lifestyle-based intervention (Clark, 2012; Clark et al., 2012; Jackson et al., 2009). Each small group was recruited from the same site and the intervention was delivered by the same interventionist.

The Current Study

Data Access / Data Source

Data from the Well Elderly 2 Study are a de-identified, publicly access dataset for Inter-University Consortium for Political and Social Research (ICPSR) member institutions and authorized users. In the Well Elderly 2 study, the data were managed by a five-member data safety monitoring board. Data quality control with standard procedures including data entry, data management, and data analyses were performed by the research data analysis center (Clark, 2012; Clark et al., 2012). Instrument-specific algorithms were used to calculate each assessment's summary scores.

The type of data is clinical, survey, and experimental. The unit of observation is individual. The date of data collection was from November 22, 2004 to October 30, 2008(Clark, 2012; Clark et al., 2012). The data set was released by ICPSR in 2012. The format of the dataset is SPSS. A total of 435 variables were included in this data file. Variables categories contained demographics, health survey, feelings, attitudes, stressful events, connections, activities, issues, beliefs, and supports.

Sample

To avoid designing experimental studies that are underpowered, researchers need to perform sample size calculations. Cohen's power table (Polit, 2010; Polit & Beck, 2012), G*Power (Faul, Erdfelder, Buchner, & Lang, 2009; Faul, Erdfelder, Lang, &

Buchner, 2007), and nQuery Advisor software (Elashof, 2005) are frequently used to estimate sample size and power analysis for experimental research. In this study, participants who self-reported taking blood pressure medication at baseline in the Well Elderly 2 Study were selected as subjects (n=196). Cohen (1988) defined 0.50 as a medium effect size. Using G*Power 3.1 in a test for power calculations to detect the differences between two-group means (t-test), an alpha level of 0.05, a medium effect size, a two-tailed test, an estimated 103 participants in the intervention group and 93 participants in the control group, power is estimated to be 93.5 % (Faul et al., 2007; Faul et al., 2009).

Human Subjects Protection

This study was approved by the Institutional Review Board (IRB) of the University of North Carolina at Greensboro. In this study, code numbers were used in the analyses (Hulley, Cummings, Browner, Grady, & Newman, 2013). All data and the results of the statistical analysis are kept confidential by the researchers. The de-identified data file and the results of statistical analysis from the Well Elderly 2 Study are stored on the electronically password-protected computer and kept in two external hard drives in two locked cabinets in the office in the researcher's house.

Measures / Instruments

Demographic data. The self-reported demographic form, an investigator-designed instrument, was used to collect demographic data and research-related items, such as sex, age, race, and educational level.

Blood pressure. Blood pressure readings, systolic blood pressure (SBP) and diastolic blood pressure (DBP), were measured using a sphygmomanometer and stethoscope when a participant was in a sitting position for at least 10 minutes. Two blood pressure measurements were obtained and the mean of blood pressure readings was calculated (Clark, 2012). A blood pressure of 140/90 mmHg or higher is categorized as hypertension; a blood pressure level less than 120/80 mmHg is categorized as normal. Participants with blood pressure levels in between 120/80 and 140/90 are categorized as prehypertension (CDC, 2014b).

Stress. Stress was measured by using Perceived Stress Scale (Adapted). Perceived Stress Scale (PSS) was employed to measure perceived stress. The PSS is one of the most widely used scales to examine levels of perceived stress in older adults (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Williamson, 1988; Kwag et al., 2011). Also, the PSS has been translated in diverse languages such as Arabic, Spanish, Chinese, and Japanese (Andreou et al., 2011). The PSS was originally developed as a 14-item scale that measure subjective perception of stressful experiences for the past month, including seven negatively worded items (e.g., "In the last month, how often have you felt nervous and stressed?") and seven positively worded items (e.g., "In the last month, how often have you felt that things were going your way?"). This instrument examines that participants perceive the degree regarding their lives to be uncontrollable, unpredictable, and overloading during the past month.

In the Well Elderly 2 study, the adapted PSS is an 18-item scale. All items of the adapted PSS are rated on a 5-point Likert scale ranging from 1 (never) to 5 (very often).

Scores of the adapted PSS range from 18 to 90; higher scores indicate higher levels of perceived stress. Studies indicated that the PSS had adequate construct validity and Cronbach's alpha coefficient of 0.70 in use with older adults (Carlson et al., 2014; Cohen et al., 1983; Cohen & Williamson, 1988; Kwag et al., 2011). In short, the PSS is a reliable and valid instrument to measure perceived stress in older adults. In this study, Cronbach's alpha coefficient of the adapted PSS was 0.85.

Support support. Social support was assessed by using the Lubben Social Network Scale (LSNS). Lubben Social Network Scale is one of most commonly used instruments to measure perceived social support in older adults (Lubben, 1988). The LSNS is a 11-item scale for assessing the level of perceived support received from family, friends, and neighbors. Scores of the LSNS range from 0 to 50; higher scores indicate higher levels of social support. Studies have been shown that the LSNS has good reliability and validity, internal alpha estimates of 0.83 to 0.89, and high correlations with criterion variables in use with older adults (Burnette, & Myagmarjav, 2013; Gray, Kim, Ciesla, & Yao, 2014; Lubben et al., 2006). The LSNS is a short, reliable, and valid scale to assess levels of social support among older adults. In this study, Cronbach's alpha coefficient of the LSNS was 0.75.

Physical activity. Meaningful Activity Participation Assessment-Frequency (MAPA-F) was employed to examine physical activity. The MAPA-F, a 29-item tool, is used to assess activity frequency including a measurement of activity participation frequency for 29 diverse activities such as physical activity commonly performed by older adults (Eakman, Carlson, & Clark, 2010). All items for each activity using Likert scaling are scored from 0 (not at all) to 6 (every day). The possible scores of the MAPA-F range from 0 to 174; higher scores indicate greater levels of meaningful activity participation. In the current study, physical activity was measured with physical activity frequency. The possible scores of physical activity frequency range from 0 to 6; higher scores indicate higher levels of physical activity frequency.

Studies indicated that the MAPA possesses a sufficient level of internal consistency and test-retest reliability as well as construct validity within the ethnically diverse older adults (Carlson, Kuo, Chou, & Clark, 2013; Eakman et al, 2010). Two-week test-retest reliability was 0.84 and internal consistency (α) was 0.85 for the MAPA in older adults (Eakman et al, 2010). In short, the MAPA-F demonstrates to be a reliable and valid tool to measure meaningful activities such as physical activity in older adults. In the current study, Cronbach's alpha coefficient of the MAPA-F was 0.82.

Health-related quality of life. Health-related quality of life was measured using the 36-Item Short-Form Health Survey (SF-36, Version 2.0) (Ware, 2013; Ware & Sherbourne, 1992). The 36-item short-form health survey (SF-36, version 2) is frequently used to measure health-related quality of life in older adults. It is a multi-domain that measures physical and mental components of health-related quality of life with eight subscales. The SF-36 includes three components: 36 items with dichotomous or Likert-type items, eight subscales that aggregate 2 to 10 items each, and two summary measures that aggregate 4 subscales each. The eight subscales are selected from the Medical Outcomes Study including physical functioning (PF), role physical (RP), bodily pain (BP), general health (GH), mental health (MH), role emotional (RE), social function

(SF), and vitality (VT) (Holt et al., 2010). The 8 subscales are calculated into two summary measures: mental component summary (MCS) and physical component summary (PCS). The PCS focuses primarily on 4 subscales: PF, RP, BP, and GH. The MCS includes 4 subscales: MH, RE, SF, and VT. The PCS and the MCS were computed using norm-based scoring (Ware, 2013; Ware, Kosinski, & Keler, 1994). Both PCS and MCS scores range from 0 to 100, representing worst to best health. Higher scores indicated better health-related quality of life (Ware et al., 1994).

The SF-36 has been proven to be a valid and reliable instrument in assessing health-related quality of life for older adults and diverse populations in the United States and other countries (Garratt et al., 1996; Holt et al., 2010; Hu, Gruber, & Hsueh, 2010; Lyons, Perry, & Littlepage, 1994; Shyu, Lu, & Chen, 2008; Walters, Munro, & Brazier, 2001; Ware, 2013; Yang et al., 2012; Yu & Tang, 2013). Bartsch et al. (2011) tested the psychometric properties of the SF-36 with community-dwelling older adults. The results have shown that the SF-36 scale demonstrates acceptable internal consistency, with Cronbach's alpha ranging from 0.82 to 0.92 (n=41,338). The finding has confirmed the structural validity from the SF-36 with older adults. A cross-sectional community-based survey was conducted by Walters et al. (2001) to assess the utility of the SF-36 with community-dwelling older adults; the finding indicated a response rate of 82% and dimension completion rates of 86.4% - 97.7% (n=8,117). The internal consistency of the eight subscales of the SF-36 was assessed by Cronbach's α coefficient which was greater than 0.80 for each dimension except social function. These studies indicated the SF-36 is an appropriate measurement of health-related quality of life for older adults. In this study, Cronbach's alpha coefficients of the SF-36 PCS and MCS were 0.83 and 0.85 respectively.

Secondary Data Analysis

Secondary data analysis refers to the approach of using existing data, such as the National Health and Nutrition Examination Survey (NHANES) data sets, to answer research questions (Hulley et al., 2013; Trzesniewski, Donnellan, Lucas, & American Psychological Association, 2011). In other words, the investigator poses research questions that are answered by the analysis of the existing data that he/she was not involved in collecting original data. Sources of existing data for secondary data analysis with older population include NHANES, Electronic Health Records (EHRs), Health and Retirement Survey (HRS), Integrated Analysis of Longitudinal Studies of Aging (IALSA), National Long Term Care Survey (NLTCS), and National Health and Aging Trends Study (NHATS). The utility of existing data sets is a quick, inexpensive, and efficient way to expand the body of knowledge derived from the existing data, especially for new researchers with limited budgets.

Advantages of secondary data analysis. The most significant advantage of using existing data is economics, because study design and data collection were already finished (Church, 2001; Hulley et al., 2013; Polit & Beck, 2012; Trzesniewski et al., 2011). In other words, it saves money and time. A true experimental study or randomized controlled trial usually takes several years with much larger budgets to complete data collection. However, the secondary data has already been collected by other researchers, so the researcher can spend most of his/her time analyzing the data instead of devoting money and time to collecting a new set of data. Using existing data is especially ideal and useful for new investigators, such as PhD students with limited resources and research experience. New investigators can acquire valuable and precious experience from secondary data analysis in research design and data analyses (Friedman, 2007; Trzesniewski et al., 2011).

Another advantage is the breadth of secondary data sets and generalization of the results (Church, 2001; Hulley et al., 2013; Trzesniewski et al., 2011). Many national data sets contain thousands of variables to answer specific and large scale questions. Also, most national data sets are well-organized with excellent documentation that can be used independently. In addition, some national data sets are longitudinal data that the same population was examined over time, so the researcher can using these data sets to analysis trends and changes of behavior/phenomena. In general, studies funded by the government typically include large samples that are more representative of the target population. It means that national data sets often have greater external validity for generalization.

