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HEALTHY LIFESTYLES OF ADULTS IN A WORK SETTING

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by

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Abstract

Nurses have a key role in promoting healthy lifestyles to reduce incidence of disease in adults. Since the 1980's, researchers have recognized readiness as a key component of adopting healthy lifestyle change. Prochaska's transtheoretical model, which contains readiness, or stage of change, served as the theoretical framework for the current study**.** The purpose of this study was to test an exercise behavior model, and in so doing: (a) compare the concurrence rates of exercise stage of change classifications obtained from the four selected exercise stage of change self-report measures; and (b) determine the relative strength of the predictive factors of exercise stage of change and of exercise performance, in healthy adults in a work setting. This correlational study used a one-group design. Ninety-five subjects, aged 19 to 62, completed six questionnaires and two structured interviews about healthy lifestyles. The first stage of change, precontemplation, was not used in data analysis due to few subjects classified in this stage. Agreement of stage classification by four measures of exercise stage of change was determined, with most agreement found between five answer choice and ladder ($k = 0.82$, $p < .01$), and between ladder and the structured interview ($k = 0.86$, $p < .01$). Using multinomial logistic regression, exercise self-efficacy ($p = .003$) and behavioral processes of change ($p = .005$) were significant predictors of stage classification. Differences in mean exercise performance across the stages were found, with exercise performance significantly ($p < .05$) lower in contemplation than in maintenance. Using multiple regression, exercise self-efficacy was the strongest positive

predictor of exercise performance ($\beta = .39$, $p < .01$), followed by behavioral processes of change ($\beta = .30$, $p = .021$). Decisional balance pros was a significant negative predictor of exercise performance ($\beta = -.22$, $p = .031$). No significant relationships were found between demographic variables, and exercise stage of change or exercise performance. The results from this study may help to identify accurate measures which enable more correct classification of an individual's exercise stage of change. Revisions to enhance clarity of wording and directions and further testing of selected instruments are recommended.

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CHAPTER I

Introduction

Chapter I contains specific detail regarding the statement of the problem for the current study. It includes a discussion of the background and significance of the study. This chapter concludes with associated assumptions and the research questions for this study.

Statement of the Problem and Purpose

Since the 1980's, theorists and researchers have recognized the importance of readiness as a key component in behavior change (Prochaska & DiClemente, 1982; Prochaska & Marcus, 1994). In 1992, Marcus and colleagues studied adults at work sites and recognized the importance of readiness as a predictor of the performance of regular exercise, an important component of overall wellness (Marcus, Rossi, Selby, Niaura, & Abrams, 1992). Marcus created an exercise behavior model that contains two important concepts, which are motivational readiness to change, also called stage of change, and exercise performance. The model contains three relationships: (a) factors predicting exercise stage of change, (b) relationship between exercise stage of change and exercise performance, and (c) factors predicting exercise performance (Marcus, Eaton, Rossi, & Harlow, 1994). Factors relevant to predicting exercise stage of change are exercise self-efficacy, decisional balance pros of exercise, and decisional balance cons of exercise (Cardinal, 1997; Gorely & Gordon, 1995; Hellman, 1997; Herrick, Stone, & Mettler, 1997).

These same factors are hypothesized to predict exercise performance (Marcus, Eaton, et al., 1994).

With increasing awareness of the relationship between thoughts and feelings about exercise, the exercise behavior model was extended to include a factor called processes of change, or behavioral and experiential strategies that are used to help behavior change occur. While research has been conducted on the relationship of exercise self-efficacy and decisional balance pros and cons to both exercise stage of change and exercise performance, fewer studies have been conducted on the relationship of processes of change to both exercise stage of change and exercise performance (Dunn et al., 1997; Marcus, Rossi, et al., 1992; Gorely & Gordon, 1995; Simons-Morton et al., 2000; Wallace & Buckworth, 2001). Even though processes of change is an important precursor to behavior change, rarely do exercise behavior studies examine processes of change with other predictive factors together in the same study, and rarely do these studies control for possible influences of age, gender, race, education, and income. Therefore, the exercise behavior model requires further testing.

Theoretical definitions for the two core concepts within the model have been identified. Exercise stage of change has five stages (Prochaska & Marcus, 1994). The earliest stage, precontemplation, refers to those individuals who do not intend to exercise in the foreseeable future. The second stage, contemplation, refers to those individuals who intend to exercise in the foreseeable future. The third stage, preparation, refers to those individuals who

intend to exercise in the near future. The fourth stage, action, refers to those individuals who have begun to exercise. The last stage, maintenance, refers to those individuals who are continuing to exercise over time. For the theoretical definition of exercise performance, Sallis and Owen (1999) refer to exercise performance as physical activity of varying intensity that requires the use of energy.

Although theoretically defining stage of change and exercise performance has been accomplished, and although operationally defining exercise performance using recall has been accomplished, operationalizing stage of change has not been fully accomplished and has proven to be more challenging. There are at least 15 different self-report measures of exercise stage of change. Researchers have found that stage classification may vary, depending on the exercise stage of change measures used (Reed, Velicer, Prochaska, Rossi, & Marcus, 1997). However, because of the lack of studies comparing measures, it is not known how likely people are to be classified the same across measures. Variations in format, wording, and scoring of exercise stage of change measures may account for the various resultant stage classifications. For example, some ladder and double ladder instruments contain as many as ten numbered spaces between the rungs to measure five stages, which makes response selection complex (Marcus, Rakowski, et al., 1992; Reed et al., 1997). Some exercise stage of change instruments with the true false format contain negative and unclear wording in some items (Reed et al., 1997). Some exercise stage of change five-answer choice instruments

contain unclear wording in some items (Reed et al., 1997). The exercise stage of change unstructured interviews contain unclear wording of some of the questions and a lack of consistency in the use of the scoring algorithms (Steptoe, Rink, & Kerry, 2000). Exercise stage of change instruments using Likert scales contain unclear wording and have lengthy response formats (Marcus, Simkin, Rossi, & Pinto, 1996; Reed et al., 1997)

There is only one study comparing agreement of stage classifications obtained when using different exercise stage of change self-report instruments and one pilot study comparing instruments and a structured interview (Fish et al., 2006). An overarching problem for the researcher, therefore, is determining which exercise stage of change self-report measure to select. One approach is to use the criteria (see Appendix A) developed by Reed et al. (1997) to facilitate the selection of an exercise stage of change measure for use in research. Using these criteria, the author chose scale-true false by Marcus and Simkin (1993), scale-ladder by Cardinal (1995a), scale-five answer choice by Nigg and Riebe (2002), and a structured interview by Fish et al. (2006). A structured interview was included in the current study because nurses spend considerable amounts of time interviewing patients about readiness to exercise.

In summary, more research is needed on the exercise behavior model. More research also is needed comparing exercise stage of change self-report measures. Although the initial studies on the exercise behavior model and on agreement between exercise stage of change instruments were done using worksite populations, the research comparing instruments with a structured

interview did not use a worksite population. The purpose of the current study was to test the exercise behavior model, and in so doing: (a) compare the concurrence rates of exercise stage of change classifications obtained from the four selected exercise stage of change self-report measures; and (b) determine the relative strength of the predictive factors of exercise stage of change and of exercise performance, in healthy adults, ages 18 to 65, in a work setting.

Background

The background includes a section on the model of exercise behavior and the relationships within the model. The second section includes measurement of exercise stage of change and exercise performance.

Toward a Model of Exercise Behavior

In the model by Marcus, Eaton, et al. (1994), three relationships are identified: 1) factors predicting exercise stage of change, 2) the relationship between exercise stage of change and exercise performance, and 3) factors predicting exercise performance. The factors predicting exercise stage of change, as well as exercise performance, include exercise self-efficacy, decisional balance pros, and decisional balance cons. Exercise self-efficacy is an individual's confidence in ability to exercise (Marcus, Selby, Niaura, & Rossi, 1992). Decisional balance pros are the individual's perceived benefits of performing the exercise behavior (Marcus, Rakowski, & Rossi, 1992). Decisional balance cons are the individual's perceived costs of performing the exercise behavior (Marcus, Rakowski, et al., 1992). Based on recent research, the model was expanded to include the factor, processes of change, which are

behavioral and experiential strategies used by the individual to increase the likelihood of exercise behavior change (Marcus, Rakowski, et al., 1992).

Factors Predicting Exercise Stage of Change.

Four factors predict exercise stage of change. These are exercise self-efficacy, decisional balance pros, decisional balance cons, and processes of change. While the Marcus, Eaton, et al. (1994) model of exercise behavior proposes significant relationships between three of the predictive factors and exercise stage of change and is supportive of relationships within the model, some studies do not support these findings.

Exercise self-efficacy. One important relationship in the model is exercise self-efficacy and exercise stage of change. Exercise self-efficacy was significantly ($p \leq .05$) higher in individuals in the later exercise stages of change (Cardinal, 1997; Gorely & Gordon, 1995; Fahrenwald & Walker, 2003; Herrick et al., 1997; Marcus, Pinto, Simkin, Audrain, & Taylor, 1994; Marcus, Selby, et al., 1992; Sarkin, Johnson, Prochaska, & Prochaska, 2001; Wallace & Buckworth, 2001). No studies were found that refuted this finding.

Decisional balance pros. A second important relationship in the model is decisional balance pros and exercise stage of change. Decisional balance pros were significantly ($p \leq .05$) lower in the earlier exercise stages of change (Gorely & Gordon, 1995; Herrick et al., 1997; Marcus, Pinto, et al., 1994; Marcus, Rakowski, et al., 1992; Wallace & Buckworth, 2001). In contrast, Sullum, Clark, and King (2000) reported no significant difference in decisional

balance pros was found in individuals in the maintenance stage as compared to those who were exercise relapsers.

Decisional balance cons. A third important relationship in the model is decisional balance cons and exercise stage of change. Decisional balance cons were significantly ($p \leq .05$) higher in the earlier exercise stages of change, precontemplation, contemplation, and preparation, (Marcus, Pinto, et al., 1994; Sullum et al., 2000). Cons also were significantly ($p \leq .05$) lower in individuals in the later exercise stages of change, action and maintenance, than in the earlier stages (Gorely & Gordon, 1995; Fahrenwald & Walker, 2003; Herrick et al., 1997; Marcus, Pinto, et al., 1994; Marcus, Rakowski, et al., 1992; Wallace & Buckworth, 2001). No studies were found that refuted this finding.

Processes of change. A fourth important relationship in the model is processes of change and exercise stage of change. Use of processes of change in individuals in precontemplation and contemplation was significantly ($p \leq .05$) less than the use of processes by individuals in the later stages of action and maintenance (Simons-Morton et al., 2000; Wallace & Buckworth, 2001). However, Gorely & Gordon (1995) found that only half of the ten processes of change were used by individuals in precontemplation significantly ($p \leq .05$) less than those used in all other stages.

In summary, further research is needed on the relationships between the predictive factors of self-efficacy, decisional balance pros, decisional balance cons, and processes of change and exercise stage of change. Although scale-true false by Marcus and Simkin (1993) and scale-ladder by Cardinal (1995a)

have been utilized in studies examining some of the predictive factors and exercise stage of change, more research is needed to explore the findings when using other instruments that meet the criteria for selecting a measure of exercise stage of change, such as scale-five answer choice by Nigg and Riebe (2002) instrument and the structured interview by Fish et al. (2006). Last, more research is needed studying all the factors simultaneously in one sample.

Exercise Stage of Change and Exercise Performance

In agreement with the model of exercise behavior, other investigators also have substantiated the findings that exercise stage of change and exercise performance are related (Cardinal, 1995a; Cardinal, 1997; Hellman, 1997; Marcus, Eaton, et al., 1994; Marcus et al., 1998; Reed et al., 1997; Sarkin et al., 2001). Exercise performance increases with each higher exercise stage of change classification (Cardinal, 1995a; Cardinal, 1997; Hellman, 1997; Marcus et al., 1998; Reed et al., 1997). A significant ($p \leq .05$) increase in the amount of moderate and strenuous exercise performed was associated with action and maintenance as compared to the earlier stages of precontemplation or precontemplation, contemplation, and preparation (Sarkin et al., 2001). Further evaluation of exercise stage of change and exercise performance will expand knowledge of: (a) the validity of exercise stage of change measures in providing correct stage classifications, and (b) the relationship between accurate exercise stage classifications and exercise performance, expecting that exercise performance will increase across the exercise stages up to action and then remain about the same. Although exercise stage of change measures such as

scale-ladder (Cardinal, 1995a) and scale-true false (Marcus & Simkin, 1993) have been utilized in studies examining exercise stage of change and exercise performance, more research needs to be conducted using other formats, such as scale-five answer choice (Nigg & Riebe, 2002) and structured interview (Fish et al., 2006).

Factors Predicting Exercise Performance.

In agreement with the Marcus, Eaton, et al. (1994) model of exercise behavior, there is evidence to suggest that the same predictive factors of exercise stage of change are predictive of exercise performance (Bock, Marcus, Pinto, & Forsyth, 2001; Dunn et al., 1997; Simons-Morton et al., 2000). These predictive factors are exercise self-efficacy, decisional balance pros, decisional balance cons, and processes of change. Yet, there is strong evidence both for, and against, which factors are significant predictors of exercise performance.

Exercise self-efficacy. Exercise self-efficacy was significantly ($p \leq .05$) associated with achievement of increased moderate to vigorous exercise performance (Bock et al., 2001; Dunn et al., 1997).

Decisional balance. Decisional balance pros were significantly ($p \leq .05$) higher in those who increased exercise performance as compared to those who did not (Marcus & Owen, 1992). In contrast, Bock et al. (2001) found decisional balance pros were not significantly different in those who were exercising moderately compared to those who were not. Decisional balance cons of exercise were significantly ($p \leq .05$) lower in those who increased exercise

performance as compared to those who did not (Bock et al., 2001; Dunn et al., 1997).

Processes of change. Processes of change also are related to exercise performance. Some researchers have reported significantly ($p \leq .05$) increased use of some of the processes of change in those with increased exercise performance (Dunn et al., 1997). Yet, another researcher found no increased use of some of the processes in individuals who exercise moderately compared to those who did not exercise moderately (Bock et al., 2001).

In summary, further research is needed on the relationships between the predictive factors of self-efficacy, decisional balance pros, decisional balance cons, and processes of change and exercise performance. Additionally, research is needed studying all the factors simultaneously in one sample to increase knowledge of exercise behavior.

Measurement of Exercise Stage of Change and Exercise Performance

Exercise Stage of Change Measures

There is a paucity of research on determination of the most accurate exercise stage of change measures. This process could start by determining if there was a gold standard against which exercise stage of change measures could be compared. Because there is not a gold standard the only option is to compare exercise stage of change measures to one another. Measuring exercise stage of change using self-report measures is challenging given that there are at least fifteen instruments available, with little evaluation of their psychometric properties. Evaluation of the psychometric properties of the

instruments can be done by comparing agreement of a) exercise stage of change instruments to structured interview and b) the three exercise stage of change instruments to each other, and c) determining the predictive factors of exercise stage of change. In one pilot study, Fish et al. (2006) compared exercise change of stage classifications between three exercise stage of change instruments: scale-ladder (Cardinal, 1995a), scale-true false (Marcus & Simkin, 1993), and scale-five answer choice (Marcus, Rakowski, et al., 1992), and a structured interview (Fish et al., 2006). Fish et al. reported that all three instruments exhibited substantial agreement with the structured interview with the greatest agreement observed between the scale-ladder and structured interview.

Exercise Performance Measure

The Seven-Day Physical Activity Recall was used to measure exercise performance (Blair et al., 1985; Sallis et al., 1985). This self-report interview includes both leisure time and occupational physical activity and allows for determination of different intensities of physical activity. Dishman and Steinhardt (1998) reported a significant correlation of the Seven Day Physical Activity Recall with measured VO_{2max} ($r = .61$; $p<. 05$). This measure is one of the best self-report measures of exercise performance (Dishman & Reinhardt, 1998; Sallis et al., 1985).

Summary

In summary, more research is needed to determine the predictive factors of exercise stage of change and of exercise performance. There is a paucity of

research evaluating the psychometric properties of exercise stage of change measures by comparing concurrence of exercise stage of change structured interview to instruments. There is also a paucity of research evaluating the psychometric properties of exercise stage of change measures by comparing concurrence of exercise stage of change instruments to each other. More research is needed to further evaluate the psychometric properties of exercise stage of change measures.

Significance

Because healthy lifestyles are linked to a lower incidence of cardiovascular disease, more research is needed to facilitate adoption and maintenance of healthy lifestyles. There is a need for further study of the exercise behavior model, along with accurate measurement of exercise stage of change. There is no research on the exercise behavior model that examines all the predictive factors of exercise stage of change and exercise performance in the same study. This is important because the distribution of stage classification can vary in different samples. In addition, prior research did not always control for possible intervening influences such as age, gender, race, education, or income (Reed et al., 1997). No current research provides strong support to recommend the clinical use of any of the existing exercise stage of change instruments or interviews. Prior research used various populations, different settings, and different instruments or unstructured interviews, which did not allow for comparison among self-report measures (Marshall & Biddle, 2001). The pilot study that has been done by Fish et al. (2006), comparing exercise stage of

change instruments with a newly developed face-to-face structured interview, needs to be expanded.

The current study is significant for many reasons. This study tests the three relationships in the exercise behavior model in the same sample. The study examines (a) factors predicting exercise stage of change, (b) relationship between exercise stage of change and exercise performance, and (c) factors predicting exercise performance. The predictive factors include exercise self-efficacy, decisional balance pros and cons, and processes of change (Marcus, Eaton, et al., 1994; Marcus, Rossi, et al., 1992). The study also controls for possible intervening influences of age, gender, race, education, and income. The study simultaneously compares agreement of stage classifications obtained using the three selected exercise stage of change instruments and a structured interview. Finally, the study expands the pilot work in four ways. First, the study includes a larger sample size than the pilot study. Second, while the pilot study compared scale-true false, scale-ladder, and a five-answer choice instrument with the structured interview, the current study uses all the same self-report measures except for a different five answer choice instrument with clearer wording (Fish et al., 2003; Nigg & Riebe, 2002). Third, the study includes the examination of the predictive factors of exercise stage of change, whereas the pilot study did not. Fourth, the study determines the reliability and validity of the structured interview, whereas the pilot study did not.

By testing the exercise behavior model and comparing agreement between selected exercise stage of change self-report measures, the current study

provides new knowledge of the validity of the selected exercise stage of change instruments and structured interview. In turn, the exercise stage of change self-report measures that have the highest agreement and the strongest validity will be recommended for use in future research. Future research includes revision and retesting of these exercise stage of change measures as needed. It is essential to have measures that yield “correct” classification of exercise stage of change (Reed et al., 1997). Only with correct classification can nurses validly match exercise stage of change classification with stage-specific interventions to enhance exercise behavior.

Associated Assumptions

The first assumption is that the use of exercise stage of change is a mechanism for understanding exercise behavior. The second assumption is that exercise stage of change can be measured. The third assumption is that incorrect stage of change classification is not ideal (Reed et al., 1997).

