# An Evaluation of Physical Activity Surveys

# in a Multi-ethnic Sample of Mid-life Women

by

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ABSTRACT

The health enhancing effects of physical activity are well documented in the literature. However, women continue to report lower participation in exercise and physical activity (PA) compared to men. As women age an overall trend in decreased activity is observed. The primary place of activity reported in women is the home and one of the most commonly reported reasons for lack of physical activity is the lack of time. Few instruments have been developed that focus on the activity patterns of women. The Cross Cultural Physical Activity Study that this study was based on targeted women of color to assess the types of activity and constraints to activity experienced by African American and Native American women over 40 years old. This secondary data analysis focused on the psychometric properties of two scales used in the above study, The Physical Recreation Questionnaire (PRQ) and The Typical Week Physical Activity Survey (TWPAS).

An exploratory factor analysis (EFA) was conducted on the 18 items from the Physical Recreation Questionnaire (PRQ) which focused on constraints to PA. The results of the EFA were a poor fit of a two factor model. The three factor model had a favorable fit in the EFA.  Confirmatory factor analysis (CFA) was then conducted on the 18 items in the PRQ. Results of the CFA supported the presence of three latent variables: enjoyment of PA, constraints to PA, and negotiation of constraints to PA.

The Typical Week Physical Activity Survey (TWPAS) is a 35 item measure of moderate PA that includes the activities most often reported by women. The purpose of the TWPAS was to capture habitual PA that might not be recorded in other PA questionnaires. The TWPAS was correlated with criterion measures of PA records, treadmill, accelerometer, and BMI. Although correlations were small, they were in the expected direction with the criterion measures. The evaluation of the instruments supported the presence of the construct of constraints to PA in the PRQ and the measurement of moderate intensity PA in the TWPAS.

DEDICATION

To my mother and father who embody the ethic of care and unconditional love.

## ACKNOWLEDGMENTS

Thank you Dr. Ainsworth for serving as my committee chair and for giving your time to mentor me in exercise science and public health. My thinking about physical activity and health has been transformed and I will always be grateful. Thank you for your wisdom, patience, and willingness to participate in this interdisciplinary project.

Thank you Dr. Komnenich and Dr. Belyea for serving on my committee. Dr. Komnenich your persistent nudge kept me on task and focused on the goal. Dr. Belyea you taught me to never be afraid of new challenges in theory or statistics and gave me a true appreciation for all things SAS. Thank you both for inspiring me to work smarter and never give up.

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## Chapter 1

## INTRODUCTION

The evidence for benefits from regular moderate-to-vigorous-intensity physical activity (PA) is well documented in the literature (U. S. Department of Health and Human Services, 1996). Yet there are many Americans who remain inactive and who are not meeting the PA recommendations for moderate to vigorous-intensity activity. The 2009 National Health Interview Survey (NHIS) found 55% of all adults reported that they never participated in 10 minutes or more of vigorous intensity PA (Vital & Health Statistics, 2010). Sixty percent of women in the same survey reported that they had no vigorous activity in a week (Vital & Health Statistics, 2010). This is consistent with the Behavioral Risk Surveillance Survey (BRSS) PA prevalence in which women over age 65 reported a greater decline in PA compared to men (35.9% vs. 44.0%; Centers for Disease Control and Prevention, 2008).

Various factors influence PA preferences, participation, and enjoyment (Jackson, 2000). Historically women report less PA than men and women and sociocultural factors such as family support impact PA behavior (Brownson, Eyler, King et al., 2000; Crespo, Smit, Andersen, Carter-Pokras, & Ainsworth, 2000; USDHHS, 2010; Sternfeld, Ainsworth, & Quesenberry, 1999). Gender-specific PA patterns in relationship to the public health PA recommendations are the focus of this dissertation.

## Background and Significance

Increasing PA participation is one of the most beneficial health promotion efforts that can be made. Regular moderate-to-vigorous PA is inversely related to coronary heart disease (Morris, 1994), diabetes (Helmrich et al., 1991; Knowler et al., 2002), some types of cancer (Lee, 2003; Thune & Furberg, 2001), and hypertension (Paffenbarger et al., 1993). Powell and Blair (1994) argued that the evidence for PA is so strong that if 50% of the population increased activity to meet the PA guidelines of at least 30 minutes of moderate-to-vigorous intensity activity an estimated reduction of 30,000-35,000 deaths per year is possible. Based upon the evidence for the health enhancing effects of PA the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM) recommend that adults participate in at least moderate-intensity PA for 30 minutes/day for a total of 150 minutes per week or vigorous intensity PA for 20 minutes/ day for a total of 120 minutes per week (Haskell, et al., 2007a, b; US Department of Health & Human Services, 2008).

Moderate-intensity PA in women was assessed in the Cross Cultural Physical Activity Participation Study (CAPS) conducted from 1995 to 2000 with Native American (NA) women in Albuquerque, New Mexico and African American (AA) women in the greater Columbia, SC area. PA questionnaires at the time of the CAPS did not capture moderate-intensity PA (Kriska & Caspersen, 1997; Masse, et al, 1998) such as household, occupational, and gardening activities. The CAPS was one of the first studies to use the CDC and ACSM recommendation for light (<3 METs), moderate (3-6 METs), and vigorous intensity PA (>6 METs) with women (Pate et al., 1995).

**Purpose Statement**

The purpose of this dissertation was to evaluate PA questionnaires developed specifically for women in AA and NA communities. The research questions for this study were:

1. To what extent does the Physical Recreation Questionnaire (PRQ) identify the constructs of constraint and negotiation of constraint to PA in the CAPS participants?
2. To what extent does the Typical Week Physical Activity Survey (TWPAS) reflect the concept of moderate-intensity PA?

The specific aims and hypothesis refine the research questions and clarify the direction of this study.

**Specific Aim 1.** To examine the underlying structure of the PRQ in an exploratory factor analysis.

Hypothesis 1: When analyzed in an exploratory factor analysis the underlying factor structure of the PRQ supports two factors.

**Specific Aim 2.** To test the hypothesis of two latent variables in the PRQ with a confirmatory factor analysis.

Hypothesis 2: When tested in a confirmatory factor analysis the PRQ supports the latent variables of constraint and negotiation of constraint to PA.

**Specific Aim 3**. To examine the TWPAS with a categorical exploratory factor analysis.

Hypothesis 3: When analyzed in an exploratory factor analysis the TWPAS supports three factors.

**Specific Aim 4.** To determine the efficacy of the TWPAS for moderate-intensity PA assessment through correlations of PA reported in the TWPAS with objective and subjective measures of PA from CAPS Phase 2.

Hypothesis 4: Scores for moderate-intensity PA on the TWPAS will correlate with objective- and subjective measures of PA in the CAPS Phase 2.

## Conceptual Framework

**Feminist perspectives.** The assumption that women's leisure activity and PA participation was different from men's leisure and PA participation (Ainsworth, 2000a; Ainsworth, 200b; Deem, 1982) provided a frame of reference for exploring the instruments used in the CAPS. The authors of the CAPS surveys regarded structured gender roles in society as a primary influence upon women's constraints to leisure (Shaw, 1985) and proposed that women's position in society impacted their participation in leisure and PA (Deem, 1982). Feminist approaches to research place women at the center and acknowledge the conditions that devalue the experiences of women (Sigsworth, 1995). The CAPS surveys sought to validate women's experiences recognizing that many women did not formally leave their places of work to participate in leisure activity or PA (Henderson, Bialeschki, Shaw, & Freysinger, 1989). Factors such as gender, social class, family situation, and employment were understood as influential in women's PA participation both outside and inside the home. Women's perceptions of PA were central in the development of the CAPS surveys (Henderson, Ainsworth, Bialeschki, & Hardy, 1995).

## Concepts

**Constraints.** Constraints were defined as anything that inhibits a person's ability to participate in (PA) leisure activities (Henderson, Bialechski, Shaw, & Freysinger, 1996). Some feminist researchers asserted that the study of women's leisure was the study of constraints (Henderson, 1994, p. 5; Deem, 1982). Although a variety of constraint models were developed to explore and articulate constraints as limitations to any activity (Jackson, 1988), some models were developed specifically for women to assessed hindrances to participation in leisure time PA (Henderson & Bialechski, 1993). A constraints approach to PA participation was valuable because it investigated components of life that might be adapted in order to participate in enjoyable PA (Jackson, 2000).

**Moderate-intensity PA**. The concept of moderate intensity PA was the basis of the Typical Week Physical Activity Survey (TWYPAS). At the time that the CAPS was conducted the term moderate-intensity PA was not consistently used in public health settings (Pate et al., 1995). The women in the CAPS disclosed perceptions of leisure time PA as sports or structured recreational activities as opposed to any moderate-intensity activity such as walking (Henderson & Ainsworth, 2003; Tudor-Locke et al., 2003). Women's perceptions of PA are relevant because less than 25% of the women in the CAPS reported participation in conditioning or sport activities, the traditional indicators of PA in surveys (Ainsworth, Irwin, Addy, Whitt, & Stolarczyk, 1999). The PA reported in the CAPS was primarily home related activity (95%).

## Significance for Nursing

The health enhancing effects of PA and the promotion of PA for health is consistent with nursing's commitment to disease prevention and optimal wellness. Health promotion through exercise and PA was found in the nursing literature as early as the 1900's (Breeze, 1909; Speck, 2002). Exercise and sports were stressed as health promoting behaviors that were enthusiastically embraced in many nursing specialties (Schmelling, 1985). Activities such as swimming, dancing, and sports were a cornerstone of school nursing for most of the last century (Speck, 2002). Although exercise was valued in nursing practice and research, the concept of moderate- intensity PA within many domains of movement (Casperson, et al., 1985) was a scientific paradigm shift that was gradually disseminated in nursing research and practice (Speck, 2002). Promotion of PA beyond exercise or structured sports is part of a holistic schema to contextualize chronic disease prevention in distinct environments.

**Definitions**

1. Basal metabolic rate: The number of kilocalories (kcal) the body needs to function while at rest (Ravussin & Bogardus, 1992).

2. Constraint: Factors that limit the formation of leisure preferences and inhibit or prohibit participation and enjoyment in leisure (Jackson, 1991, p. 279).

3. Domain: PA classification that reflects the type of activity.

4. Duration: The dimension of PA behavior referring to the time spent performing an activity.

5. Energy expenditure: The exchange of energy used to perform biological work including basal metabolic rate, the thermic effect of food, and PA (Ravussin & Bogardus, 1992).

6. Exercise: Planned, structured, and repetitive body movement performed to improve or maintain one or more components of physical fitness (Caspersen, Powell, & Christensen, 1985).

7. Frequency: The dimension of physical activity referring to how often an activity is performed often expressed over a time frame such as how many times per week.

8. Intensity: The dimension of PA referring to the level of effort or physiological demand required. Explains how hard the activity is to perform.

9. Kilocalories (kcal): Used to express the energy extended during PA and is often expressed as caloric expenditure over time such as kcal/week.

10. Leisure: Activity that is not required as essential activities of daily living and is performed at the discretion of the individual (Bammel & Burrus-Bammel, 1992).

11. Lifestyle PA: the daily accumulation of at least 30 minutes of self-scheduled activities which includes all leisure, occupational, or household activities that are at least moderate to vigorous in their intensity and could be planned or unplanned activities that are part of everyday life (Dunn, et al, 1998).

12. Metabolic Equivalent (MET): A unit used to estimate the metabolic cost (oxygen consumption) of PA. One MET is defined as the activity metabolic rate divided by the resting metabolic rate. It also represents resting energy expenditure and is roughly equivalent to 1 kilocalorie per kilogram body weight per hour (1 kcal/kg/ hour) (Taylor, Jacobs, & Schucker, et al., 1978)

13. Mode: The dimension of PA that identifies the specific type of activity performed.

14. Physical Activity (PA): Any bodily movement produced by skeletal muscles resulting in increased energy expenditure (Caspersen, Powell, & Christensen, 1985).

15. Physical fitness: A set of attributes that relate to the ability to perform PA such as muscle fitness, cardiorespiratory fitness, and flexibility.

# Chapter 2

## LITERATURE REVIEW

This chapter provides an overview of the core literature in PA and health promotion that comprised the background for the development of the TWPAS. The literature review begins with a discussion of the measurement of PA and the health enhancing effects of PA. PA research with women is presented and the concept of constraints to PA in women is introduced. The chapter ends with an example of an empiric model of constraint to recreation activity.

### Physical Activity Measurement

Before discussing PA behavior and health promotion it is important to delineate how PA and exercise differ. PA is defined as any bodily movement incorporating the skeletal muscles that results in energy expenditure (kilocalories) from high to low (Caspersen, Powell, & Christensen, 1985, p. 126). Exercise is a subcategory under the larger umbrella of PA and is defined as planned, structured, repetitive body movement with the objective of improving fitness (Caspersen, et al., 1985, p. 126). Fitness is a set of outcomes that relate to one's ability to perform PA and involves muscle strength, endurance, and cardiorespiratory measures that are most accurately measured in a laboratory setting.

**PA behavior.** PA as a behavior has the unique challenge of accurate measurement. PA is specified through the dimensions of type (mode), duration, frequency, and intensity. Mode is the specific type of activity performed such as walking, running, gardening, etc. Duration is the amount of time that an activity is performed such as minutes or hours. Frequency is how often the activity is performed. For example how many times per week an activity was performed. Intensity is the level of effort or physiological demand required to perform an activity. Intensity is most often expressed as metabolic equivalents (METs).

**PA Intensity.** A metabolic equivalent (MET) is the ratio of the energy cost of an activity divided by the energy cost of the resting metabolic rate (RMR: 1 MET). The resting metabolic rate or basal metabolic rate is the number of kilocalories the body requires to function at rest (Ravussin & Bogardus, 1992) and energy expenditure is the total exchange of energy required to perform a specific type of biological work. One MET is equal to 1 kcal/kg/hour (Taylor et al., 1978). The intensity of activity can be expressed as MET-time/week and is created by multiplying the MET value for each activity (Ainsworth et al., 2011) by the amount of time spent performing the activity. The calculation of PA intensity levels is provided in *The Compendium of Physical Activities* (Ainsworth, et al., 2000; Ainsworth et al., 2011). *The Compendium* was created to provide standard intensity levels of PA among a variety of activities. This classification of the energy expenditure of PA consists of many domains of activity such as leisure (including recreational activity), transportation, occupation, home, volunteer and inactivity (Ainsworth, et al., 2011).

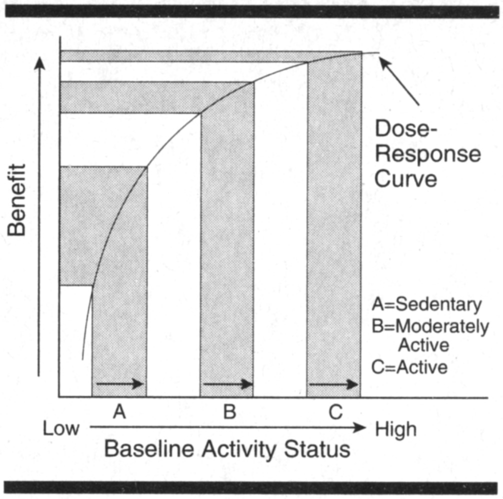


**Figure 1**. The Dose-Response Curve. This represents the best estimate of the relationship between physical activity (dose) and health benefit (response). Reprinted from "Physical Activity and Public Health: A Recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine," 1995. By Pate, et al, *Journal of the American Medical Association, 273,* p. 404. Copyright 1995 by American Medical Association. Reproduced with permission.

Distinctive measures clearly convey the relationship between PA and specific health outcomes using the dose-response curve (Pate, et al., 1995). As illustrated in Figure 1, the dose-response curve demonstrates how increased PA is progressively associated with greater health benefit. The most health benefits were observed with the highest activity. The updated PA recommendations (Haskell, et al., 2007) refined the dose of PA to moderate-intensity aerobic (endurance) for a total of 150 minutes per week or vigorous activity for a minimum of 75 minutes per week. Strength activities to increase muscular endurance are also recommended at least two days per week. The current activity dose recommendation is based upon the research findings for PA intensity and duration (Haskell, et al., 2007; USDHHS, 2008).

**PA domains.** Lifestyle physical activity was defined as the daily accumulation of at least 30 minutes of self-selected activity including all leisure, occupational, or household activities planned or unplanned that are at least moderate to vigorous intensity and are a part of everyday life (Dunn, Andersen, & Jakicic, 1998, p. 399). A randomized trial comparing lifestyle PA with structured exercise in men and women used maximum oxygen consumption as an outcome (Dunn et al., 1999). Both lifestyle and structured activity groups had significant increases in PA and cardiorespiratory fitness over 24 months with mean differences of 0.84 (95% CI, 0.42-1.25 kcal/kg per day). The CDC-ACSM PA recommendations include lifestyle activity such as brisk walking, shopping, climbing stairs, and work such as gardening or carpentry (Haskell et al., 2007b).

**Direct measures of energy expenditure.** Direct calorimetry is a method to measure the heat production of an individual confined in an insulated sealed room usually for 24 hours. The advantage of this method is that the measure of energy expenditure is very precise. The disadvantage is that it is not a true reflection of free living activity (Dale, Welk, & Matthews, 2002) and this type of measurement can only be conducted in a specialized lab.

The criterion measure for total daily energy expenditure in free living conditions is doubly labeled water (Schoeller & Hnilicka, 1996). This method is based on carbon dioxide ($C^{18}O_2$) in a urine sample as an indication of the rate of metabolic carbon dioxide ($CO_2$) production and an estimate of energy expenditure in the body. The advantages of doubly labeled water (DLW) are that it is safe and easy to carry out for humans in free living conditions. Another advantage is the PA assessment can be conducted over a period of 1 to 2 weeks. The disadvantages are the high cost and the urine analysis must be conducted in a laboratory by individuals trained in the technique. DLW is impractical for large public health settings, therefore pedometers, accelerometers, and surveys are commonly used measures of PA in free living environments.

**Indirect measures of energy expenditure.** Indirect calorimetry is an alternative that allows the assessment of energy expenditure for specific activities outside the confinements of a laboratory. The Cosmed $K4b^2$ device is a portable system that measures oxygen and carbon dioxide while an individual engages in physical activity. This method of assessment has been tested for accuracy and reliability (Duffield, Dawson, Pinnington, & Wong, 2004) and has been used in the development of activity questionnaires as well as assessment of activity monitors. Although this technique is objective and accurate it is not frequently used in PA epidemiology research due to the specialized equipment required.