Finally, one of the great contributions of secondary data is that secondary data can be used to examine patterns of utilization, rare adverse events, regional, cultural, and ethnic variations, and outcomes of interventions/treatments (Hulley et al., 2013; Polit & Beck, 2012; Trzesniewski et al., 2011). For example, secondary data can sometimes be tested the difference between efficacy and effectiveness in the real world that randomized controlled trials cannot answer. Additionally, the advantage of using secondary data is that original studies were often designed by skillful researchers and professional scientists with many years of experience in that particular research. It implies that national data sets are high quality in research design and data collection. In short, secondary data analysis is a fast, inexpensive, and effective approach to examine critical assumptions and answer research questions.

Disadvantages of secondary data analysis. The main disadvantage of using secondary data is that the researcher has no or little control over existing data because the study design and data collection have already completed. Existing data may not facilitate or answer specific research questions for the researchers (Kaplan, Chambers, & Glasgow, 2014). Also, it may not have been collected in the specific population that the researcher is interested in studying. In addition, secondary data may involve missing data or inappropriate measurement. Possible confounding factors and critical outcomes may not have been examined. Using existing data is particularly difficult to assess potential confounders when the original study was not designed to test the effectiveness of interventions. In short, using secondary data sets may involve sampling bias and measurement error (Kaplan et al., 2014; Trzesniewski et al., 2011)

Another disadvantage of using secondary data is that the researchers may not know all of the information or important details regarding how the data collection procedures were done and how exactly the quality of data set was guaranteed (Hulley et al., 2013; Polit & Beck, 2012). Basically, national data sets or federal-funded data sets are readily available for this information or important details regarding original study design and data collection process. However, many other existing data are not offered this type of information and documents. Nevertheless, the researcher must do her/his best and invest energy and time to learn the details about the original study. All in all, these disadvantages may limit the analysis in statistical precision or alter the important research questions that the researcher sought out to answer.

Data Analysis

The goal of the statistical analysis in the current study was to test the differences between the intervention and the control groups in changes in physical activity, blood pressure, and health-related quality of life (HRQOL), from pre-test (baseline) to post-test (6 months). A total of 196 subjects were analyzed in this study. Descriptive statistics was initially calculated using means and standard deviation, frequencies, or percentages. Continuous variables were checked for outliers and normality in univariate analysis using boxplots, Quantile-Quantile plots (Q-Q plots), and the Kolmogorov-Smirnov test (K-S test). Analysis of covariance (ANCOVA) using baseline values and demographic factors as the covariates were performed to test differences between the two groups on outcome variables (Fitzmaurice, Laird, & Ware, 2011; Polit, 2010; Polit & Beck, 2012).

To test hypotheses 1 and 2, multiple linear regression using a hierarchical regression approach was performed to test the effect of the intervention and make predictions on criterion variables (Fitzmaurice et al., 2011; Polit, 2010). Demographic variables (age, race, gender, education, income), stress at baseline, and group types (intervention group / control group) as independent variables were entered for modeling the change in stress; demographic variables, social support at baseline, and group types (intervention group / control group) as independent variables were entered for modeling the change in social support. To model the change in HRQOL, independent variables including demographic variables (age, race, gender, education, income), HRQOL at baseline, stress at baseline, change in stress, social support at baseline, change in social support, and group types (intervention group / control group) were entered in the hierarchical multiple regression analysis. For modeling the change in blood pressure, anticipated independent variables include demographic variables, blood pressure at baseline, stress at baseline, change in stress, social support at baseline, change in social support, and group types (intervention group / control group). To model the change in physical activity frequency, independent variables including demographic variables (age, race, gender, education, income), physical activity frequency at baseline, stress at baseline, change in stress, social support at baseline, change in social support, and group types (intervention group / control group) were entered in the hierarchical multiple regression analysis.

Variance inflation factors (VIFs) were examined to check multicollinearity. Studentized deleted residuals (SDRs) were checked for the assumptions of independence (Durbin-Watson statistic), normality (normal Probability–Probability plot, K-S test), homoscedasticity (in a residual plot), and linearity (using scatter plots and LOESS fits). A two-sided p-value < 0.05 was considered statistically significant. All analyses of the hypotheses were performed using SPSS, version 23 (SPSS Inc., Chicago, IL).

Missing Data

Missing data are still common in randomized controlled trials. The reasons for missing data in the Well Elderly 2 study include withdrawal (time commitment, scheduling, and illness), death, moved, and lost contacts (Clark et al., 2012). In this study, five steps of handling missing data in secondary data analysis were applied. The five steps include (a) understanding missing data (e.g., nature, effects, statistical language); (b) preventing missing data (e.g., variable transformation, data reduction); (c) diagnosing missing data (e.g., amount, pattern); (d) dealing with missing data (e.g., deletion, weighting, or imputation); (e) reporting treatment results of missing data (Polit, 2010; Trzesniewski et al., 2011). There is no universal method for dealing with missing data (Dziura, Post, Zhao, Fu, & Peduzzi, 2013; Polit, 2010; Trzesniewski et al., 2011); however, the five-step process will limit the amount of missing data and make full use of available data (Dziura et al., 2013; National Research Council of the National Academies, 2010). In this study, listwise deletion was performed using SPSS, version 23 (SPSS Inc., Chicago, IL).

Summary

Secondary data analysis is widely used by researchers undertaking analysis of quantitative data. Using existing data is an effective and inexpensive approach to further examine study outcomes. Clearly, secondary data analysis will be an important methodology for most of areas of sciences to transform existing data into new knowledge. In this study, existing data from the Well Elderly 2 Study was used to examine the effects of a 6-month lifestyle intervention in older adults with hypertension in comparison to a control group. The researcher carefully considers the advantages and disadvantages of using existing data before performing secondary data analysis. This study with rigorous methodological designations has the potential to advance the scientific knowledge on the lifestyle intervention in older adults with hypertension and move the field of self-management of hypertension forward.

CHAPTER IV

RESULTS

Introduction

The purpose of this study was to examine the effects of a lifestyle intervention on blood pressure, physical activity, and health-related quality of life (HRQOL) in older adults with hypertension, accounting for stress and social support as mediating variables. This study hypothesized that the intervention group will have significant improvements in person (stress), environment (social support), and outcomes (physical activity behavior, blood pressure, and HRQOL) in older adults with hypertension from pre-test (baseline) to post-test (6 months) compared to the control group, after receiving a 6-month lifestyle-based intervention. The goal of the statistical analysis in this study was to test the differences between the intervention and the control groups in the changes in physical activity frequency, blood pressure, and HRQOL, from pre-test (baseline) to post-test (6 months). Descriptive statistics were used to analyze characteristics of sample. Hierarchical multiple regression was used to test hypotheses about change over time between groups. This chapter describes the results of the statistical analyses.

Characteristics of Sample

There were a total of 196 participants in this study. Of the 196 participants, 103 were randomly assigned to the intervention group and 93 to the control group. Table 1 presents baseline characteristics of the participants. At baseline, the mean age of participants was 74.8 ± 7.7 years; 63% were women. Most participants were White (33%) and African American (40%); the majority reported having a high school education or more (71%). Also, more than half (54%) reported a monthly income less than $1,000. In addition to taking hypertension medication, 32% of the participants reported that they also took diabetes medication and 49% used antihyperlipidemic agents. Intervention and control groups did not statistically significantly differ on any sample characteristics (all $p>0.05$).

Table 2 presents descriptive statistics for major study variables at baseline. The average stress score was 43.7 ± 10.7 and the average of social support score was 27.2 ± 9.1. The mean scores of the SF-36 Mental Component Summary (MCS) and Physical Component Summary (PCS) were 46.7 ± 11.4 and 39.6 ± 10.1, respectively. The average physical activity frequency score was 3.9 ± 2.2. The mean systolic blood pressure (SBP) was 144.2 mmHg ± 20.2 and the mean diastolic blood pressure (DBP) was 78.0 mmHg ± 11.9. As shown in Table 2, there were no significant differences between the intervention and control groups on measures at baseline ($p > 0.05$).

Table 1. Characteristics of the Sample (N=196)

Characteristic	Overall (N=196)	Intervention group (n=103)	Control group (n=93)	p
Education, n (%)				.284
Less than high school graduate	57 (29)	36 (35)	21 (23)	
High school graduate	48 (25)	24 (23)	24 (26)	
Some college or technical school	71 (36)	33 (32)	38 (41)	
Four years of college or more	20 (10)	10 (10)	10 (11)	
Gender, n (%)				.083
Male	72 (37)	32 (31)	40 (43)	
Female	124 (63)	71 (69)	53 (57)	
Race, n (%)				
White	64 (33)	31 (30)	33 (36)	.275
African American	79 (40)	46 (45)	33 (36)	
Hispanic/Latino	33 (17)	19 (18)	14 (15)	
Asian	5 (3)	3 (3)	2 (2)	
Other	14 (7)	4 (4)	10 (11)	
Age (years), mean ± SD	74.75 ± 7.674	74.21 ± 7.670	75.34 ± 7.675	.304
Monthly Income, n (%)				.564
$0 - $999	104 (54)	56 (54)	48 (53)	
$1,000 - $1,999	44 (23)	20 (19)	24 (27)	
$2,000 - $2,999	24 (12)	15 (15)	9 (10)	
$3,000 or more	21 (11)	12 (12)	9 (10)	
Other medications used, n (%)				
Diabetes medication	62 (32)	33 (32)	29 (31)	.898
Anti-depressant medication	21 (11)	14 (14)	7 (8)	.170
Anti-psychotic medication	39 (20)	22 (21)	17 (18)	.590
Cholesterol reducer medication	95 (49)	49 (48)	46 (50)	.792

Note: Abbreviation: SD = Standard Deviation.

Table 2. Descriptive Statistics for Study Variables at Baseline (N=196)

Variables Mean ± SD	Total (N=196)	Intervention group (n=103)	Control group (n=93)	p
Stress	43.72 ± 10.734	43.83 ± 10.984	43.60 ± 10.508	.885
Social support	27.18 ± 9.065	27.11 ± 8.471	27.26 ± 9.725	.907
HRQOL: MCS	46.73 ± 11.390	46.09 ± 12.260	47.45 ± 10.359	.405
HRQOL: PCS	39.59 ± 10.068	39.08 ± 10.131	40.15 ± 10.022	.459
Systolic blood pressure (mmHg)	144.16 ± 20.243	141.85 ± 18.706	146.58 ± 21.589	.131
Diastolic blood pressure (mmHg)	77.99 ± 11.918	77.11 ± 12.529	78.91 ± 11.244	.328
Physical activity frequency (0-6 score)	3.89 ± 2.152	3.87 ± 2.163	3.91 ± 2.152	.899

Note: Abbreviation: SD = Standard Deviation; HRQOL = Health-related quality of life; MCS = Mental Component Summary; PCS = Physical Component Summary.