Research Questions

The research questions for the study are:

1. What are the concurrence rate comparisons for exercise stage of change classification between three instruments and a structured interview?
2. What are the concurrence rate comparisons for exercise stage of change classification between three instruments?
3. What is the relative strength of each of the predictive factors of exercise stage of change classification, while controlling for age, gender, race, education, and income?

4. What is the difference in exercise performance according to exercise stage of change classification?
5. What is the relative strength of each of the predictive factors of exercise performance, while controlling for age, gender, race, education, and income?

CHAPTER II

Introduction

Chapter II contains specific details on the theoretical definitions, theoretical framework, and the review of the literature. The first section of this chapter includes the theoretical definitions for each of the major concepts for measuring exercise stage of change and exercise performance used in the current study. Next, the section on the theoretical framework includes the transtheoretical model (TTM) of behavior change and its related constructs, a model of exercise behavior, and a psychometric framework. The TTM of behavior change includes stage of change and processes of change, as well as the TTM-related constructs of self-efficacy and decisional balance, and critical assumptions, criticisms, and advantages of the TTM. The model of exercise behavior includes the constructs and propositions related to exercise stage of change and exercise performance. The psychometric framework focuses on the measurement of exercise stage of change. The third section, the review of literature, includes the three relationships in the exercise behavior model. The three relationships include: (a) factors predicting exercise stage of change, (b) the relationship between exercise stage of change and exercise performance, and (c) factors predicting exercise performance (Marcus, Eaton, et al., 1994; Marcus, Rossi, et al., 1992). The predictive factors include the following constructs: (a) exercise self-efficacy, (b) decisional balance pros, (c) decisional balance cons, (d) behavioral processes of change, and (e) experiential processes of change. The review of literature also includes a section on the

measurement of exercise stage of change and exercise performance. Although there are exercise stage of change studies that have utilized four, five, and six exercise stage of change classifications, the studies included in the review of the literature are only those that used the five exercise stage of change classifications, as recommended by Marcus and others (Marcus & Owen, 1992; Marcus, Rossi, et al., 1992; Marcus, Selby, et al., 1992).

Theoretical Definitions

The constructs in the exercise behavior model are defined. The constructs include exercise stage of change, exercise self-efficacy, decisional balance pros and cons, behavioral and experiential processes of change, and exercise performance.

Exercise Stage of Change

Exercise stage of change refers to motivational readiness to exercise (Marcus & Owen, 1992; Marcus, Rakowski, et al., 1992). There are five stages of exercise stage of change. The first stage, precontemplation, refers to those individuals who do not intend to exercise in the foreseeable future. The second stage, contemplation, refers to those individuals who do intend to exercise in the foreseeable future. The third stage, preparation, refers to those individuals who intend to exercise in the near future. The fourth stage, action, refers to those individuals who have begun to exercise. The last stage, maintenance, refers to those individuals who are continuing to exercise over time (Prochaska & Marcus, 1994).

Exercise Self-Efficacy

Exercise self-efficacy is an individual's confidence in his or her own ability to exercise (Marcus, Selby, et al., 1992).

Decisional Balance

Decisional balance is a comparison of the perceived benefits and costs of making a behavior change (Janis & Mann, 1977). Decisional balance has two components: decisional balance pros and decisional balance cons.

Decisional Balance Pros

Decisional balance pros for exercise are the perceived benefits of exercising (Marcus & Owen, 1992).

Decisional Balance Cons

Decisional balance cons for exercise are the perceived costs, or disadvantages, of exercising (Marcus & Owen, 1992).

Processes of Change

Processes of change are strategies used by an individual to increase the likelihood of behavior change in the individual (Marcus, Rossi, et al., 1992; Prochaska, Norcross, & DiClemente, 1994). Using factor analysis, the processes were ordered into one of two hierarchical factors: behavioral or experiential (Marcus, Rossi, et al., 1992).

Behavioral Processes of Change

The five behavioral processes for exercise include: counter conditioning, helping relationships, self-liberation, reinforcement management, and stimulus

control (Marcus, Rossi, et al., 1992). Table 1 presents definitions of behavioral processes of change as applied to exercise.

Table 1

Definitions of Behavioral Processes of Change as Applied to Exercise

Behavioral Process	Definition
Counter conditioning	Substitution of alternative behaviors (exercise) for the problem behavior (lack of exercise)
Helping relationships	Trusting, accepting, and utilizing the support of caring others during attempts to change the problem behavior (lack of exercise)
Self-liberation	The individual's choice and commitment to change the problem behavior (lack of exercise), including the belief that one *can* change
Reinforcement management	Changing the contingencies that control or maintain the problem behavior (lack of exercise)
Stimulus control	Control of situations and other causes that trigger the problem behavior (lack of exercise)

Note. From "The stages and processes of exercise adoption and maintenance in a worksite sample" by B. H. Marcus, J. S. Rossi, et al., 1992, *Health Psychology, 11,* p. 387.

Experiential Processes of Change

The five experiential (cognitive) processes for exercise include consciousness raising, dramatic relief, self-reevaluation, environmental

reevaluation, and social liberation (Marcus, Rossi, et al., 1992). Table 2 presents definitions of experiential processes of change as applied to exercise.

Table 2

Definitions of Experiential Processes of Change as Applied to Exercise

Experiential Process	Definition
Consciousness raising	Efforts by the individual to seek new information and to gain understanding and feedback about the problem (lack of exercise)
Dramatic relief	Affective aspects of change, often involving intense emotional experiences related to the problem behavior (lack of exercise)
Self-reevaluation	Emotional and cognitive reappraisal of values by the individual with respect to the problem behavior (lack of exercise)
Environmental reevaluation	Consideration and assessment by the individual of how the problem (lack of exercise) affects the physical and social environments
Social liberation	Awareness, availability, and acceptance by the individual of alternative, problem-free life styles in society (a lifestyle including regular exercise)

Note. From "The stages and processes of exercise adoption and maintenance in a worksite sample" by B. H. Marcus, J. S. Rossi, et al., 1992, *Health Psychology, 11,* p. 387.

Exercise Performance

Exercise performance is defined as physical activity of varying intensity that requires the use of energy (Sallis & Owen, 1999).

Theoretical Framework

The theoretical framework consists of three sections: the transtheoretical model, a model of exercise behavior, and a psychometric framework. The section on the TTM includes: (a) the constructs, stage of change and processes of change; (b) the theoretical bases for the related constructs of self-efficacy and decisional balance pros and cons; (c) the critical assumptions of the TTM; (d) the criticisms of the TTM; and (e) the advantages of the TTM. The section on the model of exercise behavior includes: constructs in the model of exercise behavior and propositions in the model of exercise behavior. The section on the psychometric framework includes: steps for selection of exercise stage of change self-report measures and the agreement of stage of change classifications.

Transtheoretical Model

The primary theoretical basis for the current study is the TTM. This integrative model contains ideas from several different theories of psychotherapy and behavior change to facilitate understanding of behavior change (Prochaska & DiClemente, 1982; Prochaska, Norcross, & DiClemente, 1994). In this model, behavior change occurs over time through a series of stages, reflecting the temporal nature of behavior change. The stages also are considered both dynamic and stable. An individual can remain at one stage for

a considerable length of time or quickly move from stage to stage. When changing behavior, an individual progresses forward through the various stages, or the individual may regress, or relapse, to a previous stage. This feature of the model considers the complex nature of behavior change, as the individual does not necessarily follow a linear pattern of change. The individual may progress or regress through the stages several times before the behavior change is ultimately achieved (Prochaska, DiClemente, & Norcross, 1992). Additionally, the TTM considers that some individuals are more ready to change than others at any one point in time. The earlier stages reflect varying degrees of intention, or readiness to change behavior in the future, while the later stages reflect evidence of the behavior change.

Stage of Change

The central construct of the TTM is stage of change. Originally, the model was applied to the study of smoking cessation and contained six stages: precontemplation, contemplation, preparation, action, maintenance, and termination (Prochaska & DiClemente, 1983). So, for smoking cessation stages of change, an individual in precontemplation does not intend to change in the foreseeable future, usually six months. An individual in contemplation intends to change in the foreseeable future. An individual in preparation intends to change in the near future and has taken some steps toward the behavior change. An individual in action has adopted the behavior change. An individual in the maintenance has continued the behavior change for at least six months. An individual in termination has sustained the behavior change and has no

temptation to return to the old behavior. These stage definitions are from the smoking cessation literature and are slightly different from the definitions for the exercise stages developed by Marcus, Selby, et al. (1992) and Prochaska and Marcus (1994). For example, the termination stage has not been used in the exercise research. Prochaska and Marcus (1994) suggested the termination stage might not be useful when studying exercise as an individual may always be at some risk for relapse. Marcus and colleagues adopted the use of five stages for studying exercise behavior change (Marcus, Banspach, Lefebvre, Rossi, Carleton, & Abrams, 1992; Marcus & Owen, 1992; Marcus, Selby, et al. 1992; Marcus & Simkin, 1993).

Processes of Change

The second construct of the TTM is processes of change. Processes of change are actions or strategies that help modify an individual's way of thinking, feeling, or behaving (Prochaska et al., 1994). These processes were derived from several theories of psychotherapy, including psychoanalytic, gestalt, humanistic, cognitive, and behavioral. The processes of change are used by an individual to facilitate progression through the stages of behavior change. Initial research in smoking cessation showed that the use of the processes of change varied with the stages of behavior change. Prochaska and DiClemente (1982) identified ten processes, which can be organized into two higher-order constructs, behavioral and experiential processes of change (see Table 1 and Table 2). Prochaska and colleagues noted that each of the processes is used at one or more specific stages (Prochaska et al., 1994; Prochaska & DiClemente,

1983). Table 3 presents use of processes of change by stage of change. Moreover, use of the processes of change seems to differ from sample to sample (Marcus, Rossi, et al., 1992; Prochaska & DiClemente, 1983). The adoption of these processes of change can facilitate the adoption and maintenance of a new behavior.

Table 3

Use of Processes of Change by Stage of Change

Stage of change	Processes of change used
Precontemplation	Consciousness raising, Social liberation
Contemplation	Consciousness raising, Social liberation, Dramatic relief, Self-reevaluation, Environmental reevaluation
Preparation	Social liberation, Dramatic relief, Self-reevaluation, Self-liberation, Environmental reevaluation
Action	Social liberation, Environmental reevaluation, Self-liberation, Reinforcement management, Counter conditioning, Stimulus control, Helping relationships
Maintenance	Self-liberation, Reinforcement management, Counter conditioning, Stimulus control, Helping relationships

Note. From *Changing for good* (p. 54), by J. Prochaska, J. Norcross, and C. DiClemente, 1994, NY: Avon. and "Stages and processes of self-change of smoking: Toward an integrative model of change," by J.O. Prochaska and C.C. DiClemente, 1983, *Journal of Consulting and Clinical Psychology, 51,* p. 394.

Self-Efficacy

Bandura's theory (1977a) is the basis for self-efficacy, a TTM-related construct according to DiClemente, Prochaska, and Gilbertini (1985). Bandura described self-efficacy as the belief in one's ability to perform a desired behavior. Bandura also contended that an individual's motivation level, affective states, and actions are based more on the beliefs of ability than actual ability. Self-efficacy theory includes cognitive processes that determine behavior such as efficacy expectations, outcome expectations, and outcome value (Buckworth & Dishman, 2002). Efficacy expectations reflect the belief that one can successfully perform the desired behavior to produce an outcome. Outcome expectancy is the belief that performance of the desired behavior will lead to a certain outcome. Outcome value is concerned with the reinforcement value of the expected outcome. Efficacy expectations are most important to the TTM. Bandura identified four dimensions of efficacy expectations including performance accomplishments, vicarious experiences, verbal persuasion, and emotional arousal. Performance accomplishments increase self-efficacy because one is more likely to repeat successful past behaviors. Vicarious experiences increase self-efficacy through role modeling, or the notion that seeing others' success will cause efficacy in one's own performance of the desired behavior. Verbal persuasion affects efficacy expectations when one is led to believe in one's ability by other verbal encouragement. Emotional arousal is concerned with one's efficacy during threatening situations. Self-efficacy is usually greater in situations that are not perceived to be threatening. In the

TTM, research has shown that self-efficacy is positively related to progression through the stages of exercise behavior change (Cardinal, 1997; Cardinal, Tuominen, & Rinatala, 2004; DiClemente et al., 1985; Fahrenwald & Walker, 2003; Gorely & Gordon, 1995; Herrick et al., 1997; Marcus, Pinto, et al., 1994; Marcus, Selby, et al., 1992; Sarkin, Johnson, Prochaska, & Prochaska, 2001; Wallace & Buckworth, 2001).

Decisional Balance Pros and Cons

Decisional balance pros and cons are TTM-related constructs according to Velicer et al. (1988), and are derived from the conflict model of decision-making by Janis and Mann (1977). Janis and Mann described five stages of decision-making. Stage one is appraising the challenge and considering the seriousness of the risks of not changing. The second stage is surveying all available alternatives and considering the acceptability of each alternative. The third stage is weighing the alternatives and considering more specific benefits and costs of each alternative. The fourth stage is deliberating about commitment and considering possible reactions from others regarding the implementation of each alternative. The fifth stage is adhering to the decision despite negative feedback. Only when the negative feedback becomes powerful enough to evoke dissatisfaction with the decision, will the individual repeat the decision-making process. Janis and Mann also stated that optimal decision making occurs when the decision-maker follows these specific criteria: (a) look at a wide range of alternatives, (b) consider the full range of objectives to be fulfilled, (c) weigh the costs of each alternative, (d) seek new information about the

alternatives, (e) assimilate the new information correctly, (f) re-examine the positive and negative consequences of the alternatives, and (g) make a detailed plan for implementation of the chosen alternative. Additionally, this model identifies decisional conflicts that come about when the decision-maker seeks to make an important decision and realizes there are risks associated with the decision. In order to cope with this conflict, Janis and Mann identified five possible coping patterns. The first pattern is unconflicted inertia, in which the decision-maker considers the current course of action as posing no serious risk and continues on the same course. The second pattern is unconflicted change to a new course of action, in which the decision-maker considers a new course of action as posing less risk than the current course. The third pattern is defensive avoidance, in which the decision-maker is dissatisfied with the current course of action and the alternative courses and avoids or procrastinates with decision-making. The fourth pattern is hypervigilance, in which the decision maker recognizes the need to change course, but panics and can only make simple changes, such as do what others are doing. The fifth pattern is vigilance, in which the decision-maker makes the optimal decision. To supplement the coping patterns, Janis and Mann identified decisional balance. Decisional balance was a way of categorizing all the pro and con information to consider, when making a decision. The four main categories were gains, approval, losses, and disapproval. The gains included the utilitarian benefits of the decision for the individual and for others. Approval included approval of the decision from the individual and from others. The losses included the utilitarian

costs of the decision for the individual and for others. Disapproval included disapproval of the decision from the individual and from others. Decisional balance theory postulates that an individual will determine that the new behavior has higher gains than losses and more approval than disapproval (Janis & Mann, 1977). In a smoking cessation study using the transtheoretical model, these four categories of decisional balance were simplified into two categories, or factors, decisional balance pros and decisional balance cons (Velicer et al., 1985). These two factors, decisional balance pros and cons, have also been studied in exercise behavior change (Cardinal et al., 2004; Fahrenwald & Walker, 2003; Gorely & Gordon, 1995; Herrick et al., 1997; Marcus, Pinto, et al., 1994; Marcus, Rakowski, et al., 1992; Wallace & Buckworth, 2001). The pros and cons are important in the first three stages of precontemplation, contemplation, and preparation, and less important in action and maintenance. Prochaska, Velicer, et al. (1994) studied 12 health-related behaviors and found that the cons were always greater than the pros in the earliest stage, or precontemplation. They also found that the pros were always greater than the cons in the later stages of action and maintenance. The crossover of the pros and cons of behavior change generally occurred in contemplation or preparation. No specific criticisms of this model were found. However, most researches who use the TTM for research reported the pros and cons, and not the net gain or loss.

Critical Assumptions of the Transtheoretical Model

Prochaska and Velicer (1997) have described several critical assumptions of the TTM. First, multiple theories are needed to account for the complex process of behavior change. Second, behavior change occurs over time. Third, stages are both stable and open to change. Fourth, planned interventions are needed for behavior change to occur; there is no inherent motivation. Fifth, specific processes work at different stages; not every process or principle works at every stage. Finally, stage-matched interventions are necessary to enhance self-control and consequent change in the behavior.

Criticisms of the Transtheoretical Model

One criticism is the notion that the transtheoretical approach to behavior change encompasses many different and seemingly incompatible theories. Because of this belief, Bandura (1977b) claims that the TTM is atheoretical. Another criticism of the TTM is concerned with the core concept of stages. Bandura's argument was that the stages of the TTM are too discrete for the complexity of human behavior. Instead, transitions between stages and even sub stages need to be created. Bandura also commented that true stages are non-reversible and must be qualitatively different. Also, progression through stages is inevitable and irreversible. True stages are akin to the biological stages a butterfly progresses through, each one different and not reversible. Bandura gave the example of the TTM stage definitions of action and maintenance; the definition of maintenance is simply an extension of action, and therefore the two stages are not inherently different. A third area of criticism

is related to the tautology of the model, in that the stages are defined in the same terms as the behavior itself (Bandura, 1997b). A final criticism is related to the numerous measures of exercise stage of change and the need for valid measures of the construct, stage of change (Ashworth, 1997; Marshall & Biddle, 2001; Reed et al., 1997). There is little research to determine if the multiple measures of exercise stage of change are equally valid (Ashworth, 1997).

Advantages of the Transtheoretical Model

Despite criticisms, the TTM, the TTM core constructs, and the TTM-related constructs are being widely used in studies of exercise behavior change. Wernstein, Rothman, & Sutton (1998) did not consider the criticism of the irreversible nature of a stage as applicable to stage theories involving humans' behavior change. Instead, these authors agreed with the importance of a dynamic aspect of the stage model. For example, an individual can be at a stage for a very short time or can be there for a long time if the right interventions are not received (Prochaska, Norcross, & DiClemente, 1994). Additionally, this model is unique in that it considers not only the behavior change, but also the degrees of readiness to change behavior. Last, the TTM is useful for the development of interventions targeted for a specific stage (Marcus, Emmons, et al., 1998; Prochaska & Velicer, 1997). This can be facilitated with knowledge of the specific processes used in each stage of change (Ashworth, 1997).