***Heart rate monitors*.** Heart rate monitors are digital receivers worn on the wrist that record the electrical activity transmitted from chest electrodes. The heart rate is accurate, but the application to PA measures is problematic because the heart rate does not provide information about the type of activity performed. Other factors such as temperature, emotional state, and body position also affect the heart rate. The percentage of maximal heart rate is a good estimate of relative intensity of PA in graded exercise testing.

***Accelerometers*.** Accelerometers are battery operated devices that are valid and reliable in a variety of settings. The device is worn on the waist and records the rate and magnitude of body movement. Acceleration counts per minute are stored in a memory chip and later downloaded to a computer. One advantage of accelerometers is that intensity of movement is captured so that minute by minute patterns of activity can be recorded for several weeks. The specific type of activity is not recorded therefore accelerometers are often used with a questionnaire or PA record to document the type of activity. One of the limitations of accelerometers is that equations are not available yet to assess the cost of energy such as walking uphill or carrying a heavy load. Also accelerometers were found to underestimate lifestyle activities and do not record upper body movement (Ainsworth, et al., 2000a). Other disadvantages of the accelerometer are the high cost (about $350 each) and the requirement of a technician to download and interpret data (Ainsworth, 2009).

***Pedometers*.** The pedometer is another device that is worn at the waist, but it is used to record step counts when walking. Pedometers are frequently used in research and practice settings because they are inexpensive ($20) and easy to use. One of the disadvantages are they are easily lost and do not store information (Ainsworth, 2009). Step counts of 10,000 to 12, 499 steps per day are the standard used to classify one as highly active (Tudor-Locke & Bassett, 2004).

***Questionnaires*.** Questionnaires are the most popular method of assessing PA in research and public health surveillance because they are cost effective and portable for large populations. The value of a questionnaire is that it can assess duration, frequency, mode, and intensity. The limitations are that it cannot provide energy expenditure information and some groups such as children or the elderly have difficulty recalling the details of past PA patterns (Ainsworth, 2009).

When both questionnaires and objective measures are used they provide a wide range of information about the PA behaviors of the population. Pedometers and accelerometers used in conjunction with questionnaires provided more objective measures to classify PA.

## Health Enhancing Effects of Physical Activity

Infectious diseases such as pneumonia, influenza, tuberculosis, and enteritis were the leading causes of death in 1900. Public health interventions such as improved sanitation, antibiotics, and vaccines resulted in a trend away from infectious diseases to chronic disease such as heart disease, cancer, and cerebrovascular disease as the leading causes of death in 2000 (Anderson, 2002). Just as wide scale public health policies protected against infectious disease, PA is a public health strategy to prevent completely or reduce the complications of chronic disease (McGinnis, 1992). The next section of the literature review presents the evidence for health benefits of moderate to vigorous PA.

**Early evidence.** The first epidemiologic studies investigating the relationship between PA and coronary heart disease (CHD) took place in London with bus drivers and conductors (Morris, Heady, Raffle, Roberts, & Parks, 1953; Paffenbarger, Blair, & Lee, 2001). The incidence of coronary heart disease was higher in bus drivers (2.7) than in conductors (1.9) and mortality from sudden heart attack in the bus drivers (1.1) was more than twice as high as the conductors (0.5) (Morris, et al., 1953). Inverse relationships between PA and mortality were also observed in later occupational studies with postal employees, railroad workers, and longshoremen (Kahn, 1963; Taylor et al, 1962; Paffenbarger & Hale, 1975). Comparing mail clerks to mail carriers the age-adjusted risk for CHD was 1.26 (Kahn, 1963). The age adjusted coronary death in highly active longshoremen was 26.9 per 10,000 work years compared to 49 per 10,000 work years in the low active category of workers (Paffenbarger et al., 1975). The case for the protective effect of PA was evident as prevention research expanded.

The early evidence for PA as primary prevention for hypertension derived from cohort studies such as The Harvard Alumni Health Study (Paffenbarger et al, 1993) and the Aerobics Center Longitudinal Study (Blair, Wei, & Lee, 1998). The findings of these two studies indicated physically inactive individuals had a 35% to 52% greater risk of developing hypertension than physically active adults. Similar results were found in a meta-analysis of stroke risk for active versus inactive participants in cohort and case-controlled study designs (Lee, Folsom, & Blair, 2003). The results from the cohort studies included a 25% lower risk of stroke incidence for the highly active people compared to the low-active individuals (RR=0.75). Case control studies indicated a 64% lower risk of stroke incidence in highly active individuals compared to the low-active individuals (RR=0.36) (Lee, et al., 2003). Moderate PA was associated with lower all cause-mortality (Paffenbarger, Hyde, & Wing, et al, 1993; Lee & Skerrett, 2001). Participation in moderately vigorous PA was associated with a 23 percent lower risk of death (RR= 0.77) than individuals who did not engage in moderately vigorous activity (Paffenbarger, et al., 1993).

**PA and diabetes.** The first study to compare PA levels and risk of developing diabetes in men was conducted with alumni from the University of Pennsylvania. A 6% decline in the age-adjusted risk of developing diabetes was observed for every 500 kcal/week increment in leisure time PA (Helmrich, Ragland, & Leung, et al., 1991). The relationship continued after adjustment for obesity, hypertension, and parental history of diabetes (Helmrich, et al., 1991). This pattern was observed in other studies. For example, The Physicians' Health Study discovered that men who engaged in vigorous exercise at least once a week had a relative risk of type 2 diabetes of 0.71 during a five year follow up (Manson, et al., 1992). High levels of physical fitness also produced a protective effect in prospective cohort study of 1947 healthy middle-aged men (Bjornholt, et al., 2001).

A randomized control trial of 3,234 non-diabetic adults also found an inverse relationship between PA and diabetes type 2. The Diabetes Prevention Program (DPP) assigned participants to a placebo, 850 mg of metformin twice a day, or a lifestyle program with the goal of a 7 percent weight loss and a minimum of 150 minutes of PA per week. One of the strengths of this study design was the large number of women (68%) and non-white (45%) study participants. The variety of activity that the participants were encouraged to do maintained the premise that lifestyle PA is as effective as structured exercise (Knowler, et al., 2002). Brisk walking was the main activity promoted in the intervention, but participants were encouraged to engage in PA of all types for at least 10 minute intervals.

The lifestyle intervention was effective in all body mass index (BMI) groups. BMI $kg/m^2 < 30$ risk reduction = 65%; BMI 30 $kg/m^2$ to <35 risk reduction=61%; and BMI $\geq 35\ kg/m^2$ risk reduction = 51% (Knowler, et al., 2002). As shown in Figure 2, lifestyle modification was statistically significantly more effective than metformin in reducing the incidence of diabetes by 58 percent. Metformin twice a day reduced the incidence by 31 percent as compared to the placebo (Knowler, et al., 2002).

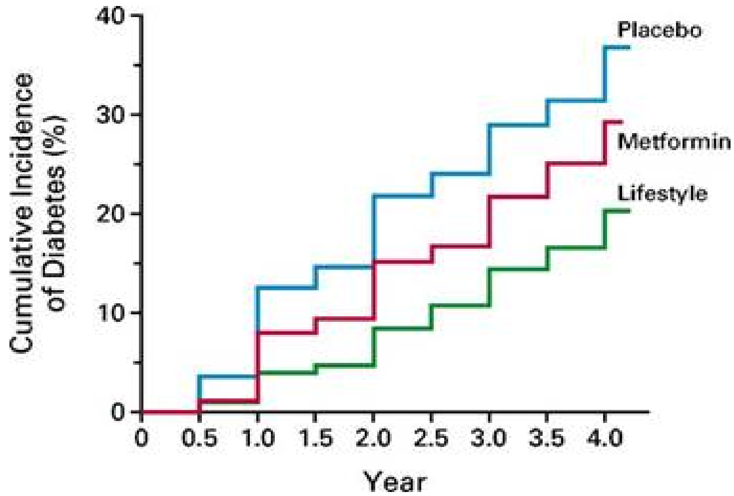


**Figure 2.** Cumulative Incidence of Diabetes According to Study Group. The incidence of diabetes differed significantly among the three groups. (P<.001 for each comparison). Reprinted from "Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin**,"** by W. C. Knowler, et al., 2002, *New England Journal of Medicine*, *346*, p. 397. Copyright 2002 by Massachusetts Medical Society. Reproduced with permission.

The American College of Sports Medicine (ACSM) & American Diabetes Association (ADA) joint position statement on PA and type 2 diabetes endorsed the evidence that PA increased glucose uptake into active muscle and improved systemic insulin action lasting for 2 to 72 hours (ACSM, 2010). The current recommendation is moderate-to-vigorous PA for at least 2.5 hours per week for the prevention of the development of type 2 diabetes in adults (ACSM, 2010). The 25.8 million people affected by diabetes in the U. S. (CDC, 2011) benefit from the secondary prevention of moderate PA such as brisk walking for at least 2.5 hours per week.

**PA and cancer.** Light, moderate, vigorous, and no PA were compared with cardiovascular (CVD) and cancer mortality. PA was also evaluated by domain: domestic, transportation, work, and leisure. Significant risk reduction was reported for all-cause and CVD mortality with work, household, and leisure activity. Leisure time activity and total activity were inversely associated with cancer mortality ($p_{trend}<0.01$) (Autenrieth, et al., 2011). This is one of the few studies to compare PA and health outcomes by domain. The exploration of PA by domain has public health implications because habitual moderate and vigorous PA could be promoted in public health settings.

**PA and dementia.** The first randomized trial to test the effects of PA on cognitive function was conducted with 170 adults in the Netherlands. Adults in this study were ≥ 50 years old and reported memory problems without meeting the criteria for dementia. A baseline screening test revealed 100 of the 170 study participants had evidence of mild cognitive impairment. The usual care group received educational material on memory loss, nutrition, alcohol consumption, and smoking. No information on PA was given to the usual care group. The PA group received the same educational material as the usual care group, but they also received a 24 week walking intervention. Daily PA was recorded in a diary. The intervention group also received a behavior modification program designed to increase activity adherence. The intervention group had better delayed recall and better scores in memory, language, and visual perceptive skills compared to the usual care group (0.26 points) at the end of the trial. At 18 months follow up the intervention group had an improvement of 0.73 points on the ADAS-Cog instrument. Verbal fluency, Beck depression scores, and Medical Outcome short form summaries did not change significantly (Lautenschlager, et al., 2008).

PA and cognitive decline was also investigated in a longitudinal study with 347 elderly men (mean age 74.6 years) in the Netherlands. Baseline blood samples were used to isolate the apolipoprotein (E4 APOE 4) allele. PA was measured using a self-report questionnaire that categorized time periods of 30 minutes or less per day, 31 to 60 minutes per day, and greater than 60 minutes per day. If someone reported no engagement in PA they were coded zero. Global cognitive function was measured with the Mini Mental State Examination (MMSE) given by trained staff. The change in MMSE and PA was compared using regression analysis. Cognitive decline in the inactive carriers of the APOE 4 allele was almost 4 times the risk of the physically active carriers. Carriers of the APOE 4 allele who were active for less than 1 hour per day had a 13.7 fold increased risk of cognitive decline when compared to the noncarriers who were active for more than 1 hour per day (Schuit, et al., 2001).

The public health implications of this research could potentially affect 5.4 million people in the U.S. who have Alzheimer's disease. Alzheimer's is the fifth leading cause of death in the U. S. and it is the only cause of death in the top ten that cannot be prevented (Alzheimer's Association, 2011). One in eight Americans over age 65 has Alzheimer's disease and almost half of the people over age 85 have Alzheimer's (43%). By 2030 the number of people with Alzheimer's will grow to 7.7 million and by 2050 an estimated 11 to 16 million individuals will have Alzheimer's disease (Alzheimer's Association, 2011). The projected cost of care in 2050 is 1.1 trillion dollars (Alzheimer's Association, 2011). If PA decreased the rate of cognitive decline, the promotion of moderate to vigorous daily PA on a population level could potentially improve the quality of life for millions of older adults.

**PA and depression.** PA and cognitive decline was also investigated in a longitudinal study with 347 elderly men (mean age 74.6 years) in the Netherlands. Baseline blood samples were used to isolate the apolipoprotein (E4 APOE 4) allele. PA was measured using a self-report questionnaire. Activity was categorized in time periods of 30 minutes or less per day, 31 to 60 minutes per day, and greater than 60 minutes per day. If someone reported no engagement in PA they were coded zero. Global cognitive function was measured with the Mini Mental State Examination (MMSE) given by trained staff. The change in MMSE and PA was compared using regression analysis. Cognitive decline in the inactive carriers of the APOE 4 allele was almost 4 times the risk of the physically active carriers. Carriers of the APOE 4 allele who were active for less than 1 hour per day had a 13.7 fold increased risk of cognitive decline (95% CI, 4.2 to 45.5) when compared to the noncarriers who were active for more than 1 hour per day (Schuit, et al., 2001).

A large longitudinal study in Denmark used hospital discharge records to identify clinical depression of all types except bipolar disorders. Leisure time PA was measured using The Copenhagen City Heart Study Leisure time Physical Activity Questionnaire. Covariates that were included in the analysis were income, education, smoking, alcohol intake, BMI, occupational PA, and chronic disease. The Cox proportional hazard with adjustment for age was conducted. The three models were 1) unadjusted, 2) adjusted for all covariates, and 3) adjusted for education and all other covariates. No interaction was found between gender and PA. Women with a low level of PA had higher risk of depression compared to women with high level PA. The association did not change when the model was adjusted for covariates. Adjustment for education and chronic disease identified a HR for depression of 1.07 for women with moderate PA and 1.80 for women with low levels of PA. The association was not statistically significant for men. The strengths of this study include large sample size, prospective design, and the separate analysis of men and women (Mikkelsen, et al., 2010).

**PA and aging.** The health effects of PA that were first identified in men were reproduced in later studies with women and the elderly. The Health, Aging, and Body Composition (Health ABC) study compared free-living activity energy expenditure and all-cause risk of mortality in community dwelling adults age 70-82. Women in the study had lower levels of activity energy expenditure (mean (SD), 576 (252) kcal/day vs. 769 (289) kcal/day) but similar levels of PA (mean (SD), 1.68 (0.25) kcal/day vs. 1.72 (0.230) kcal/day). Higher levels of energy expenditure were associated with lower mortality risk (every 287 kcal/day: hazard ratio (HR), 0.68). Kaplan-Meier survival estimates for energy expenditure found no interaction by sex or race. Compared to the lowest tertile for energy expenditure those in the highest tertile had a lower risk of mortality (HR, 0.31). The absolute risk of mortality was 12.1% in the highest tertile of activity energy expenditure, 17.8% in the middle tertile, and 24.7% in the lowest. Adjustment for smoking, education, self-rated health, and health condition did not change the effects. One of the strengths of this study was the measurement of total daily expenditure using doubly labeled water and resting metabolic rate measured using indirect calorimetry with respiratory gas analyzer (Manini et al., 2006).

The value of walking was demonstrated in a prospective cohort study of women age 65 and older with risk factors for fractures (Gregg, et al. 2003). The greatest magnitude of association was total PA to CVD mortality (HR 0.58). Women who were sedentary at baseline who became active had significantly reduced all-cause mortality (HRR, 0.52), CVD (HRR, 0.64), and cancer (HRR, 0.49) after controlling for age, BMI, smoking, co-morbid conditions, and baseline PA (Gregg, et al., 2003). Women who had high levels of PA at both visits also had significantly reduced mortality due to all causes (HRR, 0.68) and CVD (HRR, 0.62), but not cancer (Gregg et al., 2003). Sedentary women who increased PA levels to approximately 1 mile per day of walking between baseline and a follow-up 6 years later had 40% to 50% lower all-cause, CVD, and cancer mortality rates than continuously sedentary study participants (Gregg, et al, 2003). The findings of this study suggest that PA interventions for older populations are beneficial to reduce mortality.

**Women and Physical Activity**

PA measures obtained from self-report questionnaires were employed in the Women's Health Initiative, a prospective study with 73,743 postmenopausal women age 50 to 79 years old. The Women's Health Initiative compared intensity, duration, and frequency of activity using a questionnaire to rank activity as mild (less than 2.5 METs), moderate (2.6-10.0 METs), or strenuous (greater than 10.0 METs). Study participants were asked to report number of hours they spent in sedentary behavior such as sitting, lying down, and sleeping. Total PA in MET-hours/week at baseline had a strong inverse relationship to risk of coronary heart disease during the 5.9 year follow up period. Women who engaged in both vigorous-intensity PA and walking had the highest reductions in CVD risk compared to those who did either vigorous-intensity activity or walking alone (Manson, et al., 2002). As seen in Figure 3, brisk walking for at least 2.5 hours/week had a 30% reduction in the relative risk of cardiovascular disease after adjustment for age, body mass index (BMI), and other cardiovascular risk factors (Manson, et al., 2002). No difference was observed in the relative risk of white and black women. The ethnic diversity in this large sample is one of the strengths of this study

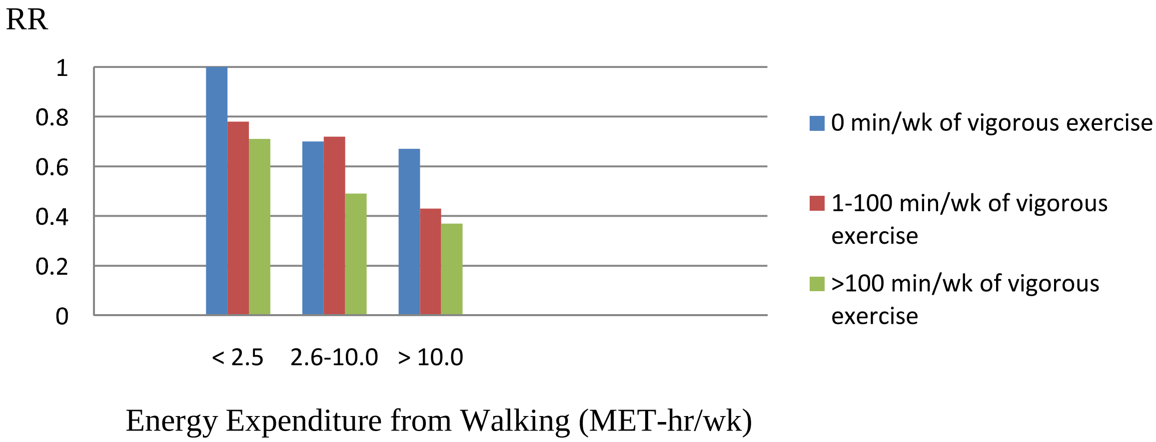


**Figure 3**. Age adjusted relative risk of CVD in women. Joint association of walking and vigorous exercise with the age adjusted risk of cardiovascular disease. Adapted from" Walking Compared with Vigorous Exercise for the Prevention of Cardiovascular Events in Women," by J. E. Manson et al., 2002, *New England Journal of Medicine, 341,* p. 721. Copyright 2002 by Massachusetts Medical Society. Adapted with permission.