Hypotheses Testing

Two hypotheses were tested to examine the effect of the lifestyle-based intervention using hierarchical multiple regression.

Hypothesis 1: There Will Be a Significant Improvement in Stress and Social Support

To test hypothesis 1, a 3-step block entry of predictor variables into the hierarchical multiple regression was used. Table 3 indicates the results of the predictor variables at each step and in the final model for predicting change in stress (post – baseline) after lifestyle-based intervention. As shown in Table 3, there was no statistically significant difference between the intervention and control groups on change in stress, but the final regression model was statistically significant. In the final hierarchical regression model, demographic variables (education, gender, race, age, and monthly income), stress at baseline, and intervention vs. control significantly accounted for 25% of the variance in change in stress (R^2=.25, p < .001). In addition, stress at baseline accounted for a significant amount of variance in change in stress, after controlling for the effect of demographic variables ($\Delta R^2 = .20$, p < .001). Four years of college or more, Hispanic/Latino vs. White Americans, stress at baseline were significant predictors. Adjusting for all other factors, participants who received four years of college or more education were associated with a 0.22 increase in standard deviation (SD) units of predicted change in stress compared to participants who received less than high school; Hispanic/Latino participants were associated with a 0.20 increase in SD units of predicted change in stress compared to White participants. For every 1 SD increase in stress at baseline, the predicted mean decrease in change in stress was 0.49 SD units, adjusting for all other factors.

Table 4 presents the results for the predictor variables at each step and in the final model for predicting change in social support (post – baseline) after lifestyle-based intervention. As shown in Table 4, there was no statistically significant difference between the intervention and control groups on change in social support, but the final regression model was statistically significant. In the final hierarchical regression model, demographic variables, social support at baseline, and intervention vs. control significantly accounted for 18% of the variance in change in social support (R^2=.18, $p < .01$). In addition, social support at baseline accounted for a significant amount of variance in change in social support, after controlling for the effect of demographic variables ($\Delta R^2 = .11$, $p < .001$). The only significant predictor was social support at baseline. For every 1 SD increase in social support at baseline, the predicted mean decrease in change in social support was 0.37 SD units, adjusting for all other factors.

Table 3. Hierarchical Multiple Regression Analyses Predicting Change in Stress (Post – Baseline) After Lifestyle-Based Intervention (N= 169)

Predictor	Δ R^2	β^a
Step 1: Demographic variables	.05	
Education		
Less than high school graduate[b]		
High school graduate		.07
Some college or technical school		.11
Four years of college or more		.22*
Gender		
Male [b]		
Female		.08
Race		
White [b]		
African American		.11
Hispanic/Latino		.20*
Asian		-.03
Other		.10
Age (years)		-.04
Monthly Income		
\$0 - \$999 [b]		
\$1,000 - \$1,999		-.08
\$2,000 - \$2,999		-.04
\$3,000 or more		.09
Step 2	.20***	
Stress at baseline (points)		-.49***
Step 3	<.01	
Control group [b]		
Intervention group		.03
Total R^2	.25***	

Note: [a] β shown is for the last step.
[b]Reference category.
p* < .05. ** *p* < .01. * *p* < .001.

Table 4. Hierarchical Multiple Regression Analyses Predicting Change in Social Support (Post – Baseline) After Lifestyle-Based Intervention (N= 168)

Predictor	Δ R^2	β[a]
Step 1: Demographic variables	.07	
Education		
Less than high school graduate[b]		
High school graduate		.07
Some college or technical school		.05
Four years of college or more		-.05
Gender		
Male [b]		
Female		-.07
Race		
White [b]		
African American		.15
Hispanic/Latino		.07
Asian		-.02
Other		.13
Age (years)		-.03
Monthly Income		
$0 - $999 [b]		
$1,000 - $1,999		.13
$2,000 - $2,999		.06
$3,000 or more		.01
Step 2	.11***	
Social support at baseline (points)		-.37***
Step 3	<.01	
Control group [b]		
Intervention group		-.06
Total R^2	.18**	

Note: [a] β shown is for the last step.
[b]Reference category.
*$p < .05$. ** $p < .01$. *** $p < .001$.

Hypothesis 2: There Will Be a Significant Improvement in HRQOL, Blood Pressure, and Physical Activity Frequency

To test hypothesis 2, a 4-step block entry of predictor variables into the hierarchical multiple regression was used. Table 5 indicates the results of the associations with the predictor variables at each step in predicting change in the SF-36 mental component summary (MCS; post – baseline) according to lifestyle-based intervention, stress, and social support. As shown in Table 5, there was no statistically significant difference between the intervention and control groups on change in the SF-36 MCS, but the final regression model was statistically significant. In the final hierarchical regression model, demographic variables, SF-36 MCS score at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support significantly accounted for 39% of the variance in the change in the SF-36 MCS (R^2=.39, $p < .001$). In addition, the SF-36 MCS at baseline accounted for a significant amount of variance in change in the SF-36 MCS, after controlling for the effect of demographic variables ($\Delta R^2 = .26$, $p < .001$). In the last step, stress at baseline, change in stress, social support at baseline, and change in social support accounted for a significant amount of variance in change in the SF-36 MCS, after controlling for the effect of demographic variables, SF-36 MCS score at baseline, and the effect of intervention ($\Delta R^2 = .08$, $p < .01$). SF-36 MCS score at baseline, stress at baseline, and change in stress were significant predictors in the final model. For every 1 SD increase in the SF-36 MCS at baseline, the predicted mean decrease in the change in the SF-36 MCS was 0.66 SD units; for every 1 SD increase in stress at baseline, the predicted mean decrease in change in the SF-36 MCS was 0.27 SD units; for every 1 SD increase in change in stress, the predicted mean decrease in change in the SF-36 MCS was 0.28 SD units, adjusting for all other factors.

Table 6 shows the results for the associations with the predictor variables at each step for predicting change in the SF-36 physical component summary (PCS; post – baseline) according to lifestyle-based intervention, stress, and social support. As shown in Table 6, there was no statistically significant difference between the intervention and control groups on change in the SF-36 PCS, but the final regression model was statistically significant. In the final hierarchical regression model, demographic variables, SF-36 PCS score at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support significantly accounted for 18% of the variance in change in the SF-36 PCS (R^2=.18, $p < .05$). In addition, SF-36 PCS score at baseline accounted for a significant amount of variance in the change in the SF-36 PCS, after controlling for the effect of demographic variables ($\Delta R^2 = .10$, $p < .001$). The SF-36 PCS at baseline and change in stress were significant predictors in the final model. For every 1 SD increase in the SF-36 PCS at baseline, the predicted mean decrease in the change in the SF-36 PCS was 0.38 SD units; for every 1 SD increase in change in stress, the predicted mean decrease in change in the SF-36 PCS was 0.18 SD units, adjusting for all other factors.

Table 7 presents the results for the associations with the predictor variables at each step for predicting change in systolic blood pressure (SBP; post – baseline) according to lifestyle-based intervention, stress, and social support. As shown in Table 7, there was no statistically significant difference between the intervention and control groups on change in SBP, but the final regression model was statistically significant. In the final hierarchical regression model, demographic variables, SBP at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support significantly accounted for 36% of the variance in change in SBP (R^2=.36, $p < .001$). In addition, SBP at baseline accounted for a significant amount of variance in change in SBP, after controlling for the effect of demographic variables ($\Delta R^2 = .16$, $p < .001$). SBP at baseline and monthly income ($1,000 - $1,999 vs. $0 - $ 999) were significant predictors in the final model. Adjusting for all other factors, participants whose monthly income was $ 1,000 - $1,999 were associated with a 0.21 decrease in SD units of predicted change in SBP compared to participants whose monthly income was $ 0 - $999. For every 1 SD increase in SBP at baseline, the predicted mean decrease in change in SBP was 0.45 SD units, adjusting for all other factors.

Table 8 presents the results for the associations with the predictor variables at each step for predicting change in diastolic blood pressure (DBP; post – baseline) according to lifestyle-based intervention, stress, and social support. As shown in Table 8, there was no statistically significant difference between the intervention and control groups on change in DBP, but the final regression model was statistically significant. In the final hierarchical regression model, demographic variables, DBP at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support significantly accounted for 49% of the variance in change in

DBP (R^2=.49, p < .001). In addition, demographic variables (education, gender, race, age, and monthly income) accounted for a significant amount of variance in change in DBP (ΔR^2 = .21, p < .05). Also, DBP at baseline accounted for a significant amount of variance in change in DBP, after controlling for the effect of demographic variables (ΔR^2 = .26, p < .001). Age and DBP at baseline were significant predictors in the final model. For every 1 SD increase in age, the predicted mean decrease in change in DBP was 0.17 SD units; for every 1 SD increase in DBP at baseline, the predicted mean decrease in change in DBP was 0.56 SD units, adjusting for all other factors.

Table 9 presents the results for the associations with the predictor variables at each step for predicting change in physical activity frequency (post – baseline) according to lifestyle-based intervention, stress, and social support. As shown in Table 9, there was no statistically significant difference between the intervention and control groups on change in physical activity frequency, but the final regression model was statistically significant. In the final hierarchical regression model, demographic variables, physical activity frequency at baseline, intervention vs. control, stress at baseline, change in stress, social support at baseline, and change in social support significantly accounted for 33% of the variance in change in physical activity frequency (R^2=.33, p < .001). In addition, physical activity frequency at baseline accounted for a significant amount of variance in change in physical activity frequency, after controlling for the effect of demographic variables (ΔR^2 = .29, p < .001). The only significant predictor of decreased change in physical activity frequency was physical activity frequency at baseline (β = -.57, p<.001).

Table 5. Hierarchical Multiple Regression Analyses Predicting Change in Health-Related Quality of Life (MCS; Post – Baseline) According to Lifestyle-Based Intervention, Stress, and Social Support (N= 167)

Predictor	Δ R^2	β^a
Step 1: Demographic variables	.05	
Education		
Less than high school graduate[b]		
High school graduate		.03
Some college or technical school		.13
Four years of college or more		.10
Gender		
Male [b]		
Female		-.13
Race		
White [b]		
African American		.02
Hispanic/Latino		-.01
Asian		.01
Other		.01
Age (years)		.06
Monthly Income		
\$0 - \$999 [b]		
\$1,000 - \$1,999		.03
\$2,000 - \$2,999		.00
\$3,000 or more		-.01
Step 2	.26***	
MCS at baseline (points)		-.66***
Step 3	<.01	
Control group [b]		
Intervention group		.07
Step 4	.08**	
Stress at baseline (points)		-.27**
Change in stress		-.28**
Social support at baseline (points)		.07
Change in social support		.05
Total R^2	.39***	

Note: Abbreviation: MCS = Mental Component Summary.

[a] β shown is for the last step.

[b] Reference category.

p* < .05. ** *p* < .01. * *p* < .001.