The TTM and the core and related constructs of the model were analyzed using Walker and Avant's framework (1995) of origin, meaning, logical

adequacy, usefulness, generalizability, parsimony, and testability. The origin of the TTM is from several theories of psychotherapy, in an effort to better facilitate behavior change in individuals with substance addiction, such as smokers (Prochaska & DiClemente, 1982; Prochaska & DiClemente, 1983). The meaning of the TTM is apparent in the relationships between the constructs of the model. For example, different processes of change are used at different stages. Generally, use of experiential processes is greater in the earlier stages, and the use of behavioral processes occurs more in the later stages of behavior change. The logical adequacy of the TTM is shown in studies of the ability of self-efficacy, decisional balance, and processes of change to predict stage of change (Wallace & Buckworth, 1997). The usefulness of the TMM is evident in the relationship of decisional balance pros and cons with the stages in many health behaviors (Prochaska, Velicer, et al., 1994). The generalizability of the TTM was shown by researchers who have studied the model in different settings, populations, and health behaviors (Cardinal, 1995a; Cardinal et al., 2004; Fahrenwald & Walker, 2003; Gorely & Gordon, 1995; Riebe, Garber, Rossi, Greaney, Nigg, Lees, et al., 2005; Tseng, Jaw, Lin, & Ho, 2003; Wallace & Buckworth, 2001). Although the TTM was originally developed to stop negative behaviors such as smoking, the model has been applied to the acquisition of more positive behaviors, such as exercise (Marcus, Banspach, et al., 1992). However, the relationships between the constructs and stage of change may vary, depending on the behavior study (Prochaska, Velicer, et al., 1994). The parsimony of the TTM is apparent because it is concise and easily

understood, and has been applied to many different behaviors (Ashworth, 1997; Prochaska, Velicer, et al., 1994). The testability of the TTM was demonstrated by researchers who tested the relationship between stage of change and the amount of exercise performed (Cardinal, 1995a; Cardinal, 1997; Cardinal, et al., 2004; Fahrenwald & Walker, 2003; Marcus, Eaton, et al., 1994; Marcus, Emmons, et al., 1998; Marcus & Simkin, 1993).

Model of Exercise Behavior

Two central constructs of a model of exercise behavior are readiness to exercise, or exercise stage of change, and exercise performance (Marcus, Eaton, et al., 1994). The model also includes the following relationships: (a) factors predicting exercise stage of change, (b) the relationship between exercise stage of change and exercise performance, and (c) factors predicting exercise performance. These factors were exercise self-efficacy, decisional balance pros, and decisional balance cons. Marcus, Eaton, et al. (1994) found significant relationships between exercise self-efficacy, decisional balance pros, and decisional balance cons, and exercise stage of change. There also was a significant relationship between exercise stage of change and exercise performance. Fewer studies have been conducted on the relationship between the predictive factors and exercise performance. Originally, the model of exercise behavior included these three factors of exercise self-efficacy, decisional balance pros, and decisional balance cons. In the current study, the model of exercise behavior will be extended to include an additional factor, processes of change. Researchers have found significant relationships between

behavioral and experiential processes of change and exercise stage of change (Gorely & Gordon, 1995; Hellman, 1997).

Constructs in the Model of Exercise Behavior

The constructs in the model of exercise behavior are exercise stage of change, exercise self-efficacy, decisional balance, processes of change, and exercise performance. Because many of these constructs have already been outlined, only exercise performance will be discussed.

Health behavior change is complex and encompasses physical, psychological, and social aspects. Therefore, the framework underlying exercise performance includes both physiologic and psychosocial aspects (American College of Sports Medicine [ACSM], 2000). The physiology of exercise is the science that deals with body function during exercise (Brooks, Fahey, White, & Baldwin, 2000). The American College of Sports Medicine (ACSM, 2000) and Healthy People 2010 (US Department of Health and Human Services, 2000) emphasized that health benefits are obtained through regular participation in physical activity and/or exercise. Exercise performance is defined as physical activity of varying intensity that requires the use of energy (Sallis & Owen, 1999). Some specific health benefits inherent in the performance of exercise include improved cardio respiratory function, decreased risk of coronary artery disease, decreased cardiac mortality and morbidity, and improved mental health. The health benefits increase with longer duration of physical activity (ACSM, 2000).

The second aspect of exercise performance is the psychosocial aspect. The psychology of exercise performance includes application of several different theories of behavior change. Some of these theories include behaviorism, cognitive behaviorism, social cognitive theory, self-efficacy theory, stage theory, theory of reasoned action, theory of planned behavior, health belief model, relapse prevention, and habit theory (Buckworth & Dishman, 2002). Taylor and Miller (2001) identified stages of health behavior change. These stages were called antecedents, adoption, and maintenance and were based on social learning theory. This framework for facilitating behavior change was likened to the TTM. Taylor and Miller's antecedent stage included things that can help or hinder behavior change. These things were information, instruction, role models, experience, and incentives and disincentives. This antecedent stage is similar to the precontemplation, contemplation and preparation stages of the TTM. Taylor and Miller's adoption stage is similar to the action stage in the TTM, and the importance of self-efficacy in achieving adoption of behavior change. Taylor and Miller's maintenance stage, similar to the maintenance stage of the TTM, included strategies for monitoring, reinforcing, preventing relapse, and contracting health behavior change. Many of these strategies are similar to the processes of stage as in the TTM.

Propositions in the Model of Exercise Behavior

Exercise self-efficacy and exercise stage of change. Exercise self-efficacy is related to exercise stage of change. There is a linear increase in exercise self-efficacy across the stages (Cardinal, 1997; Gorely & Gordon, 1995; Fahrenwald

& Walker, 2003; Herrick et al., 1997; Marcus, Eaton, et al., 1994; Marcus, Selby, et al., 1992). More specifically, exercise self-efficacy is significantly ($p < .05$) greater in maintenance and in action than in the early stages (Marcus, Selby, et al., 1992).

Decisional balance pros and exercise stage of change. For those in action and maintenance, the pros of exercise are significantly ($p < .05$) greater than in those in the early stages (Marcus, Rakowski, et al., 1992). In other words, the benefits of the exercise behavior outweigh the costs of the exercise behavior. For those in preparation, the pros and cons are balanced (Marcus & Owen, 1992; Marcus, Rakowski, et al., 1992).

Decisional balance cons and exercise stage of change. In the decision-making process for exercise, the cons of exercise are significantly ($p < .05$) greater for those in precontemplation and contemplation (Marcus, Rakowski, et al., 1992). This means that in the early stages, the costs of the exercise behavior outweigh the benefits of the exercise behavior (Marcus & Owen, 1992; Marcus, Rakowski, et al., 1992).

Behavioral processes of change and exercise stage of change. Use of the behavioral processes increases from precontemplation to action and then levels off (Marcus, Rossi, et al., 1992). Individuals in action use the behavioral processes significantly ($p < .05$) more than those in the earlier stages. There was no significant difference in the use of behavioral processes between those in action and in maintenance. Individuals in precontemplation used behavioral

processes less than those in the later stages. Use of the behavioral processes was significantly ($p < .05$) greater from contemplation to action.

Experiential processes of change and exercise stage of change. Use of the experiential processes generally peaks in the action stage and then slightly decreases in maintenance (Marcus, Rossi, et al., 1992). There were no significant differences in the use of these processes between those in contemplation and preparation. Individuals in precontemplation used experiential processes significantly ($p < .05$) less than those in the later stages. Use of experiential processes increased between the stages of precontemplation and contemplation.

Exercise stage of change and exercise performance. Those in the later stages performed more exercise than those in the early stages. Specifically, those in action and maintenance reported significantly ($p < .05$) greater amounts of moderate and vigorous activity than those in precontemplation and contemplation (Marcus & Simkin, 1993). Those in preparation reported significantly ($p < .05$) more moderate activity than those in precontemplation and contemplation.

Exercise self-efficacy and exercise performance. Exercise self-efficacy is positively related to exercise performance. More specifically, those who exercise have significantly ($p < .05$) higher exercise self-efficacy than those who do not exercise (Bock et al., 2001; Dunn et al., 1997).

Decisional balance pros and exercise performance. Decisional balance pros are positively related to exercise performance. More specifically, as exercise

performance increases, decisional balance pros for exercise are greater; however no significance was found (Bock et al., 2001).

Decisional balance cons and exercise performance. Decisional balance cons are inversely related to exercise performance. As exercise performance increases, decisional balance cons for exercise are decreased, however no significance was found (Bock et al., 2001; Brown, 2005).

Behavioral processes of change and exercise performance. Behavioral processes of change are associated with exercise performance. Use of most behavioral processes is significantly ($p < .05$) greater in those who perform more exercise than in those who perform no exercise (Dunn et al., 1997; Bock et al., 2001).

Experiential processes of change and exercise performance. Experiential processes of change are associated with exercise performance. Use of experiential processes of change is greater in those who perform more exercise than in those who do not exercise (Dunn et al., 1997). However, only the use one of the experiential processes of change was significant ($p < .05$).

Psychometric Framework

Steps for Selection of Exercise Stage of Change Self-report Measures

Psychometrics is the study of the science of measurement (Nunnally & Bernstein, 1994). In the current study, the psychometric framework is specifically concerned with the measurement of exercise stage of change. The steps for psychometric evaluation of measurement of exercise stage of change are: (a) define theoretical model and include constructs, definitions, and

relationships in the model, (b) describe framework for choosing the best exercise stage of change measures, (c) choose the measures and operationally define the concepts, (d) determine psychometric properties of the exercise stage of change measures; (e) examine results of exercise behavior model testing, (f) compare measures to determine what measures are most ideal, and (g) revise measures as needed and retest (Reed et al., 1997).

Agreement of Stage of Change Classifications

The current study focused on agreement of stage classifications obtained from the selected exercise stage of change measures. Measurement of exercise stage of change results in a stage classification. Reed et al. (1997) reported that individuals could be placed in different exercise stage of change classifications when different measures of exercise stage of change are used. Therefore, these researchers provided criteria to use when selecting exercise stage of change measures (see Appendix A). Using the criteria, the following measures were selected for this study: scale-true false (Marcus & Simkin, 1993), scale-ladder (Cardinal, 1995a), scale-five answer choice (Nigg & Riebe, 2002), and a recently developed structured interview (Fish et al. 2006). Then, using the selected exercise stage of change measures, agreement of the stage classifications was determined.

Review of Literature

Toward a Model of Exercise Behavior

Within the exercise behavior model, there are three major relationships: (a) factors predicting exercise stage of change, (b) the relationship between

exercise stage of change and exercise performance, and (c) factors predicting exercise performance (Marcus, Eaton, et al., 1994). Factors identified as predictors of exercise stage of change are exercise self-efficacy, decisional balance pros, decisional balance cons, behavioral processes of change, and experiential processes of change (Cardinal, 1997; Cardinal et al., 2004; Gorely & Gordon, 1995; Hellman, 1997; Herrick et al., 1997; Wallace & Buckworth, 2001). These same factors are hypothesized to predict exercise performance (Dunn et al., 1997; Marcus, Eaton, et al., 1994). Exercise behavior researchers rarely examine these five predictive factors together in the same study, and studies rarely control for possible influences of age, gender, race, education, and income.

Factors Predicting Exercise Stage of Change

Researchers have studied some of the predictive factors of exercise stage of change using many different staging instruments (Cardinal, 1997; Cardinal et al., 2004; Gorely & Gordon, 1995; Marcus, Eaton, et al., 1994; Marcus, Emmons, et al., 1998; Marcus & Owen, 1992; Marcus, Rakowski, et al., 1992; Marcus, Rossi, et al., 1992; Marcus, Selby, et al., 1992; Marcus, Simkin, Rossi, & Pinto, 1996; Plotnikoff, Hotz, Birkett, & Courneya, 2001; Reed et al., 1997). These predictive factors included exercise self-efficacy, decisional balance pros, decisional balance cons, and behavioral and experiential (cognitive) processes of change (Gorely & Gordon, 1995; Plotnikoff et al., 2001; Wallace & Buckworth, 2001).

Exercise self-efficacy and exercise stage of change. A higher self-efficacy for exercise is related to later exercise stages of change, such as action and maintenance, while a lower exercise self-efficacy is related to an earlier exercise stage of change, such as precontemplation. Exercise self-efficacy differentiated the exercise stages of change, in that exercise self-efficacy was significantly ($p < .05$) higher in individuals in the later stages (Cardinal, 1997; Fahrenwald & Walker, 2003; Gorely & Gordon, 1995; Hellman, 1997; Herrick et al., 1997; Marcus, Eaton, et al., 1994; Marcus, Pinto, et al., 1994; Marcus, Selby, et al., 1992; Reed et al., 1997, Simons-Morton et al., 2000; Wallace & Buckworth, 2001). Using confirmatory structural modeling, researchers found a good fit between exercise self-efficacy and exercise stage of change in a study of 698 healthy adults from four worksites (Marcus, Eaton, et al., 1994). Wallace and Buckworth (2001) studied exercise behavior in 680 nontraditional college students and found significant ($p < .01$) differences in exercise self-efficacy scores across the five stages of exercise behavior change. Overall, individuals in precontemplation and contemplation had significantly ($p < .05$) lower exercise self-efficacy scores than all subsequent stages. Individuals in preparation and action had significantly ($p < .05$) lower exercise self-efficacy scores that those in maintenance. Similarly, King, Marcus, Pinto, Emmons, and Abrams, (1996) studied 332 smokers at two different worksites and found that subjects in precontemplation had significantly ($p < .05$) lower exercise self-efficacy scores than those in later exercise stages of change. Using a stepwise discriminant function analysis, Cardinal et al. (2004) found barrier self efficacy a significant

predictor of exercise stage of change in American and Finnish college students. Other researchers have reported a significantly ($p < .05$) higher exercise self-efficacy scores across the exercise stages of change in a variety of populations and settings (Fahrenwald & Walker, 2003; Marcus, Pinto, Simkin, Audrain, & Taylor, 1994; Marcus, Selby, et al., 1992).

In a longitudinal study, Plotnikoff et al. (2001) looked at predictive factors of stage transition in a community sample of 683 healthy adults, ages 18-65, at six months and twelve months. Exercise self-efficacy was a significant ($p < .05$) predictor of transition from early stages to later stages from six to twelve months. Similarly, Sullum et al. (2000) studied college students (age 18 to 23 years) who were only in the stages of action or maintenance at baseline and eight weeks later. Those who continued to exercise at the initial level were referred to as maintainers. Those students who did not continue to exercise at the maintenance level, called relapsers, scored significantly ($p = .01$) lower on exercise self-efficacy.

Decisional balance pros and exercise stage of change. Decisional balance pros were lower in the early stages of change (Fahrenwald & Walker, 2003; Gorely & Gordon, 1995; Marcus, Eaton, et al., 1994; Marcus, Emmons, et al., 1998; Marcus & Owen, 1992; Reed et al., 1997). Individuals in precontemplation had significantly ($p < .05$) lower pros scores than the other four stages (Herrick et al., 1997; Marcus & Owen, 1992; Marcus, Rakowski, et al., 1992; Marcus, Rossi, et al., 1992; Sarkin et al., 2001; Wallace & Buckworth, 2001). Marcus, Rakowski, et al. (1992) studied decisional balance in 778

healthy adults in four worksites. Decisional balance pros scores were significantly ($p < .0001$) different according to exercise stage of change. Individuals in maintenance and action had significantly ($p < .05$) higher pros scores than those in precontemplation and contemplation. Individuals in preparation and contemplation had significantly ($p < .05$) higher pros scores than those in precontemplation. Wallace and Buckworth (2001) studied exercise behavior in 680 nontraditional college students and found decisional balance pros scores were significantly ($p < .01$) higher across the stages. The individuals in precontemplation had lower pros scores than those in the other four stages. In contrast, Sullum et al. (2000) found no significant differences in decisional balance pros between the relapse and maintainer groups.

Decisional balance cons and exercise stage of change. Decisional balance cons were higher in the early stages (Fahrenwald & Walker, 2003; Gorely & Gordon, 1995; Marcus, Eaton, et al., 1994; Marcus, Emmons et al., 1998; Marcus & Owen, 1992; Reed et al., 1997). Cons were significantly ($p < .05$) lower in individuals in maintenance and action than in the early stages (Herrick et al., 1997; Marcus, Rakowski, et al., 1992; Simons-Morton et al., 2000; Wallace & Buckworth, 2001). Researchers showed that the cons of exercise scores were significantly ($p < .05$) higher in individuals in the earlier stages of precontemplation and contemplation than those in the later stages (Marcus, Rakowski, et al., 1992; Marcus, Eaton, et al., 1994). Cons included things such as feeling sore after exercise, not having enough time, and being too tired to exercise. Marcus, Rakowski, et al. (1992) studied decisional balance in 778

healthy adults in four worksite and found decisional balance cons scores were significantly ($p < .05$) lower in maintenance than in all other stages. Decisional balance cons scores were significantly ($p < .05$) lower in all other stages than in contemplation. Those in the action stage had significantly ($p < .05$) lower cons scores than those in the preparation stage. In the Wallace and Buckworth (2001) study, decisional balance cons scores were significantly ($p < .01$) different across the stages. Individuals in maintenance and action had significantly ($p < .05$) lower cons scores than those in the earlier stages. In the study by Sullum et al. (2000), the subjects who relapsed had significantly ($p = .04$) higher decisional balance cons scores than those who maintained exercise.

Behavioral processes of change and exercise stage of change. Individuals in precontemplation used behavioral processes significantly ($p < .05$) less than those in the later stages (Fahrenwald & Walker, 2003; Gorely & Gordon, 1995; Simons-Morton et al., 2000; Tseng et al., 2003; Wallace & Buckworth, 2001). The behavioral processes also were used significantly ($p < .05$) less in contemplation and preparation as compared to those in the subsequent later stages (Gorely & Gordon, 1995; Marcus, Rossi, et al., 1992). Gorely and Gordon (1995) studied exercise behavior change in 583 adults, aged 50 to 65 years and found only five of the ten processes were significant predictors of exercise stage of change. Specifically, three behavioral processes of change scores were significantly ($p <. 05$) lower in precontemplation than in those in the later stages of change. Similarly, in the Wallace and Buckworth

(2001) study, individuals in precontemplation used behavioral processes significantly ($p < .05$) less than those in the later stages. Use of behavioral processes was significantly less in contemplation and preparation as compared to those in the later stages. Tseng et al. (2003) found that use of all the behavioral processes of change was significantly higher in maintenance than in precontemplation in adults aged 65 to 89 years. Cardinal et al. (2004) found that behavioral processes of change were significant ($p < .05$) predictors of exercise stage of change in college students. Hellman (1997) studied predictors of exercise stage of change in older adults with a cardiac diagnosis, ages 65 to 92. Although she noted the behavioral processes of change scores increased with the later stages, only group means were presented and no significance was reported. In contrast, Sullum et al. (2000) found no significant differences in use of behavioral processes between the relapse and maintainer groups.

Experiential processes of change and exercise stage of change. With respect to processes of change, individuals in precontemplation used experiential processes significantly ($p < .05$) less than those in the later stages (Cardinal et al., 2004; Fahrenwald & Walker, 2003; Gorely & Gordon, 1995; Simons-Morton et al., 2000; Tseng et al., 2003; Wallace & Buckworth, 2001). There were also significant ($p < .05$) differences between the preparation and later stages, with those in preparation having some lower experiential (cognitive) processes of change scores (Gorely & Gordon, 1995). In the Wallace and Buckworth (2001) study, individuals in precontemplation used experiential processes significantly less than those in the later stages. Tseng et

al. (2003) found that use of all the experiential processes of change was significantly higher in maintenance than in precontemplation in older adults. Fahrenwald and Walker (2003) found all but one of the experiential processes of change were significant ($p < .05$) different by exercise stage of change, with those in precontemplation using these processes significantly less than those in the other stages. Gorely and Gordon (1995) found two of the five experiential processes of change were significant predictors of exercise stage of change. More specifically, those in precontemplation had significantly ($p < .05$) lower processes of change scores than those in the later stages. In addition, those in preparation had significantly ($p < .05$) lower processes scores than those in maintenance. In contrast, Sullum et al. (2000) found no significant differences in use of experiential processes between the relapse and maintainer groups.