All-cause mortality and cardiorespiratory fitness (CRF) were compared in overweight, obese, and normal weight women (N=11,335) in the Cooper Center Longitudinal Study (CCLS). The baseline examinations were provided between 1970 and 2005 at the Cooper Clinic by a physician. The clinical assessment included blood chemistry, health history, resting blood pressure, ECG, a maximal graded treadmill exercise test, height, and weight. Body Mass Index (BMI) was calculated as weight (kilograms)/height (meters$^2$). Overweight or obese was classified as BMI > 25 kg/m$^2$. Mortality was surveyed using the National Death Index. Adjusted all-cause mortality rates were calculated across low-, moderate-, and high CRF categories, categories of adiposity, and smoking status and health status (Farrell, Fitzgerald, McAuley, and Barlow, 2006).

The fit overweight (HR=1.1) and fit obese women (HR=0.5) were no more likely to die than fit normal weight women (referent) in the sample. Unfit normal weight women had higher HR=1.7 than fit normal weight women (Farrell, Fitzgerald, McAuley, & Barlow 2010). The measure of fitness was defined in this study as a maximal MET level ≥7.3 or the equivalent of traveling 1.1 miles in the Cooper 12 minute run-walk test. This was an important study because moderate-intensity activity was beneficial and moderate aerobic intensity is plausible for most healthy women from 40 to 49 years of age (Farrell, et al., 2010).

One of the limitations of the study is that it was conducted with primarily white upper class participants at the Cooper Center where most of the women were leaner than the general population. The majority of the study participants were either normal BMI category or overweight (92%). Only 5.3% (n=625) of the women were obese. While the data support the assumption that not all overweight women are unfit, further research is needed on the relationship of fitness and obesity in women (Farrell, Fitzgerald, McAuley, & Barlow, 2010).

Nursing interventions and observational studies with multi-ethnic samples of women used a variety of measures to assess PA. For example, a cross-sectional internet survey incorporated a modified Backe Questionnaire to investigate the relationship between ethnicity, social context, and health-related variables to exercise and leisure time PA (Lee & Im, 2010). A diverse sample of women (N=441) reported their participation in 3 domains of PA (work, sports, and leisure) providing details about time (duration), intensity, and domain of activity. Statistically significant differences in hours for exercise ($F = 4.40$) and hours for LTPA ($F = 7.14$) were observed between ethnic groups. For example, Asian American women's activity patterns in this sample were more likely to involve traditional female gender roles such as mother and wife. The authors inferred that a collectivist value system in Asian cultures tended to influence Asian American women in their family commitments and roles when compared to White women (Lee & Im, 2010).

A limitation of the study was the cross-sectional design which depicts relationships and associations at the point in time when the data were collected. Another limitation was the lack of measurement of lifestyle PA such as housework or yard work. If Asian women had higher levels of moderate PA in home care or family caregiving this was not captured in the questionnaire. Strengths of this study were the large, ethnically diverse sample and the integration of technology (Lee & Im, 2010).

PA was hypothesized as the mediator between benefits of exercise, self-efficacy for exercise, goal setting, plans, relapse prevention, and social support in a cross-sectional study targeting sedentary women (N=198) from age 30 to 60 years (Nies & Kershaw, 2002). The sample was reported as 52% European American and 48% African American. The mean age was 44 years old (*SD* =7.7). PA behavior was measured using the 7-day Physical Activity Recall (PAR) reported in metabolic equivalents (METS) and the Rockport 1-mile walk test. The Rockport test timed walkers during a 1 mile walk. Longer walking times were indicated by higher numbers and reflected poorer performance of PA (Nies & Kershaw, 2002). The latent variables of vigor and fatigue were measured with the Profile of Mood States Inventory (POMS). Results of the path analysis for the final model tested had $x^2$ (408) = 604.0, $p < .01$, Comparative Fit Index (CFI) = 0.91, and Root Mean Square of Approximation (RMSEA) = 0.049. The direct effect of walking performance upon negative physiological effects was significant. For a one standard deviation decrease in walking time (PA performance) a 0.56 standard deviation decrease in negative physiological effects was observed when holding physical activity recall constant in the path model. There was no statistically significant relationship observed between PA reported on the 7-Day Physical Activity Recall (Sallis, 1985) and negative physiological effects.  Women's PA engagement by walking had more psychological benefit than had been expected (Nies & Kershaw, 2002).

**Breast Cancer Patients and PA.** The Paffenbarger PA Questionnaire and pedometer step counts were used to compare PA outcomes in a longitudinal trial for women age 40 to 55 years old with breast cancer. Volunteers were randomized to a walking intervention group or a control group receiving bisphoshonates for bone mineral density. Walking 10,000 steps per day was the recommended goal for the women (Tudor-Locke & Bassett, 2004). Motivational interviewing sessions focusing on PA were provided at regular chemotherapy visits for the intervention group. Only the PA data was analyzed in the longitudinal model. PA measures were collected at 3, 6, 9, and 12 months. (Swenson, Nissen, & Henly, 2010).

Twenty nine women completed the walking protocol. Study participants were mostly White (90%) and premenopausal (69%) at the time of enrollment. PA from the pedometer readings was compared to the Paffenbarger PA Questionnaire with Spearman correlations at baseline, 3, 6, 9, and 12 months. The correlations were never higher than 0.53 in absolute values for all time points.

Correlations between blocks walked per day and pedometer steps per day ranged from 0.19 to 0.38. There was an increase in mean steps walked per day from week 1 (2,519 steps /day) to month 12 (3,488 steps/day). The authors note that perhaps the 10,000 steps per day goal was not well suited to this population of chemotherapy patients (Swenson, Nissen, & Henly, 2010). Although the goal of 10,000 steps per day was not met the value of this study is that the women increased their steps per day and continued to walk after their chemotherapy cycle was finished.

A path model was used to examine the relationship between cancer-related fatigue, self-efficacy for PA, and PA with quality of life (QOL) in women with breast cancer. PA was hypothesized to be instrumental in increasing quality of life (QOL). Seventy three women from age 37 to 83 years old were recruited at physician's offices to participate in a cross-sectional observational study. The majority of the women was White (85%) and had early stage I/II breast cancer (75%). PA was measured with an instrument called the Human Activity Profile (HAP). The 94-item PA assessment included all activity such as home, work, or leisure and estimated the metabolic expenditure from sedentary to vigorous intensity. Possible scores range from 0 to 94 with high scores reflecting higher energy expenditure. The HAP was chosen because it recorded both structured activity and unstructured activity in individuals with chronic pain or illness (Haas, 2011).

The mean level of activity reported in HAP scores was 56.41 reflecting activity levels equal to walking 6 blocks at a moderate intensity. The path model for direct effects from cancer related fatigue, self-efficacy, and PA to QOL had statistically significant paths between the measured variables. The model accounted for 53% of the variance in QOL scores ($R^2 = 0.53$). The PA that was positively associated with QOL in these breast cancer survivors was primarily moderate-intensity PA performed at home. One of the strengths of the study was the measure of PA at the intensity level which the individuals could tolerate. None of the participants reported participation in structured exercise (Haas, 2011).

**Community interventions.** The 7-Day PAR and accelerometers were used to assess PA change in AA women age 35 to 65 years in a community-based social support intervention (Petersen & Cheng, 2011). A one-group pre and post-test quasi-experimental design was used to evaluate four domains of social support: appraisal, belonging, tangible support, and self-esteem. Participants (N=18) attended six two hour sessions focusing on self-esteem and social support for PA. Change in PA intensity after the intervention $t$ (17) = 1.75 was not significant between groups. However, after 6 weeks an increase in PA intensity from 3.33 mean METS per week to 4.33 mean METS per week was observed. The correlation between accelerometer and self-report on the 7-Day PAR was good (r= 0.83- 0.96). The limitation of the study was the small sample size and a larger study was recommended by the authors. The strength of this study was the development of a theory-based community model and the use of accelerometers with the self-report questionnaire.

Another community intervention targeted ethnically diverse (AA= 80%; 5%=NA; White =15%) women (N= 104) ages 18 to 63 years old and measured total PA as an outcome (Speck, Hines-Martin, Stetson, & Looney, 2007). The 26-week intervention compared PA outcomes between nurse practitioner (NP) facilitated telephone support for PA with a control group without NP telephone support. Both groups had access to a community center for NP facilitated PA sessions. PA was measured using pedometers (mean number of steps) and the 7-Day Physical Activity Recall (PAR) as a self-administered assessment of mean METS (Sallis, 1985). The 7- Day PAR is a record of number of hours spent sleeping in addition to all activity for the past 7 days. At the end of the 26-week intervention no significant group difference from time 1 to time 2 in mean number of steps per day or in mean MET scores was observed (Speck, et al., 2007).

Limitations of the study reported by Speck and colleagues (2007) included difficulties commonly reported in many pedometer studies. Problems included losing the pedometer, dropping it and the pedometer resetting to zero, forgetting to wear the pedometer, or children playing with the pedometer resulting in loss of step counts. A limitation in the self-reported PA measurement was that the participants might not have understood the explanations of PA levels and how to record their own PA. The mean daily MET scores were from 42.9 to 49.2. These values are higher than those in the most active groups such as distance runners. The advantage of interview-based assessment is the ability to clarify the participant's understanding of activity levels and their report of PA. Despite the limitations in this study, participants reported a greater awareness of the variety of activities that are beneficial for health (Speck, Hines-Martin, Stetson, & Looney, 2007).

**Worksite intervention.** The Paffenbarger Physical Activity Questionnaire was used in a theory-based workplace controlled trial with sedentary women (N=287) age 18 to 69 years. The Transtheoretical Model was used as the conceptual framework for this worksite intervention. The intervention group received a 6-week theory-based wellness program from an NP and telephone follow up call while the usual care group only received general personal health advice and the recommendation to increase PA. The outcome variables used from the Paffenbarger PA Questionnaire were flights of stairs climbed per day, blocks walked per day, vigorous and moderate weekend and weekday PA (Purath & Michaels Miller, 2005). The total minutes walked per week were obtained from four questions adapted from the National Health Interview Survey. Minutes walked per week for exercise, errands, on breaks, at lunch, and to work or school were totaled and reported as the total minutes walked per week.

There was no statistically significant change in flights of stairs climbed per day, moderate-, and vigorous-intensity weekday PA from baseline to six weeks. PA outcomes that did have a statistically significant increase were blocks walked per day, moderate- and vigorous-intensity weekend PA, and the total number of minutes walked per week. Change in self efficacy and stage of change correlated after six weeks (r=.164; *p* = .009). Black, Hispanic, and Asian women (18% of the women in the study) had significantly improved stage of change after the intervention (r = .130; *p* = .035). Baseline self-efficacy was not a significant predictor in regression analysis and increase in self efficacy did not predict improved stage of change or increased blocks walked per day. The authors stated that increased self-efficacy could be a consequence rather than a predictor of increased PA behavior (Purath & Michaels Miller, 2005).

Strengths of the study were the theory-based intervention, the measurement of unstructured PA, and the incorporation of walking as a PA outcome. The authors cited one of the limitations of the study is that they recruited from a workplace which was an educational institution and individuals who were more conscious of health behaviors self-selected to participate. The results of this study are not generalizable to a wider population (Purath & Michaels Miller, 2005).

## Constraint Models

**Early models.** The purpose of constraint models for recreation providers was to facilitate the identification of factors contributing to decreased leisure participation and to encourage strategies for navigating through one's constraints

(Boothby, Tungatt, & Townsend, 1981). The first leisure constraint models regarded constraints as static obstacles to participation in leisure activity (Jackson, 1988) through a dichotomy of internal and external constraints. Internal constraints were defined as physical ability, knowledge, or interest (Francken & van Raaij, 1981) while examples of external constraints included circumstances, lack of time or money, and lack of facilities or geographical distance.

The internal/external dichotomy, however, was not consistent among all scholars. For example, lack of time and money were classified by some as internal constraints (Francken & van Raaij, 1981). Others suggested that physical ability could be regarded as an external constraint in the sense that one might not have access to a facility in order to learn a certain skill (Boothby, Tungatt, & Townsend, 1981). Thus the use of an internal /external portrayal of constraints was limited.

Another typology of constraints to leisure was identified as interpersonal, intrapersonal, and structural constraints (Crawford & Godbey, 1987; Crawford, Jackson, & Godbey, 1991). Interpersonal constraints involved relationships such as group participation in an activity (Crawford & Godbey, 1987; Godbey, Crawford, & Shen, 2010). Intrapersonal barriers were classified as psychological states that existed within a person that prevented leisure activity participation. An example of an intrapersonal constraint is lack of interest in an activity. Structural constraints were depicted as obstructions to leisure activity such as time, money, or facilities and were related to both preference and participation in an activity (Crawford & Godbey, 1987). The interpersonal, intrapersonal, and structural specification of constraints was supported with the development of empirical models that tested relationships between specific constraints and leisure activity participation.

Constraint models were expanded to include context and meanings of leisure preferences. The new models adopted differences in age, gender, and class in the perception of leisure activity (Shaw, Bonen, & McCabe, 1991). A later definition of constraints described them as factors that were assumed by researchers or perceived by individuals to limit the formation of leisure preferences and /or to inhibit or prohibit participation and enjoyment in leisure (Jackson, 2000, p. 62). Constraint to leisure activity became a less static concept and the dialogue was directed towards strategies of constraint negotiation (Jackson, Crawford, & Godbey, 1993).

**Constraints and women**. Constraint models were helpful in understanding women’s PA behavior and leisure meanings. Women’s reported constraints to PA were often associated with gender roles (Henderson, Bialeschki, Shaw, & Freysinger, 1989). Focus group participants verbalized the conviction that PA was beneficial for health, but reported PA participation was not a priority as high as family or work (Im et al., 2011). AA women age 40 to 60 years old also confirmed that they felt too exhausted for recreation or PA after completing responsibilities of child care, jobs, or housework. These women disclosed conceptions of PA as a luxury or a self-indulgent behavior (Im, Ko, Hwang, et al., 2011). Similar responses were communicated by participants in Phase 1 of the CAPS who identified constraints to PA as employment demands, the needs or expectations of families, and economic conditions. Women in the CAPS also cited environmental conditions such as safety or weather.

**Empiric model**. A contemporary study demonstrated how a constraint model could be used to assess constraint leisure participation (White, 2008). The model tested the relationship between constraints and outdoor recreation participation with a hierarchical confirmatory factor analysis (CFA). This type of analysis evaluates the degree to which an a priori model explains the observed relationships between variables. White hypothesized that constraint would have a direct negative effect on outdoor recreation participation and negotiation would have a positive direct effect upon outdoor recreation participation. The construct of constraint was defined by the degree to which a condition limited outdoor recreation participation and was measured with 13 statements that included the fear of getting hurt by animals and not having people to go with. Negotiation was defined as strategies to start, continue, or increase outdoor recreation participation and was measured with an 8-item Negotiation scale developed by Hubbard and Mannell (2001). Outdoor recreation participation was the dependent variable measured with an ordinal scale ranging from 0 = *never* to 2 = *frequently*.

The results of the model supported a constraint to outdoor participation latent variable but negotiation was not supported in the model. The path from negotiation to outdoor recreation was in the predicted direction, but it was not significant. Fit indices compare the goodness of fit between the hypothesized model and the observed model. A RMSEA of 0.05 or less indicates a close fit while a value of 0.10 or higher indicates a poor fit. An AGFI and GFI of 0.9 reflect a good fitting model (Hu & Bentler, 1999). Relative chi square of the model was 2.20 and the Root Mean Square Error of Approximation (RMSEA) of .05 reflected a good fit. The Comparative Fit Index (CFI) was 0.87, Goodness of Fit Index (GFI) was 0.87, and Adjusted Goodness of Fit Index (AGFI) was .84. The value of a constraints model is the identification of the constraint and then leveraging strategies to negotiate the constraint with the goal of improving the leisure (PA) experience (McGuire, 1984).

**Chapter Summary**

The most commonly reported constraint to leisure activity cited in the literature by women was lack of time (Henderson & Ainsworth, 2000; Henderson & Ainsworth, 2001, Henderson & Ainsworth, 2003; Tudor-Locke, 2003).

The constraint to PA and negotiation of constraint conceptual model was central in the creation of the PRQ. Negotiation of constraints was interpreted as a strategy to start, continue, or increase participation in enjoyable activity (Hubbard & Mannell, 2001). The TWPAS developed in the CAPS provided women with options for PA participation beyond exercise or formal sports and recreation. The

TWPAS was developed from the scientific literature in exercise science and the PRQ was based on the literature in leisure studies. Both instruments were produced with the specific findings about women and PA from the CAPS Phase I.

# Chapter 3

# METHODS

The two projects described in the dissertation arise out of the Cross Cultural Activity Participation study (CAPS). This chapter explains the methods used in the CAPS to collect the data and the methods employed in the evaluation of the CAPS questionnaires.

## Design of the CAPS

The CAPS was a five year cross-sectional study with an overarching goal to characterize the PA behaviors in the African American (AA) and Native American (NA) participants over 40 years old. The original study was funded by the Women's Health Initiative of the National Institutes of Health (WHI-NIH) in cooperation with the Centers for Disease Control (CDC). The primary aim was to develop a set of surveys to appraise moderate-intensity PA in AA and NA women over 40 years old. The surveys were written in terminology that would be understandable to the lay user and were designed to be disseminated in the various communities for future use. It was believed that the information gained through the surveys could be utilized in future work in PA promotion with women (Ainsworth, et al., 2001).

Phase 1 of the CAPS included qualitative interviews on the meanings of PA and the assessment of constraints to PA. Phase 1 also identified PA habits and routines using the existing methodology for surveying PA in women such as PA records, accelerometers, and pedometers. Phase 2 was organized to make available and validate an instrument created from the data obtained in Phase 1 to measure moderate intensity PA. Measures used in Phase 2 included: PA records, accelerometers, cardiovascular fitness and BMI.