Table 6. Hierarchical Multiple Regression Analyses Predicting Change in Health-Related Quality of Life (PCS; Post – Baseline) According to Lifestyle-Based Intervention, Stress, and Social Support (N= 167)

Predictor	ΔR^2	β[a]
Step 1: Demographic variables	.03	
Education		
Less than high school graduate[b]		
High school graduate		-.04
Some college or technical school		-.04
Four years of college or more		-.07
Gender		
Male [b]		
Female		-.03
Race		
White [b]		
African American		-.01
Hispanic/Latino		-.01
Asian		-.03
Other		.03
Age (years)		.06
Monthly Income		
$0 - $999 [b]		
$1,000 - $1,999		-.01
$2,000 - $2,999		.12
$3,000 or more		.04
Step 2	.10***	
PCS at baseline (points)		-.38***
Step 3	<.01	
Control group [b]		
Intervention group		.04
Step 4	.05	
Stress at baseline (points)		-.13
Change in stress		-.18*
Social support at baseline (points)		.12
Change in social support		.07
Total R^2	.18*	

Note: Abbreviation: PCS = Physical Component Summary.

[a] β shown is for the last step.

[b]Reference category.

*p < .05. ** p < .01. *** p < .001.

Table 7. Hierarchical Multiple Regression Analyses Predicting Change in Systolic Blood Pressure (Post – Baseline) According to Lifestyle-Based Intervention, Stress, and Social Support (N= 118)

Predictor	ΔR^2	β^a
Step 1: Demographic variables	.16	
Education		
Less than high school graduate[b]		
High school graduate		-.12
Some college or technical school		.03
Four years of college or more		-.01
Gender		
Male [b]		
Female		.11
Race		
White [b]		
African American		-.12
Hispanic/Latino		-.05
Asian		.03
Other		-.10
Age (years)		-.07
Monthly Income		
$0 - $999 [b]		
$1,000 - $1,999		-.21*
$2,000 - $2,999		-.03
$3,000 or more		-.01
Step 2	.16***	
Systolic blood pressure at baseline (mmHg)		-.45***
Step 3	<.01	
Control group [b]		
Intervention group		.05
Step 4	.04	
Stress at baseline (points)		.13
Change in stress		-.04
Social support at baseline (points)		.15
Change in social support		.12
Total R^2	.36***	

Note: [a] β shown is for the last step.
[b]Reference category.
*$p < .05$. ** $p < .01$. *** $p < .001$.

Table 8. Hierarchical Multiple Regression Analyses Predicting Change in Diastolic Blood Pressure (Post – Baseline) According to Lifestyle-Based Intervention, Stress, and Social Support (N= 117)

Predictor	ΔR^2	β[a]
Step 1: Demographic variables	.21*	
Education		
Less than high school graduate[b]		
High school graduate		-.06
Some college or technical school		-.19
Four years of college or more		-.03
Gender		
Male [b]		
Female		.12
Race		
White [b]		
African American		-.05
Hispanic/Latino		-.04
Asian		.07
Other		-.03
Age (years)		-.17*
Monthly Income		
$0 - $999 [b]		
$1,000 - $1,999		-.08
$2,000 - $2,999		.08
$3,000 or more		-.07
Step 2	.26***	
Diastolic blood pressure at baseline (mmHg)		-.56***
Step 3	.01	
Control group [b]		
Intervention group		.12
Step 4	.01	
Stress at baseline (points)		-.02
Change in stress		-.08
Social support at baseline (points)		-.02
Change in social support		.03
Total R^2	.49***	

Note: [a] β shown is for the last step.
[b]Reference category.
p* < .05. ** *p* < .01. * *p* < .001.

Table 9. Hierarchical Multiple Regression Analyses Predicting Change in Physical Activity Frequency (Post – Baseline) According to Lifestyle-Based Intervention, Stress, and Social Support (N= 167)

Predictor	ΔR^2	β^a
Step 1: Demographic variables	.01	
Education		
Less than high school graduate[b]		
High school graduate		-.06
Some college or technical school		-.05
Four years of college or more		-.02
Gender		
Male [b]		
Female		.03
Race		
White [b]		
African American		-.04
Hispanic/Latino		-.003
Asian		.04
Other		.02
Age (years)		-.02
Monthly Income		
$0 - $999 [b]		
$1,000 - $1,999		0.06
$2,000 - $2,999		.11
$3,000 or more		.11
Step 2	.29***	
Physical activity frequency at baseline		-.57***
Step 3	<.01	
Control group [b]		
Intervention group		.02
Step 4	.02	
Stress at baseline (points)		-.12
Change in stress		-.16
Social support at baseline (points)		-.05
Change in social support		-.01
Total R^2	.33***	

Note: [a] β shown is for the last step.
[b]Reference category.
p* < .05. ** *p* < .01. * *p* < .001.

Summary

A total of 196 participants were included in the analyses of this study. Most participants were female (63%) and had a high school education or more (71%). Also, the majority reported a monthly income less than $1,000 (54%). In addition to taking hypertension medicine, nearly half of the participants used antihyperlipidemic agents and 32% took diabetes medication.

There were no statistically significant differences between the intervention and control groups on change in blood pressure, HRQOL, and physical activity frequency. However, the final regression models were statistically significant. The hierarchical multiple regression analyses indicated that the models are statistically significant in predicting change in HRQOL, blood pressure, and physical activity frequency according to lifestyle-based intervention, stress, and social support. Also, the result of hierarchical multiple regression analyses indicated that the models are statistically significant in predicting change in stress and change in social support after a lifestyle-based intervention. Four years of college or more, Hispanic/Latino vs. White Americans, stress at baseline were significant predictors for predicting change in stress; social support at baseline was the significant predictor for predicting change in social support. In addition, for change in the SF-36 MCS, SF-36 MCS score at baseline, stress at baseline, and change in stress were significant predictors. For change in the SF-36 PCS, SF-36 PCS score at baseline and change in stress were significant predictors. SBP at baseline and monthly income ($1,000 - $1,999 vs. $0 - $999) were significant predictors for predicting change in SBP; age and DBP at baseline were significant predictors for predicting change in DBP. For change in physical activity frequency, physical activity frequency at baseline was the only significant predictor.

CHAPTER V

DISCUSSION

The purpose of this study was to explore the effectiveness of a lifestyle intervention on blood pressure, physical activity, and health-related quality of life (HRQOL) in older adults with hypertension, accounting for stress and social support as mediating variables. The specific aims were to test the differences in blood pressure, physical activity, and HRQOL between the intervention and the control groups adjusting for any mediating effects of stress and social support and to examine the effects of a 6-month lifestyle-based program on blood pressure, physical activity, and HRQOL in older adults with hypertension. This chapter aims to interpret and discuss the findings and the theoretical framework, limitations of the study, and implications for research and nursing practice.

Stress and Social Support

The findings of the study indicated that there were no statistically significant intervention effects on stress and social support. According to Baron and Kenny (1986), social support and stress failed to function as mediators in the current study. In this study, the modular content of the activity-based intervention included impact of everyday activity on health, time spending and energy conservation, transportation utilization, home and community safety, social relationship, cultural awareness, goal setting, and changing routines and habits (Clark et al., 2012; Jackson et al., 2009). However, for older adults, stress and lack of social support can come from chronic illness, financial difficulties, retirement, change in living situation, family problems, or aging-related physical impairments (Rimmele et al., 2009; Rueggeberg et al., 2012; Yoshiuchi et al., 2010). Therefore, an activity-based intervention may not have significant effects on change in stress and social support. Also, many stressors are chronic and long term in older adults (Rimmele et al., 2009; Rueggeberg et al., 2012). Hence, the 6-month duration of the intervention may not sufficient for changing stress.

In this study, the lifestyle-based intervention did not have statistically significant effects on stress and social support. This result is different from previous studies. Rueggeberg et al. (2012) tested the long-term effect of physical activity on perceived stress in community-dwelling older adults; the result indicated that older adults who frequently engaged in physical activity significantly decreased high levels of perceived stress. In a longitudinal study, Fernandez et al. (2014) found that the relevance of social support as a moderator in physical activity changes. Also, Orsega-Smith and colleagues (2007) found that social support from friends was positively associated with physical activity in older adults. Hence, physical activity interventions are highly suggested for future research in order to reduce perceived stress and promote higher social support for older adults.

HRQOL, Blood Pressure, and Physical Activity

The results of this study showed that there were no statistically significant intervention effects on HRQOL, blood pressure, and physical activity. Most multiple-behavior lifestyle interventions were long-term interventions which delivered and followed for average of 1.5 – 2.7 years in order to initiate and maintain health behaviors (Clark et al., 2012; Fielding et al., 2011; Jackson et al., 2009; Rejeski et al., 2011). Hence, the 6-month lifestyle intervention may not have significant short-term effects on change in blood pressure, HRQOL, and physical activity frequency.

In addition, this result is similar to the findings in Clark et al.'s (2012) study. Clark et al. (2012) examined the effects of a 6-month lifestyle intervention on health-related quality of life in community-dwelling older adults; the results indicated that there were significant intervention effects on bodily pain, vitality, social functioning, and mental health, but there were no significant improvements in physical function, role physical, general health, and role emotional. Conversely, Ip et al. (2013) tested the effects of a one-year lifestyle intervention on physical function in older adults aged 70-89. The results indicated that the experimental group (received a physical activity intervention) was more likely to maintain and improve physical functions than the control group (received an education intervention). Also, Rejeski et al. (2011) examined the effectiveness of a 6-month lifestyle intervention on weight loss in older, obese adults. They suggested that weight loss in combination with physical activity group (WL+PA group) had significantly greater improvements on weight management than the physical activity group (PA group) and health education group (SA group). Hence, in order to promote both physical and mental health in older adults, lifestyle-based interventions in combination with physical activity interventions are highly recommended for future research.

In this study, stress at baseline and change in stress were significant predictors in predicting mental component of HRQOL; change in stress was a significant predictor in predicting physical component of HRQOL. Gerber (2012) also found that higher perceived stress was significantly associated with poorer mental HRQOL in older adults. Also, Frias and Whyne (2015) found that stress was negatively associated with HRQOL in community-dwelling older adults. Hence, these findings suggest that stress should be considered as a significant predictor for HRQOL in older adults.

Social Cognitive Theory

The conceptual framework in this study was based on the social cognitive theory (SCT). This study assumes that there is a relationship between person (e.g., stress), environment (e.g., social support), and behavior (e.g., physical activity). Demographic factors (age, race, gender, education, and income) may determine stress (person) and social support (environment), and can influence physical activity (behavior). Lifestyle-based interventions would significantly improve changes in stress (person), social support (environment), and physical activity (behavior).