Exercise Stage of Change and Exercise Performance

Exercise performance increases across the stages to the action stage and then levels off (Marcus, Eaton, et al., 1994). Some researchers have established concurrent validity for the five exercise stages of change using the Seven-Day Physical Activity Recall (Cardinal, 1995a; Cardinal, 1997; Marcus & Simkin, 1993). A significant ($p < .05$) increase in the amount of moderate and strenuous exercise performed was associated with the later exercise stages of change of action and maintenance as compared to the earlier stages of precontemplation and contemplation (Sarkin et al., 2001). Similarly, researchers such as Cardinal et al. (2004), Hellman (1997) and Fahrenwald and Walker (2003) found a significant ($p < .05$) increase in the amount of exercise

performed in action and maintenance as compared to the earlier stages. In a study of four worksites, Marcus, Eaton, et al. (1994) measured both exercise stage of change and hours of exercise performed weekly. Using factor analysis, these researchers found that exercise stage of change was significantly related to exercise performance ($r = .43$, $p<.001$). In addition, they found that a sizeable amount of variance (24%) in exercise performance was explained by exercise stage of change. Similar findings were reported by Griffin-Blake and DeJoy (2006), who found significant positive correlations between exercise stage of change and self-report physical activity ($r = .45$, $p < .05$) in a work site population. Riebe et al. (2005) reported a significantly ($p < .05$) higher amount of physical activity in maintenance as compared to the earlier stages of precontemplation, contemplation, and preparation in older adults as well. Reed et al. (1997), comparing three exercise stage of change instruments in a sample of adults in a community, described a positive linear progression in exercise performance across the five stages. Marcus, Emmons, et al. (1998) found a significant positive correlation between exercise stages of change and the amount of exercise performed ($r_s =. 72$, $p < .05$).

Factors Predicting Exercise Performance

Few examined the relationships between the factors of exercise self-efficacy, decisional balance pros, decisional balance cons, behavioral processes of change, and experiential processes of change, and exercise performance.

Exercise self-efficacy and exercise performance. Exercise self-efficacy is associated with exercise performance. More specifically, higher exercise self-efficacy is associated with those who perform more exercise than those who do not exercise (Bock et al., 2001; Dunn et al., 1997; Simons-Morton et al., 2000; Steptoe, Rink, & Kerry, 2000). Simons-Morton et al. studied characteristics of 874 primary care patients in the Activity Counseling Trial. These researchers found significantly ($p < .001$) higher exercise self-efficacy scores in those who performed some moderate intensity physical activity as compared to those who performed no moderate or vigorous physical activity. They also found significantly ($p < .001$) higher exercise self-efficacy scores in those who performed some vigorous intensity physical activity as compared to those who performed moderate physical activity. In addition, significantly ($p < .001$) greater exercise self-efficacy was found in patients who performed some vigorous physical activity as compared to those who did some moderate intensity physical activity. Similar findings were reported by Steptoe et al. (2000). They studied 505 overweight patients and found that exercise self-efficacy was significantly ($p = .005$) and positively associated with physical activity, but no “r” values were reported. Using a sample of 235 healthy adults in a community setting, Dunn et al. (1997) found significantly ($p < .05$) greater exercise self-efficacy in 235 healthy adults who performed 30 minutes or more of moderate intensity exercise on most days of the week than in those who exercised less. Bock et al. (2001) reported similar findings in 150 healthy adults. Those who performed more exercise showed significantly ($p < .01$) higher exercise self-

efficacy. In undergraduate college students, Brown (2005) found a significant relationship between physical activity and exercise self efficacy ($r = .29$, $p < .05$).

Decisional balance pros and exercise performance. Decisional balance pros are associated with exercise performance. Brown (2005) found a significant relationship between perceived benefits (pros) and physical activity ($r = .20$, $p < .05$). In the Project Active study, researchers studied benefits and barriers (pros and cons) of exercise together, but did not study the specific relationship between pros and exercise performance (Dunn et al., 1997). Total pros scores were calculated but not reported. While some research has shown a positive relationship between decisional balance pros and exercise performance, one study did not. Bock et al. (2001) found no significant differences in decisional balance pros in those who improved exercise levels as compared to those who did not.

Decisional balance cons and exercise performance. Decisional balance cons is associated with exercise performance. Bock et al. (2001) reported significantly ($p < .05$) fewer cons in those who exercised more as compared to those who exercised less. Similar findings were reported by Steptoe et al (2000) who found that subjects reporting more cons performed significantly ($p < .001$) less exercise. A regression analysis identified barriers to exercise (cons) as a significant ($p = .003$) predictor of exercise. Although Dunn et al. (1997) studied benefits and barriers (pros and cons) of exercise together, these researchers did not study the specific relationship between cons and exercise performance. Total cons scores were calculated but not reported. In contrast, Brown (2005)

found no significant relationship between perceived barriers (cons) and physical activity in undergraduate college students.

Behavioral processes of change and exercise performance. The behavioral processes of change are associated with exercise performance (Bock et al., 2001; Dunn et al., 1997). In the Project Active study, Dunn et al. (1997) found that most of the behavioral processes were significantly ($p < .05$) predictive of exercise performance. Those who exercised 30 minutes or more on most days of the week reported significantly ($p < .05$) greater use of the behavioral processes than those who exercised less. These findings were similar to those of Bock et al. (2001) who reported significant ($p < .05$) increases in the use of the behavioral processes in those who exercised.

Experiential processes of change and exercise performance. The behavioral processes of change are associated with exercise performance (Dunn et al., 1997). Dunn et al. reported significant ($p< .05$) use of some of the experiential processes of change in those with increased exercise performance. However, regression analysis indicated that many of the behavioral processes were used significantly ($p < .05$) more than experiential processes when increasing exercise behavior. In contrast, Bock et al. (2001) found no significant differences in use of the experiential processes in those who exercised and those who did not.

Measurement of Exercise Stage of Change

Regarding measurement of exercise behavior, there is a commonly used valid and reliable self-report measure of exercise performance. In contrast,

there are at least 15 different self-report measures of exercise stage of change. Researchers have found that stage classification may vary, depending on the exercise stage of change measures (Reed et al., 1997). Variations in format, wording, and scoring of exercise stage of change measures account for the various resultant stage classifications. Additionally, there has been limited research using more than one measure of exercise stage of change.

Agreement Between Instruments and Structured Interview

Only one study compared exercise change of stage classifications between instruments and a structured interview. In a pilot study, Fish et al. (2006) examined exercise stage of change classification in 30 healthy adults in a community sample using three exercise stage of change instruments, scale-ladder (Cardinal, 1995a), scale-true false (Marcus & Simkin, 1993), and scale-five answer choice (Marcus, Banspach, et al., 1992), plus a structured interview. These researchers reported that all three instruments, scale-ladder (Cardinal), scale-true false (Marcus & Simkin), and scale-five answer choice (Marcus, Banspach, et al.), exhibited substantial agreement with the structured interview (weighted kappas--k_w from 0.620 to 0.790), with the greatest agreement observed between the structured interview and scale-ladder. In fact, the agreement between the structured interview and scale-ladder was significantly ($p < .05$) greater than the agreement between the structured interview and the scale-five answer choice (Fish et al., 2006). Scale-five answer choice (Marcus, Banspach, et al.) was the least optimal due to the lack of clarity in the wording of some of the answer choices, as indicated by the study

subjects. This scale was not recommended for future use without revision of some of the answer choices.

Agreement Between Exercise Stage of Change Instruments

Fish et al. (2006) also compared three exercise stage of change instruments. They found almost perfect agreement (k_w = 0.897) between the scale-ladder (Cardinal, 1995a) and scale-true false (Marcus & Simkin, 1993) and substantial agreement between the scale-five answer choice (Marcus, Banspach, et al., 1992) and both scale-ladder (Cardinal) and scale-true false (k_w = 0.736 and 0.734 respectively). The agreement between scale-ladder (Cardinal) and scale-true false (Marcus & Simkin) was significantly ($p < .05$) greater than the agreement between the scale-five answer choice (Marcus, Banspach, et al.) and scale-true false (Marcus & Simkin). Reed et al. (1997) compared eight different exercise stage of change instruments during studies using three different populations without using weighted kappas to determine agreement statistically. Because some aspects of the studies were not reported, it was difficult to draw conclusions. More research is needed focusing on agreement of exercise stage of change instruments and structured interview studied in the same sample.

Summary

The need for further study of the exercise behavior model, along with accurate measurement of exercise stage of change, is apparent for many reasons. There is no research on the exercise behavior model, which examines all the predictive factors of exercise stage of change and exercise performance

in the same study. Researchers used different populations, different settings, and different instruments or unstructured interviews, that did not allow for comparison of findings (Marshall & Biddle, 2001). Researchers often did not control for possible intervening influences of demographic variables such as age, gender, race, education, or income (Reed et al., 1997). No comparisons of self-report measures of exercise stage of change, other than the work of Reed et al., have been done. No current research provides strong support to recommend the clinical use of any of the existing exercise stage of change instruments or interviews. The pilot study that has been done, comparing exercise stage of change instruments with a newly developed face-to-face structured interview, needs to be expanded. It is essential to have measures that yield correct classification of exercise stage of change. Only with correct classification can nurses validly match exercise stage of change classification with stage-specific interventions to enhance exercise behavior.

CHAPTER III

Introduction

Chapter III contains specific detail regarding the research design used to answer the research questions. It includes a discussion of the operational definitions for the variables studied and the instrumentation used. This chapter also describes the setting, the sample, the data collection procedures, and the data analysis. Last, the strengths and limitations of the current study are presented.

Research Questions

The research questions were:

1. What are the concurrence rate comparisons for exercise stage of change classification between three instruments and a structured interview?
2. What are the concurrence rate comparisons for exercise stage of change classification between three instruments?
3. What is the relative strength of each of the predictive factors of exercise stage of change classification, while controlling for age, gender, race, education, and income?
4. What is the difference in exercise performance according to exercise stage of change classification?
5. What is the relative strength of each of the predictive factors of exercise performance, while controlling for age, gender, race, education, and income?

Methods

Design

This correlational study used a one-group design to measure exercise stage of change, exercise self-efficacy, two dimensions of decisional balance (pros and cons), two dimensions of processes of change (behavioral and experiential), and exercise performance. No exercise intervention was delivered.

Setting

The study site was a Midwestern university that employs over 3400 men and women. A quiet office space was used for data collection. The work setting was chosen because of the availability of a potentially large, diverse sample.

Sample

The sample included a total of 99 men and women who were employed at the study work setting. The sample size was calculated based on the formula, 50 + 8p, where p is equal to the number of predictor variables (Tabachnick & Fidell, 2001). The total number of predictor variables in the current study was five. The total sample size was 99, which included a 10% attrition rate. Subjects were included if they: (a) were male or female, (b) were ages 18 to 65 years, (c) were able to think clearly, (d) had a good memory, (e) had a minimum of a sixth grade education, (f) were able to read and speak English, and (g) consented to participate. Subjects were excluded if they: (a) had mobility or balance problems; (b) used assistive devices; (c) had health concerns such as chest pain, dizziness, or bone or joint problems that limits physical activity;

(d) had been told by a physician that they have physical limitations; or (e) were pregnant (American College of Sports Medicine, 2000). Due to discrepancies in subject responses during the screening process and study visits, only data on 95 subjects were analyzed. Data on one subject was not used due to difficulty reading the instruments during data collection. Data on three subjects were not used due to information disclosed during the visit which did not meet the inclusion criteria (back, ankle, and shoulder injuries). Forty-five subjects of the total sample, who consented to participate in the reliability testing of the exercise stage of change structured interview, were asked to return in one week to undergo the exercise stage of change structured interview for a second time.

Operational Definitions

Exercise stage of change was defined as the classification determined from each of three exercise stage of change instruments and a structured interview. The three instruments were scale-true false (Marcus & Simkin, 1993), scale-ladder (Cardinal, 1995a), and scale-five answer choice (Nigg & Riebe, 2002).

Exercise self-efficacy was defined as the total score on the Self-Efficacy for Exercise Questionnaire, developed by Marcus and Owen (1992).

Decisional balance pros for exercise was defined as the total pros score on the Decisional Balance Questionnaire (Nigg & Riebe, 2002).

Decisional balance cons for exercise was defined as the total cons score on the Decisional Balance Questionnaire (Nigg & Riebe, 2002).

*P*rocesses of change was defined as two factor scores on the Processes of Change Questionnaire (Nigg & Riebe, 2002). The two factor scores were the

experiential processes of change factor score and the behavioral processes of change factor score. The experiential factor score consisted of the sum of the following five processes sub scores: (a) consciousness raising, (b) dramatic relief, (c) self-reevaluation, (d) environmental reevaluation, and (e) social liberation, (Marcus, Rossi, et al., 1992). The behavioral factor score consisted of the sum of the following five processes subscores: (a) counter conditioning, (b) helping relationships, (c) self-liberation, (d) reinforcement management, and (e) stimulus control (Marcus, Rossi, et al., 1992).

Exercise performance was defined as the total energy expenditure score, reported in kilocalories per kilogram per week, on the Seven-Day Physical Activity Recall (PAR) questionnaire (Blair et al., 1985; Sallis et al., 1985).

Data Collection Measures

Exercise Stage of Change

Exercise stage of change was measured by scale-true/false, scale-ladder, scale-five answer choice, and a structured interview. Each of these measures was used to indicate the degree of the subject's readiness to change his or her exercise behavior.

Scale-true false. Scale-true false, developed by Marcus and Simkin (1993), contains five statements (see Appendix B). Scoring is based on the true or false responses to each statement and use of the scoring algorithm, which results in classification of the subject into one of five exercise stages of change. For example, answering true to statement one and false to statements two through five indicate precontemplation, and answering false to statement one and true to statements two through five indicate maintenance. Test-retest reliability of

this scale with a two-week interval was reported as r_s = .78 (Marcus, Selby, et al., 1992). Construct validity of scale-true false has been established with significant ($p < .001$) associations of vigorous and moderate self-reported physical activity across the stages of exercise behavior change. The stages of exercise behavior change were positively related to moderate and vigorous exercise, indicating that subjects at a later stage of exercise behavior change were likely to spend more time performing moderate and vigorous exercise (Marcus et al., 1998).

Scale-ladder. Scale-ladder, developed by Cardinal (1995a), is a four-rung ladder with five descriptors, 0 to 4, corresponding to the five exercise stage of change classifications (see Appendix C). For instance, a score of "0" indicates precontemplation and a score of "4" indicates maintenance. Test-retest reliability of this scale with a three-day interval was reported as r_s = 1.00 (Cardinal, 1995b). Construct validity of scale-ladder has been established through relationships with changes in the objective fitness level, estimated maximal oxygen uptake, or $VO_{2\ max}$ (Cardinal, 1997). Cardinal (1997) found increasingly higher VO_{2max} across the stages in 235 adults. Maintenance was associated with significantly ($p \leq .05$) higher estimated $VO_{2max,}$ indicating a greater level of fitness and a higher self-report exercise index score. Cardinal (1997) also found increasingly higher exercise index scores across the stages. Those in the later stages, action and maintenance, spent significantly ($p \leq .05$) more time exercising than those in the earlier stages of precontemplation, contemplation, and preparation (Cardinal, 1995a; Cardinal, 1997).

Scale-five answer choice. Scale-five answer choice, described by Nigg and Riebe (2002), contains one question with five answer choices (see Appendix D). Each answer choice corresponds to one of the five exercise stage of change classifications. For instance, marking the first answer choice indicates precontemplation, and marking the fifth answer choice indicates maintenance. Test-retest reliability of this scale with a two-week interval was reported as $r_s = .79$ (Lee, Nigg, DiClemente, & Courneya, 2001). Construct validity of scale-five answer choice was established through relationships with self-report physical activity (Lee et al., 2001). The stages of exercise behavior change were positively related to exercise performance indicating that adolescent subjects at later stages, action and maintenance, spent significantly ($p < .01$) more time performing exercise than those in precontemplation, contemplation and preparation.

Structured interview. The exercise stage of change structured interview, developed by Fish et al. (2006), consists of a set of questions with a scoring algorithm to determine exercise stage of change classification (see Appendix E). The questions are typical of those that would be asked about readiness to exercise by nurses in a clinical setting. For example, negative responses to the first two questions indicate precontemplation and positive responses to all the questions indicate maintenance. Face and content validity of the structured interview were determined by a panel of nurse and exercise experts (Fish et al., 2006). Feasibility of using the structured interview in the community also was established by Fish in a pilot study.

Exercise Self-Efficacy

The Self-Efficacy for Exercise Questionnaire (SEEQ), developed by Marcus and Owen (1992), was used to indicate the degree of confidence the subject has in his or her ability to exercise (see Appendix F). This instrument contains five items and uses a 5-point Likert scale of responses, ranging from not at all confident (1) to very confident (5). The exercise self-efficacy score is obtained by averaging the responses on the five items. Higher scores indicate a greater self-efficacy for exercise. One-week test-retest reliability was r = .94 (Wallace & Buckworth, 2001). Test retest reliability also was reported with a two-week interval as r = .90 (Marcus, Selby, et al., 1992). Internal consistency reliability was moderately high in studies of 393 to 1083 adults at the worksite, alphas ranging from .76 - .85 (Herrick et al., 1997; Marcus & Owen, 1992). Construct validity was established using factor analysis and modeling. Marcus, Eaton, et al. (1994) used this instrument when building the exercise behavior model. They entered these five instrument items into the exploratory factor analysis, resulting in factor loadings of .806 - .858 on the first three items. The three self-efficacy items were retained in the final structural equation modeling analysis. Standardized maximum likelihood parameter estimates showed a significant ($p < .001$) positive relationship between exercise self-efficacy and stage of change in a cross sectional study in 349 adults at a worksite, and in a longitudinal study of 433 adults at a worksite. Exercise self efficacy scores were higher in the maintenance stage and lowest in the precontemplation stage.

Decisional Balance

The Decisional Balance Questionnaire (DBQ), described by Nigg and Riebe (2002), was used to indicate the degree of the subjects' perceptions of benefits and costs of physical activity when making the decision to participate in leisure-time physical activity. The DBQ has two subscales, one that measures the pros for exercise and one that measures the cons for exercise.

Decisional balance pros. The Decisional Balance pros is one 5-item DBQ subscale that measures decisional balance pros for exercise (see Appendix G). This instrument uses a 5-point Likert scale of responses, ranging from not at all important (1) to extremely important (5). The decisional balance pros score is obtained by summing the responses on the five items. A higher pros score indicates that the subject perceives greater benefits associated with exercise performance. Internal consistency reliability for this subscale was reported as α = .89 (Nigg & Riebe, 2002). Construct validity was established using principal components analysis and confirmatory factor analysis. The pros factor accounted for 36.08% of the total item variance (Nigg & Riebe, 2002). Construct validity was established further in studies of undergraduate students (Nigg & Riebe, 2002). Decisional balance pros scores were significantly different across the five exercise stages of change. The pros scores were highest in the action stage and then dropped slightly in maintenance. The later stages of exercise behavior change, action and maintenance, are associated with higher decisional pros scores, indicating that those in later stages perceived more

benefits than those in the earlier stages. The pros scores were highest in the action stage and lowest in the precontemplation stage.