The CAPS was conducted from 1995 to 2000 and was approved by Institutional Review Board (IRB) at University of South Carolina, the University of New Mexico, Bemidji State University in Minnesota, the U.S. Centers for Disease Control and Prevention, and the Indian Health Service. The approval of local community leaders and tribal authorities was obtained before the original study. The evaluation of the questionnaires in the dissertation was approved by the Office for Research Integrity and Assurance at Arizona State University.

**Data management.** All data were recorded on paper questionnaires and entered by hand into the Epi-Info (CDC, 2000) and SAS FSEDIT (Cary, NC) data entry programs. Individuals were given an identification number that was used on all forms. No individual names or identities were retained. All data were analyzed in aggregate form by identification number only. Electronic data were stored on computer disks in a locked cabinet in the Principal Investigator's office. Only the Principal Investigator and study personnel were authorized to access to the data.

## Sample and Setting

**Recruitment.** CAPS participants were recruited through fliers, newspapers, radio announcements, and word of mouth among Native American women in the greater Albuquerque, New Mexico area and African American women in the greater Columbia area in South Carolina. Study inclusion criteria were age 40 years old or older; self- identification as African American or Native American; the ability to read English well enough to complete the surveys; and the ability to participate in at least moderate-intensity PA such as walking. All volunteers gave written consent to participate in the study.

Eligibility was determined during a phone interview before the first study visit. A different sample was recruited for each phase of the study. Volunteers were compensated $25 at the completion of each round of data collection. There were 3 rounds of data collection in Phase 1 and 2 rounds in Phase 2. Each round lasted 4 days. Phase 1 was completed over a period of six months. Phase 2 was completed in 5 visits over six weeks. Participants came to the study site for physical data collection and interviews were conducted at participants' homes.

## Procedures

A health history and blood pressure were obtained at baseline during both phases. Other measures taken at baseline were height and weight using a wall mounted tape measure and a portable scale (Seca, Model 770, Seca Corporation, Hanover, MD). Body mass index (BMI) calculated as weight (kilograms)/ height (meters$^2$) and waist-to-hip ratio was measured using a standard tape measure at the level of the umbilicus. PA records were kept by participants for four days during each round of data collection. Pedometers and Caltrac accelerometers were worn concurrently on the four days that the PA records were completed.

Additional measures obtained in Phase 2 were the Typical Week Physical Activity Survey (TWPAS) and cardiorespiratory fitness (CFR) on the treadmill. All measures were collected using standardized procedures according to the study's manual of operations. The measures used in the dissertation are described in detail below.

**Measures**

Baseline measures used in both Phase 1 and 2 included demographic information and body mass index (BMI). Age and education were reported in years and were continuous variables. Ethnicity was reported as a categorical variable (African American =1; Native American = 2; and Non-Hispanic White = 3). Marital status (married = 1 or single = 2) and responsibility for children or grandchildren (yes = 1 or no = 2) were other categorical variables reported in the demographic questionnaire. BMI was calculated from weight and height as weight in kilograms divided by height in meters squared.

**PA records.** The Physical Activity Record (PAR) was a booklet for recording 4-day periods of activity and each day participants recorded their activities as performed during three eight hour periods. The following information was recorded: type of PA performed, time activity started, body position during the activity (supine, sit, stand, walk), perceived effort during the activity (light, moderate, vigorous), and the purpose of each activity (e.g. occupation, household, self-care, exercise, etc.). The recorded activity was assigned a 5-digit code using the 2000 *Compendium of Physical Activities* (Ainsworth, et al., 2000) that distinguished the type of activity by purpose, type, and intensity. The outcome variable of the PA record was minutes of activity per day and MET-minutes per day by intensity (light, moderate, and vigorous) and domain.

**Caltrac accelerometer.** Accelerometers were also worn during the 4-day period. The Caltrac accelerometer was an objective measure of activity (Muscle Dynamics, Torrance, CA) that was worn on the hip to record vertical accelerations of the body. Total daily energy expenditure (kcal/day) was estimated as a function of the total accelerations and the estimated resting metabolic rate (RMR) computed from age, weight, and sex. Participants were instructed wear the Caltrac all day and to record the number of kilocalories expended in the PA record before going to bed each night. The monitor was worn from morning until bedtime over a period of 4 days except when swimming or bathing. The outcome variables for the Caltrac data were total energy expenditure in kilocalories per day and total MET-minutes of PA per day.

**Cardiorspiratory fitness (CRF).** CRF was measured with a symptom-limited maximal graded exercise test on an electric treadmill. The test consisted of two-minute stages that were graded in speed and elevation by 1 MET per stage. An electrocardiogram, blood pressure, and perceived exertion were recorded at rest, during the final 30-seconds of each stage, and during recovery. Peak heart rate in beats/minute and maximal speed and grade completed on the treadmill were used to estimate maximal oxygen uptake ($VO_2$ max). The data recorded for CRF were total minutes on treadmill, estimated $VO_2$ max, and blood pressure. For individuals under 50 years of age a maximal treadmill duration less than or equal to 16 minutes was classified as low fitness level. Treadmill duration of more than 16 minutes was considered high fitness. For ages 50 years and older a maximum duration of greater than 14 minutes was classified as high fitness and equal to or under 14 minutes of duration on the treadmill was considered low fitness level.

**Physical Recreation Questionnaire (PRQ).** The PRQ is an 18-item interviewer-administered scale developed by Dr. Karla Henderson to explore constraints to PA in women. Constraints to PA and negotiation of constraints are unidimensional constructs that are hypothesized to exist in the PRQ. The 18 likert scale choices reflect frequency of a PA constraint or negotiation of PA behavior and range from 1 = *Almost never true* to 4 = *Almost always true*. Scores for the all of the items in the scale were summed and range from a low of 18 to a possible high of 72. A lower score corresponds to increased PA constraints that have not been negotiated and a higher score corresponds to increased negotiation of constraints to PA. PRQ items 02, 07, 08, 09, 10, 11, 12, and 13 were hypothesized to be indicators for the construct of constraint to PA and were negatively coded in the analysis. Items 01, 03, 04, 05, 06, 14, 16, 17, and 18 were hypothesized to be indicators of the construct of negotiation of constraints to PA. The PRQ is presented in Appendix A.

**The Typical Week Physical Activity Survey (TWPAS).** The TWPAS is focused on the concept of moderate-intensity PA in women. This questionnaire was developed using PA records data obtained in Phase 1 and was administered by a study interviewer at baseline, during visit two, and visit three. The 35-items in the TWPAS identify the minutes per day spent in a variety of activities to include the following: House care (n=3 items), Lawn/Garden (n=2 items), Family Care giving (n=3 items), Non-occupational walking (n=6 items), Transportation (n=1 item), Dance/ Sport (n=2 items), Conditioning (n=6 items), Leisure or Inactivity (n=4 items), Occupation (n=7 items), and Volunteer (n=1 item). Outcome variables of TWPAS were total minutes per day by domain and by intensity: light, moderate, and vigorous. The TWPAS is presented in Appendix B.

## Evaluation of the Questionnaires

**Validity.** Validity is a scale's capability to measure a specific variable and is inferred through the relationship of the measure to the constructs (DeVellis, 2012). Construct validity explains the degree that the instrument measures the proposed construct and begins with the explicit definition of the underlying concepts (Cook & Campbell, 1979). Criterion related validity can be calculated using a predictor and criterion variable. The criterion is any standard of the phenomenon of investigation. The strength of the correlation between predictor and criterion is a reflection of the instrument's estimated performance on each criterion (DeVon, et al., 2007) and provides further support for the validity of the instrument (Bryant, 2000). Validity of PA questionnaires is tested by comparing the PA scores from the scale to criterion measures such as fitness tests, motion sensors, and PA diaries (Bauman, Phonsavan, Schoeppe, & Owen, 2006).

The analyses of the CAPS data were conducted to provide support for construct and criterion related validity as part of an ongoing process of instrument development and evaluation (Cronbach & Meehl, 1995). Descriptive statistics and the correlation were conducted in SAS 9.2 (Cary, NC). Factor analysis was conducted in M*plus* 6.0 (Muthén & Muthén, Los Angeles, CA).

**Factor Analysis**

One of the methods to provide support for construct validity of instruments is factor analysis. The underlying factor structure of a scale can be examined to distinguish the number of factors (Tabachnick & Fidell, 2007). Factor extraction partitions the shared variance of a variable from the unique variance and error variance (Tabachnick & Fidell, 2007). The types of factor analysis used in this study were exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA is based upon factors extracted from matrices of association or covariance matrices (Costello & Osborne, 2005) and has no parameter constraints. EFA is conducted when no a priori number of factors has been tested. The number of factors and the pattern structure can be determined through the data (Fabrigar, Wegener, McCallum, & Strahan, 1999).

**Assumptions.** Assumptions in factor analysis include multivariate normality, linearity, and adequate sample size. Multivariate normality is the assumption that all variables and all linear combinations of variables are normally distributed. Normality can be assessed by skew and kurtosis of the single variables. Linearity was assessed by inspection of scatter plots of the data. The required sample size depends on number of factors, number of items, and magnitude of the population's correlations. Sample size should be large enough for reliable estimates to be made from correlation coefficients (Tabachnick & Fidell, 2007).

**Project 1 The Physical Recreation Questionnaire**

The first project evaluated the PRQ which was based upon the conceptualizations of constraints to PA commonly identified by women.

**Specific Aim 1.** To determine the underlying factor structure of the PRQ model presented in Figure 4 with an exploratory factor analysis.

Hypothesis 1: The underlying structure of the PRQ supports two factors.

Since the PRQ had not been previously analyzed for factor structure, the exploratory factor analysis was conducted first (Fabrigar, et al., 1999). Rectangles represent the measured variables and ovals represent the factors. As seen in Figure 4, the exploratory model was specified with paths from all factors to all items. No a priori theory dictated the relationships between factors and items in the exploratory analysis.

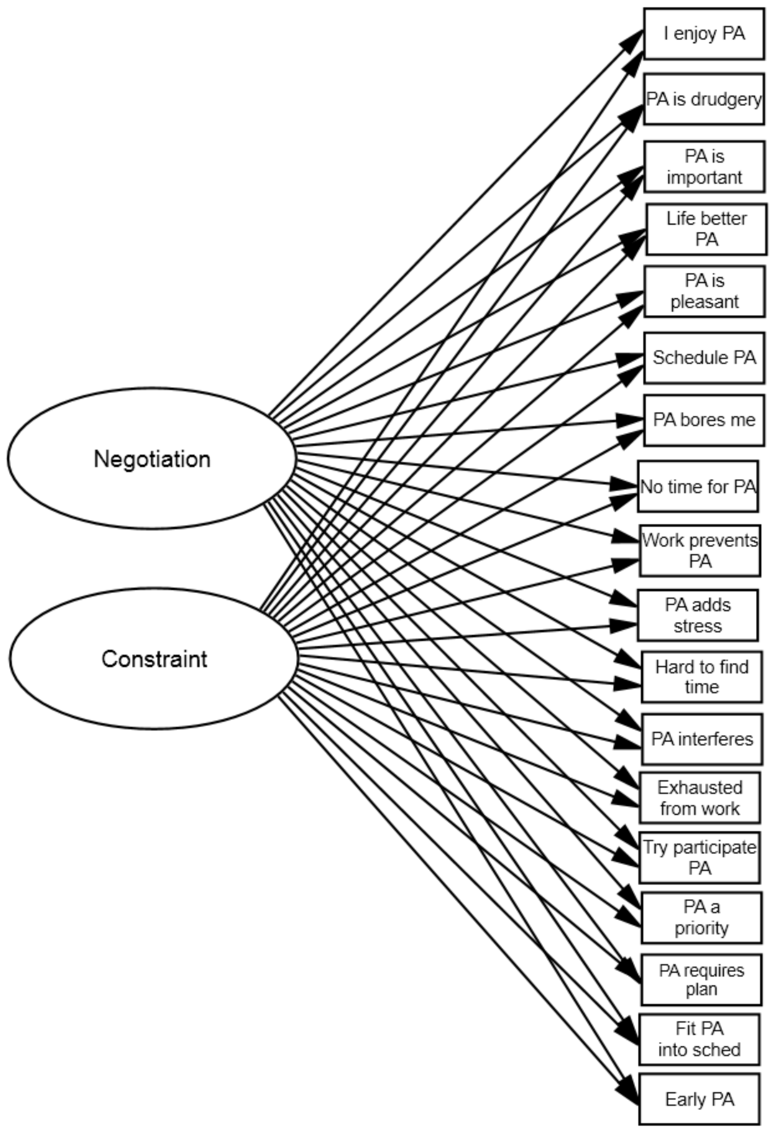


**Figure 4.** Exploratory Two Factor Model of Physical Recreation Questionnaire.

**Specific Aim 2.** To test the model of the PRQ in Figure 5 with a confirmatory factor analysis.

Hypothesis 2: When tested in a confirmatory factor analysis the PRQ supports the latent variables of constraint and negotiation of constraint to PA.

Confirmatory factor analysis (CFA) is a form of structural equation modeling (SEM) that compares a hypothesized model to the observed model. CFA is based upon theoretical entities called latent variables (Byrne, 2012). The latent variable is not observed or directly measured. The observed measures are a reflection of the underlying latent variable. The CFA model includes unique variance that is not explained by the factors and depicted in the model by the error terms with each measure (Kline, 2011). Maximum likelihood estimation in M*plus* was used for the CFA (Tabachinick & Fidell, 2007).

***Model identification.*** A model is identified if there is a unique solution for the parameters in the model. The parameters in the model are the factor weights and the variances of the exogenous variables (independent variables). The first parameter on each factor was fixed at 1.00 and the error terms were fixed at 1.00. All other parameters were free to vary according to the number of degrees of freedom in the model (Kline, 2010). Free parameters are estimated from the data and the total number of free parameters is never more than $p$ ($p$+1)/2 when $p$ is the number of observed variables (Byrne, 2012). If the model was correctly specified then a well fitting model is expected to be identified with a unique solution.

***Model specification.*** As seen in Figure 5, factor one was hypothesized to be the negotiation latent variable that was the causal factor of the indicators in items number 1, 3, 4,5, 6, 14, 16, 17, and 18. The negotiation latent variable was hypothesized to tap the variety of attitudes and actions that typify people who participate in PA. Factor 2 was hypothesized to be the constraint to PA latent variable contributing to items 2 and items 7 through 13. The presence of the latent variable was determined using the fit indices and the factor structure.

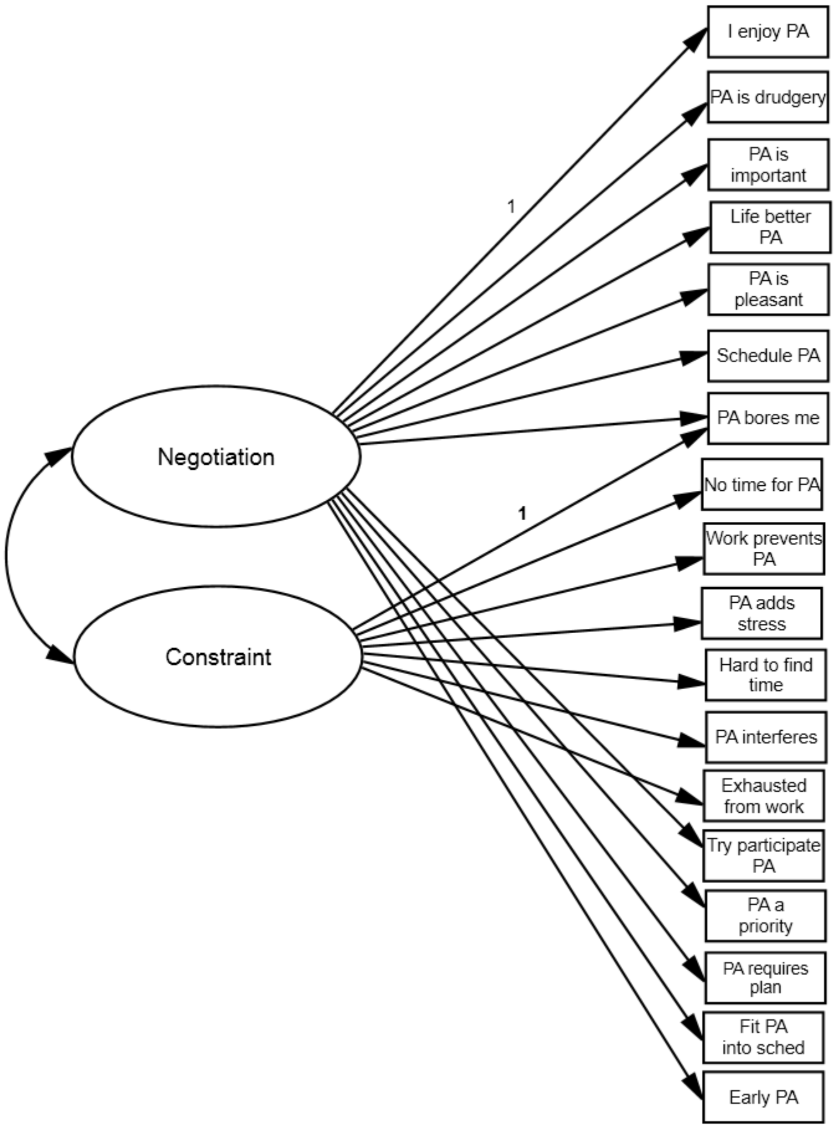


**Figure 5.** Two Factor Confirmatory Model of Physical Recreation Questionnaire.

**Project 2 The Typical Week Physical Activity Survey**

The second project evaluated the TWPAS as a measure of moderate-intensity PA over the course of four days. The items in the TWPAS were selected from the data gathered in Phase 1 PA records and the qualitative interviews with Phase 1 study volunteers. The activities in the TWPAS reflect a typical week of habitual PA performed. Categorical factor analysis can be performed when the assumptions for factor analysis have been met (Muthén, 1993).

**Specific aim 3**. To examine the underlying structure of the TWPAS with a categorical exploratory factor analysis as seen in Figure 6.

Hypothesis 3: When analyzed in an exploratory factor analysis of the TWPAS supports three factors.

The exploratory model had no a priori hypothesis about the relationships between factors and measures. The EFA model was drawn with all factors contributing to all items.