In the current study, the SCT model in the hierarchical multiple regression analysis accounted for 33% of the variance in physical activity frequency (R^2=.33, p < .001). Similarly, Anderson, Winett, Wojcik, and Williams (2010) examined the SCT model on nutrition and physical activity; the findings revealed that self-regulation, social support, and outcome expectations accounted for 36% of the variance in nutrition and physical activity. A longitudinal study was conducted by Rovniak, Anderson, Winett, and Stephens (2002) to test constructs of the SCT on physical activity. The result showed that self-regulation, self-efficacy with social support, and outcome expectations explained for 55% of the variance in physical activity. These studies, along with the current study, suggest that the SCT is very useful in predicting physical activity behavior in older adults.

Limitations of the Study

One of the limitations of using existing data is that the researcher cannot control the research design and measurements, because the original study was completed. For example, this study used Meaningful Activity Participation Assessment-Frequency (MAPA-F) to measure physical activity frequency, but did not measure duration and intensity of physical activity. In the Well Elderly 2 study, both the interventionists and the participants were blind to the study design, but neither the interventionists nor the intervention group were blind to the intervention. The absence of blinding may lead to expectation bias. In addition, the Well Elderly 2 study did not conduct a readiness-to-change screen (Clark et al., 2012). Lack of the readiness-to-change screening can impact on the dropout rate and the effects of the intervention. Most participants were women and low income. Also, the sample was urban, community-dwelling older adults and cannot be generalized to older adults who live in rural areas and nursing homes.

Implications for Research and Nursing Practice

Studies indicated that regular physical activity is an effective way to promote physical functions and mental health in older adults (Chapman et al., 2013; Etnier & Karper, 2014; Rahl, 2010). Previous studies highly recommend that physical activity interventions should be included in lifestyle-based programs for future research. Older adults in the United States engage in less physical activity than young adults (CDC, 2014a). Behavior theories can provide useful strategies to develop effective physical activity interventions for older adults. However, few lifestyle intervention studies used theories to guide the development of interventions. More theory-based lifestyle intervention studies are needed to promote older adults' physical activity.

A better understanding of the psychological process to initiate and maintain regular physical activity is essential for promoting physical activity behavior and healthy lifestyles in older adults. Based on the results of this study, the reciprocal determinism of Social Cognitive Theory can effectively provide conceptual context to understand health-related behavior, guide the research to identify the determinants and mediators of behavior change, and suggest strategies and methods for promoting healthy lifestyles. Moreover, social support and stress can mediate lifestyle practices, health-related quality of life, and physical activity behavior in older adults (Carlson et al., 2012; Fernandez et al., 2014; Taylor-Piliae et al., 2010; Yoshiuchi et al., 2010). Hence, further interventions should consider how to reduce stress and increase social support for older adults.

There is limited research to examine the relationship between stress and HRQOL in older adults, particularly for perceived stress. Also, additional research is needed to further examine how perceptions of social support and different types of social support affect HRQOL and physical activity. Gerber (2012) found there were significant interactions between perceived stress and social support on mental HRQOL. However, synergistic effects of stress and social support on physical activity and HRQOL remain unclear.

Aging is a multi-faceted process and is related to reduced functional capacity and chronic diseases. Many older adults have at least one chronic disease such as hypertension, diabetes, or cardiovascular diseases. However, there has been little study to investigate the effects of lifestyle-based interventions in older adults with chronic diseases. The result of this study showed the presence of comorbidities in participants with hypertension, such as diabetes, depression, and psychiatric diseases. The effects of comorbidities on physical activity, blood pressure, and HRQOL remain unclear. Hence, comorbidities should be considered as a factor for future studies, and the conceptual framework should be expanded to include comorbidities.

Finally, there is no common language on what is the dose-response effect of lifestyle-based programs in older adults. How much is enough for older adults? The total volume of lifestyle interventions needed to both promote health benefits and the management of chronic diseases has not been fully investigated. Further research should focus on older adults with chronic diseases in exposure to lifestyle interventions and racial differences in response to lifestyle interventions.

Summary

Older adults are the fastest-growing population in the United States (CDC, 2013). Also, the older population is at high risk for developing chronic diseases and disabilities. As many older adults have high blood pressure, promoting effectively hypertension self-management in older adults is essential. In order to improve physical function and mental health, and prevent disabilities in older adults, lifestyle interventions in combination with physical activity interventions are strongly recommended. Also, stress management and social support resources should be included in the lifestyle intervention for older adults with hypertension. In addition, the utilization of behavior theory can identify the determinants and mediators of health behavior change, and develop strategies and approaches for intervention studies. Current literature indicates that theory-based interventions appear to be more successful than those are not theory-based interventions. Overall, the Social Cognitive Theory is very useful in better understanding how individual, environment, and health behavior to interact in health promotion in older adults. The results of this study indicate that physical activity behavior change should be considered within individual, interpersonal, societal, and cultural factors when implementing the lifestyle-based interventions.

REFERENCES

Achat, H., Kawachi, I., Levine, S., Berkey, C., Coakley, E., & Colditz, G. (1998). Social networks, stress and health-related quality of life. *Quality of Life Research : An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, *7*(8), 735–50.

Alzheimer's Association. (2014). *Alzheimer's disease facts and figures*. Chicago, IL: Alzheimer's Association. Retrieved from https://www.alz.org/downloads/Facts_Figures_2014.pdf

Alzheimer's Disease International. (2014). *World Alzheimer report 2014*. London, UK: Alzheimer's Disease International (ADI). Retrieved from http://www.alz.co.uk/research/WorldAlzheimerReport2014.pdf

American College of Sports Medicine, Thompson, W. R., Gordon, N. F., & Pescatello, L. S. (2010). *ACSM's guidelines for exercise testing and prescription*. Philadelphia, PA: Lippincott Williams & Wilkins.

American Heart Association. (2014). Heart disease and stroke statistics—2014 Update a report from the American Heart Association. *Circulation*, *129*(3), e28–e292. http://doi.org/10.1161/01.cir.0000441139.02102.80

Ames, S. C., Jones, G. N., Howe, J. T., & Brantley, P. (2001). A prospective study of the impact of stress on quality of life: An investigation of low-income individuals with hypertension. *Annals of Behavioral Medicine*, *23*, 112-119.

Anderson, E. S., Winett, R. A., Wojcik, J. R., & Williams, D. M. (2010). Social cognitive mediators of change in a group randomized nutrition and physical activity intervention, social support, self-efficacy, outcome expectations and self-regulation in the Guide-to-Health Trial. *Journal of Health Psychology*, *15*(1), 21–32. doi:10.1177/1359105309342297

Andreou, E., Alexopoulos, E. C., Lionis, C., Varvogli, L., Gnardellis, C., Chrousos, G. P., & Darviri, C. (2011). Perceived stress scale: Reliability and validity study in Greece. *International Journal of Environmental Research and Public Health*, *8*(8), 3287–3298. http://doi.org/10.3390/ijerph8083287

Atlantis, E., Chow, C.-M., Kirby, A., & Singh, M. F. (2004). An effective exercise-based intervention for improving mental health and quality of life measures: A randomized controlled trial. *Preventive Medicine: An International Journal Devoted to Practice and Theory*, *39*(2), 424–434. http://doi.org/10.1016/j.ypmed.2004.02.007

Bandura, A. (1985). *Social foundations of thought and action: A Social Cognitive Theory*. Englewood Cliffs, N.J: Prentice Hall.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173-1182.

Bartsch, L. J., Byles, J. E., Byles, J. E., Anstey, K. J., Anstey, K. J., & Anstey, K. J. (2011). Examining the SF-36 in an older population: Analysis of data and presentation of Australian adult reference scores from the Dynamic Analyses to Optimise Ageing (DYNOPTA) Project. *Quality of Life Research*, *20*(8), 1227–1236.

Bellg, A. J., Borrelli, B., Resnick, B., Hecht, J., Minicucci, D. S., Ory, M., … Czajkowski, S. (2004). Enhancing treatment fidelity in health behavior change studies: Best practices and recommendations from the NIH behavior change consortium. *Health Psychology*, *23*(5), 443–451. http://doi.org/10.1037/0278-6133.23.5.443

Bennett, J. A., Perrin, N. A., Hanson, G., Bennett, D., Gaynor, W., Flaherty-Robb, M., … Potempa, K. (2005). Healthy aging demonstration project: Nurse coaching for behavior change in older adults. *Research in Nursing & Health*, *28*(3), 187–197.

Berkman, L. (1995). The role of social relations in health promotion. *Psychosomatic Medicine*, *57*, 245-254.

Bherer, L., Erickson, K. I., & Liu-Ambrose, T. (2013). A review of the effects of physical activity and exercise on cognitive and brain functions in older adults. *Journal of Aging Research*, *2013*. Retrieved from http://www.hindawi.com/journals/jar/2013/657508/

Borrelli, B. (2011). The assessment, monitoring, and enhancement of treatment fidelity in public health clinical trials. *Journal of Public Health Dentistry*, *71*, S52–S63. http://doi.org/10.1111/j.1752-7325.2011.00233.x

Breitenstein, S., Gross, D., Garvey, C., Hill, C., Fogg, L., & Resnick, B. (2010). Implementation fidelity in community-based interventions. *Research in Nursing & Health*, *33*(2), 164–173. http://doi.org/10.1002/nur.20373

Brinke, L. F. ten, Bolandzadeh, N., Nagamatsu, L. S., Hsu, C. L., Davis, J. C., Miran-Khan, K., & Liu-Ambrose, T. (2015). Aerobic exercise increases hippocampal volume in older women with probable mild cognitive impairment: A 6-month randomised controlled trial. *British Journal of Sports Medicine*, *49*(4), 248–254. doi:10.1136/bjsports-2013-093184

Burnette, D., & Myagmarjav, S. (2013). Translation and validation of the 18-item Lubben Social Network Scale with older adults in Mongolia. *International Psychogeriatrics*, *25*(09), 1493–1502. http://doi.org/10.1017/S104161021300080X

Carlson, J. A., Sallis, J. F., Conway, T. L., Saelens, B. E., Frank, L. D., Kerr, J., . . . King, A. C. (2012). Interactions between psychosocial and built environment factors in explaining older adults' physical activity. *Preventive Medicine*, *54*(1), 68–73. http://doi.org/10.1016/j.ypmed.2011.10.004

Carlson, M., Jackson, J., Mandel, D., Blanchard, J., Holguin, J., Lai, M.-Y., … Clark, F. (2014). Predictors of retention among African American and Hispanic older adult research participants in the Well Elderly 2 randomized controlled trial. *Journal of Applied Gerontology*, *33*(3), 357–382. DOI: 10.1177/0733464812471444

Carlson, M., Kuo, A., Chou, C. P., & Clark, F. (2013). Relationship of global activity evaluative ratings to psychosocial and health-related aging outcomes. *Occupation, Participation & Health, 33*(4), 180-189.