Decisional balance cons. The Decisional Balance cons is the second 5-item DBQ subscale that measures decisional balance cons for exercise (See Appendix G). This instrument uses a 5-point Likert scale of responses, ranging from not at all important (1) to extremely important (5). The decisional balance cons score is obtained by summing the responses on the five items. A lower cons score indicates that the subject perceives fewer costs associated with exercise performance. A higher cons score indicates that the subject perceives greater costs associated with exercise performance. Internal consistency reliability for this subscale was reported, α = .64 (Nigg & Riebe, 2002). Construct validity was established using principal components analysis and confirmatory factor analysis. The cons factor accounted for 23.65% of the total item variance (Nigg & Riebe, 2002). Construct validity was further established in undergraduate students (Nigg & Riebe, 2002). Decisional balance cons scores were significantly different across the five exercise stages of change. There was a significant negative relationship between decisional cons and stages of exercise behavior changes. Results showed that those in later stages, action and maintenance, perceived fewer costs than those in the earlier stages. Furthermore, while the highest cons scores were found among those in the contemplation stage, the lowest scores were found among those in the maintenance stage.

Processes of Change

The Processes of Change Questionnaire (POCQ), a 30-item questionnaire described by Nigg and Riebe (2002), was used to indicate the subjects' degree of use of the ten processes of change for exercise behavior. Research showed two subscales for this questionnaire (Marcus, Rossi, et al., 1994; Nigg & Riebe, 2002). Each subscale contains 15 items. The behavioral subscale contains five behavioral processes and the experiential subscale contains five experiential processes. Researchers have reported either a behavioral subscale score or an experiential subscale score, or ten individual process scores. In the current study the two subscale scores, behavioral and experiential, are used because research has shown the two-factor model plausible and useful when studying behavior change (Marcus, Rossi, et al., 1992; Prochaska & DiClemente, 1983).

Behavioral processes of change. The Processes of Change Questionnaire subscale contains five factors with 15 items measuring five different behavioral processes of changing exercise behavior (see Appendix H). This instrument uses a 5-point Likert scale of responses, ranging from never (1) to repeatedly (5). The behavioral processes of change score is obtained by summing the responses on the 15 behavioral items. A higher score indicates greater use of these processes. Internal consistency reliability for each of the five processes was reported in a community sample of 346 adults with α = .64 to .86 (Nigg & Riebe, 2002). Face and content validity of this questionnaire were reported in college students and older adults by Nigg and Riebe (2002).

Experiential processes of change. The experiential processes of change subscale also contains five factors with 15 items measuring five different experiential processes of changing exercise behavior (see Appendix H). This instrument uses a 5-point Likert scale of responses, ranging from never (1) to repeatedly (5). The experiential processes of change score is obtained by summing the responses on the15 experiential items. A higher score indicates greater use of these processes. Internal consistency reliability for each of the five experiential processes was reported in a community sample of 346 adults with α = .64 to .86 (Nigg & Riebe, 2002). Face and content validity of this questionnaire were reported in college students and older adults by Nigg and Riebe (2002).

Exercise Performance

The Seven Day Physical Activity Recall (PAR) measures exercise performance (see Appendix I). The PAR, studied by Blair et al. (1985) and Sallis et al. (1985), is an interviewer-administered questionnaire to measure and quantify physical activity patterns in free-living individuals in community and work settings. The PAR is a self-report survey technique in which the subject identifies patterns of physical activity, including type, intensity, duration, and frequency, performed in the last seven days. The PAR includes questions about activity patterns during work, leisure-time, and sleep (Blair et al., 1985; Sallis et al., 1985). A formula is used to compute energy expenditure in kilocalories per kilogram per week, using the total number of minutes spent sleeping, and doing light, moderate, hard, and very hard physical activity during a previous seven-

day period. A two-week test-retest reliability of this interview was reported for a community sample of men and women, age 20 to 74, as r = .74 for sleep; r = .65 for light activity; r = .08 for moderate activity; r = .31 for hard activity; and r = .61 for very hard activity (Sallis et al., 1985). Construct validity was established; significant relationships were found with measured VO_{2max}, r = .61, $p < .05$ (Blair et al., 1985). Other findings suggested that weekly total energy expenditure was positively associated with VO_{2max}, indicating that higher PAR scores were associated with higher levels of fitness (Dishman & Steinhardt, 1998). Likewise, a similar significant ($p < .05$) association was found between PAR total energy expenditure and concurrently matched data from an activity monitor over each of seven days, with r = .86 to .95 (Dunn et al., 1997). Findings showed that higher weekly total energy expenditure scores on the PAR were associated with more minutes of exercise performed, when using a commercial activity-monitoring device (Dunn et al., 1997).

Data Collection Procedures

After approval was obtained from the University of Missouri-St. Louis Institutional Review Board (IRB) and notification of the Illinois State University IRB, the subjects were recruited from the work setting by the researcher (see Appendix J). Subjects were recruited using IRB-approved flyers posted at the workplace (see Appendix K). Prospective subjects were screened by the researcher, using a five-minute telephone interview. Questions about the inclusion and exclusion criteria were included in the written script for the telephone interview (see Appendix L). Upon determination of eligibility, an

appointment for the subject's first visit was made by the researcher. The study was conducted in a quiet office space in the work setting to minimize distractions.

Visit 1

At Visit 1, an information sheet about the study was provided to the subject along with an opportunity to ask the researcher any questions about the study (see Appendix M). The purpose, procedure, number of observations, length of time involved, potential risks, and benefits of the study were described on the information sheet. In addition to the subjects' right to withdraw at any time, subjects were assured that the decision to participate would neither affect employment nor become a part of the individual's health records. After reading the Visit 1 information sheet and agreeing to continue, a packet of randomly ordered exercise stage of change measures was given to the subject to complete. The exercise stage of change measures were randomly ordered using Minitab software. All interviews and instruments were administered by the researcher to insure constancy of conditions. When it was time for the subject to undergo the face-to-face structured interview to measure exercise stage of change, the researcher had a set of standard answers that were used if subjects asked questions. The subject was offered a one-minute break before proceeding with the remainder of the protocol. The study then continued with the administration of the instruments and exercise performance interview in the following order: Self-Efficacy for Exercise Questionnaire, Decisional Balance Questionnaire, Processes of Change Questionnaire, and the PAR. Sample

demographic characteristics were obtained using the Participant Information Sheet, including age, gender, race, education, and annual family income (see Appendix N). Responses to two evaluation questions about the clarity of the wording of items and the directions for the study measures were obtained (see Appendix O). The instruments also were reviewed by the researcher for completeness of responses. Subjects were given ten dollars. The time to complete Visit 1 was one hour per subject.

Scoring of the study measures was completed as follows. Scoring the exercise stage of change measures was completed by four persons from the university, who comprised a panel of experts. Standard scoring algorithms were used. The exercise stage of change instruments were independently scored by two of the experts. Any discrepancies in scoring between the two experts scoring the exercise stage of change instruments were negotiated between them. The exercise stage of change interviews were independently scored by the remaining two experts. These scores were kept separate for future analysis. Any discrepancies in scoring between the two experts that scored the exercise stage of change interview were negotiated by them. Therefore, all scoring of the exercise stage of change measures were done independent of the researcher. If any scoring of the exercise stage of change measures resulted in an inability to determine a classification, an explanation for the decision was provided by the scoring experts. If any scoring discrepancies were not resolved between the initial two experts, a decision was made by all four of the experts meeting together. Only after the data collection was ended and the data entered into the computer, did

the researcher do a final check on the scoring of both the exercise stage of change instruments and the structured interview during the data cleaning process. Standard scoring algorithms were used by the researcher and expert scorers for the remainder of the measures used in the study.

Training was completed by the researcher to become proficient in the administration of the Seven-Day PAR Interview. The training steps were completed as follows: (a) read the PAR training manual, (b) listen to a training tape of three PAR interviews, prepared by the PAR author, (c) tape the administration of two practice PAR interviews, while being observed by a person who is proficient with the use of the PAR, (d) record the data on the Seven-Day PAR work sheet during the practice interviews, and (e) score the answers from the two practice PAR interviews and compare scores with the PAR proficient person. The practice interviews were completed with persons who would resemble the study population, but had not seen the PAR previously. Training was completed when the researcher had scored two practice interviews and training tapes correctly.

Scoring the PAR was completed by two persons from the university, who comprised a panel of experts. The panel of experts for the PAR was different from the experts used to score the exercise stage of change measures. The scoring experts were given training for scoring the PAR (see Appendix P). The PAR was independently scored by the two trained experts. These scores were kept separate for future analysis. Any discrepancies in scoring between the two experts scoring the PAR were negotiated between them. The PAR was also

independently scored by the researcher. Any discrepancies in scoring between the two experts that scored the PAR and the researcher were negotiated between them.

Visit 2

In the study, one-week test-retest reliability of the exercise stage of change structured interview was determined. To accomplish this aspect, at the end of Visit 1, a second information sheet describing Visit 2, the reliability aspect of the study, was given to subjects until 45 subjects were obtained (see Appendix Q). The forty-five subjects, who agreed to return in one week for Visit 2, were included. At this visit, each subject was given the same exercise stage of change structured interview as the first visit (see Appendix E). The time to complete Visit 2 was five to ten minutes. The forty-five subjects were each given ten dollars for Visit 2. These data were matched to each subject's data from the first visit. The scoring of the interviews from Visit 2 was completed by the same experts who scored the interviews from Visit 1. The same standard scoring protocol that was used on the first visit was used.

Only codes, and not names, were used on the data for 54 of the 99 subjects who completed Visit 1. However, names of the 45 subjects who agreed to come back for the reliability testing of the exercise stage of change structured interview were kept confidential and separate from the anonymous data. At the completion of Visit 2, names of the 45 subjects who had completed both Visits 1 and 2 were removed from the data and replaced with a code number. Therefore, after the completion of Visit 2, no names were contained on the code list or the data.

Only the researcher has access to the study data, which will be kept for five years in a locked file in the researcher's home office. Data collection for the study began September 2004 and ended in December 2004. The data collected will be used solely for research purposes.

Data Management and Analysis

Data were analyzed for: (a) describing the sample profile; (b) determining agreement of selected instruments and structured interview; and (c) testing the exercise behavior model. All data were statistically analyzed using the statistical program SPSS version 13.0. The p value was set at $\leq .05$ for a significant test (Tabachnick & Fidell, 2001).

For Research Question 1, agreement of exercise stage of change classifications obtained using the selected instruments and structured interview, was determined. The kappa statistic was used to measure agreement between each of the selected exercise stage of change instruments and the structured interview. For Research Question 2, the kappa statistic was used to measure agreement between the selected exercise stage of change instruments. Often, percent agreement between any two methods of classification is used to assess agreement. However, percent agreement is often not a good indication of the true agreement between methods because some agreement is expected purely by chance. A better measure of agreement that adjusts for agreement by chance is the Kappa statistic. Researchers have developed descriptors of the amount of agreement present based on the Kappa value: < 0 is poor; 0 - 0.20 is slight; 0.21 - 0.40 is fair; 0.41 - 0.60 is moderate; 0.61 - 0.80 is substantial; and

> 0.80 is close to perfect (Landis & Koch, 1977; Seigel, Podgor, & Remaley, 1992).

To test the exercise behavior model using the selected instruments and a structured interview, Research Questions 3, 4, and 5 were answered. For Research Question 3, multinomial logistic regression was used to determine the relative strength of each of the predictive factors of exercise stage of change classification, while controlling for age, gender, race, education, and income. For Research Question 4, analysis of variance was used to determine the difference in exercise performance according to stage classification. For Research Question 5, multiple linear regression was used to determine the relative strength of each of the predictive factors of exercise performance, while controlling for age, gender, race, education, and income.

Descriptive statistics were used to indicate the frequency and percentage of exercise stage of change classifications for the selected instruments and structured interview. One-week test-retest reliability of the exercise stage of change structured interview was determined, using the kappa statistic. A one-week interval was chosen for the reliability testing of the structured interview because it fell between the range of three days to two weeks as cited in the literature (Cardinal, 1995b; Lee et al., 2001; Marcus, Selby, et al., 1992). Internal consistency reliability of the Self-Efficacy for Exercise Questionnaire, Decisional Balance Questionnaire, and Processes of Change Questionnaire was determined using Cronbach's alpha (Nunnally & Bernstein, 1994). In addition, further item analysis for each of these instruments was conducted;

item means and standard deviation, inter-item correlations, and item-total correlations were analyzed for evaluation of homogeneity of instrument items (Ferketich, 1991). Construct validity was evaluated for these instruments as well, using principal components factor analysis.

Descriptive statistics were used to characterize the sample demographics: (a) age was measured in years; (b) gender was measured as male or female; (c) race was measured using the categories of African American, Asian, Caucasian, or other; (d) education was measured in years; and (e) income was measured as categories of annual family income. The data also were examined for relationships between sample demographics and exercise stage of change classification, and between sample demographics and exercise performance.

Strengths and Limitations

This study contained both strengths and limitations. A major strength was comparing agreement in exercise stage of change instruments and interview in the same sample. In addition, reliability was determined for the structured interview, measuring exercise stage of change one week apart. Another strength was that all predictive factors, recognized in the literature as important predictors, were used. These predictive factors included exercise self-efficacy, decisional balance pros and cons for exercise, and the behavioral and experiential processes of change. Other strengths of this study included random ordering of the exercise stage of change measures, using a larger sample size than the pilot study, and using a diverse worksite population. Despite its potential limitations, self-report data allowed for the practical, inexpensive

collection of exercise behavior data that may not otherwise be feasible to measure. Use of a more direct measure of exercise performance, such as maximal fitness testing, was cost prohibitive.

CHAPTER IV

Introduction

Chapter IV contains the findings of the study. The purpose of the current study was to test the exercise behavior model, and in so doing: (a) compare the concurrence rates of exercise stage of change classifications obtained from the four selected exercise stage of change self-report measures; and (b) determine the relative strength of the predictive factors of exercise stage of change and of exercise performance, in healthy adults, ages 18 to 65, in a work setting.

Sample Characteristics

This correlational study used a one-group, cross-sectional, design. Data was collected on 99 adults in a worksite setting. Due to discrepancies in subject responses during the screening process and study visits, only data on 95 subjects were analyzed. Data on one subject was not used due to difficulty reading the instruments during data collection. Data on three subjects were not used due to information disclosed during the visit which did not meet the inclusion criteria (back, ankle, and shoulder injuries). Table 4 presents frequencies and percentages of sample characteristics.

Most of the subjects were female (87.4%). The mean age of subjects was 38.19 years (*SD* = 13.05), ranging from 19 to 62 years. The subjects were Caucasians (87.4 %), African American (9.5%), or from other racial groups (3.2%). Most were non-Hispanic (88.4%). The mean number of years of education completed was 16.89 (*SD* = 3.34), ranging from 12 to 31 years.

Table 4

Frequencies and Percents of Sample Characteristics (n = 95)

Sample Characteristic	Frequency	Percent
Gender		
Female	83	87.4
Male	12	12.6
Race		
Caucasian	83	87.4
African-American	9	9.5
Other	3	3.2
Asian	0	0
Ethnicity		
Non-Hispanic	84	88.4
Hispanic	2	2.1
Missing data	9	9.5
Income		
0 - $9,999	8	8.4
$10,000 - 19,999	3	3.2
$20,000 - 29,999	8	8.4
$30,000 - 39,999	12	12.6
$40,000 - 49,999	8	8.4
$50,000 - 59,999	10	10.5
$60,000 - 69,999	5	5.3
$70,000 – 79,999	11	11.6
$80,000 or more	30	31.6

Note. Due to rounding, percentage totals may not equal 100%.

The median income range was $50,000 to $59,999; the income category that occurred most frequently was $80,000 or more (31.6%). In summary, most of the subjects were female, middle-aged, and Caucasian with a college education and a high annual family income level.

Properties of Measures

Frequencies of exercise stage of change classifications

Descriptive statistics were used to determine the frequency and percentage of exercise stage of change classification for each of the three instruments and structured interview. Table 5 presents crosstabulations comparing frequencies and percentages of subjects in each exercise stage of change classification determined by instrument or interview. There was one subject whose exercise stage of change classification could not be determined on the true-false instrument.

There were few subjects in the precontemplation stage, as scored with three exercise stage of change measures, and no subjects in precontemplation, as scored with scale-ladder. The most variation in classification was in the contemplation and preparation stages. Most of the subjects were classified in the maintenance stage on each of the four exercise stage of change measures.

Exercise stage of change structured interview reliability

The kappa statistic (k) was used to determine test-retest reliability of the exercise stage of change structured interview because it had not been done.

Table 5

Crosstabulations Comparing Frequencies and Percentages of Subjects in Each Exercise Stage of Change Classification Determined by Interview or Instrument (n = 95)

	Exercise stage of change				
Interview or Instrument	PC	C	P	A	M
Interview	4 (4.2)	5 (5.3)	33 (34.7)	9 (9.5)	44 (46.3)
Scale-true false*	1 (1.1)	23 (24.2)	17 (17.9)	8 (8.4)	45 (47.4)
Scale-ladder	0 (0.0)	7 (7.4)	36 (37.9)	8 (8.4)	44 (46.3)
Scale-five answer choice	4 (4.2)	15 (15.8)	23 (24.2)	10 (10.5)	43 (45.3)

Note. *One case could not be scored (n = 94); PC = Precontemplation, C = Contemplation, P = Preparation, A = Action, M = Maintenance

One week test-retest reliability was calculated for 45 of the 95 subjects (k = .64, $p < .01$), indicating substantial reliability. The percent agreement between Visit 1 and Visit 2 classifications was 75.56%. Most of the agreement was among those in the maintenance stage. Of those with classifications that did not agree between Visit 1 and Visit 2, most variability occurred over one adjacent stage. Most variability in agreement was found in those in the

preparation and action stages; four subjects scored in preparation at Visit 1 and then scored in action at Visit 2. Another area of variability was found in those in the maintenance and action stages; two subjects scored in maintenance at Visit 1, and then scored in action at Visit 2. Only 2 subjects had variability in classifications over two adjacent stages; one subject varied from maintenance to preparation and one subject from precontemplation to preparation.

Instrument reliability and validity

Exercise self-efficacy. The Self-Efficacy for Exercise Questionnaire (SEEQ) was used to measure exercise self-efficacy. The scores ranged from 1.20 to 4.80, on a 5-point scale from 1 to 5. The mean total score on the SEEQ was 3.24 (SD = .74), indicating moderate confidence in ability to exercise. Table 6 presents a summary of the Cronbach's alpha coefficients, inter-item and item-total correlations, and factor loadings for instruments measuring the five predictive factors. Cronbach's alpha coefficient for the SEEQ was .73, indicating acceptable reliability. All inter-item correlations were positive, indicating the items were measuring the same construct (Green & Salkind, 2005). All of the item-total correlations reached the criterion $r > .30$, except SEEQ item 4 ($r = .292$) (Nunnally & Bernstein, 1994). Item 4 is "When I am on vacation."