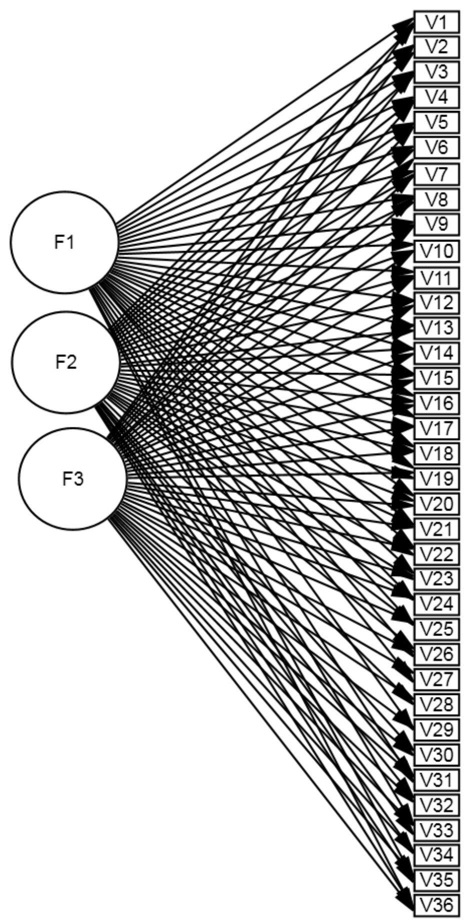


**Figure 6.** Exploratory Model of the Typical Week Physical Activity Survey.

**Specific aim 4.** To determine the efficacy of the TWPAS for moderate-intensity PA assessment through correlations of PA reported in the TWPAS with objective and subjective measures of PA.

Hypothesis 4: Scores for moderate-intensity PA on the TWPAS correlate with objective and subjective measures of PA data from the CAPS Phase 2.

Descriptive measures including median, interquartile range, skewness, and kurtosis were recorded for the TWPAS domains and intensity of PA. Comparison to a criterion measure such as the PA record and Caltrac accelerometer data provide further demarcation of the presence of the construct (Clark & Watson, 1995). The TWPAS was compared to criterion measures including the PA record, treadmill time, body mass index (BMI), and Caltrac accelerometer data to provide support for the measurement of moderate-intensity PA.

## Chapter 4

## RESULTS

The purpose of the secondary data analysis was to evaluate the scales developed in the CAPS study. The first research question focused on the evaluation of the Physical Recreation Questionnaire (PRQ) with the conceptual model of constraint and negotiation. The second research question evaluated the concept of moderate-intensity PA in the Typical Week Physical Activity Survey (TWPAS). This chapter reports the results of the analyses in each specific aim.

### Sample Demographics

Descriptive statistics of the study sample are presented in Table 1. Continuous data are reported with means and standard deviations and frequency statistics were reported for categorical data. A total of 160 women were recruited before the first round of data collection. After the three rounds of data collection 20 women dropped out of the study for various reasons ranging from physical illness to lack of time. The total number of women included in the final data analysis was 140 in Phase 1. The volunteers were middle-aged with the mean age of 52.6 years (SD 9.7) and a range in age from 40 to 75 years old. Mean number of years of education was 16.2 (SD 9.0). There were slightly more Native American women (n=76) than African American women (n=64). Approximately half of the women were married (n=71) and 54 were raising children or grandchildren.

The Phase 2 sample was similar to Phase 1 with the exception of an additional subpopulation of Non-Hispanic White women. A total of 160 women were recruited and enrolled at the start of Phase 2. Over the course of the study 20 individuals dropped out due to health problems limiting their PA participation and other reasons. The final data analysis in Phase 2 included 140 women. The average age was 56 years (SD ±10.8) with a range from 40 to 83 years of age. The average number years in school was 15 (SD ± 2.6). Half of the women were married (n=72) and one third reported caring for children or grandchildren (n=54).

Table 1. Sample Demographics from CAPS Phase 1 and 2

| | N | *M* (*SD*) |
|---|---|---|
| **Phase I** | | |
| Age (years) | 140 | 53.8 (10.7) |
| Education (years) | 140 | 16.2 (9.0) |
| *Ethnicity* | | |
| African American | 64 | |
| Native American | 76 | |
| *Family Status* | | |
| Married | 71 | |
| Single | 69 | |
| Raising Children or Grandchildren | | |
| Yes | 54 | |
| No | 86 | |
| **Phase 2** | | |
| Age (years) | 140 | 54.8 (10.8) |
| Education (years) | 140 | 15.4 (2.6) |
| *Ethnicity* | | |
| African American | 46 | |
| Native American | 45 | |
| White | 49 | |
| *Family Status* | | |
| Married | 72 | |
| Single | 68 | |
| Raising Children or grandchildren | | |
| Yes | 54 | |
| No | 86 | |

## Descriptive Statistics of the Measures

Table 2 displays the results of the PA Record, Caltrac accelerometer, and BMI. The PA Record was coded for analysis using the *Compendium of Physical Activities* (Ainsworth et al., 2000). Each activity recorded was assigned a data code as it was completed from day 1 to day 4. The activities were then coded by the day of the week the activity was performed (Monday-Sunday) along with the recording of the starting time. Duration, intensity, and domain of activity were all obtained from the PA records. Summary scores of minutes per day of domain-specific PA, total PA, and intensity-specific PA (Light <3 METS; Moderate 3-6 METS, and Vigorous > 6 METS) are reported in Table 2. Caltrac scores were computed as MET-minutes/day by dividing the total daily energy expenditure of kilocalorie per day (kcal/day) by estimated metabolic rate (RMR) and then multiplying by 1440 minutes per day.

Based upon the PA records from visit 2 the study volunteers spent an average of 113 minutes/day in moderate activity and an average of 64 minutes/ day in vigorous activity. Caregiving activity and yard work had the highest duration of time with 75 minutes/day and 72 minutes/day, respectively. The lowest average duration of time was conditioning (21 minutes/day) and sports activities (6 minutes/day). Mean body mass index (BMI) in the Phase 1 sample was 30.4 kg/$m^2$.

Table 2. Descriptive Data for the PA Record (min/day), Caltrac Accelerometer (MET-min/day), and Body Mass Index for Participants in Phase 1 (N= 140)

| | *M (SD)* | Median | $25^{th}$-$75^{th}$ Percentile |
|---|---|---|---|
| **PA Record** | | | |
| Activity (Min/day) | | | |
| Household | 163 (71) | 152 | 110-208 |
| Walk for exercise | 71 (31) | 65 | 49-87 |
| Occupational | 232 (114) | 238 | 143-311 |
| Caregiving | 24 (28) | 12 | 5-31 |
| Lawn / garden | 14 (15) | 8 | 3-17 |
| Volunteer | 21 (23) | 12 | 6-34 |
| Home Repair | 10 (13) | 5 | 1-13 |
| Conditioning | 9 (10) | 5 | 3-12 |
| Sports/ Recreation | 6 (5) | 3 | 1-9 |
| PA Intensity | | | |
| Light (> 3 METs) | 1334 (79) | 1350 | 1307-1381 |
| Moderate (3-6 METs) | 94 (59) | 82 | 55-124 |
| Vigorous (< 6 METs) | 9 (10) | 5 | 3-12 |
| Caltrac (MET-min/day) | 387 (224) | | |
| Body Mass Index ($kg/m^2$) | 30 (6) | | |

## Project 1 The PRQ Evaluation

**Specific aim 1**. Descriptive data were obtained for each item in the PRQ using the univariate procedure in SAS 9.2 (Cary, NC). The mean, standard deviation, and degree of skewness for the PRQ summary scores are reported in Table 3. Item number one, “I enjoy PA” had the highest mean score of 3.46 (SD±0.64). The hypothesized negotiation item scores were consistently high and negatively skewed while the proposed constraint item average scores were lower and more often positively skewed.

An exploratory factor analysis was conducted on the 18 items of the PRQ using M*plus* 6.0 (Muthén & Muthén, Los Angeles, CA). The maximum likelihood estimation method and geomin rotation were used to estimate the model. This type of rotation allowed the factors to be correlated. Missing data were signified by a missing flag in the syntax. Eigenvalues, factor coefficients, and goodness of fit indices were used to evaluate the model. Item loadings above 0.30 and no cross-loadings were used as the criteria for factor structure.

Table 3. Mean, Standard Deviation, Skewness, and Kurtosis for Physical Recreation Questionnaire (N = 140)

| Item | M | SD | Skewness | Kurtosis |
|---|---|---|---|---|
| 1. I enjoy PA | 3.46 | 0.64 | -1.05 | 1.51 |
| 2. PA is drudgery | 1.84 | 0.81 | 0.86 | 0.62 |
| 3. PA is important | 3.59 | 0.62 | -1.14 | 1.96 |
| 4. Life better with PA | 3.52 | 0.66 | -1.04 | 1.23 |
| 5. PA is pleasant | 3.44 | 0.59 | -0.65 | 1.67 |
| 6. Change schedule PA | 2.76 | 0.92 | -0.50 | -0.48 |
| 7. PA bores me | 1.54 | 0.72 | 1.04 | 1.26 |
| 8. No time for PA | 1.96 | 0.81 | 0.84 | 0.70 |
| 9. Work prevents PA | 2.02 | 0.75 | 0.65 | 0.63 |
| 10. PA adds stress | 1.75 | 0.77 | 0.59 | 0.23 |
| 11. Hard to find time | 1.87 | 0.65 | 0.35 | 0.40 |
| 12. PA interferes | 1.79 | 0.89 | 1.01 | 0.315 |
| 13. Exhausted from wk | 2.00 | 0.86 | 0.51 | -0.23 |
| 14. Try participate PA | 3.00 | 0.79 | -0.49 | 0.04 |
| 15. PA a priority | 2.92 | 0.92 | -0.60 | -0.33 |
| 16. PA requires plan | 2.87 | 0.84 | -0.35 | -0.48 |
| 17. Fit PA in schedule | 3.08 | 0.82 | -0.63 | 0.18 |
| 18. Early PA | 2.46 | 1.10 | -0.01 | -1.45 |

***Two factor model.*** The two factor solution for the Physical Recreation Questionnaire is presented in Table 4. Items that loaded on factor 1 were primarily the negotiation of constraint to PA items. The exception to this trend was item 2 “PA is drudgery” which had a negative value to signify the negative relationship to negotiation. The items that loaded on the second factor included items number 8) “I don’t have time for PA” and item number 11) “Life is so structured that it is hard to find time for PA.” Item number 16 “To be involved in physical activity requires that I carefully plan my day” loaded on both factors in the two factor model. The problems with the two factor model were evident in the poor fit [$x^2$ = 240.84 (118) $p$ < .005; RMSEA=0.086 (90% CI 0.071-0.102), CFI=0.84, TLI=0.79].

Table 4. Two Factor EFA of Physical Recreation Questionnaire (N=140)

| Item | 1 | 2 |
|---|---|---|
| I enjoy PA | 0.710 | 0.014 |
| PA is drudgery | -0.318 | -0.019 |
| PA is vitally important | 0.641 | -0.060 |
| Life is better because of PA | 0.519 | -0.211 |
| PA is pleasant | 0.719 | 0.017 |
| I arrange schedule for PA | 0.290 | -0.171 |
| PA bores me | -0.245 | 0.134 |
| I don’t have time for PA | -0.127 | 0.604 |
| Work schedule prevents PA | 0.112 | 0.765 |
| Planning PA adds stress | -0.053 | 0.613 |
| No time for PA | 0.059 | 0.823 |
| PA interferes | 0.001 | 0.707 |
| Exhausted from work | -0.091 | 0.676 |
| Try to participate in PA | 0.257 | -0.351 |
| I make PA a priority in my life | 0.415 | -0.361 |
| PA requires plan | 0.299 | 0.270 |
| Fit PA into schedule | 0.402 | -0.325 |
| Early PA | 0.324 | -0.214 |

***Three factor model.*** A three factor model was explored and the results are displayed in Table 5. The first factor included items 1 through 5 and item number 7. The second factor contributed to items 8 through 13 and item 15. The third factor included items 6, 14, 15, 17, and 18. The factor coefficients in this model were more distinct and reflected a well-fitting model. The fit indices in the three factor model also reflected a better fitting model [x2 = 138.60 (102) $p$ =.009; RMSEA=0.051 (90% CI 0.026-0.071), CFI=0.95, TLI=0.92].

Table 5. Three factor EFA of the Physical Recreation Questionnaire (N=140)

| Item | 1 | 2 | 3 |
|---|---|---|---|
| I enjoy PA | 0.772 | 0.054 | 0.005 |
| PA is drudgery | -0.431 | -0.003 | 0.139 |
| PA is important | 0.599 | -0.019 | 0.091 |
| Life better PA | 0.564 | -0.172 | 0.121 |
| PA is pleasant | 0.776 | 0.058 | 0.008 |
| Schedule PA | -0.116 | 0.007 | 0.724 |
| PA bores me | -0.415 | 0.192 | 0.266 |
| No time for PA | -0.114 | 0.616 | 0.014 |
| Schedule prevents PA | 0.152 | 0.788 | 0.001 |
| PA adds stress | -0.035 | 0.629 | 0.009 |
| Hard to find time | 0.129 | 0.826 | -0.052 |
| PA interferes | -0.020 | 0.755 | 0.104 |
| Exhausted from work | -0.003 | 0.655 | -0.110 |
| Try participate in PA | 0.022 | -0.260 | 0.384 |
| PA is a priority | -0.004 | -0.173 | 0.763 |
| PA requires plan | 0.119 | 0.359 | 0.310 |
| Fit PA in schedule | 0.162 | -0.221 | 0.398 |
| Early PA | 0.004 | -0.071 | 0.550 |

Figure 7 displays the scree plot for the exploratory analysis. The scree test is a measure of relative value rather than an absolute value. The number of factors could be obtained by examining the magnitude of the drop among factors (Cattell, 1966). The change in magnitude of eigenvalue sharply decreased between factor 3 and factor 4.

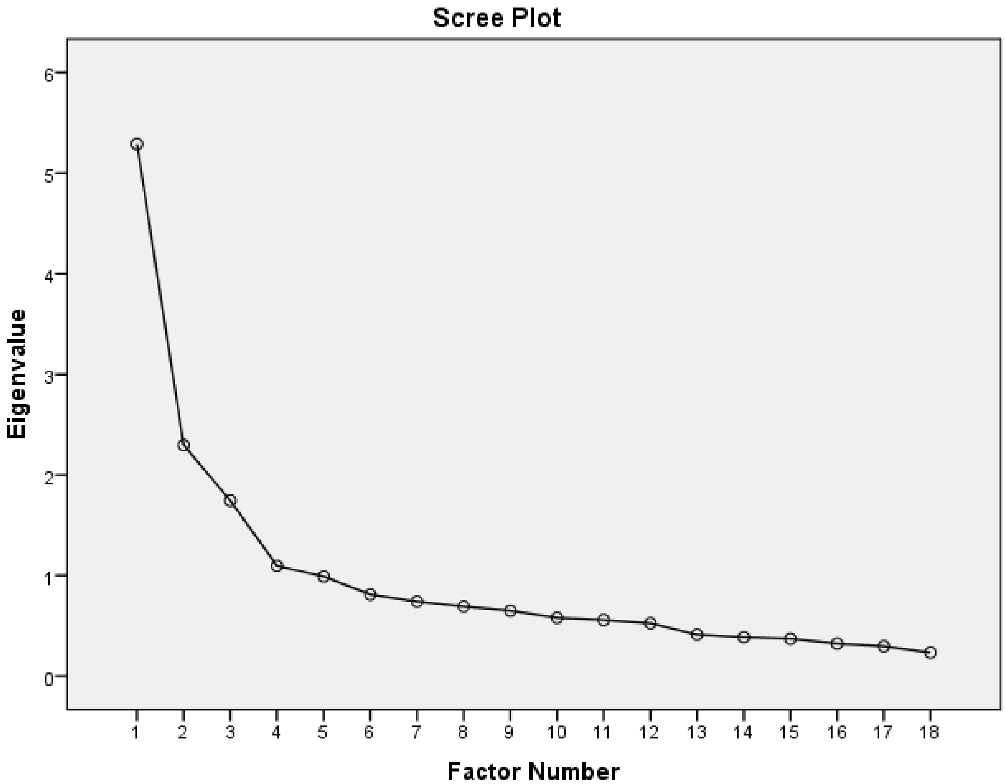


**Figure 7.** Scree plot of the Eigenvalues Associated with the EFA of the Physical Recreation Questionnaire.

A four factor solution was considered and the results of the EFA with four factors are presented in Table 6. Only one item loaded on the fourth factor. Items 1-5 loaded on the first factor. Items 8-13 loaded on the second factor and items 14, 15, 17, and 18 loaded on the third factor.

Table 6. Four factor EFA Results for Physical Recreation Questionnaire (N=140)

| Item | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| I enjoy PA | 0.795 | 0.047 | 0.046 | -0.094 |
| PA is drudgery | 0.442 | 0.002 | 0.064 | 0.152 |
| PA is important | 0.573 | -0.045 | 0.013 | 0.180 |
| Life better PA | 0.442 | -0.176 | 0.092 | 0.097 |
| PA is pleasant | 0.775 | 0.037 | 0.024 | -0.045 |
| Schedule PA | -0.038 | 0.097 | 0.773 | -0.044 |
| PA bores me | -0.368 | 0.235 | 0.295 | -0.084 |
| Don’t have time for PA | -0.098 | 0.625 | 0.050 | -0.122 |
| Schedule prevents PA | 0.127 | 0.764 | -0.045 | 0.057 |
| PA adds stress | -0.034 | 0.624 | 0.001 | -0.020 |
| Find time for PA | 0.112 | 0.807 | -0.076 | 0.008 |
| PA interferes | 0.015 | 0.755 | 0.079 | 0.004 |
| Exhausted from work | 0.039 | 0.619 | -0.175 | 0.089 |
| Try to participate in PA | 0.026 | -0.234 | 0.311 | 0.211 |
| PA is a priority | 0.068 | -0.102 | 0.741 | 0.061 |
| PA requires plan | -0.006 | 0.378 | 0.012 | 0.874 |
| Fit PA in schedule | 0.175 | -0.192 | 0.358 | 0.135 |
| Early PA | 0.015 | -0.036 | 0.459 | 0.240 |

Figure 8 illustrates the fourth factor with only one item loading on it. A factor with only 1 item does not reflect the overall structure of the scale so the four factor solution was not retained.