Centers for Disease Control and Prevention. (2011). Physical activity and health: The Benefits of physical activity. Retrieved from http://www.cdc.gov/physicalactivity/everyone/health/index.html?s_cid=cs_284

Centers for Disease Control and Prevention. (2012). Vital signs: Awareness and Treatment of uncontrolled hypertension among adults – United States, 2003-2010. *MMWR*, *61*(35), 703-709. Retrieved from http://www.cdc.gov/mmwr

Centers for Disease Control and Prevention. (2013). *The state of aging and health in America*. Atlanta, GA: Centers for Disease Control and Prevention, US Department of Health and Human Services. Retrieved from http://www.cdc.gov/aging/pdf/state-aging-health-in-america-2013.pdf

Centers for Disease Control and Prevention. (2014a). How much physical activity do older adults need? Retrieved from http://www.cdc.gov/physicalactivity/everyone/guidelines/olderadults.html

Centers for Disease Control and Prevention. (2014b). Measuring Blood Pressure. Retrieved from http://www.cdc.gov/bloodpressure/measure.htm

Centers for Disease Control and Prevention. (2015). FastStats: Older persons' health. Retrieved from http://www.cdc.gov/nchs/fastats/older-american-health.htm

Chapman, S. B., Aslan, S., Spence, J. S., DeFina, L. F., Keebler, M. W., Didehbani, N., & Lu, H. (2013). Shorter term aerobic exercise improves brain, cognition, and cardiovascular fitness in aging. *Frontiers in Aging Neuroscience, 5*. http://doi.org/10.3389/fnagi.2013.00075

Charles, S.T., Piazza, J. R., Mogle, J., Sliwinski, M. J., & Almeida, D. M. (2013). The wear and tear of daily stressors on mental health. *Psychological Science, 24*(5), 733-741. doi: 10.1177/0956797612462222

Chiang, C-Y, & Sun, F.-K. (2009). The effects of a walking program on older Chinese American immigrants with hypertension: A pretest and posttest quasi-experimental design. *Public Health Nursing, 26*(3), 240-248.

Chodzko-Zajko, W. J. (2014). *ACSM's exercise for older adults*. Philadelphia, PA: Wolters Kluwer/Lippincott Williams & Wilkins.

Church, R. M. (2001). The effective use of secondary data. *Learning and Motivation, 33,* 32 – 45. doi:10.1006/lmot.2001.1098

Clark, F. (2012). *Well Elderly 2, Los Angeles, California, 2004-2008: ICPSR33641-v1*. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor]. http://doi.org/10.3886/ICPSR33641.v1

Clark, F., Jackson, J., Carlson, M., Chou, C.-P., Cherry, B. J., Jordan-Marsh, M., . . . Azen, S.P. (2012). Effectiveness of a lifestyle intervention in promoting the well-being of independently living older people: Results of the Well Elderly 2 randomised controlled trial. *Journal of Epidemiology of Community Health*, *66*, 782-790.

Cohen, S. (1988). Psychosocial models of the role of social support in the etiology of physical disease. *Health Psychology*, *7*, 269-297.

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

Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan & S. Oskamp (Eds.), *The social psychology of health* (pp. 31-67). Newbury Park, CA: Sage.

Dhabhar, F. S. (2014). Effects of stress on immune function: The good, the bad, and the beautiful. *Immunologic Research*, *58*(2-3), 193–210. http://doi.org/10.1007/s12026-014-8517-0

Dziura, J. D., Post, L. A., Zhao, Q., Fu, Z., & Peduzzi, P. (2013). Strategies for dealing with missing data in clinical trials: From design to analysis. *The Yale Journal of Biology and Medicine*, *86*(3), 343–358.

Eakman, A. M., Carlson, M., & Clark, F. (2010). The Meaningful Activity Participation Assessment: A measure of engagement in personally valued activities. *International Journal of Aging and Human Development*, *70*, 299-317.

Ehrman, J. K., & American College of Sports Medicine. (2010). *ACSM's resource manual for guidelines for exercise testing and prescription*. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins.

Elashof, J. (2005). *nQuery advisor 6.0 (Version 4.0)*. Saugus, MA: Statistical Solutions.

Erickson, K. I., Voss, M. W., Prakash, R. S., Basak, C., Szabo, A., Chaddock, L., . . . Kramer, A. F. (2011). Exercise training increases size of hippocampus and improves memory. *Proceedings of the National Academy of Sciences*, *108*(7), 3017–3022. http://doi.org/10.1073/pnas.1015950108

Espeland, M. A., Gill, T. M., Guralnik, J., Miller, M. E., Fielding, R., Newman, A. B., . . . Guralnik, J.M. (2007). Designing clinical trials of interventions for mobility disability: Results from the Lifestyle Interventions and Independence for Elders Pilot (LIFE-P) Trial. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *62*(11), 1237–1243.

Etnier, j. L., & Karper, W. B. (2014). Physical and psychological benefits of physical activity and exercise for healthy older adults. In W. J. Chodzko-Zajko (Ed.), *ACSM's exercise for older adults* (pp. 15 - 30). Baltimore, MD: Lippincott Williams & Wilkins.

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*, 1149-1160.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*, 175-191.

Fernandez, B. ., Montenegro, E. ., Knoll, N., & Schwarzer, R. (2014). Self-Efficacy, action control, and social support explain physical activity changes among Costa Rican older adults. *Journal of Physical Activity & Health*, *11*(8), 1573–1578.

Fielding, R. A., Rejeski, W. J., Blair, S., Church, T., Espeland, M. A., Gill, T. M., … Pahor, M. (2011). The Lifestyle Interventions and Independence for Elders Study: Design and methods. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *66A*(11), 1226–1237. http://doi.org/10.1093/gerona/glr123

Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2011). *Applied longitudinal analysis*. Hoboken, N.J.: Wiley-Interscience.

Frank, J. C., Coviak, C. P., Healy, T. C., Belza, B., & Casado, B. L. (2008). Addressing fidelity in evidence-based health promotion programs for older adults. *Journal of Applied Gerontology*, *27*(1), 4–33. http://doi.org/10.1177/0733464807308621

Frias, C. M. de, & Whyne, E. (2015). Stress on health-related quality of life in older adults: The protective nature of mindfulness. *Aging & Mental Health*, *19*(3), 201–206. http://doi.org/10.1080/13607863.2014.924090

Friedman, S. L. (2007). Finding treasure: Data sharing and secondary analysis in developmental science. *Journal of Applied Developmental Psychology*, *28*(5–6), 384–389. doi:10.1016/j.appdev.2007.07.001

Gallagher, N.A., Clarke, P.J., Ronis, D.L., Cherry, C.L., Nyquist, L., & Gretebeck, K.A. (2012). Influences on neighborhood walking in older adults. *Research in Gerontological Nursing, 5*(4), 238-250.

Gallegos-Carrillo, K., Mudgal, J., Anchez-García, S. S., Wagner, F. A., Gallo, J. J., Salmerón, J., & Ia-Peña, C. G. (2009). Social networks and health-related quality of life: A population based study among older adults. *Salud Pública De México*, *51*(1), 6–13.

Garratt, A. M., Ruta, D. A., Abdalla, M. I., & Russell, I. T. (1996). Responsiveness of the SF-36 and a condition-specific measure of health for patients with varicose veins. *Quality of Life Research, 5*(2), 223-234.

Gerber, E. J. (2012). *The relations of social support and perceived stress to health-related quality of life in older adults*. Baltimore, MD: University of Maryland.

Ginis, K. A. M., Jung, M. E., Brawley, L. R., Latimer, A. E., Hicks, A. L., Shields, C. A., & McCartney, N. (2006). The effects of physical activity enjoyment on sedentary older adults' physical activity attitudes and intentions1. *Journal of Applied Biobehavioral Research*, *11*(1), 29–43. http://doi.org/10.1111/j.1751-9861.2006.tb00018.x

Glanz, K., Rimer, B. K., & Viswanath, K. (2008). *Health behavior and health education: Theory, research, and practice*. San Francisco, CA: Jossey-Bass.

Gray, J., Kim, J., Ciesla, J. R., & Yao, P. (2014). Rasch Analysis of the Lubben Social Network Scale–6 (LSNS-6). *Journal of Applied Gerontology*. http://doi.org/10.1177/0733464814560468

Groessl, E. J., Kaplan, R. M., Rejeski, W. J., Katula, J. A., King, A. C., Frierson, G., … Pahor, M. (2007). Health-related quality of life in older adults at risk for disability. *American Journal of Preventive Medicine*, *33*(3), 214–218. http://doi.org/10.1016/j.amepre.2007.04.031

Hageman, P. A., Pullen, C. H., Hertzog, M., & Boeckner, L. S. (2014). Effectiveness of tailored lifestyle interventions, using web-based and print-mail, for reducing blood pressure among rural women with prehypertension: Main results of the Wellness for Women: DASHing towards health clinical trial. *The International Journal of Behavioral Nutrition and Physical Activity*, *11*, 148. doi:10.1186/s12966-014-0148-2

Hamer, M. (2012). Psychosocial stress and cardiovascular disease risk: The role of physical activity. *Psychosomatic Medicine*, *74*(9), 896–903. http://doi.org/10.1097/PSY.0b013e31827457f4

Harber, K. D., Schneider, J. K., Everard, K. M., & Fisher, E. B. (2005). Directive support, nondirective support, and morale. *Journal of Social & Clinical Psychology*, *24*(5), 691–722.

Holt, E. W., Muntner, P., Joyce, C. J., Webber, L., & Krousel-Wood, M. A. (2010). Health-related quality of life and antihypertensive medication adherence among older adults. *Age and Ageing*, *39*, 481-487.

Horner, S. D. (2012). Best practices for improving intervention fidelity that every nurse should know. *Journal for Specialists in Pediatric Nursing*, *17*(2), 171–174. http://doi.org/10.1111/j.1744-6155.2012.00327.x

Hu, J. (2007). Health-related quality of life in low-income older African Americans. *Journal of Community Health Nursing*, *24*(4), 253–265. http://doi.org/10.1080/07370010701645901

Hu, J., Gruber, K. J., & Hsueh, K.-H. (2010). Psychometric properties of the Chinese version of the SF-36 in older adults with diabetes in Beijing, China. *Diabetes Research and Clinical Practice, 88*, 273-281.

Hulley, S. B., Cummings, S. R., Browner, W. S., Grady, D. G., & Newman, T. B. (2013). *Designing clinical research* (4th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.

Ip, E. H., Church, T., Marshall, S. A., Zhang, Q., Marsh, A. P., Guralnik, J., . . . Rejeski, W. J. (2013). Physical activity increases gains in and prevents loss of physical function: Results from the lifestyle interventions and independence for elders pilot study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *68*(4), 426–432. http://doi.org/10.1093/gerona/gls186

Jackson, J., Carlson, M., Mandel, D., Zemke, R., & Clark, F. (1998). Occupation in lifestyle resign: The Well Elderly Study occupational therapy program. *The American Journal of Occupational Therapy*, *52*(5), 326-336.

Jackson, J., Mandel, D., Blanchard, j., Carlson, M., Cherry, B., Azen, S., . . . Clark, F. (2009). Confronting challenges in intervention research with ethnically diverse older adults: The USC Well Elderly II Trial. *Clinical Trials, 6*, 90-101.