Construct validity of the SEEQ was evaluated using factor analysis. Principal component factor analysis using varimax rotation was conducted, producing a scree plot which suggested one factor. One factor had an Eigenvalue of 2.52, explaining 50.46% of the variance. All other Eigenvalues were less than 1, largely indicating that the SEEQ instrument measures one construct.

Table 6

Summary of Cronbach's Alpha Coefficients, Inter-item and Item-total Correlations, and Factor Loadings for Instruments Measuring the Five Predictive Factors

Instrument or Subscale	Cronbach's alpha coefficient*	Inter-item correlation range	Item-total correlation range	Factor loading range
SEEQ	.73	.13 - .62	.29 - .61	.45 - .84
DBQ: Pros	.75	.23 - .53	.35 - .58	.52 - .79
DBQ: Cons	.50	-.03 - .59	.16 - .34	.23 - .79
POCQ: Behavioral	.82	-.10 - .75	.13 - .59	.13 - .68
POCQ: Experiential	.85	.05 - .83	.37 - .60	.44 - .72

Note. SEEQ = Self-Efficacy for Exercise Questionnaire; DBQ = Decisional Balance Questionnaire; POCQ = Processes of Change Questionnaire.

* $p < .01$

All factor loadings were over the criterion of .30, indicating acceptable correlations of the item with the factor (Nunnally & Bernstein, 1994). Table 7 presents principal components factor analysis: loading values for exercise self-efficacy.

Table 7

Principal Components Factor Analysis: Loading Values for Exercise Self-Efficacy

Exercise self-efficacy questionnaire items	Component 1
Self efficacy item 1	.837
Self efficacy item 2	.750
Self efficacy item 3	.709
Self efficacy item 4	.446
Self efficacy item 5	.747

Note. No rotation occurred due to identification of just one component with an Eigenvalue greater than 1.

Decisional balance pros. The Decisional Balance Questionnaire (DBQ) subscale for pros was used to measure decisional balance pros. The scores ranged from 11 to 25, on a possible scale from 5 to 25. The mean score on the DBQ pros subscale was 21.26 (SD = 3.32), indicating that the items were very important in making the decision to exercise. Cronbach's alpha coefficient for the DBQ pros subscale was .75, indicating fair reliability (see Table 6). All the inter-item correlations were positive, indicating the items were measuring the same construct (Green & Salkind, 2005). All of the item-total correlations reached the criterion $r > .30$. Principal component factor analysis was conducted, producing a scree plot which suggested one factor. One factor had an Eigenvalue of 2.58, explaining 51.68% of the variance. All other Eigenvalues were less than 1, largely indicating that the DBQ pros items measure one

construct. All factor loadings exceeded the criterion of .30, indicating acceptable correlation of the items with the factor (Nunnally & Bernstein, 1994). Table 8 presents principal components factor analysis: loading values for decisional balance pros.

Table 8

Principal Components Factor Analysis: Loading Values for Decisional Balance Pros Subscale

Decisional balance pros subscale	Component 1
Decisional balance item 1	.737
Decisional balance item 3	.764
Decisional balance item 5	.786
Decisional balance item 7	.516
Decisional balance item 9	.758

Note. No rotation occurred due to identification of just one component with an Eigenvalue greater than 1.

Decisional balance cons. The DBQ subscale for cons was used to measure decisional balance cons. The scores ranged from 5 to 14, on a possible scale from 5 to 25. The mean score on the DBQ cons subscale was 7.07 (SD = 2.35), indicating the items were not of much importance in making the decision to exercise. Cronbach's alpha coefficient for the DBQ cons subscale was .50, indicating poor reliability (see Table 6). All the inter-item correlations were positive, except for correlations of DBQ item 2, “I would feel embarrassed if

people saw me exercising, " and DBQ item 6, "I feel uncomfortable or embarrassed in exercise clothes" with DBQ item 10, "Exercise puts an extra burden on my significant other," indicating that perhaps not everyone had a significant other. All of the item-total correlations reached the criterion, .30, except DBQ items 8 (r = .229) and 10 (r = .159). DBQ item 8 is "There is too much I would have to learn to exercise." Principal component factor analysis using varimax rotation was conducted, producing a scree plot which suggested two factors. Two factors had an Eigenvalue greater than 1.0. One factor has an Eigenvalue of 1.72, which explained 34.44% of the variance, and the second factor has an Eigenvalue of 1.31, which explained an additional 26.29% of the variance. All factor loadings for Factor one exceeded the criterion, r > .30, except for DBQ item 10. The items that loaded on factor 1 had the commonalities of embarrassment or knowledge; the items that loaded on factor 2 had the commonality of extra time or burden. Table 9 presents principal components factor analysis: loading values for decisional balance cons.

Behavioral processes of change. The Processes of Change Questionnaire (POCQ) behavioral subscale was used to measure behavioral processes of change. The scores ranged from 23 to 72, on a possible scale from 15 to 75. The mean score on the POCQ behavioral subscale was 49.16 (SD= 9.75), indicating occasional occurrence of these behavioral events in the past month.

Table 9

Principal Components Factor Analysis With Varimax Rotation: Loading Values for Decisional Balance Cons Subscale

Decisional balance cons subscale	Component 1	Component 2
Decisional balance item 2	.882	.055
Decisional balance item 4	.148	.722
Decisional balance item 6	.151	.568
Decisional balance item 8	-.173	.752
Decisional balance item 10	.875	.076

POCQ items with large standard deviations included 7, 10, 16, and 20, indicating more variability in the distribution of these scores and possibly measurement error. POCQ item 7 is “I have a friend who encourages me to exercise when I don’t feel up to it.” POCQ item 10 is “I keep a set of exercise clothes with me so I can exercise whenever I get the time.” POCQ item 16 is “Instead of taking a nap after work, I exercise.” POCQ item 20 is “I use my calendar to schedule my exercise time.” Cronbach's alpha coefficient for the POCQ behavioral subscale was .82, indicating good reliability (see Table 6). Most inter-item correlations were positive, except for negative correlations of POCQ items 6, 7, 20, 27, and 30 with item 5. POCQ item 5 is “I have noticed that many people know that exercise is good for them.” POCQ item 6 is “When I feel tired, I make myself exercise anyway because I know I will feel better

afterwards." POCQ item 27 is "My friends encourage me to exercise." POCQ item 30 is "I make sure I always have a clean set of exercise clothes." Other negative inter-item correlations indicated these of POCQ items 6, 16, and 18 with item 25, and between items 15 and 16. POCQ item 15 is "I am aware of more and more people who are making exercise a part of their lives." POCQ item 18 is "I try to think of exercise as a time to clear my mind as well as a workout for my body." POCQ item 25 is "I notice that famous people often say that they exercise regularly." All of the item-total correlations reached the criterion of .30, except POCQ items 5 ($r = .157$) and 25 ($r = .127$), indicating that items 5 and 25 may not be measuring the same construct that the rest of the items are measuring. Principal component factor analysis using varimax rotation was conducted, producing a scree plot which suggested four factors. Four factors had Eigenvalues of greater than 1.0 and suggest that this subscale could be measuring at least four factors. Table 10 presents the processes of change subscales with Eigenvalues greater than 1.0. The four factors reflected the specific behavioral processes. Factor 1 reflected counter conditioning, reinforcement management, and some aspects of stimulus control. Factor 2 reflected some components of helping relationships. Factor 3 reflected self-liberation. Factor 4 reflected one aspect of stimulus control. Table 1 presents definitions of behavioral processes of change.

All of the factor loadings for the Factor 1 exceeded the criterion of .30, except POCQ items 5, "I have noticed that many people know that exercise is good for them," and item 25, "I notice that famous people often say that they exercise

regularly." These items may be harder to answer because the subjects may not know what others think about exercise and may have problems identifying with famous people.

Table 10

Processes of Change Subscales with Eigenvalues Greater than 1.0

Processes of change subscale	Component	Eigenvalue	Total % variance
Behavioral			
	1	4.67	31.15
	2	2.25	14.98
	3	1.69	11.26
	4	1.18	7.85
Experiential			
	1	5.11	34.09
	2	2.00	13.34
	3	1.79	11.90
	4	1.31	8.71

Because all factor loadings did not exceed the criterion of .30, the POCQ behavioral subscale items do not seem to be measuring the one construct. Table 11 presents principal components factor analysis with varimax rotation: loading values for behavioral processes of change.

Experiential processes of change. The POCQ experiential subscale was used to measure experiential processes of change.

Table 11

Principal Components Factor Analysis With Varimax Rotation: Loading Values for Behavioral Processes of Change Subscale

Behavioral POC subscale item	Component 1	Component 2	Component 3	Component 4
POC item 5	.181	-.034	.809	.131
POC item 6	.678	-.329	-.199	-.088
POC item 7	.674	.505	-.174	-.213
POC item 8	.649	-.407	.201	-.288
POC item 10	.500	-.013	.061	.564
POC item 15	.409	.357	.503	.122
POC item 16	.512	-.576	-.152	.224
POC item 17	.644	.542	-.107	-.321
POC item 18	.630	-.218	.139	-.174
POC item 20	.535	.030	-.357	.388
POC item 25	.128	.292	.581	.262
POC item 26	.479	-.563	-.015	.120
POC item 27	.641	.551	-.078	-.107
POC item 28	.673	-.345	.240	-.350
POC item 30	.644	.299	-.293	.375

Note. POC = processes of change

The scores ranged from 28 to 72, on a possible scale from 15 to 75. The mean score on the experiential subscale was 51.00 (SD = 9.09), indicating occasional occurrence of experiential events in the past month. All items' standard deviations were less than half their item means, except for POCQ item 13. Cronbach's alpha coefficient for the POCQ experiential subscale was .85, indicating good reliability (see Table 6). All inter-item correlations were positive. All item-total correlations exceeded the criterion of .30. Principal component factor analysis using varimax rotation was conducted, producing a scree plot which suggested four or five factors. Four factors had Eigenvalues of greater than 1.0, suggesting this subscale could be measuring at least 4 factors (see Table 10). The four factors seem to reflect the specific experiential processes. Factor 1 reflected conscious raising, social liberation, and one aspect of dramatic relief. Factor 2 reflected self-reevaluation relation. Factor 3 reflected environmental relief. Factor 4 reflected some aspects of dramatic relief. See Table 2 for experiential process of change definitions. All factor loadings exceeded the criterion of .30, indicating that, despite four factors, the POCQ experiential subscale items seem to be measuring the same construct. Table 12 presents the principal components factor analysis with varimax rotation: loading values for experiential processes of change.

Table12

Principal Components Factor Analysis With Varimax Rotation: Loading Values for Experiential Processes of Change Subscale

Experiential POC subscale item	Component 1	Component 2	Component 3	Component 4
POC item 1	.087	.876	.169	.065
POC item 2	.128	.140	.127	.835
POC item 3	-.015	.024	.824	.179
POC item 4	.846	.134	.180	.152
POC item 9	.320	.370	.341	-.140
POC item 11	.106	.908	.167	.091
POC item 12	.192	.170	.644	.183
POC item 13	.107	.160	.776	.048
POC item 14	.701	-.126	.350	-.011
POC item 19	.641	.292	-.043	.222
POC item 21	.150	.858	.166	.138
POC item 22	.180	.050	.132	.838
POC item 23	.140	.199	.773	-.019
POC item 24	.884	.016	.120	.075
POC item 29	.643	.344	-.012	.126

Note. POC = processes of change

Findings Related to Research Questions

Research question 1: What are the concurrence rate comparisons for exercise stage of change classification between three instruments and a structured interview?

The concurrence rate among the four exercise stage of change measures was 100% in 56.84% of the subjects (54/95). The concurrence rate comparisons, or agreement, of exercise stage of change classification between three instruments and a structured interview was determined using two methods, percent agreement and the kappa statistic. Table 13 presents agreement between four measures for classifying exercise stage of change. First, percent agreement between the exercise stage of change instruments and the structured interview was determined. The percent agreement ranged from 72% to 86%, with the largest percent agreement found between the scale-ladder and the structured interview. Second, the kappa statistic was calculated to determine agreement of exercise stage of change classifications obtained using the selected instruments and structured interview. Because of the small number of subjects in the first stage of precontemplation, the kappa statistic was determined only on stages two through five. Researchers have developed descriptors of the amount of agreement present based on the kappa value: < 0 is poor; 0 - .20 is slight; .21 - .40 is fair; .41 - .60 is moderate; .61 - .80 is substantial; and greater than .80 is close to perfect (Landis & Koch, 1977; Seigel, Podgor, & Remaley, 1992). The kappa value for each of the selected exercise stage of change instruments and the structured interview ranged from .59 - .77, indicating moderate to substantial

agreement. The highest agreement was between the structured interview and scale-ladder. The percent agreement and the kappa were congruent, both indicating highest agreement between interview and scale-ladder.

Table 13

Agreement Between Four Measures for Classifying Exercise Stage of Change

Method	Method	Percent agreement	k*
Interview	Scale-true false	72%	.59
	Scale-ladder	86%	.77
	Scale-five answer choice	77%	.65
Scale-true false	Scale-ladder	77%	.67
	Scale-five answer choice	73%	.61
Scale-ladder	Scale-five answer choice	82%	.74

Note. The kappa is based on agreement for stages two through five.

* $p < .01$

Research question 2: What are the concurrence rate comparisons for exercise stage of change classification between three instruments?

The concurrence rate among the three exercise stage of change instruments was 100% in 62.11% of the subjects (59/95). The concurrence rate comparisons, or agreement, of exercise stage of change classifications between three instruments was determined using two methods, percent agreement and the kappa statistic.

Table 13 presents agreement between four measures for classifying exercise stage of change. First, percent agreement between the exercise stage of change instruments was determined. The percent agreement ranged from 73% to 82%, with the largest percent agreement found between scale-ladder and scale-five answer choice. Second, the kappa statistic was calculated to determine agreement of exercise stage of change classifications obtained using the selected instruments. Because of the small number of subjects in the first stage of precontemplation, the kappa statistic was determined only on stages two through five. The agreement between the three instruments ranged from .61 to .74, indicating substantial agreement. The highest agreement was between scale-ladder and scale-five answer choice. The percent agreement and the kappa were congruent, both indicating highest agreement between scale-ladder and scale-five answer choice.

Research question 3: What is the relative strength of each of the predictive factors of exercise stage of change classification, while controlling for age, gender, race, education, and income?

Exercise self-efficacy and behavioral processes of change were the strongest predictive factors, in an analysis of exercise stages two through five. The relative strength of each of the predictive factors of exercise stage of change classification, while controlling for age, gender, race, education, and income was determined using multinomial logistic regression. Because of the small number of subjects in the first stage of precontemplation, the analyses were only performed on stages two through five. A two-step analysis was used.

First, to control for the demographic variables of age, gender, race, education, and income, multinomial logistic regression analysis with SPSS NOMREG was performed using the demographic variables. Second, multinomial logistic regression analysis was repeated using only significant demographic variables and the five predictive factors of exercise self-efficacy, decisional balance pros, decisional balance cons, behavioral processes of change, and experiential processes of change. The model fitting information was examined to determine if the model was significant. If the X^2 was significant, then the final model out performed the null. Then, the goodness of fit test, the Pearson, was examined. A non-significant X^2 indicated that the final model fits the data. The pseudo R-square test, the Nagelkerke, provided an approximation of the variance in stage classification, as explained by the multinomial logistic regression model. If the final model was significant, then the likelihood ratio tests, the X^2, indicated which predictor variables were significant. The odds ratio, or Exp (B), indicated the relative strength of each significant variable per stage of change, as compared to the reference stage. Stage two (contemplation) was used as the reference value. This analysis was performed using the classifications obtained with each of the four measures of exercise stage of change. The SPSS NOMREG procedure was run four times, one for each measure of exercise stage of change: scale-true false, scale-ladder, scale-five answer choice, and the structured interview.

Scale-true false. The first step of the multinomial logistic regression analysis was conducted on the demographic variables and exercise stage of change,

using the scale true-false exercise stage of change measure. The overall model was not significant, X^2 (15) = 9.09, p = .873, indicating no significant demographic predictors of stage classification. During the second step of the regression analysis, the overall model was significant X^2 (15) = 46.91, p < .01. The goodness of fit tests were supportive of the model, Pearson X^2 (261) = 249.36, p = .687. The Nagelkerke R^2 of .434 indicated that the model explained 43.4% of the variance in exercise stage of change classification. According to the likelihood ratio tests, the significant predictive factors of the stage classification model were exercise self-efficacy, X^2 (3) = 14.05, p = .003, and the behavioral processes of change, X^2 (3) = 13.04, p = .005. Table 8 presents the summary of the relative strength of each significant predictive factor of stage, as compared to contemplation, per exercise stage of change measure, while controlling for age, gender, race, education, and income. Contemplation was the reference category for the regression. From Table 14, for scale-true false, the two highest odds ratios for exercise self-efficacy and behavioral processes of change are presented. Exercise self-efficacy increased the odds of being in maintenance by 6.02, as compared to contemplation. Behavioral processes of change increased the odds of being in action by 1.23, as compared to contemplation.

Scale-ladder. The first step of the multinomial logistic regression analysis was conducted on the demographic variables and exercise stage of change, using the scale-ladder exercise stage of change measure.

Table 14

Summary of Relative Strength of Each Significant Predictive Factor of Stage, as Compared to Contemplation, per Exercise Stage of Change Measure, While Controlling for Age, Gender, Race, Education, and Income*

		Scale-true false	Scale-ladder	Scale-five answer choice	Structured interview
Stage number/ name	Variable	Odds ratio	Odds ratio	Odds ratio	Odds ratio
Three/ Preparation	ESE	1.62	.79	.72	.67
	BPOC	1.11	1.18	.97	1.30
Four/ Action	ESE	2.77	1.66	1.44	.58
	BPOC	1.23	1.41	1.16	1.49
Five/ Maintenance	ESE	6.02	3.67	3.54	2.55
	BPOC	1.18	1.33	1.12	1.40

Note. Stages two through five analyzed; reference category is stage two, contemplation;

ESE = exercise self-efficacy, BPOC = behavioral processes of change

* $p < .05$

The overall model was not significant, X^2 (15) = 22.12, p = .105, indicating no significant demographic predictors of stage classification. During the second step of the regression analysis, the overall model was significant X^2 (15) = 50.87, p < .01. The goodness of fit tests were supportive of the model, Pearson X^2 (267) = 240.85, p = .873. The Nagelkerke R^2 of .463 indicated the model explained 46.3% of the variance in exercise stage of change classification. According to the likelihood ratio tests, the significant predictive factors of the stage classification model were exercise self-efficacy, X^2 (3) = 13.07, p = .004, and the behavioral processes of change, X^2 (3) = 18.00, p < .01. Contemplation was the reference category for the regression. From Table 14, for scale-ladder, the two highest odds ratios (exercise self-efficacy and behavioral processes of change) are presented. Exercise self-efficacy increases the odds of being in maintenance by 3.67, as compared to contemplation. Behavioral processes of change increases the odds of being in action by 1.41, as compared to contemplation.