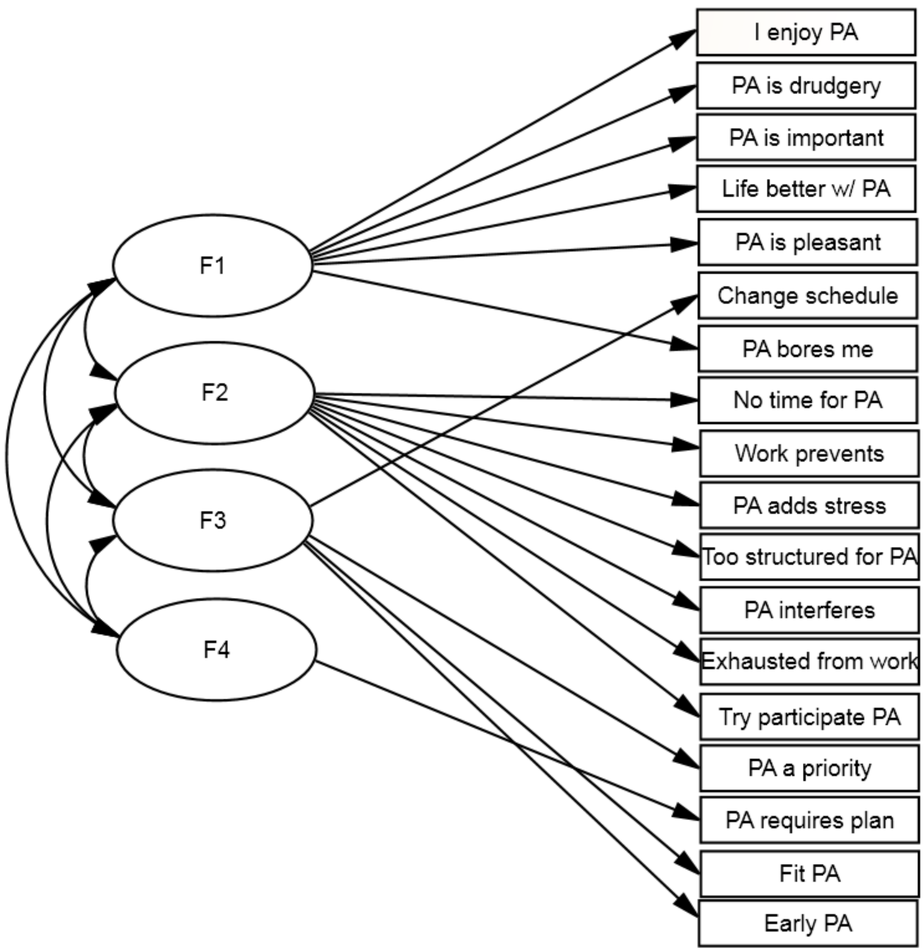


**Figure 8**. Four factor solution for the EFA of the Physical Recreation Questionnaire.

Table 7 shows fit indices from EFA of the Physical Recreation Questionnaire. The four factor model was the best fitting EFA model [$x^2 = 109.92$ (87) $p < .049$; RMSEA=0.043 (90% CI 0.003-0.067), CFI=0.97 TLI=0.94]. The fourth factor with only one item loading on it was not providing improved information about the scale. Therefore the four factor solution was not retained.

Table 7. Fit Indices from EFA of the Physical Recreation Questionnaire (N=140)

| Model | $x^2$ | *df* | *p* | CFI | TLI | RMSEA | 95 % CI |
|---|---|---|---|---|---|---|---|
| 2 Factor | 240.84 | 118 | < 0.005 | .840 | .792 | .086 | [.071-.102] |
| 3 Factor | 138.60 | 102 | 0.009 | .952 | .928 | .051 | [.026-.071] |
| 4 Factor | 109.92 | 87 | 0.049 | .970 | .947 | .043 | [.003-.067] |

*Note:* $x^2$ =Chi-square; *df* = Degrees of Freedom; CFI = Comparative Fit Index; TLI=Tucker-Lewis Index; RMSEA=Root Mean Square Error of Approximation; CI = Confidence Interval.

Table 8 shows the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) are predictive and parsimony corrected fit indices. The AIC rewards a parsimonious model that has less parameter estimates. Both the AIC and BIC are often used when there are a number of plausible models and the best fitting model is sought (Tabachnick & Fidell, 2007). The fit did not significantly improve from the three factor model to the four factor model. Another limitation of the 4 factor model is that only one item, number 16 "To be involved in physical activity requires that I carefully plan my day, loaded on it. Since a 1-item factor is not desirable the three factor model was selected as the best-fitting model to describe the underlying factor structure of the PRQ.

Table 8. The AIC and BIC for EFA Models in the Physical Recreation Questionnaire (N=140)

| Model | AIC | BIC |
|---|---|---|
| 1 Factor | 6135.053 | 6293.902 |
| 2 Factor | 5989.085 | 6197.942 |
| 3 Factor | 5918.845 | 6174.768 |
| 4 Factor | 5920.164 | 6220.211 |

*Note:* AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion.

**Specific aim 2.** Specific aim 2 tested the hypothesis that there were two latent variables in the PRQ with a confirmatory factor analysis (CFA). Conceptually the PRQ was developed with the two constructs of constraint to PA and negotiation of constraint to PA. The first CFA tested the hypothesis of a constraint and negotiation construct in a two factor model. Table 9 displays the results of the two factor CFA. The two factor model was not a good fit [x2 = 313.09 (134) $p < .005$; RMSEA=0.062 (90% CI 0.045-0.078), CFI=.906, TLI=.892]. Item 16 “PA requires plan” did not perform well. A three factor CFA model was then tested.

Table 9. Fit Indices for CFA of the Physical Recreation Questionnaire (N=140)

| Model | $x^2$ | *df* | *p* | CFI | TLI | RMSEA | 95% CI |
|---|---|---|---|---|---|---|---|
| 2 Factor | 313.09 | 134 | <.005 | .769 | .736 | .093 | [0.080 -0.107] |
| 3 Factor | 203.75 | 132 | .001 | .906 | .892 | .062 | [0.045- 0.079] |
| 3 Factor [a] | 187.94 | 131 | .008 | .913 | .926 | .056 | [0.037-0.073] |
| 3 Factor [b] | 171.37 | 129 | .007 | .945 | .934 | .048 | [0.026- 0.067] |
| 3 Factor [c] | 155. 24 | 115 | .007 | .945 | .934 | .048 | [0.026-0.067] |

***Note***: $x^2$ = Chi square; *df* = degrees of freedom; CFI = Comparative Fit Index; TLI=Tucker-Lewis Index; RMSEA=Root Mean Square Error of Approximation; CI=Confidence Interval; [a] V16 cross loaded on F1 and F2;
[b] V16 Cross loaded and Correlated Error V12 with V4 and V6 with V15;
[c] Without V16

Figure 9 shows the two factor CFA model of the Physical Recreation Questionnaire. The two factor model shows the negotiation factor with items 1-7 and items 14-18 loaded on factor 1. The constraint factor was hypothesized to include items 8-13.

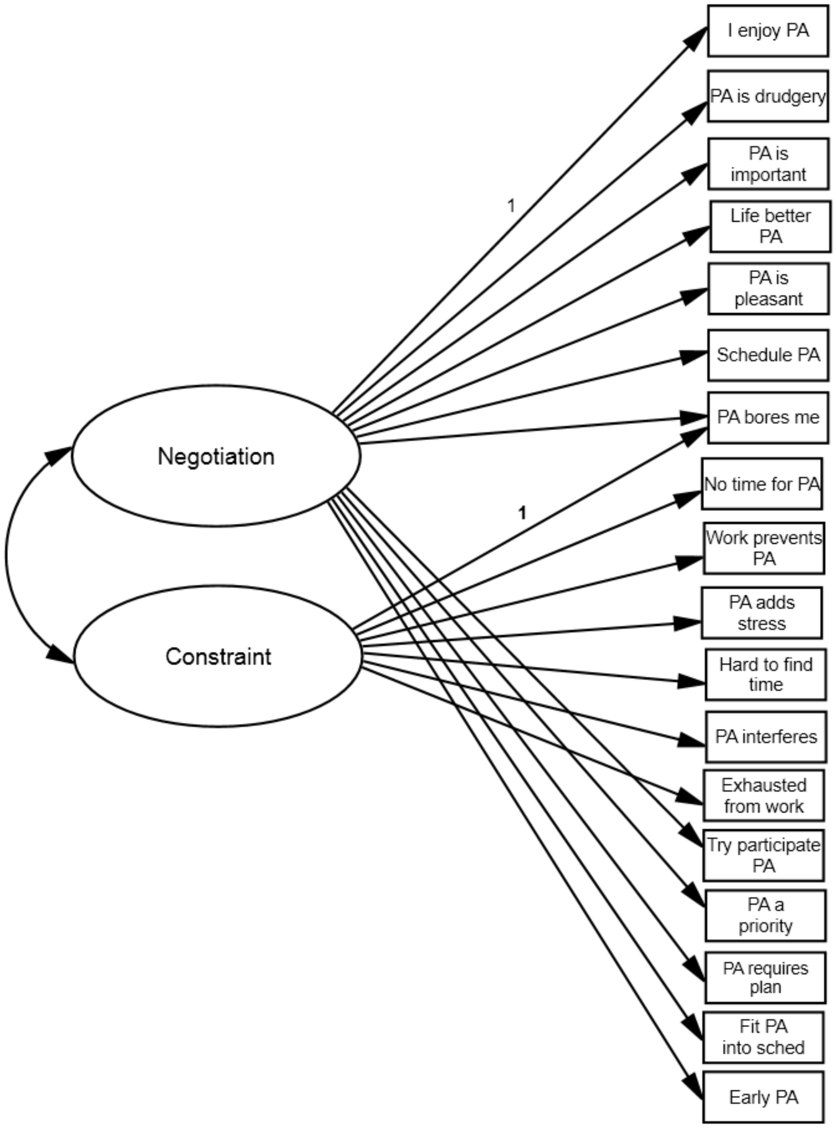


**Figure 9.** Two factor CFA model of the Physical Recreation Questionnaire.

Table 10 shows the two factor CFA results for the Physical Recreation Questionnaire. As expected the items loading on the negotiation factor were items 1-6 and 14-18. The items loading on factor 2 the constraint factor were items 7-13.

Table 10. Two Factor CFA Results for the Physical Recreation Questionnaire (N=140)

| Item | Negotiation | Constraint |
|---|---|---|
| I enjoy PA | 1.000 | |
| PA is drudgery | | 1.000 |
| PA is important | 1.042 | |
| Life is better PA | 1.422 | |
| PA is pleasant | 0.838 | |
| Schedule for PA | 2.091 | |
| PA bores me | | 1.276 |
| No time for PA | | -5.038 |
| Work prevents PA | | -5.386 |
| PA adds stress | | -3.964 |
| Hard to find time | | 5.609 |
| PA interferes | | 4.760 |
| Exhausted from work | | 5.129 |
| Try participate PA | 2.014 | |
| PA a priority | 2.767 | |
| PA requires plan | 0.870 | |
| Fit PA in schedule | 2.222 | |
| Early PA | 2.386 | |

The three factor conceptual model was adopted and tested for of the latent variables of enjoyment of PA, constraint, and negotiation of constraints to PA. The results of this model are presented in Table 11. Items 1, 2, 3, 4, 5, and 7 were indicators of the latent variable called enjoyment. PRQ items 8, 9, 10 11, 12, and 13 were hypothesized to be indicators of factor 2 the constraint latent variable. Items 6 and 14 through 18 loaded on the third factor the negotiation latent variable. Item 16 did not perform well in the 3 factor model with a factor loading of .201 on the second factor. The inter-factor correlations were moderately strong and ranged from .33 to -.52 with the second factor and .50 between factor 1 and factor 3. The fit for a three factor model was better [$x^2 = 203.75$ (132) $p < .005$; RMSEA=0.062 (90% CI 0.045-0.079), CFI=0.906, TLI=0.892].

Table 11. Three Factor CFA of the Physical Recreation Questionnaire (N=140)

| Item | Enjoyment | Constraint | Negotiation |
|---|---|---|---|
| I enjoy PA | 1.00 | | |
| PA is drudgery | -0.664 | | |
| PA is important | 0.731 | | |
| Life better w/ PA | 0.883 | | |
| PA is pleasant | 0.901 | | |
| Schedule for PA | | | 1.00 |
| PA bores me | -0.496 | | |
| No time for PA | | 1.000 | |
| Work prevents PA | | 1.136 | |
| PA adds stress | | 0.897 | |
| Too structured for PA | | 1.179 | |
| PA interferes | | 0.986 | |
| Exhausted from work | | 1.118 | |
| Try participate PA | | | 0.775 |
| PA a priority | | | 1.313 |
| Plan PA | | 0.201 | |
| Fit PA in schedule | | | 0.850 |
| Early PA | | | 0.965 |

Figure 10 shows a model for a three factor CFA model of the Physical Recreation Questionnaire. The proposed structure of this solution were factor one an enjoyment construct with items 1-6 loading on it; factor two the constraint latent variable with items 7-12 and item number 16 loading on it; and factor three the negotiation construct with items 14, 15, 17, and 18 loading on it.

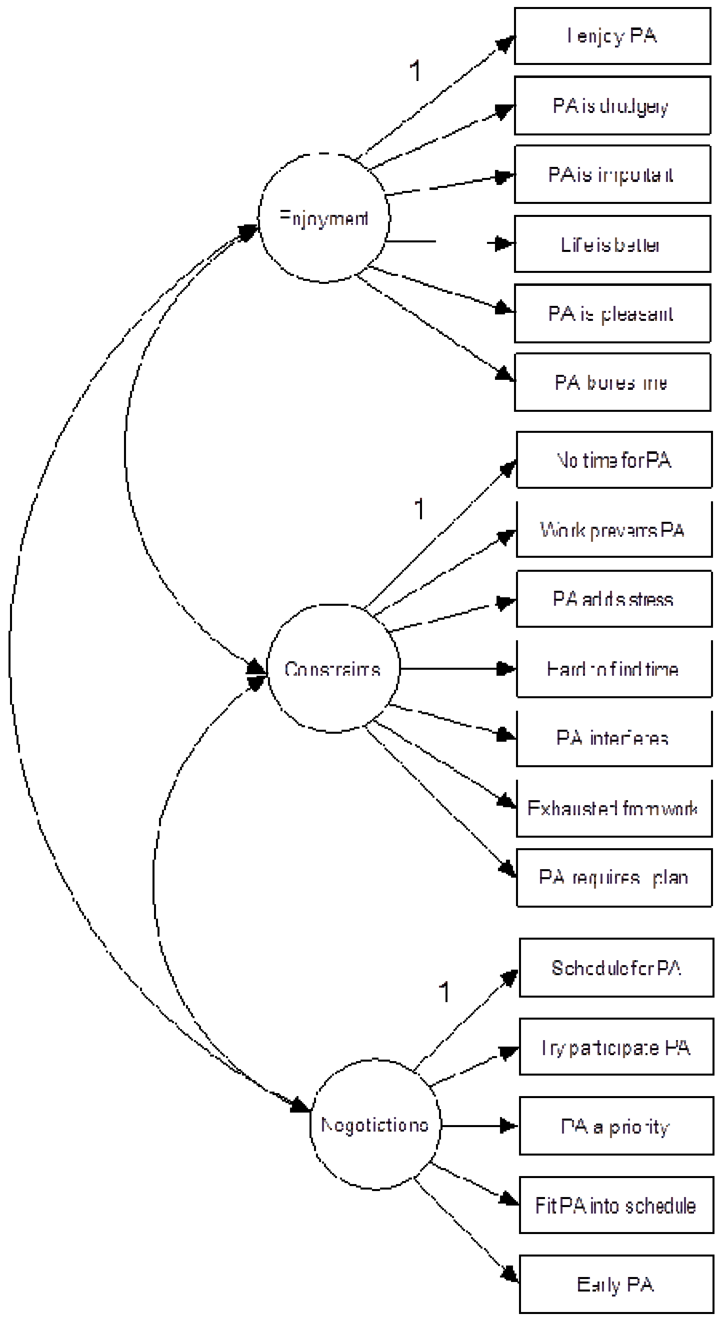


**Figure 10.** Three factor CFA model of the Physical Recreation Questionnaire.

Table 12 shows a three factor model with item 16 cross loaded on factor 2 and factor 3. A further evaluation to better understand the structure of the PRQ allowed item 16 to cross load on factor 2 (constraint) and factor 3 (negotiation). This model demonstrated an improvement in fit [$x^2$ = 187.94 (131) $p$ < .008; RMSEA=0.056 (90% CI 0.037-0.073), CFI=0.913, TLI=0.926].

Table 12. Three Factor Model with Item 16 Cross Loaded on Factor 2 - Constraint and Factor 3 - Negotiation (N=140)

| Item | Enjoyment | Constraint | Negotiation |
|---|---|---|---|
| I enjoy PA | 1.000 | | |
| PA is drudgery | -0.341 | | |
| PA is vitally important | 0.661 | | |
| Life is better PA | 0.593 | | |
| PA is pleasant | 0.739 | | |
| Schedule PA | | | 1.000 |
| PA bores me | -0.332 | | |
| No time for PA | | 1.000 | |
| Work prevents PA | | 0.732 | |
| PA adds stress | | 0.628 | |
| Hard to find time | | 0.802 | |
| PA interferes | | 0.704 | |
| Exhausted from work | | 0.712 | |
| Try participate PA | | | 0.543 |
| PA a priority | | | 0.815 |
| PA requires plan | | 0.483 | 0.462 |
| Fit PA in schedule | | | 0.614 |
| Early PA | | | 0.585 |

A second model with item 16 cross loading included residual covariance between V12 with V4 and V15 with V6 is presented in Table 13. The fit indices of this model also improved [$x^2$ = 171.37 (129) $p$ < .007; RMSEA=.048; CI (.026-.067), CFI=.945 and TLI=.934]. Although the model with residual covariance was a well-fitting model it was not parsimonious.

Table 13. Three Factor CFA Model with Item 16 Cross loaded and Residual Covariance of V12 with V4 and V15 with V6 (N=140)

| Item | Enjoyment | Constraint | Negotiation |
|---|---|---|---|
| I enjoy PA | 1.000 | | |
| PA is drudgery | -0.334 | | |
| PA is important | 0.666 | | |
| Life better w/ PA | 0.593 | | |
| PA is pleasant | 0.741 | | |
| Schedule for PA | | | 1.000 |
| PA bores me | -0.324 | | |
| No time for PA | | 1.000 | |
| Work prevents PA | | 0.729 | |
| PA adds stress | | 0.623 | |
| Too structured for PA | | 0.802 | |
| PA interferes | | 0.683 | |
| Exhausted from work | | 0.716 | |
| Try participate PA | | | 0.562 |
| PA a priority | | | 0.750 |
| Plan PA | | 0.574 | 0.568 |
| Fit PA in schedule | | | 0.630 |
| Early PA | | | 0.579 |

Table 14 presents the final three factor model that had item 16 removed from the scale. This model provided good fit and remained parsimonious [$x^2$ = 155 (115) $p$ < .007; RMSEA=.048; CI (.026-.067), CFI=.945; TLI=.934]. When item number 16 “To be involved in PA requires that I carefully plan my day” was removed the total model fit improved. Recommendation for future versions of the Physical Recreation Questionnaire would be to remove item 16 because it did not make a strong contribution to the scale.