Kachan, D., Tannenbaum, S. L., Olano, H. A., LeBlanc, W. G., McClure, L. A., & Lee, D. J. (2014). Geographical variation in health-related quality of life among older US adults, 1997–2010. *Preventing Chronic Disease*, *11*. http://doi.org/10.5888/pcd11.140023

Kaplan, R. ., Chambers, D. ., & Glasgow, R. (2014). Big data and large sample size: A cautionary note on the potential for bias. *Clinical and Translational Science*, *7*(4), 342–346.

Kay, S. J., & Fiatarone Singh, M. A. (2006). The influence of physical activity on abdominal fat: A systematic review of the literature. *Obesity Reviews*, *7*(2), 183–200. http://doi.org/10.1111/j.1467-789X.2006.00250.x

Keyes, C. L., Michalec, B., Kobau, R., Zahran, H., Zack, M. M., Simoes, E. J. (2005). Social support and health-related quality of life among older adults: Missouri, 2000. *MMWR*, *54*(17), 433-437. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5417a4.htm

Kivimaki, M., Leino-Arjas, P., Luukkonen, R., Riihimaki, H., Vahtera, j., & Kirjonen, J. (2002). Work stress and risk of cardiovascular mortality: Prospective cohort study of industrial employees. *British Medical Journal*, *325*(7369), 857 - 860.

Klumb, P. L., & Maier, H. (2007). Daily activities and survival at older ages. *Journal of Aging and Health*, *19*(4), 594–611. doi:10.1177/0898264307301167

Kochanek, K. D., Xu, J., Murphy, S. L., Miniño, A. M., & Kung, H.-C. (2011). Deaths: Final data for 2009. *National Vital Statistics Reports, 60* (3), 7-13

Kulmala, J., von Bonsdorff, M.B., Stenholm, S., Tormakangas, T., von Bonsdorff, M.E., Nygard, C.H., . . . Rantanen, T. (2013). Perceived stress symptoms in midlife predict disability in old age: A 28-year prospective cohort study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences, 68,* 984-991. doi:10.1093/gerona/gls339

Kwag, K.H. , Martin P, Russell D, Franke W, & Kohut M. (2011). The impact of perceived stress, social support, and home-based physical activity on mental health among older adults. *International Journal of Aging & Human Development*, *72*(2), 137–54.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York, NY: Springer Pub. Co.

Lee, L. L., Avis, M., & Arthur, A. (2007). The role of self-efficacy in older people's decisions to initiate and maintain regular walking as exercise: Findings from a qualitative study. *Preventive Medicine, 45*, 62-65.

Li, W.-W., Stewart, A.L., Stotts, N., & Froelicher, E.S. (2006). Cultural factors associated with antihypertensive medication adherence in Chinese immigrants. *Journal of Cardiovascular Nursing*, *21*(5), 354-362.

Liu, C. K., Leng, X., Hsu, F.-C., Kritchevsky, S. B., Ding, J., Earnest, C. P., . . . Fielding, R. A. (2013). The impact of sarcopenia on a physical activity intervention: The lifestyle interventions and independence for elders pilot study (LIFE-P). *The Journal of Nutrition, Health & Aging*, *18*(1), 59–64. http://doi.org/10.1007/s12603-013-0369-0

Lubben, J. E. (1988). Assessing social networks among elderly population. *Family Community Health*, 11, 42–52.

Lubben, J., Blozik, E., Gillmann, G., Iliffe, S., Kruse, W. von R., Beck, J. C., & Stuck, A. E. (2006). Performance of an Abbreviated Version of the Lubben Social Network Scale Among Three European Community-Dwelling Older Adult Populations. *The Gerontologist*, *46*(4), 503–513. http://doi.org/10.1093/geront/46.4.503

Lyons, R. A., Perry, H. M., & Littlepage, B. N. C. (1994). Evidence for the validity of the short-form 36 questionnaire(SF-36) in an elderly population. *Age and Aging, 23*, 182-184.

Marsh, A. P., Lovato, L. C., Glynn, N. W., Kennedy, K., Castro, C., Domanchuk, K., … Guralnik, J. M. (2013). Lifestyle interventions and independence for elders study: Recruitment and baseline characteristics. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *68*(12), 1549–1558. http://doi.org/10.1093/gerona/glt064

Matthews, C. E., Chen, K. Y., Freedson, P. S., Buchowski, M. S., Beech, B. M., Pate, R. R., & Troiano, R. P. (2008). Amount of time spent in sedentary behaviors in the United States, 2003–2004. *American Journal of Epidemiology*, *167*(7), 875–881. http://doi.org/10.1093/aje/kwm390

Matthews, C. E., George, S. M., Moore, S. C., Bowles, H. R., Blair, A., Park, Y., … Schatzkin, A. (2012). Amount of time spent in sedentary behaviors and cause-specific mortality in US adults. *The American Journal of Clinical Nutrition*, *95*(2), 437–445. http://doi.org/10.3945/ajcn.111.019620

Matthews, M. M., Hsu, F.-C., Walkup, M. P., Barry, L. C., Patel, K. V., & Blair, S. N. (2011). Depressive symptoms and physical performance in the lifestyle interventions and independence for elders pilot study. *Journal of the American Geriatrics Society*, *59*(3), 495–500. http://doi.org/10.1111/j.1532-5415.2011.03319.x

McAlister, A. L., Perry, C. L., & Parcel, G. S. (2008). How individuals, environments, and health behaviors interact: Social cognitive theory. In Glanz K, Rimer BK, Viswanath K, (Eds.), *Health behavior and health education: Theory, research, and practice* (pp. 167-188). San Francisco: Jossey-Bass.

McEwen, B. S. (2007). Physiology and neurobiology of stress and adaptation: central role of the brain. *Physiological Reviews*, *87*(3), 873–904. http://doi.org/10.1152/physrev.00041.2006

McVicar, A., Ravalier, J. M., & Greenwood, C. (2014). Biology of stress revisited: Intracellular mechanisms and the conceptualization of stress. *Stress and Health*, *30*(4), 272–279. http://doi.org/10.1002/smi.2508

Molloy, G. J., Dixon, D., Hamer, M., & Sniehotta, F. F. (2010). Social support and regular physical activity: Does planning mediate this link? *British Journal of Health Psychology*, *15*(4), 859–870. http://doi.org/10.1348/135910710X490406

Moreno-John, G., Gachie, A., Fleming, C. M., Napoles-Springer, A., Mutran, E., Manson, S. M., & Perez-Stable, E. J. (2004). Ethnic minority older adults participating in clinical research: Developing trust. *Journal of Aging and Health*, *16*(Suppl. 5), 93S-123S. doi:10.1177/0898264304268151

Moriarty, D. G., Zack, M. M., Kobau, R. (2003). The Centers for Disease Control and Prevention's healthy days measures: Population tracking of perceived physical and mental health over time. *Health Quality of Life Outcomes, 1,* 37-45.

National Institute of Mental Health. (2015). Fact sheet on stress. Retrieved from http://www.nimh.nih.gov/health/publications/stress/index.shtml

National Research Council of the National Academies. (2010). *The prevention and treatment of missing data in clinical trials.* Washington, D.C.: The National Academies Press.

Neff, J. A. (2011). Maximizing treatment fidelity in public health clinical trials. *Journal of Public Health Dentistry*, *71*, S66–S66. http://doi.org/10.1111/j.1752-7325.2011.00226.x

Nezu, A. M., Nezu, C. M., Geller, P. A., & Weiner, I. B. (2013). *Health psychology*. Hoboken, NJ: John Wiley & Sons.

Office of Disease Prevention and Health Promotion. (2008). Physical activity guidelines for Americans. Retrieved from http://www.health.gov/paguidelines/pdf/paguide.pdf

Office of Disease Prevention and Health Promotion. (2013). Healthy People 2020: Nutrition, physical activity, and obesity. Retrieved from http://www.healthypeople.gov/2020/leading-health-indicators/2020-lhi-topics/Nutrition-Physical-Activity-and-Obesity/data?tab=data

Office of Disease Prevention and Health Promotion. (2015a). Healthy People 2020: Health-related quality of life and well-being. Retrieved from https://www.healthypeople.gov/2020/about/foundation-health-measures/Health-Related-Quality-of-Life-and-Well-Being

Office of Disease Prevention and Health Promotion. (2015b). Healthy People 2020: Physical activity. Retrieved from https://www.healthypeople.gov/2020/topics-objectives/topic/physical-activity/objectives

Olander, E. K., Fletcher, H., Williams, S., Atkinson, L., Turner, A., & French, D. P. (2013). What are the most effective techniques in changing obese individuals' physical activity self-efficacy and behaviour: A systematic review and meta-analysis. *International Journal of Behavioral Nutrition & Physical Activity*, *10*(1), 29–43. doi:10.1186/1479-5868-10-29

Orsega-Smith, E. M., Payne, L. L., Mowen, A. J., Ho, C.-H., & Godbey, G. C. (2007). The role of social support and self-efficacy in shaping the leisure time physical activity of older adults. *Journal of Leisure Research*, *39*(4), 705–727.

Pahor M., Guralnik, J. M., Ambrosius, W. T., Blair, S.; Bonds, D. E., Church, T. S., . . . Williamson, J. D. (2014). Effect of structured physical activity on prevention of major mobility disability in older adults: The LIFE study randomized clinical trial. *JAMA*, *311*(23), 2387–2396. http://doi.org/10.1001/jama.2014.5616

Park, H., Togo, F., Watanabe, E., Yasunaga, A., Park, S., Shephard, R. J., & Aoyagi, Y. (2006). Relationship of bone health to yearlong physical activity in older Japanese adults: Cross-sectional data from the Nakanojo Study. *Osteoporosis International*, *18*(3), 285–293. http://doi.org/10.1007/s00198-006-0237-4

Paukert, A. L., Pettit, J. W., Kunik, M. E., Wilson, N., Novy, D. M., Rhoades, H. M., … Stanley, M. A. (2010). The roles of social support and self-efficacy in physical health's impact on depressive and anxiety symptoms in older adults. *Journal of Clinical Psychology in Medical Settings*, *17*(4), 387–400. http://doi.org/10.1007/s10880-010-9211-6

Picarsic, J. L., Glynn, N. W., Taylor, C. A., Katula, J. A., Goldman, S. E., Studenski, S. A., & Newman, A. B. (2008). Self-reported napping and duration and quality of sleep in the Lifestyle Interventions and Independence for Elders Pilot Study. *Journal of the American Geriatrics Society*, *56*(9), 1674–1680. http://doi.org/10.1111/j.1532-5415.2008.01838.x

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. doi:10.1111/j.1464-0597.2008.00344.x

Polit, D. F. (2010). *Statistics and data analysis for nursing research* (2nd ed.). Upper Saddle River, NJ: Pearson Education Inc.