Scale-five answer choice. The first step of the multinomial logistic regression analysis was conducted on the demographic variables and exercise stage of change, using the scale-five answer choice exercise stage of change measure. The overall model was not significant, X^2 (15) = 15.82, p = .394, indicating no significant demographic predictors of stage classification. During the second step of the regression analysis, the overall model was significant, X^2 (15) = 45.22, p < .01. The goodness of fit tests were supportive of the model, Pearson X^2 (255) = 234.20, p = .821. The Nagelkerke R^2 of .427 indicated the model

explained 42.7% of the variance in exercise stage of change classification. According to the likelihood ratio tests, the significant predictive factors of the stage classification model were exercise self-efficacy, X^2 (3) = 12.29, p = .006, and the behavioral processes of change, X^2 (3) = 12.17, p = .007. Contemplation was the reference category for the regression. From Table 14, for scale-five answer choice, the two highest odds ratios (exercise self-efficacy and behavioral processes of change) are presented. Exercise self-efficacy increases the odds of being in maintenance by 3.54, as compared to contemplation. Behavioral processes of change increases the odds of being in action by 1.16, as compared to contemplation.

Structured interview. The first step of the multinomial logistic regression analysis was conducted on the demographic variables and exercise stage of change, using the structured interview exercise stage of change measure. The overall model was not significant, X^2 (15) = 20.28, p = .161, indicating no significant demographic predictors of stage classification. During the second step of the regression analysis, the overall model was significant, X^2 (15) = 47.72, $p < .01$. The goodness of fit tests were supportive of the model, Pearson X^2 (255) = 220.02, p = .945. The Nagelkerke R^2 of .458 indicated the model explained 45.8% of the variance in exercise stage of change classification. According to the likelihood ratio tests, the significant predictive factors of the stage classification model were exercise self-efficacy, X^2 (3) = 12.80, p = .005, and the behavioral processes of change, X^2 (3) = 14.06, p = .003. Contemplation was the reference category for the regression. From Table 14,

for the structured interview, the two highest odds ratios (exercise self-efficacy and behavioral processes of change) are presented. Exercise self-efficacy increased the odds of being in maintenance by 2.55, as compared to contemplation. Behavioral processes of change increased the odds of being in action by 1.49, as compared to contemplation.

In summary overall, exercise self-efficacy and behavioral processes were significant predictors of stage classification. This overall finding was consistent across all four measures (see Table 14).

Of all the predictive factors of exercise stage of change, exercise self-efficacy was the best predictor of stage classification (maintenance versus contemplation). This finding was consistent across all four measures (see Table 14). Behavioral processes of change was a significant, but weak predictor of stage classification (maintenance versus contemplation, and action versus contemplation) across all four measures. Exercise self-efficacy was a stronger predictor of stage classification (maintenance versus contemplation) than behavioral processes of change across all four measures.

Research question 4: What is the difference in exercise performance according to exercise stage of change classification?

An increase in mean exercise performance across the stages was found. The difference in exercise performance according to exercise stage of change classification was determined using a one-way analysis of variance (ANOVA). The analysis was conducted using each of the four exercise stage of change measures: scale-true false, scale-ladder, scale-five answer choice, and the

structured interview. The dependent variable, exercise performance, was measured in total kilocalories of energy expended per week. Because of the small number of subjects in the first stage of precontemplation, the analysis was only performed on stages two through five. Table 15 presents mean exercise performance according to exercise stage of change classifications determined by four measures. Because homogeneity of variance could not be assumed, the Game Howell post hoc test was conducted with each ANOVA.

Table 15

Mean Exercise Performance According to Exercise Stage of Change Classifications Determined by Four Measures

Exercise stage of change	Mean exercise performance (SD) (kcal/week)			
	Scale true false	Scale ladder	Scale 5 answer choice	Structured interview
Contemplation	234.57 (8.52)	232.98 (10.07)	233.63 (8.51)	234.65 (11.65)
Preparation	235.01 (6.62)	235.22 (6.98)	235.68 (7.44)	234.91 (7.55)
Action	241.06 (10.34)	242.78 (10.33)	241.14 (9.75)	240.35 (10.13)
Maintenance	245.81 (11.91)	245.49 (12.26)	245.79 (12.24)	245.84 (11.99)

Note. Kcal/week = kilocalories of energy expended per week

Table 16 presents post hoc tests of significant differences in mean exercise performance among exercise stages. Post hoc tests were conducted to determine

the significant pair wise differences in mean exercise performance according to exercise stage of change.

Table 16

Post Hoc Tests of Significant Differences in Mean Exercise Performance Among Exercise Stages

Exercise stage of change measure	Stage differences*
Scale-true false	C, P < M
Scale-ladder	P < M
Scale-five answer choice	C, P < M
Structured interview	P < M

Note. C = contemplation; P = preparation; M = maintenance.

* $p < .05$

Scale true-false. Using ANOVA, exercise performance according to stage classification obtained using the scale true-false, was significant, $F(3, 89) = 8.33$, $p < .01$. The mean exercise performance increased across the stages (see Table 15). Mean exercise performance in contemplation and preparation was significantly ($p < .05$) lower than in maintenance (see Table 16).

Scale-ladder. Using ANOVA, exercise performance according to stage classification obtained using the scale-ladder was significant,

$F(3, 91) = 8.08$, $p < .01$. The mean exercise performance increased across the stages (see Table 15). Mean exercise performance in preparation was significantly lower ($p < .05$) than in maintenance (see Table 16).

Scale-five answer choice. The ANOVA for exercise performance according to stage classification obtained using the scale five answer choice was significant, $F(3, 87) = 7.56$, $p < .01$. The mean exercise performance increased across the stages (see Table 15). Mean exercise performance in contemplation and preparation was significantly lower ($p < .05$) than in maintenance (see Table 16).

Structured interview. The ANOVA for exercise performance according to stage classification obtained using the structured interview was significant $F(3, 87)= 7.59$, $p < .01$. The mean exercise performance increased across the stages (see Table 15). Mean exercise performance in preparation was significantly lower ($p < .05$) than in maintenance (see Table 16).

In summary, mean exercise performance in action was not significantly different from maintenance, as was expected. This finding indicates that the amount of exercise performed in action and maintenance is consistent with the stage definitions. This further indicates the definition between action and maintenance also pertains to length of time an individual has been exercising. Differences in mean exercise performance in contemplation, or in contemplation and preparation were consistently less than in maintenance across all measures of exercise stage of change ($p < .05$).

Research question 5: What is the relative strength of each of the predictive factors of exercise performance, while controlling for age, gender, race, education, and income?

Exercise self-efficacy, decisional balance pros, and behavioral processes of change were the significant predictors of exercise performance. The relative strength of each of the predictive factors of exercise performance, while controlling for age, gender, race, education, and income was determined using standard multiple regression. A two-step analysis was used. First, to control for the demographic variables of age, gender, race, education, and income, a multiple regression analysis was performed using these demographic variables. Second, the multiple regression analysis was repeated using only significant demographic variables and the five predictive factors of exercise self-efficacy, decisional balance pros, decisional balance cons, behavioral processes of change, and experiential processes of change. The results of the multiple regression analysis of the demographic variables indicated that the linear combination of the demographic variables did not significantly predict exercise performance, $R^2 = .07$, $R^2_{adj} = .02$, $F(5, 87) = 1.35$, $p = .250$.

A second standard multiple regression analysis was conducted using the five predictive factors on exercise performance. The results of this analysis indicated that the overall model significantly predicted exercise performance, $R^2 = .34$, $R^2_{adj} = .30$, $F(5, 89) = 9.01$, $p < .01$. Exercise self-efficacy, decisional balance pros, and behavioral processes of change significantly predicted exercise performance. The regression model accounted for 33.6% of the

variance in exercise performance. Table 17 presents the model summary of the regression coefficients of predictive factors of exercise performance.

Table 17

Model Summary of Regression Coefficients of Predictive Factors of Exercise Performance

Predictive Factors	B	β	*t*	*p*	Bivariate r	Partial r
Exercise self-efficacy	5.99	.39	4.07	.000	.48	.40
Decisional balance pros	-.76	-.22	-2.20	.031	-.004	-.23
Decisional balance cons	.69	.14	1.63	.107	.03	.17
Behavioral processes of change	.35	.30	2.36	.021	.41	.24
Experiential processes of change	.09	.07	.56	.580	.27	.06

Exercise self-efficacy and the behavioral processes of change were positively related to exercise performance. Exercise self-efficacy was the strongest predictor of exercise performance (β = .39, $p < .01$), followed by behavioral processes of change (β = .30, $p = .021$), indicating that high exercise self-efficacy and high use of behavioral processes of change were related to high exercise performance. Decisional balance pros was negatively related to exercise performance, Decisional balance pros was a weaker, but significant predictor of exercise performance, indicating that low decisional balance pros

was related to high exercise performance (β = -.22, *p* = .031), an unexpected finding.

Secondary Data Analyses

Age, gender, race, education, and income and exercise stage of change

Chi-square tests were conducted to study relationships between the demographic variables of gender, race, and income and exercise stage of change classifications. Analyses were conducted using each exercise stage of change measure. No significant relationships between the demographic variables and exercise stage of change were found.

Spearman's rho correlation coefficient tests were conducted to determine the relationship between the demographic variables of age and education and exercise stage of change classifications. Analyses were conducted using each exercise stage of change measure. No significant relationships between the demographic variables and exercise stage of change were found.

Age, gender, race, education, and income and exercise performance

Spearman correlations were calculated to study relationships between the demographic variables of gender, race, and income and exercise performance. Pearson correlations were calculated to study the relationship between the demographic variables of age and education and exercise performances. No significant relationships between the demographic variables and exercise performance were found.

Evaluation of Study Measures

At the end of Visit 1, each subject was asked to respond to two evaluation questions about the instrument items and directions. Most subjects indicated that the items and directions were clear and understandable (57%, 81%, respectively). Most of the 43% of subjects who indicated that the instrument items were not clear and understandable specifically found the wording of items on scale-true false, DBQ, and POCQ confusing. Specifically, subjects indicated that Item 2 on scale-true false, “I intend to exercise in the next 6 months,” was confusing. Other subjects indicated that scale-true false item 4 “I have exercised regularly for the past 6 months.” and item 5 “I have exercised regularly in the past for a period of at least 3 months.” seemed redundant. Subjects indicated that DBQ item 8 “There is too much I would have to learn to exercise.” and that POCQ items 3, 13, and 16 were confusing or did not apply, so were hard to answer. POCQ item 13 is “I think that by exercising regularly I will not be a burden to the health care system.” POCQ item 16 is “Instead of taking a nap after work, I exercise.” Several also said that the directions on DBQ and POCQ were confusing and that they needed to go back and reread the instructions several times to be able to respond to the items.

Summary of Results

The concurrence rate for exercise stage of change classification between three instruments and a structured interview was 100% for 56.84% of the subjects. The highest agreement was found between scale-ladder and the structured interview ($k = .77$, $p < .01$).

The concurrence rate for exercise stage of change classifications between three instruments was 100% for 62.11% of the subjects. The highest agreement was found between scale-ladder and scale-five answer choice ($k = .82$, $p < .01$).

Overall, exercise self-efficacy and behavioral processes of change ($p < .01$) were significant ($p < .01$) predictors of exercise stage of change. These results were consistent for all tested measures of exercise stage of change. Exercise self-efficacy was the strongest predictor of maintenance as compared to contemplation. Behavioral processes of change was a significant, but weak predictor of stage classification (maintenance versus contemplation, and action versus contemplation) across all four measures. Exercise self-efficacy was a stronger predictor of stage classification (maintenance versus contemplation) than behavioral processes of change across all four measures.

Mean exercise performance increased across all the stages, regardless of the exercise stage of change measures used. Post hoc tests indicated that those in contemplation, or contemplation and preparation had significantly ($p < .05$) lower exercise performance as compared to maintenance across all measures of exercise stage of change.

Exercise self-efficacy, decisional balance pros, and behavioral processes of change were significant predictors of exercise performance ($p < .01$). Exercise self-efficacy and behavioral processes of change were positively related to exercise performance. Exercise self-efficacy was the strongest predictor of exercise performance ($\beta = .39$, $p < .01$), followed by behavioral processes of change ($\beta = .30$, $p = .021$). Decisional balance pros was negatively related to

exercise performance. Decisional balance pros was a weaker, but negative predictor of exercise performance (β = -.22, *p* = .031).

CHAPTER V

Introduction

Chapter V contains a summary of the problem and a statement of purpose. Then the findings of the study related to sample characteristics, properties of measures, and research questions are discussed. The limitations of the study and implications for future research are addressed. Finally, the study conclusions are presented.

Summary of the Problem

A. In a model of exercise behavior proposed by Marcus, Eaton, et al. (1994), exercise self-efficacy, decisional balance pros, and decisional balance cons were predictive of exercise stage of change and exercise performance. The model has been expanded to include behavioral and experiential processes of change (Gorely & Gordon, 1995; Wallace & Buckworth, 2001). Further testing of the model is needed.
B. There are at least 15 different self-report measures of exercise stage of change. Only two studies were found that compared any of these measures (Fish et al., 2006; Reed et al., 1997). Because it is not known if and to what extent stage classification will vary with different measures, there is a need for more research comparing exercise stage of change measures.
C. There was no reliability testing for a newly developed structured interview that measures exercise stage of change.

Summary of Purpose

The purpose of the current study was to test the exercise behavior model, and in so doing: (a) compare the concurrence rates of exercise stage of change classifications obtained from the four selected exercise stage of change self-report measures; and (b) determine the relative strength of the predictive factors of exercise stage of change and of exercise performance, in healthy adults, ages 18 to 65, in a work setting.

Findings Related to Sample Characteristics

Most of the subjects were white, middle-aged females with a college education and high income level. The age range of this sample is representative of the work setting. This age range was consistent with other studies in the work setting (Marcus, Banspach, et al., 1992; Marcus, Eaton, et al., 1994).The racial mix of the sample is representative of the work setting. This is also fairly consistent with other studies using a work setting population (Marcus, Pinto, et al., 1994) and in a college setting with nontraditional students (Wallace & Buckworth, 2001). The gender mix of the sample was not representative of the work setting, in that slightly more than half of the employees are female. Samples in other studies and work settings consisted of a range of approximately 50% female (Marcus, Emmons, et al., 1998) to 77% female (Marcus, Banspach, et al., 1992). Education was consistent with the setting and somewhat similar to other studies in work settings that had subjects with at least a high school education or more (Marcus, Pinto, et al., 1994;

Marcus, Rakowski, et al., 1992). It is unknown if the income of the sample is representative of the work setting. Few studies reported income range. One study, which reported income, did not use the same ranges as the current study. Pinto et al. (2001) used fewer income ranges with the highest income range being “greater than $20,000.” Over half of the subjects in the Pinto study were in this income range. Ideally, future research would include use of more males, a more racially diverse sample, and subjects with more variable amounts of education and income.

Findings Related to Properties of Measures

Distributions of stage classifications across all measures were similar with a few exceptions. Scale-ladder scored no one in precontemplation. Scale-true false and scale-five answer choice scored more in contemplation and fewer in preparation, as compared to the other two measures. All the measures scored most subjects in maintenance. In contrast, Fish et al. (2006).found that most of the community subjects in her study were scored in preparation. Fish and colleagues used scale-true false, scale-ladder, the structured interview, and a different scale-five answer choice. Reed and colleagues (1997) reported distributions of classifications with most in contemplation or preparation in a work setting and a community setting. These researchers compared instruments with double ladder, Likert-type, true false, and five-answer choice formats. Because Reed and colleagues (1997) published their research without methodological details, their research findings must be viewed with caution. Findings from the current study may have differed in distributions of stages from

Reed's study because distribution of exercise stage of change depends on the sample studied.

The one week test-retest reliability of the exercise stage of change structured interview was calculated for 45 subjects (α = .64, $p < .01$), indicating substantial agreement. No other studies tested reliability of the structured interview. Researchers reported variable test-retest time frames, from three days for scale-ladder to two weeks for scale-true false and scale-five answer choice (Cardinal, 1995b; Lee et al., 2001; Marcus, Selby, et al., 1992).

The instruments used to measure predictive factors had internal consistency reliabilities ranging from .50 to .85. The reliability for the SEEQ in the current study (α = .73) was similar to the .76 found by Marcus and Owen (1992) in a work setting population. The reliability for the DBQ pros subscale (α = .75) in the current study was lower than that reported by Nigg and Riebe (2002), who reported a reliability of .89 for pros in a community sample of adults. The reliability for the DBQ cons subscale (α = .50) in the current study was lower than that reported by Nigg and Riebe (2002), who reported a reliability of .64 for the cons subscale in a community sample of adults. Reliabilities for the POCQ behavioral and experiential subscales in the current study were .82 and .85, respectively. However, only reliabilities for each of the five behavioral and five experiential processes were found. The reliabilities for the ten processes subscales were .64 to .86 (Nigg and Riebe, 2002). Findings from the evaluation of the study measures used in the current study indicated that several subjects found some of the DBQ and POCQ items confusing and the directions hard to

follow. Inconsistencies for the decisional balance subscales suggest the need for item clarification or revision. Further testing of this instrument is warranted.

No reliability was determined for the PAR in the current study. However, comparison of mean exercise performance and stage classifications indicated the finding that exercise performance increases across stages, providing some construct validity for the exercise stage of change measures.

Generally, these findings suggest a need for better wording of items on the Decisional Balance Questionnaire, especially the cons subscale and the Processes of Change Questionnaire, and further testing of exercise stage of change instruments. The variability in the stage distributions among researchers may also support the need for clearer definitions for the stage of preparation as suggested by Nigg and Riebe (2002).

Findings Related to Research Questions

Research Question 1

The concurrence rate among the exercise stage of change measures was 100% for 56.84% of the subjects. This is consistent with the findings of Fish et al. (2006), who found 100% concurrence in 50% of the subjects. The concurrence, or agreement, of exercise stage classification obtained from three instruments and an interview were moderate to substantial. The highest agreement was between scale-ladder and the structured interview. These findings were also similar to the findings of Fish, although these researchers used weighted kappas. In contrast, Fish used a smaller sample, analyzed stages one through five, and used a different five answer choice measure. The

percent agreement between each instrument and interview ranged from 72% to 86% in the current study, which was slightly greater than the 63% to 80% in the study by Fish and colleagues (2006). This slight difference may be due to the smaller sample size in the Fish study. No other studies were found that compared agreement between exercise stage of change instruments with a structured interview.

Research Question 2

The concurrence rate among the three instruments was 100% for 62.11% of the subjects. There were no other studies that reported concurrence rate among instruments. The concurrence, or agreement, of exercise stage of change classifications obtained for the three instruments was substantial. The percent agreement was 73% to 82%. In the current study, the most agreement was found between scale-ladder and scale-five answer choice. Fish et al. (2006) reported slightly different results, in that most agreement, 86.7%, was found between scale-ladder and scale-true false. Fish used a smaller sample, analyzed stages one through five, and used a different five answer choice measure. These differences may be due to a smaller sample size in the Fish et al. study, or that only stages two through five were analyzed in the current study. In the current study, there was one case in which the scale-true false could not be scored. In the current study, few subjects were classified in precontemplation and no one was classified in precontemplation using scale-ladder. These differences may be related to the format and appearance of the ladder, as no one may want to admit being a “0,” or at the bottom of the ladder.