Table 14. Three Factor CFA Model Item 16 Removed from the PRQ (N=140)

| Item | Enjoyment | Constraint | Negotiation |
|---|---|---|---|
| I enjoy PA | 1.00 | | |
| PA is drudgery | -.339 | | |
| PA is important | .658 | | |
| Life better w/ PA | .589 | | |
| PA is pleasant | .742 | | |
| Schedule for PA | | | 1.00 |
| PA bores me | -.323 | | |
| No time for PA | | 1.00 | |
| Work prevents PA | | .729 | |
| PA adds stress | | .627 | |
| Too structured for PA | | .798 | |
| PA interferes | | .683 | |
| Exhausted from work | | .710 | |
| Try participate PA | | | .525 |
| PA a priority | | | .837 |
| Fit PA in schedule | | | .600 |
| Early PA | | | .569 |

**Project 2 The TWPAS Evaluation**

Project 2 was designed to evaluate a PA questionnaire to assess moderate intensity activity in African American and Native American women over 40 years old. Two specific aims were developed in the Typical Week Physical Activity Survey evaluation.

**Specific Aim 3.** The first aim proposed a categorical exploratory factor analysis to distinguish the categories of light-, moderate-, and vigorous intensity PA. The exploratory model could not be identified in M*plus*. Two possible reasons are the small sample size and the assumption of multivariate normality was not met.

Table 15 presents the descriptive data from the TWPAS. The median minutes and the inter-quartile range were provided since the data were negatively skewed. The most time was spent in light activity with a median of 668 minutes/day. Fewer median minutes per day were reported in moderate-intensity activity (77 min/day) and the least amount of reported time was in vigorous-intensity activity with no median minutes. The highest daily median minutes were reported in occupational activity (342 min/day), inactivity (154 min/day), and household activity (137 min/day). Sports/conditioning had the lowest number of median minutes with 17 min/day.

Table 15. Descriptive Statistics for the Typical Week Physical Activity Survey (N=140)

| | Median | 25-75 Percentile | Skewness | Kurtosis |
|---|---|---|---|---|
| TWPAS | | | | |
| Household | 140 | 84-206 | 0.84 | 0.76 |
| Lawn/Garden | 17 | 0-17 | 1.8 | 4.07 |
| Caregiving | 28 | 0-31 | 2.79 | 10.48 |
| Walking | 21 | 11-38 | 1.42 | 2.64 |
| Transportation | 49 | 29-60 | 1.62 | 3.40 |
| Dance | 0 | 0-6 | 3.5 | 14.7 |
| Sports/ Conditioning | 17 | 1-28 | 2.12 | 5.78 |
| Inactivity | 154 | 94-238 | 1.07 | 1.29 |
| Occupation | 342 | 0-343 | 0.41 | 4.14 |
| Volunteer | 25 | 0-17 | 1.78 | 3.71 |
| Intensity | | | | |
| Total | 762 | 565-807 | -0.70 | 1.78 |
| Light (< 3 METS) | 668 | 448-672 | -0.32 | 0.65 |
| Moderate (3-6 METS) | 77 | 55-165 | 1.58 | 3.75 |
| Vigorous (>6 METS) | 0 | 6-17 | 3.47 | 14.16 |

**Specific aim 4.** Aim 4 was developed to assess the validity evidence of the Typical Week Physical Activity Survey against subjective and objective measures of PA. Descriptive data for the TWPAS and the criterion measures for physical activity are presented in Table 16.

The TWPAS data had distributions that were not normally distributed. Therefore the TWPAS variables were log transformed in SAS before the correlation with the PA record scores, Caltrac scores, treadmill time, and BMI.

Table 16. Mean and standard deviations for the PA Record (min/day), Caltrac Accelerometer (MET-min/day), Treadmill (minutes), and Body Mass Index for Participants in Phase 2 (N=140)

| | *M* (*SD*) | Median | 25-75 Percentile |
|---|---|---|---|
| PA Record (Minutes/day) | | | |
| Household | 156 (92) | 135 | 84-207 |
| Walking | 28 (22) | 22 | 11-38 |
| Occupational | 199 (175) | 257 | 0-343 |
| Caregiving | 30 (52) | 10 | 0-31 |
| Lawn /Garden | 14 (20) | 4 | 0-17 |
| Volunteer | 14 (23) | 0 | 0-17 |
| Sports/Conditioning | 19 (24) | 10 | 1-28 |
| Intensity | | | |
| Light (< 3 METs) | 569 (173) | 566 | 448-672 |
| Moderate (3-6 METs) | 120 (90) | 103 | 55-65 |
| Vigorous (> 6 METs) | 87 (138) | 28 | 0-17 |
| Caltrac (MET-min/day) | 2157 (383) | | |
| Treadmill (min) | 13 (4) | | |
| Body Mass Index ($kg/m^2$) | 28 (5) | | |

The results of the TWPAS Pearson correlations for the validity against objective and subjective measures of physical activity are seen in Table 17. The level of significance was set at $p < .05$ for a two-tailed test, which reflects and absolute Pearson $r > .26$. When compared with like items from the PA Records, the TWPAS scores for moderate and vigorous PA were the strongest, $r = .51$ and $r = .54$, respectively. Caregiving ($r = .55$), conditioning ($r = .63$), and occupational ($r =. 76$). Only the vigorous intensity PA score from the TWPAS was significantly correlated with the fitness measure of treadmill time ($r = .45$) and body mass index ($r = -.34$) as expected. The correlations with the Caltrac accelerometer MET-min/day were low and not statistically significant for all TWPAS items except the moderate intensity PA (min/day) at $r = .32$.

Table 17. Pearson Product Moment Correlations for TWPAS min/day for the Total Score, Intensity Levels, and PA domains with PA Criterion Measures (N=140)

| | PAR (min/day) | Treadmill (min) | Caltrac (MET-min/day) | BMI (kg/$m^2$) |
|---|---|---|---|---|
| Total | .14 | .01 | .11 | .02 |
| Intensity Levels | | | | |
| Light | .13 | -.08 | -.08 | .12 |
| Moderate | .51 | .21 | .32 | -.16 |
| Vigorous | .54 | .45 | .12 | -.34 |
| PA Domains | | | | |
| Household | .40 | -.12 | .09 | .05 |
| Lawn/ Garden | .46 | .16 | .12 | -.14 |
| Caregiving | .55 | .05 | .21 | .01 |
| Walking | .42 | .19 | .25 | -.01 |
| Transportation | .27 | -.03 | -.03 | -.03 |
| Dance | .64 | .14 | .08 | -.12 |
| Sports/Conditioning | .63 | .32 | .16 | -.23 |
| Inactivity | .36 | -.29 | -.06 | .27 |
| Occupational | .76 | .05 | -.09 | -.07 |
| Volunteer | .43 | -.16 | -.03 | .19 |

*Note*: $r > 0.26$ is significant at $\alpha = .05$, $\beta = 0.5$, and N=140.

## Chapter 5

## DISCUSSION

The purpose of the secondary data analysis in the dissertation was to evaluate two instruments developed in specifically for African American and Native American women over 40 years old. This chapter interprets the results of the analyses in light of the relevant literature. The strengths and limitations of the dissertation are also discussed.

### Constraints to PA in Women

**Specific Aim 1.** Aim 1 investigated the underlying factor structure of the in the Physical Recreation Questionnaire. The PRQ was developed with a construct of constraint to PA from data collected in Phase 1 of the CAPS (Henderson & Ainsworth, 2000b). The hypothesis of aim 1 that there would be a two factor solution in the EFA was not supported. The two factor EFA did not result in a well-fitting model. Item 16 “To be involved in PA requires that I carefully plan my day” loaded on both factor 1 and factor 2 in the two factor model. When a 3 factor exploratory model was examined a well-fitting model was observed, but item 16 cross loaded on factor two and factor 3.

The third factor was identified as an enjoyment construct. Enjoyment was described in as a vital element in leisure activity (Jackson, 1991). A classic definition of leisure is activity that is not required as essential for daily living and is performed at the discretion of the individual (Bammel & Burrus-Bammel, 1992). The enjoyment of PA is an essential part of the negotiation process

(McGuire, 1984) and in the PRQ the enjoyment construct was differentiated from negotiation. People do things they enjoy and will find time for them. The concept of preference of activity was highlighted in the CAPS study and the PRQ was developed for women to provide an assessment of attitudes towards PA. The construct of enjoyment is valuable in identifying women who have varying levels of enjoyment for PA and in assisting women in finding activities they enjoy to maintain regular PA (Jackson, 2000)

**Constraint and negotiation**. The lack of time is a factor that is repeatedly reported by women as a constraint to PA (Im et al., 2011; Im, Ko, Hwan, et al., 2011). The constraint construct provides concrete examples of what women reported as factors that inhibit or prohibit leisure preferences (Jackson, 2000). Women reported exhaustion, jobs, and caregiving as higher priorities than PA (Im et al., 2011). The construct of constraints to PA in the PRQ can help to identify women who have varying levels of constraints to PA participation. The construct of negotiation to constraints is important to identify and understand ways that women have reported overcoming constraints to PA. In the PRQ, the negotiation factor reflects types of negotiation strategies reported by women and helps to identify and to assist women to assess their priorities and seek strategies to increase their PA.

**Specific Aim 2.** The hypothesis of aim 2 was that a two factor model would result from the CFA. The hypothesis was not supported. The two factor CFA model was not a good fit. Therefore a three factor model was considered.

The three factor CFA model was a good fit. Item 16 “To be involved in PA requires careful planning” only had a factor loading of 0.201. This item was deleted from the final three factor model. Results of the three factor CFA model provided support for the hypothesis that the construct of enjoyment of PA is a separate experience outside of the process of negotiation of constraints. This makes sense as in order to consider participation in an activity, one must enjoy the experience. As well, since most women report constraints to participation in PA, ability to negotiate these constraints is necessary for participation in PA activities.

**Moderate PA in Women**

**Specific Aim 3**. The third aim focused on the measurement of moderate intensity PA in the Typical Week Physical Activity Survey. The exploratory model sought to distinguish the categorical factors; however the EFA model could not be generated in M*plus.* Future research with the TWPAS might include other types of analyses that would accommodate the data.

**Specific Aim 4.** The final aim tested the hypothesis that the moderate and vigorous intensity PA captured in the TWPAS would correlate with the objective and subjective PA criterion measures. This hypothesis was supported through the correlations of moderate and vigorous PA with the PA Record. All items from the TWPAS were significantly related with like items on the PA Records with the exception of transportation PA. Correlations between the TWPAS for vigorous-intensity, sports and conditioning were positively related with treadmill-graded exercise test duration, an indirect measure of cardiorespiratory fitness. Inactivity was inversely related with time spent on the treadmill. BMI was positively related with inactivity and inversely related with vigorous-intensity PA on the TWPAS. Time spent in moderate-intensity PA from the TWPAS was positively related with Caltrac accelerometer MET-min/day. These relationships indicate that the TWPAS reflects the types of activities minority women report doing on PA records kept for four consecutive days. This indicates the TWPAS has face validity to reflect the types of activities that make up women's lives. Only transportation PA from the TWPAS was not significantly related with like activities recorded in the PA record. This is possible if the PA records were recorded on days where transportation PA, such as walking to the bus or a store, was not performed. As expected, women with higher fitness levels and lower BMIs recorded more times in vigorous-intensity activities and less time on inactive pursuits on the TWPAS. The Caltrac MET-min/day scores reflect kcal energy expenditure over and above the estimate resting metabolic rate. The Caltrac MET-min/day scores were positively related with the TWPAS moderate-intensity PA min/day. Thus, there is confidence that the TWPAS is a good measure of moderate- and vigorous-intensity PA and that the time spent in varying domains of activity are reflective of how minority women allocate time in their daily activities.

**Strengths of the Study**

The CAPS provided a woman-centered approach to the issue of PA measurement. The concept of women's PA patterns differing from men's PA patterns had not been addressed in previous PA questionnaire development (Masse, Ainsworth, Tortolero, 1998). The first PA studies were exclusively with males (Kahn, 1963; Taylor et al, 1962; Paffenbarger & Hale, 1975) and the habitual PA of women had not previously been assessed. The CAPS research incorporated the 1995 ACSM and CDC recommendations for light (< 3 METS), moderate (3-6 METS), and vigorous (>6 METS) PA which identified the way that health- contributing PA was conceptualized into different intensity levels. The paradigm of PA as any bodily movement produced by skeletal muscles to increase energy expenditure (Caspersen, Powell, & Christensen, 1985) changed the view of PA that was any form of movement and not only vigorous exercise or structured recreation. From a public health standpoint, more of the population could participate in activity that would benefit their health if habitual PA performed at home was included in surveillance systems.

The promotion of household chores to increase PA participation seems counter-intuitive to the concept of promoting the enjoyment of PA. One of the reasons for this dichotomy is that women expressed PA participation as a self-indulgent activity (Im, Ko, Hwang, et al., 2011). The TWPAS provides individuals multiple options on how to meet the daily recommended dose of PA for health. Women were not participating in structured recreation or conditioning activities, but they were still participating in habitual activities. The TWPAS measures various types of activity that women do including moderate intensity PA performed for home maintenance, caring for others, occupation, transport, and leisure. This knowledge of health-enhancing types of activities can provide incentives for women to increase the typical or habitual moderate PA that is performed regularly. Women can select the activities that they enjoy most and increase the duration and intensity to gain the health benefit.

Another strong point of the CAPS was the use of the *Compendium of Physical Activities* (Ainsworth, et al., 2000) as the standard to categorize the reported activity in the TWPAS. The use of standardized codes was one way to increase the fidelity of the activity measurement. The energy expenditure in over 100 different activities was calculated from the PA records in Phase 1 and in the TWPAS in Phase 2. Before studies such as the CAPS the step of standardization of PA expenditure from self-report questionnaires was not a common practice. Today the *Compendium* is regularly used as one of the steps in calculation of energy expenditure from self-reported questionnaires.

The final strength of the CAPS was that the instruments were adapted to the targeted population. PA reporting with the TWPAS was equally effective with the 4 days as the 7 day report. This is because typical PA was easily recalled and was similar to the habitual activity performed during 7 days. Another way that the scale was adapted was the original inclusion of special days of activity. The test versions of the TWPAS included activity patterns on a holiday or special ceremony days. The activity intensity and frequency levels were not significantly different on special days so this measure was removed from the final version of the TWPAS. The TWPAS is a tool that could be used by women from many different backgrounds in a variety of settings. The public health PA recommendations were applied in the formation of the TWPAS.

**Limitations of the Study**

One limitation of the current project was the sample size of only 140 women in Phase 1 and Phase 2. A full battery of psychometric tests could not be conducted due to the limitation of small sample size. Along with the smaller sample size there was a limitation of negatively skewed data. The advantage of a larger heterogeneous sample at the primary stages of scale development is that the constructs could be tested in wider settings (Clark & Watson, 1995). Further testing in a larger sample will provide stronger support for the validity of both scales.

The CAPS was conducted over 15 years ago and the science of accurate and reliable measurement of PA has grown exponentially. The limitations of the Caltrac motion sensor is that it could not identify energy expended in different types of intensities, such as light, moderate, and vigorous intensity activity. Instead, the Caltrac only showed the energy expenditure expended in excess of the estimated resting metabolic rate. Further testing with current motion sensor technology would be beneficial to see how well the actual amount to time spent in varying intensities is related to reported time in different intensity activities. Accelerometry, GPS, and smart phone technology are examples of tools that are now used to assess activity intensity, location, and duration. Further testing of the

TWPAS in a larger sample using the current PA criterion measures would provide further validity.

The CAPS study was designed to develop a questionnaire to measure time spent in the 1995 definitions of light (< 3 METs), moderate (3-6 METs), and vigorous (6 METs) activities. In 2008 the National Physical Activity Recommendation altered the definition of MET values for moderate (3-5.9 METs) and vigorous ($\geq$ 6.0 METs). This could alter the relationships determined in this validation study for the treadmill and Caltrac measures given the change of time spent in moderate- and vigorous-intensity PA for the TWPAS.

Another limitation in the data evaluated in this dissertation as the lack of reflection on the historical and political issues in the chosen populations. Societal influences upon leisure perceptions and choices were acknowledged (Henderson & Ainsworth, 1988; 200b) as antecedent factors to PA participation, but this concept was not highlighted in the CAPS. A concept of societal constraints was also differentiated as unrelated to the individual (Henderson, 1997), but this concept was never developed in the literature describing the CAPS. The constraint model used in the CAPS was centered on personal (individual) values (Henderson & Ainsworth, 2001c). The major factors examined in the CAPS were related to primarily to gender and age (Henderson & Ainsworth, 2000; Henderson & Ainsworth, 2001, Henderson & Ainsworth, 2003; Tudor-Locke, 2003). Future work with health promotion in AA and NA communities should include discussions on the historical and political constraints (antecedent factors) that influence the health of communities (Brayboy, 2005; Crenshaw, 1991).

# Chapter 6

# CONCLUSION

## Implications for Future Research

Future research in PA promotion with women might include further development of the constructs of constraint, enjoyment, and negotiation of PA through qualitative studies on the meaning of PA to women. Have women's perceptions of PA changed from exercise, conditioning, and sports to broader concepts? Have public health messages in the past 15 years influenced the way that women seek to become more active?

The TWPAS should be evaluated again in another study with women of color and women who live in urban and rural settings. Comparison measures of PA should include 2012 era and later types of accelerometer and heart rate monitors, web-based or telemetry-based PA records, and measures of fitness and fatness. The new paradigm of physical inactivity is of interest to exploring on the TWPAS as time spent in the inactivity domain on the TWPAS was significantly related with like recordings on the PA record and BMI. Also, the PRQ also should be compared with the TWPAS and the other measures of PA to determine the predictive validity of PRQ for PA participation. Confirmation of the relationships identified and the reliability of the survey should be followed by examination by of how well the TWPAS measures change of PA in intervention studies in older women.