Polit, D. F., & Beck, C. T. (2012). *Nursing research: Generating and assessing evidence for nursing practice* (9th ed.). New York: Lippincott Williams & Wilkins.

Rahl, R. L. (2010). *Physical activity and health guidelines: Recommendations for various ages, fitness levels, and conditions from 57 authoritative sources*. Champaign, IL: Human Kinetics.

Rejeski, W. J., Fielding, R. A., Blair, S. N., Guralnik, J. M., Gill, T. M., Hadley, E. C., … Pahor, M. (2005). The lifestyle interventions and independence for elders (LIFE) pilot study: Design and methods. *Contemporary Clinical Trials*, *26*(2), 141–154. http://doi.org/10.1016/j.cct.2004.12.005

Rejeski, W. J., Mihalko, S. L., Ambrosius, W. T., Bearon, L. B., & McClelland, J. W. (2011). Weight loss and self-regulatory eating efficacy in older adults: The cooperative lifestyle intervention program. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *66B*(3), 279–286. http://doi.org/10.1093/geronb/gbq104

Rimmele, U., Seiler, R., Marti, B., Wirtz, P. H., Ehlert, U., & Heinrichs, M. (2009). The level of physical activity affects adrenal and cardiovascular reactivity to psychosocial stress. *Psychoneuroendocrinology*, *34*(2), 190–198. http://doi.org/10.1016/j.psyneuen.2008.08.023

Rippe, J. M. (2013). *Lifestyle Medicine* (2nd ed.). London, GBR: CRC 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. doi:10.1207/S15324796ABM2402_12

Rueggeberg, R., Wrosch, C., & Miller, G. E. (2012). The different roles of perceived stress in the association between older adults' physical activity and physical health. *Health Psychology*, *31*(2), 164–171. http://doi.org/10.1037/a0025242

Sandi, C. (2004). Stress, cognitive impairment and cell adhesion molecules. *Nature Reviews Neuroscience*, *5*(12), 1–14. http://doi.org/10.1038/nrn1555

Sasidharan, V., Payne, L., Orsega-Smith, E., & Godbey, G. (2006). Older adults' physical activity participation and perceptions of wellbeing: Examining the role of social support for leisure. *Managing Leisure*, *11*(3), 164–185. http://doi.org/10.1080/13606710600715242

Schetter, C. D., & Dolbier, C. (2011). Resilience in the context of chronic stress and health in adults. *Social & Personality Psychology Compass*, *5*(9), 634–652. http://doi.org/10.1111/j.1751-9004.2011.00379.x

Sherman, A. M., Shumaker, S. A., Rejeski, W. J., Morgan, T., Applegate, W. B., & Ettinger, W. (2006). Social support, social integration, and health-related quality of life over time: Results from the Fitness and Arthritis in Seniors Trial (FAST). *Psychology & Health*, *21*(4), 463–480. http://doi.org/10.1080/14768320500380881

Shumway-Cook, A., Ciol, M. A., Yorkston, K. M., Hoffman, J. M., & Chan, L. (2005). Mobility limitations in the medicare population: Prevalence and sociodemographic and clinical correlates. *Journal of the American Geriatrics Society*, *53*(7), 1217–1221. http://doi.org/10.1111/j.1532-5415.2005.53372.x

Shyu, Y.-I. L., Lu, J.-F. R., & Chen, S.-T. (2008). Psychometric testing of the SF-36 Taiwan version on older stroke patients. *Journal of Clinical Nursing, 18*, 1451-1459.

Sidani, A., & Braden, C. J. (2011). *Design, evaluation, and translation of nursing interventions*. Summerset, NJ: John-Wiley and Sons.

Simons-Morton, B., McLeroy, K. R., & Wendel, M. L. (2012). *Behavior theory in health promotion practice and research*. Burlington, MA: Jones and Bartlett Learning.

Skarupski, K. A., de Leon, C.F. , Bienias, J. L., Scherr, P. A., Zack, M. M., Moriarty, D. G., & Evans, D. A. (2007). Black-white differences in health-related quality of life among older adults. *Quality of Life Research : An International Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*, *16*(2), 287–96.

Smedley, B. D., Stith, A. Y., & Nelson, A. R. (2004). *Unequal treatment: Confronting racial and ethnic disparities in healthcare*. Washington, DC: The National Academic press.

Stahl, S. M., & Vasquez, L. (2004). Approaches to improving recruitment and retention of minority elders participating in research: Examples from selected research groups including the National Institute on Aging's Resource Centers for minority aging research. *Journal of Aging and Health, 16*(Suppl. 5), 9S-17S. doi:10.1177/0898264304268146

Stults-Kolehmainen, M. A., & Sinha, R. (2014). The effects of stress on physical activity and exercise. *Sports Medicine*, *44*(1), 81–121. http://doi.org/10.1007/s40279-013-0090-5

Taylor, A. H., Cable, N. T., Faulkner, G., Hillsdon, M., Narici, M., & Bij, A. V. D. (2004). Physical activity and older adults: a review of health benefits and the effectiveness of interventions. *Journal of Sports Sciences, 22*(8), 703–725. http://doi.org/10.1080/02640410410001712421

Taylor, V. M., Cripe, S.M., Acorda, E., The, C., Coronado, G., Do, H., . . . Hislop, G. (2008). Development of an ESL curriculum to educate Chinese immigrants about physical activity. *Journal of Immigrant Minority Health, 10*, 379-387.

Taylor-Piliae, R. E., Fair, J.M., Haskell, W.L., Varady, A. N., Iribarren, C., Hlatky, M., … Fortmann, S. P. (2010). Validation of the Stanford Brief Activity Survey: Examining psychological factors and physical activity levels in older adults. *Journal of Physical Activity and Health*, *7*, 87-94.

Teri, L., McCurry, S. M., Logsdon, R. G., Gibbons, L. E., Buchner, D. M., & Larson, E. B. (2011). A randomized controlled clinical trial of the Seattle protocol for activity in older adults. *Journal of the American Geriatrics Society*, *59*(7), 1188–1196. http://doi.org/10.1111/j.1532-5415.2011.03454.x

The National Institute on Aging. (2011). *Exercise & physical activity*. Bethesda, MD: National Institutes of Health.

Thompson, W. W., Zack, M. M., Krahn, G. L., Andresen, E. M., & Barile, J. P. (2012). Health-related quality of life among older adults with and without functional limitations. *American Journal of Public Health*, *102*(3), 496–502. http://doi.org/10.2105/AJPH.2011.300500

Trzesniewski, K. H., Donnellan, M. B., Lucas, R. E., & American Psychological Association. (2011). *Secondary data analysis: An introduction for psychologists*. Washington, DC: American Psychological Association.

Umstattd, M. R., & Hallam, J. (2007). Older adults' exercise behavior: Roles of selected constructs of social cognitive theory. *Journal of aging and physical activity, 15*(2), 206-218.

U.S. Census Bureau. (2014). An aging nation: The older population in the United States. Retrieved from http://www.census.gov/prod/2014pubs/p25-1140.pdf

Vitlic, A., Lord, J. M., & Phillips, A. C. (2014). Stress, ageing and their influence on functional, cellular and molecular aspects of the immune system. *AGE*, *36*(3), 1169–1185. http://doi.org/10.1007/s11357-014-9631-6

Walters, S. J., Munro, J. F., & Brazier, J. E. (2001). Using the SF-36 with older adults: A cross-sectional community-based survey. *Age and Ageing, 30,* 337–343. doi:10.1093/ageing/30.4.337

Ware, J. E. (2013). Construction of the SF-36. *SF-36 Health Survey Update*. Retrieved from http://www.sf-36.org/tools/SF36.shtml

Ware, J. E., Kosinski, M., & Keler, S. D. (1994). *SF-36 physical and mental health summary scales: A user's manual.* Boston, MA: The Health Institute.

Ware, J. E., & Sherbourne, C. D. (1992). The MOS 36-item short form health survey (SF-36): Conceptual framework and item selection. *Medical Care, 30*(6), 473-483.

Warner, L. M., Ziegelmann, J. P., Schüz, B., Wurm, S., & Schwarzer, R. (2011). Synergistic effect of social support and self-efficacy on physical exercise in older adults. *Journal of Aging and Physical Activity*, *19*(3), 249–261.

Webb, M., & Beckstead, J.W. (2002). Stress-related influences on blood pressure in African American Women. *Research in Nursing & Health, 25*, 383-393.

Wellman, N.S., Kamp, B., Kirk-Sanchez, N.J., & Johnson, P.M. (2007). Eat better and move more: A community-based program designed to improve diets and increase physical activity among older Americans. *American Journal of Public Health, 97*(4), 710-717.

White, S. M., Wójcicki, T. R., & McAuley, E. (2012). Social cognitive influences on physical activity behavior in middle-aged and older adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *67B*(1), 18–26. doi:10.1093/geronb/gbr064

Williamson, J. D., Espeland, M., Kritchevsky, S. B., Newman, A. B., King, A. C., Pahor, M., . . . Miller, M. E. (2009). Changes in cognitive function in a randomized trial of physical activity: Results of the lifestyle interventions and independence for elders pilot study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *64A*(6), 688–694. http://doi.org/10.1093/gerona/glp014

World Health Organization (2005). The World Health Organization Quality of Life Assessment (WHOQOL): Position paper from the World Health Organization. *Social Science & Medicine, 41*(10),1403–1409.

World Health Organization (2015). Definition of an older or elderly person. Retrieved from http://www.who.int/healthinfo/survey/ageingdefnolder/en/

Wu, B., Chi, I., Plassman, B.L., & Guo, M. (2010). Depressive symptoms and health problems among Chinese immigrant elders in the US and Chinese elders in China. *Aging & Mental Health*, *14*(6), 695-704.

Yang, Z., Li, W., Tu, X., Tang, W., Mssing, S., Duan, L., & Pan, J. (2012). Validation and psychometric properties of the Chinese version of SF-36 in patients with hypertension, coronary heart diseases, chronic gastritis and peptic ulcer. *The International Journal of Clinical Practice*, *66*(10), 991-998.

Yorston, L. C., Kolt, G. S., & Rosenkranz, R. R. (2012). Physical activity and physical function in older adults: The 45 and Up Study. *Journal of the American Geriatrics Society*, *60*(4), 719–725. http://doi.org/10.1111/j.1532-5415.2012.03906.x

Yoshiuchi, K., Inada, S., Nakahara, R., Akabayashi, A., Park, H., Park, S., . . . Aoyagi, Y. (2010). Stressful life events and habitual physical activity in older adults: 1-year accelerometer data from the Nakanojo Study. *Mental Health and Physical Activity*, *3*(1), 23–25. http://doi.org/10.1016/j.mhpa.2010.02.001

Yu, J., & Tang, Y.-Y. (2013). Reliability, validity, and responsiveness of the short form 36 (SF – 36) health survey questionnaire in patients with Graves' disease. *Asian Biomedicine*, *7*(3), 391-397.