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# APPENDIX A

# PHYSICAL RECREATION QUESTIONNAIRE

| | | |
|---|---|---|
| 1 | I enjoy physical activity. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 2 | Physical activity is drudgery. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 3 | Physical activity is vitally important. | 1= Almost never<br>2= Not true<br>3= True<br>4= Almost always true |
| 4 | Life is better because of my physical activity. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 5 | Physical activity is pleasant. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always |
| 6 | I arrange or change my schedule to participate in regular physical activity. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 7 | Physical activities bore me. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 8 | I don’t have time for physical activity. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |

| | | |
|---|---|---|
| 9 | My work schedule prevents me from doing the physical activities that I would like to do. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 10 | Trying to plan time for physical activity adds stress to my life. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 11 | My life is so structured that it is hard to find time for physical activity | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 12 | Involvement in physical activity interferes with other more important things I need to do in my life. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 13 | I'm often so exhausted from daily work that I have no energy for physical activity. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 14 | Even when I don't feel like it, I try to participate in physical activity. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 15 | Even though I lack the time, I still make physical activity a priority in my life. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 16 | To be involved in physical activity requires that I carefully plan my day. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |

| | | |
|---|---|---|
| 17 | I try to fit my physical activity into my work and family schedule. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |
| 18 | I get up earlier or stay up later so I can have physical activity. | 1= Almost never true<br>2= Not true<br>3= True<br>4= Almost always true |

## APPENDIX B

## TYPICAL WEEK PHYSICAL ACTIVITY SURVEY

CAPS Label Here

# CAPS TYPICAL WEEK PHYSICAL ACTIVITY SURVEY

This is a survey of the types of activities you did in a **typical week in the past 4 weeks**. We are interested in knowing how much time you spend doing different tasks during a typical week. Think about how you usually spend your time from Monday through Sunday. When we read the activities, indicate if you do any of the activities by responding YES, NO, or INFREQUENTLY. For the items you answer YES, try to recall the days in a typical week that you do these activities and for each day, the minutes or hours per day you are doing the activity. For items you do infrequently (not in a typical week, but during the past 4 weeks), recall the number of days per month and minutes per day when you do these activities.

*Write 4 week recording period below:*

___/___/___ to ___/___/___
Month Day Year (CAP36WK1) Month Day Year (CAP36WK2)

*"In a typical week in the past 4 weeks, did you do ..."* *Did you do This activity?*

**In a typical week, how many minutes did you do this activity?**

**(MINUTES)**

| HOUSEHOLD CHORES | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. *Light effort* chores such as cooking, dishes, making the bed, sweeping, straightening up, ironing, laundry, vacuuming, and/or watering plants? | ☐ 1 | ☐ 2 CAP3601 | ☐ 3 | ☐ CAP3601A | ☐ CAP3601B | ☐ CAP3601C | ☐ CAP3601D | ☐ CAP3601E | ☐ CAP3601F | ☐ CAP3601G |
| 2. *Moderate or heavy effort* chores, such as heavy cleaning, scrubbing, mopping, washing the car, moving furniture or heavy boxes, plumbing, painting, making home repairs, and/or hauling water? | ☐ 1 | ☐ 2 CAP3602 | ☐ 3 | ☐ CAP3602A | ☐ CAP3602B | ☐ CAP3602C | ☐ CAP3602D | ☐ CAP3602E | ☐ CAP3602F | ☐ CAP3602G |
| 3. Shop for groceries and put them away, shop for other home items, or shop for family members and/or others? | ☐ 1 | ☐ 2 CAP3603 | ☐ 3 | ☐ CAP3603A | ☐ CAP3603B | ☐ CAP3603C | ☐ CAP3603D | ☐ CAP3603E | ☐ CAP3603F | ☐ CAP3603G |

CAPS36 1:9 Version 1 (3/98)

(MINUTES)

| LAWN, YARD, GARDEN, FARM | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|
| 4. *Moderate effort* work in the yard doing tasks such as weeding, picking vegetables, hoeing, mowing the grass, raking the yard, cleaning the garage, and/or outdoor sweeping? | ☐ 1 | ☐ 2 CAP3604 | ☐ 3 | ☐ CAP3604A | ☐ CAP3604B | ☐ CAP3604C | ☐ CAP3604D | ☐ CAP3604E | ☐ CAP3604F | ☐ CAP3604G |
| 5. *Heavy effort* work in the yard such as digging with a shovel, shoveling snow, mending fences, and/or chopping wood? | ☐ 1 | ☐ 2 CAP3605 | ☐ 3 | ☐ CAP3605A | ☐ CAP3605B | ☐ CAP3605C | ☐ CAP3605D | ☐ CAP3605E | ☐ CAP3605F | ☐ CAP3605G |

(MINUTES)

| TAKING CARE OF OTHERS | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|
| 6. *Light effort* child care and/or older adult care? (Tasks such as bathing, dressing, feeding, changing diapers, playing, or physically involved with them?) | ☐ 1 | ☐ 2 CAP3606 | ☐ 3 | ☐ CAP3606A | ☐ CAP3606B | ☐ CAP3606C | ☐ CAP3606D | ☐ CAP3606E | ☐ CAP3606F | ☐ CAP3606G |
| 7. *Moderate or heavy effort* child or older adult care such as lifting more than 30 lbs., and/or moving a wheelchair up and down steps? | ☐ 1 | ☐ 2 CAP3607 | ☐ 3 | ☐ CAP3607A | ☐ CAP3607B | ☐ CAP3607C | ☐ CAP3607D | ☐ CAP3607E | ☐ CAP3607F | ☐ CAP3607G |
| 8. Take care of animals, such as feeding, grooming, cleaning and/or playing in the yard? | ☐ 1 | ☐ 2 CAP3608 | ☐ 3 | ☐ CAP3608A | ☐ CAP3608B | ☐ CAP3608C | ☐ CAP3608D | ☐ CAP3608E | ☐ CAP3608F | ☐ CAP3608G |

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(MINUTES)

## WALKING FOR NON-WORK REASONS

| | | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 9. | Walk to get places, such as walking to the bus, to and from your car to work and/or to go to the store? | ☐ 1 | ☐ 2 CAP3609 | ☐ 3 | ☐ CAP3609A | ☐ CAP3609B | ☐ CAP3609C | ☐ CAP3609D | ☐ CAP3609E | ☐ CAP3609F | ☐ CAP3609G |
| 10. | Walk with your dog and/or other animals? | ☐ 1 | ☐ 2 CAP3610 | ☐ 3 | ☐ CAP3610A | ☐ CAP3610B | ☐ CAP3610C | ☐ CAP3610D | ☐ CAP3610E | ☐ CAP3610F | ☐ CAP3610G |
| 11. | Walk with young children or older adults – pushing a stroller or wheel chair, and/or carrying a child less than 30 lbs. (walking slower than your usual pace)? | ☐ 1 | ☐ 2 CAP3611 | ☐ 3 | ☐ CAP3611A | ☐ CAP3611B | ☐ CAP3611C | ☐ CAP3611D | ☐ CAP3611E | ☐ CAP3611F | ☐ CAP3611G |
| 12. | Walk for exercise? | ☐ 1 | ☐ 2 CAP3612 | ☐ 3 | ☐ CAP3612A | ☐ CAP3612B | ☐ CAP3612C | ☐ CAP3612D | ☐ CAP3612E | ☐ CAP3612F | ☐ CAP3612G |
| 13. | Walk for pleasure and/or for social reasons? | ☐ 1 | ☐ 2 CAP3613 | ☐ 3 | ☐ CAP3613A | ☐ CAP3613B | ☐ CAP3613C | ☐ CAP3613D | ☐ CAP3613E | ☐ CAP3613F | ☐ CAP3613G |
| 14. | Climb Stairs? (1 flight = 30 seconds 2 flights = 1 minute) | ☐ 1 | ☐ 2 CAP3614 | ☐ 3 | ☐ CAP3614A | ☐ CAP3614B | ☐ CAP3614C | ☐ CAP3614D | ☐ CAP3614E | ☐ CAP3614F | ☐ CAP3614G |

(MINUTES)

## TRANSPORTATION

| | | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15. | Drive or ride a car, take the bus, and/or ride in a subway to get places, including traveling to and from work | ☐ 1 | ☐ 2 CAP3615 | ☐ 3 | ☐ CAP3615A | ☐ CAP3615B | ☐ CAP3615C | ☐ CAP3615D | ☐ CAP3615E | ☐ CAP3615F | ☐ CAP3615G |

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## DANCE & SPORT

(MINUTES)

| | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|
| 16. Dance in church, ceremonies, and/or for pleasure? | 1 | 2 CAP3616 | 3 | CAP3616A | CAP3616B | CAP3616C | CAP3616D | CAP3616E | CAP3616F | CAP3616G |
| 17. Did you play sports such as softball, volleyball, basketball, tennis, golf, and/or other activities? | 1 | 2 CAP3617 | 3 | | | | | | | |

| Which Activities? | *LEAVE THIS AREA BLANK* **COMPENDIUM CODE** | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|
| (A) ____________ | __ __ __ __ __ CAP3617A | CP3617AA | CP3617AB | CP3617AC | CP3617AD | CP3617AE | CP3617AF | CP3617AG |
| (B) ____________ | __ __ __ __ __ CAP3617B | CP3617BA | CP3617BB | CP3617BC | CP3617BD | CP3617BE | CP3617BF | CP3617BG |
| (C) ____________ | __ __ __ __ __ CAP3617C | CP3617CA | CP3617CB | CP3617CC | CP3617CD | CP3617CE | CP3617CF | CP3617CG |

## CONDITIONING

(MINUTES)

| | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|
| 18. Did you stretch and/or do yoga? | 1 | 2 CAP3618 | 3 | CAP3618A | CAP3618B | CAP3618C | CAP3618D | CAP3618E | CAP3618F | CAP3618G |
| 19. Did you lift weights, do sit ups and/or push ups? | 1 | 2 CAP3619 | 3 | CAP3619A | CAP3619B | CAP3619C | CAP3619D | CAP3619E | CAP3619F | CAP3619G |

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## CONDITIONING (continued)

| | YES | NO | INFREQ | | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | (MINUTES) | | | | | | |
| 20. Did you do aerobic dance exercise? | ☐ 1 | ☐ 2 CAP3620 | ☐ 3 | | ☐ CAP3620A | ☐ CAP3620B | ☐ CAP3620C | ☐ CAP3620D | ☐ CAP3620E | ☐ CAP3620F | ☐ CAP3620G |
| 21. Did you bicycle - stationary and/or outdoors? | ☐ 1 | ☐ 2 CAP3621 | ☐ 3 | | ☐ CAP3621A | ☐ CAP3621B | ☐ CAP3621C | ☐ CAP3621D | ☐ CAP3621E | ☐ CAP3621F | ☐ CAP3621G |
| 22. Did you jog or run – treadmill and/or outdoors? | ☐ 1 | ☐ 2 CAP3622 | ☐ 3 | | ☐ CAP3622A | ☐ CAP3622B | ☐ CAP3622C | ☐ CAP3622D | ☐ CAP3622E | ☐ CAP3622F | ☐ CAP3622G |
| 23. Did you swim, ski, row or canoe, use machines (like stair climber) or do other conditioning activities? | ☐ 1 | ☐ 2 CAP3623 | ☐ 3 | | | | | | | | |

| Which activities? | *LEAVE THIS AREA BLANK* **COMPENDIUM CODE** | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|
| | | (MINUTES) | | | | | | |
| (A) ______________________ | __ __ __ __ __ CAP3623A | ☐ CP3623AA | ☐ CP3623AB | ☐ CP3623AC | ☐ CP3623AD | ☐ CP3623AE | ☐ CP3623AF | ☐ CP3623AG |
| (B) ______________________ | __ __ __ __ __ CAP3623B | ☐ CP3623BA | ☐ CP3623BB | ☐ CP3623BC | ☐ CP3623BD | ☐ CP3623BE | ☐ CP3623BF | ☐ CP3623BG |
| (C) ______________________ | __ __ __ __ __ CAP3623C | ☐ CP3623CA | ☐ CP3623CB | ☐ CP3623CC | ☐ CP3623CD | ☐ CP3623CE | ☐ CP3623CF | ☐ CP3623CG |

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(MINUTES)

| | LEISURE ACTIVITIES | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 24. | Sit or recline & watch TV | ☐ 1 | ☐ 2 CAP3624 | ☐ 3 | CAP3624A | CAP3624B | CAP3624C | CAP3624D | CAP3624E | CAP3624F | CAP3624G |
| 25. | Play video games, card games, Computer or video? (not at work)? | ☐ 1 | ☐ 2 CAP3625 | ☐ 3 | CAP3625A | CAP3625B | CAP3625C | CAP3625D | CAP3625E | CAP3625F | CAP3625G |
| 26. | Arts & crafts, knitting, and/or sewing? | ☐ 1 | ☐ 2 CAP3626 | ☐ 3 | CAP3626A | CAP3626B | CAP3626C | CAP3626D | CAP3626E | CAP3626F | CAP3626G |
| 27. | Sit or recline and read, visit, sit in class, and/or just do nothing? | ☐ 1 | ☐ 2 CAP3627 | ☐ 3 | CAP3627A | CAP3627B | CAP3627C | CAP3626D | CAP3627E | CAP3627F | CAP3627G |

**OCCUPATION** *If you worked more than one JOB, include all jobs in your answers*

| | | YES | NO | INFREQ | | |
|---|---|---|---|---|---|---|
| 28. | Did you work to earn money? | ☐ 1 | ☐ 2 CAP3628 | ☐ 3 → | IF YES | How many **hours/week** did you work **in all jobs**? ☐ CAP3628H (Hours/week) |

What is your job title? (include all jobs held in a typical week in the past four weeks)

Job A ____________ (CAP3628A) How many **hours/week** did you work in job A? ☐ CP3628AH

Job B ____________ (CAP3628B) How many **hours/week** did you work in job B? ☐ CP3628BH

Job C ____________ (CAP3628C) How many **hours/week** did you work in job C? ☐ CP3628CH

Make sure these total number in the box

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**(MINUTES)**

| OCCUPATION (continued) | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|
| 29. *Light effort* sitting such as office and/or lab work, sewing and/or driving for work? | ☐ 1 | ☐ 2 CAP3629 | ☐ 3 | ☐ CAP3629A | ☐ CAP3629B | ☐ CAP3629C | ☐ CAP3629D | ☐ CAP3629E | ☐ CAP3629F | ☐ CAP3629G |
| 30. *Light effort* standing such as filing, copying, clerking, tailoring, assembly line, nursing, farming and or ranching? | ☐ 1 | ☐ 2 CAP3630 | ☐ 3 | ☐ CAP3630A | ☐ CAP3630B | ☐ CAP3630C | ☐ CAP3630D | ☐ CAP3630E | ☐ CAP3630F | ☐ CAP3630G |
| 31. *Moderate effort* standing and walking activities such as a nurse, custodian, housekeeper where you are lifting or pushing items 30 lbs. or less (empty trash, carry items, change linen, vacuum, care for others)? | ☐ 1 | ☐ 2 CAP3631 | ☐ 3 | ☐ CAP3631A | ☐ CAP3631B | ☐ CAP3631C | ☐ CAP3631D | ☐ CAP3631E | ☐ CAP3631F | ☐ CAP3631G |
| 32. Walk as part of your job? This includes walking in the hall and between buildings. Do not include walking at work that is not related to your job. | ☐ 1 | ☐ 2 CAP3632 | ☐ 3 | ☐ CAP3632A | ☐ CAP3632B | ☐ CAP3632C | ☐ CAP3633D | ☐ CAP3634E | ☐ CAP3635F | ☐ CAP3635G |
| 33. Heavy manual labor such as farm or ranch hand, load and/or unload trucks? | ☐ 1 | ☐ 2 CAP3633 | ☐ 3 | ☐ CAP3633A | ☐ CAP3633B | ☐ CAP3633C | ☐ CAP3633D | ☐ CAP3633E | ☐ CAP3633F | ☐ CAP3633G |
| 34. Did you walk during the work day that is not part of your job such as during breaks and/or your lunch hour? | ☐ 1 | ☐ 2 CAP3634 | ☐ 3 | ☐ CAP3634A | ☐ CAP3634B | ☐ CAP3634C | ☐ CAP3634D | ☐ CAP3634E | ☐ CAP3634F | ☐ CAP3634G |

| VOLUNTEER | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (MINUTES) | | | | | | |
| 35. Did you work as a volunteer and/or at church in activities you have not mentioned on this survey? | ☐ 1 | ☐ 2 CAP3635 | ☐ 3 | | | | | | | |
| Which Activities? | *LEAVE THIS AREA BLANK* **COMPENDIUM CODE** | | | | | | | | | |
| (A) ______ | ___ ___ ___ ___ ___ CAP3635A | | | ☐ CP3635AA | ☐ CP3635AB | ☐ CP3635AC | ☐ CP3635AD | ☐ CP3635AE | ☐ CP3635AF | ☐ CP3635AG |
| (B) ______ | ___ ___ ___ ___ ___ CAP3635B | | | ☐ CP3635BA | ☐ CP3635BB | ☐ CP3635BC | ☐ CP3635BD | ☐ CP3635BE | ☐ CP3635BF | ☐ CP3635BG |

| OTHER ACTIVITIES | YES | NO | INFREQ | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday | Sunday |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | (MINUTES) | | | | | | |
| 36. Did you do any other activities that were not mentioned on this survey? | ☐ 1 | ☐ 2 CAP3636 | ☐ 3 | | | | | | | |
| Which Activities? | *LEAVE THIS AREA BLANK* **COMPENDIUM CODE** | | | | | | | | | |
| (A) ______ | ___ ___ ___ ___ ___ CAP3636A | | | ☐ CP3636AA | ☐ CP3636AB | ☐ CP3636AC | ☐ CP3636AD | ☐ CP3636AE | ☐ CP3636AF | ☐ CP3636AG |
| (B) ______ | ___ ___ ___ ___ ___ CAP3636B | | | ☐ CP3636BA | ☐ CP3636BB | ☐ CP3636BC | ☐ CP3636BD | ☐ CP3636BE | ☐ CP3636BF | ☐ CP3636BG |
| (C) ______ | ___ ___ ___ ___ ___ CAP3636C | | | ☐ CP3636CA | ☐ CP3636CB | ☐ CP3636CC | ☐ CP3636CD | ☐ CP3636CE | ☐ CP3636CF | ☐ CP3636CG |

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