Consideration of format changes for scale-ladder and further testing may be needed.

Research Question 3

To test the exercise behavior model, the relative strength of the predictive factors of exercise stage of change was determined. In the current study, the researcher controlled for age, gender, race, education, and income. The primary finding was that, overall, exercise self-efficacy and behavioral processes of change were significant predictors of exercise stage of change, regardless of the exercise stage of change measure used. Although the data analysis in the current study was conducted on stages two through five (contemplation through maintenance), these results were similar to other studies. Researchers who used other multivariate procedures such as MANOVA and discriminate function analysis, also found exercise self-efficacy predictive of exercise stage of change (Gorely & Gordon, 1995; Hellman,1997). Gorely and Gordon (1995) studied the ten processes of change in older adults and found three of the five behavioral processes were significant predictors of exercise stage of change. Hellman did not find significance in behavioral processes of change. Results from the current study were also similar to those found by researchers using univariate techniques (Fahrenwald & Walker, 2003; Wallace & Buckworth, 2001).

In contrast, decisional balance pros and cons and experiential processes were not significant predictors of exercise stage of change in the current study. This is in contrast with results found by other researchers (Gorely & Gordon,

1995; Fahrenwald & Walker, 2003; Wallace & Buckworth, 2001). Possible reasons for this discrepancy may be related to use of different instruments to measure the five predictive factors and because of the relatively small sample size in the current study.

Research Question 4

Significant differences in exercise performance according to exercise stage of change classifications were obtained using each of the four exercise stage of change measures: scale-true false, scale-ladder, scale-five answer choice, and the structured interview. Mean exercise performance increased across the stages of contemplation, preparation, action, and maintenance. This finding was consistent across the exercise stage of change measures. Post hoc tests determined that exercise performance was significantly higher ($p < .05$) in maintenance than in preparation for both scale ladder and the structured interview. Exercise performance was significantly higher ($p < .05$) in maintenance than in contemplation and preparation for scale-true false and scale-five answer choice. These findings are consistent with others who have found an increase in exercise performance in action and maintenance as compared to the earlier stages (Cardinal et al., 2004; Gorely & Gordon, 1995; Hellman, 1997; Riebe et al., 2005; Wallace & Buckworth, 2001). Even though mean exercise performance for contemplation was less than that for action, no significance was obtained in the current study. This is in contrast to other studies (Gorely & Gordon, 1995; Hellman, 1997; Wallace & Buckworth, 2001). This may be partially explained by the smaller sample size in the current study

and having fewer subjects in action as compared to maintenance. Despite the differences, the current study findings support construct validity for the selected exercise stage of change measures.

Research Question 5

The primary finding of this analysis was that exercise self-efficacy, decisional balance pros, and the behavioral processes of change were significant predictors of exercise performance. Exercise self-efficacy was the strongest predictor of exercise performance. This finding in the current study is consistent with other studies which found a strong positive relationship between exercise self-efficacy and exercise performance (Bock et al., 2001; Dunn et al., 1997; Steptoe et al., 2000). Behavioral processes of change was positively related to exercise performance; this finding in the current study is consistent with the findings of others (Bock et al., 2001; Dunn et al., 1997). Decisional balance pros was negatively related to exercise performance. This finding in the current study was not consistent with findings in previous research. Typically, higher decisional balance pros scores are associated with increased exercise performance (Bock et al., 2001; Dunn et al., 1997). This discrepancy could be related to the greater numbers of subjects already exercising regularly, and do not need to be convinced of the benefits of participating in exercise. The negative relationship with decisional balance pros, as well as a low overall reliability of the decisional balance cons subscale, may suggest the need for further revision and testing of the Decisional Balance Questionnaire.

Findings Related to Secondary Data Analyses

Age, gender, race, education, and income and exercise stage of change

No significant relationship was found between the demographic variables of age, gender, race, education, and income, and stage of change. Regarding age, the finding in the current study was consistent with the findings of Marcus & Simkin, 1993 in a work place population. In contrast, Marcus and Owen (1992) reported that younger subjects were significantly ($p < .01$) more active than older ones, in a work setting. Cardinal (1997) reported that age was significantly associated with stage of change classification, in that precontemplators were, on average, seven years older then adults in action or maintenance. Taylor= et al. (2003) found that those in action were significantly younger than those in precontemplation, in a low income patient population. Regarding sex, findings from studies that used one instrument concur with the findings of the current study (Cardinal, 1997; Cowan, Logue, Milo, Britton, & Smucker, 1997; Marcus & Simkin, 1993). In contrast, Wallace and Buckworth (2001) reported that female college students were more likely in contemplation and males were more likely in maintenance. Regarding race, Suminksi and Petosa (2002) found that stage of change in college students varied by ethnicity, which was defined as Asian, White, African American, and Hispanic. They found that minorities (non-White) were more likely to be precontemplation and contemplation. In contrast, in a study of low income primary care patients, Taylor and colleagues found that there were more whites in precontemplation and more African-Americans in preparation. Regarding education, findings in

the current study were consistent with those of Cardinal (1997) in an adult sample. In contrast, Marcus and Owen (1992) found that more educated subjects were significantly more active than less educated subjects, in a work setting. Marcus and Simkin (1993) found significant differences across stages by education. For example, Marcus and Simkin (1993) reported that subjects in a combined Action/Maintenance group had, on average, one more year of education than those in a combined precontemplation/contemplation group (13.1 versus 12.2 years). This finding may not be directly applicable to the current study findings because the stage classifications were combined. Regarding income, findings in the current study were consistent with those of Marcus, Pinto, et al. (1994).

Age, gender, race, education, and income and exercise performance

No significant relationships between exercise performance and the demographic variables of age, gender, race, education, and income level, were found. Regarding age and gender, findings in the current study were consistent with those of Steptoe et al. (2000). In contrast, age and sex were significant with exercise performance in a sample of middle-aged primary care patients (Simons-Morton et al. 2000). Simons-Morton, et al found that women and older patients were less likely to participate in vigorous exercise. Regarding education, findings in the current study were consistent with those reported by Simons-Morton et al. (2000). Regarding education, findings in the current study were not consistent with those of Steptoe et al. (2000) in a sample of middle-aged primary care patients, who found that better educated patients were more

active. Regarding income, findings in the current study were consistent with those reported by Simons-Morton et al. (2000).

Limitations

Limitations of this study include the small sample size, convenience sampling method, lack of a diverse sample, and too few subjects in the first stage of precontemplation; such that only stage two, contemplation, through five, maintenance were analyzed. It is expected that a larger sample size would allow for a more complete testing of the exercise model, as well as comparing agreement among exercise stage of change measures. Use of a convenience sample may have also led to the prevalence of subjects in the higher stages of action and maintenance as compared to precontemplation and contemplation. It would seem that those who are interested in a healthy lifestyle, or who are currently pursuing the same, would be more apt to participate in a study about healthy lifestyles. A larger and more diverse sample may reduce this limitation, by providing a more diverse sample with subjects in all five stages. In view of the limitations of the current study, the findings must be interpreted with caution.

Implications for Future Research

The study findings suggest the need for further research in the areas of instrument testing and methods. Because the concurrence rate was 100% in slightly more than half of the subjects, continued testing of exercise stage of change measures is warranted. More accurate stage classification may be obtained through revision of current measures. Suggested revisions to consider for scale-true false include rewording item 2 and deleting item 5. Suggested

revisions to consider for scale-ladder include renumbering the descriptors from one to five, instead of zero to four and starting the numbering at the top of the ladder. These revisions may improve the acceptability of the numbering scale. A zero at the bottom of the ladder could have more negative connotations, thus encouraging subjects to circle a higher number, even if not accurate. Suggested revisions to consider for scale-five answer choice include clarification of wording for answer choices “d” and “e.” The wording for answer item “d” is for those exercising regularly for less than six months, and answer item “e” is for those exercising regularly for more than six months. These items do not fit an individual who has been exercising regularly for six months. Further testing of these instruments with suggested revisions may help standardize measures (Marshall & Biddle, 2001). There are no suggestions for revision of the structured interview. Moderate to substantial agreement was found between the exercise stage of change instruments and structured interview. And the structured interview performed similarly to the exercise stage of change instruments with respect to predictive factors of exercise stage of change and mean exercise performance. These findings support the use of the newly developed structured interview as a useful measure of exercise stage of change, especially in settings in which nurses and others are apt to conduct face-to-face interviews with clients.

Other considerations for testing the exercise behavior model are related to suggested revisions of the instruments which measure the predictive factors of exercise self-efficacy, decisional balance pros and cons, and the behavioral and

experiential processes of change. Item analysis and principal component factor analysis suggested that some of the instrument items do not perform as well as others. The reliability for the Self-Efficacy for Exercise Questionnaire may be improved if SEEQ item 4 is revised or deleted. The reliability for the Decisional Balance Questionnaire subscale for pros may be improved if DBQ item 7 is revised or deleted. The reliability for the Decisional Balance Questionnaire subscale for cons may be improved if DBQ item 10 is revised or deleted. Because the factor analysis for this subscale suggested two factors, revising DBQ item 4 is also recommended. The reliability for the Processes of Change Questionnaire subscale for behavioral processes may be improved if POCQ items 5 and 25 are revised or deleted. These items were also found to be problems in the factor analysis for this subscale. The reliability for the Processes of Change Questionnaire subscale for experiential processes and the factor analysis for this subscale did not reveal any problematic items. Therefore, further testing of instruments measuring the predictive factors is warranted. Improved measures of the predictive factors may also lead to better understanding of the exercise behavior model and more accurate determination of construct validity of the exercise stage of change measures.

The main methodological issue to address is related to the study sample. Sampling methods to obtain a larger, more diverse sample may give more reliable findings related to the reliability and construct validity of the exercise stage of change measures. Ultimately, more reliable and valid measures of

exercise stage of change should lead to more accurate stage classifications (Reed et al., 1997)

Directions for Future Research

With respect to exercise stage of change measures, wording of some of the scale-true false items and possibly reformatting the scale-ladder, may improve the accuracy of stage classification when using these instruments. Only with accurate staging can stage-matched interventions be implemented to improve readiness and, ultimately, encourage exercise performance in healthy adults (Marcus et al., 1992; Nigg & Riebe, 2002; Prochaska & Marcus, 1994). In addition, wording changes for some items in the SEEQ, DBQ, and the POCQ may improve the internal consistency of the instrument. This will further assist with establishing construct validity of the exercise stage of change measures and determine which perform the best. In addition to a larger, more diverse sample, Marshal and Biddle (2001) suggested that researchers take a different and longitudinal approach and study individuals as they progress through the stages. This methodological approach may increase the knowledge of the use of the TTM as applied to exercise and the effectiveness of the TTM in sustaining exercise behavior.

Conclusions

1. The most agreement was found between scale-ladder and the structured interview ($k = .77$, $p < .01$).
2. The most agreement was found between scale-ladder and scale- five answer choice ($k = .82$, $p < .01$).

3. Exercise self-efficacy and behavioral processes of change were significant ($p < .01$) predictors of exercise stage of change. Exercise self-efficacy was the stronger predictor of maintenance as compared to contemplation across all four measures. Behavioral processes of change was a weak, but significant predictor of preparation as compared to contemplation for all measures of exercise stage of change, except scale-true false.
4. Mean exercise performance increased across all the stages, regardless of the exercise stage of change measures used. Post hoc tests indicated that those in maintenance had significantly ($p \leq .05$) higher exercise performance as compared to those in contemplation, or contemplation and preparation.
5. Exercise self-efficacy, decisional balance pros, and behavioral processes of change were significant predictors of exercise performance ($p < .01$). Exercise self-efficacy and behavioral processes of change were positively related to exercise performance. Exercise self-efficacy was the strongest predictor of exercise performance ($\beta = .39$, $p < .01$), followed by behavioral processes of change ($\beta = .30$, $p = .021$). Decisional balance pros was negatively related to exercise performance. Decisional balance pros was a weaker, but negative predictor of exercise performance ($\beta = -.22$, $p = .031$), an unexpected finding.

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Appendix A

Criteria to Use When Selecting a Measure of Exercise Stage of Change

1. The definition of exercise behavior, by which subjects are to judge themselves, must be clear.
2. The format must be understandable for subjects to be able to accurately stage themselves.
3. The items must be well-defined descriptions of each of the individual stages of change.
4. The measure must focus on only one discrete behavior (exercise).

From “What makes a good staging algorithm: Examples from regular exercise,” by G. R. Reed, W. F. Velicer, J. O. Prochaska, J. S. Rossi, and B. H. Marcus, 1997, *American Journal of Health Promotion, 12, p.* 57-58.

Appendix B

Scale-True False

Regular exercise is defined as at least 3 or more times per week for 20 minutes or longer.

For items 1-5, please circle True or False.

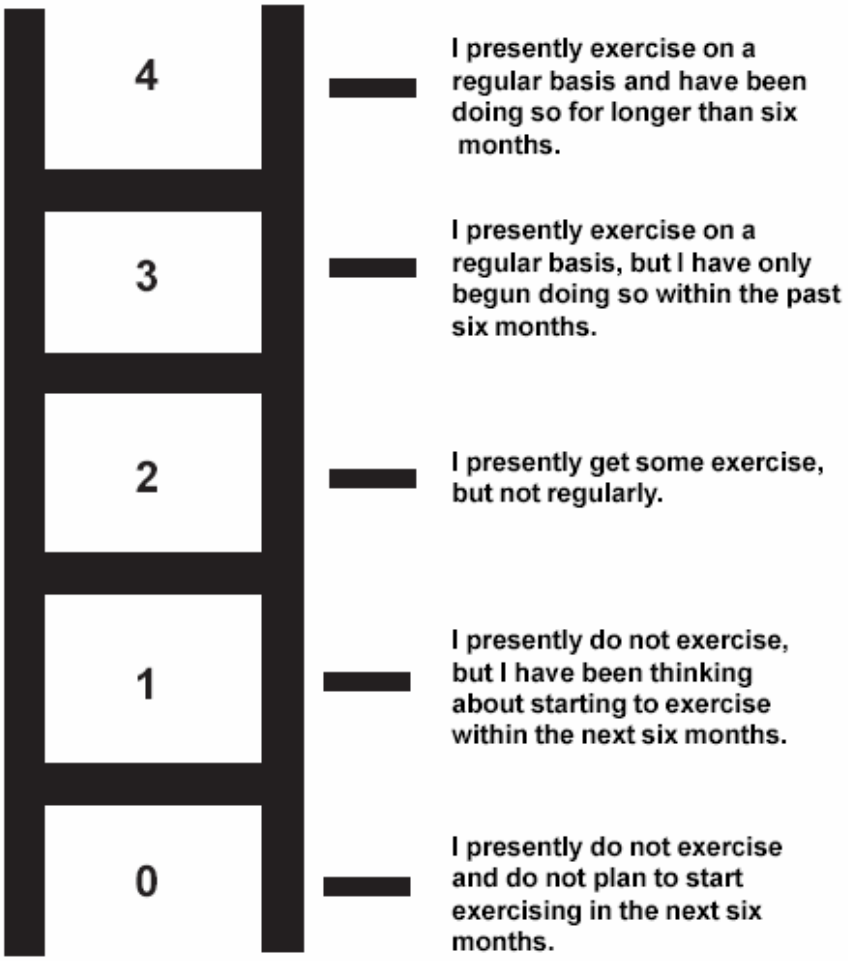
1.	I currently do not exercise.	True	False
2.	I intend to exercise in the next 6 months.	True	False
3.	I currently exercise regularly.	True	False
4.	I have exercised regularly for the past 6 months.	True	False
5.	I have exercised regularly in the past for a period of at least 3 months.	True	False

From “The stages of exercise behavior,” by B. Marcus, and L. Simkin, 1993, *Journal of Sports Medicine and Physical Fitness, 33,* p.87. Used with permission of the author.

Appendix C

Scale-Ladder

DIRECTIONS: Please circle the number on the ladder that best describes your present behavior. "Regular exercise" equals three or more days per week for 20 minutes or more each day (e.g. swim, walk).



From "The stages of exercise scale and stages of exercise behavior in female adults," by B. Cardinal, 1995a, *Journal of Sports Medicine and Physical Fitness, 35,* p. 88. Used with permission of the author.

Appendix D

Scale-Five Answer Choice

The following five statements will assess how much you currently exercise in your leisure time (exercise done outside of a job). **Regular exercise** is any *planned* physical activity (e.g., brisk walking, jogging, bicycling, swimming, line-dancing, tennis, etc.) performed to increase physical fitness. Such activity should be performed 3 *or more times* per week for 20 *or more minutes* per session at a level that increases your breathing rate and causes you to break a sweat.

Do you exercise regularly according to the definition above? **Please mark only ONE of the five statements.**

1 ____ No, and I do not intend to begin exercising regularly in the next 6 months.

2 ____ No, but I intend to begin exercising regularly in the next 6 months.

3 ____ No, but I intend to begin exercising regularly in the next 30 days

4 ____ Yes, I have been, but for less than 6 months.

5 ____ Yes, I have been for more than 6 months.

From "The transtheoretical model: Research review of exercise behavior and older adults" by C. Nigg and D. Riebe, 2002, *Promoting exercise and behavior change in older adults: Interventions with the transtheoretical model* (p. 151), P. Burbank, and D. Riebe, (eds.), New York: Springer. Used with permission of author.

Appendix E

Exercise Stage of Change Structured Interview

I would like to ask you a few questions.

Regular exercise is defined as planned physical activity performed 3 or more days per week, for 20 minutes or more each session (for example brisk walking, swimming, jogging, running, bicycling, line-dancing, or tennis).

In the last month, did you do regular exercise?		
If NO	OR	If YES
Ask, “Do you plan to start exercising in the future?’		Ask, “What kind of regular exercise do you do?” (record statement)
If no, Select Precontemplation and stop interview.		Ask, “ For how long have you been doing regular exercise, 3 or more days per week, for 20 minutes or more each session?”
If yes, Ask, “ Have you started exercising at all, even once in a while?”		If less than 6 months (24 weeks), select Action.
If no, select Contemplation and stop interview.		If 6 months (24 weeks) or greater select Maintenance.
If yes, select Preparation and stop interview.		

From “Exercise stage of change classification: A comparison of three instruments and an interview,” by A. F. Fish, D. J. Frid, J. L. Fish, S. K. Christman, and K. S. Astroth, 2006, Manuscript in preparation. Used with permission of the author.

Appendix F

Self-Efficacy for Exercise Questionnaire

INSTRUCTIONS: Circle the response that best indicates how confident you are that you could exercise in each of the following situations.

	Not at all Confident	Slightly Confident	Moderately Confident	Very Confident	Extremely Confident
1. When I am tired.	1	2	3	4	5
2. When I am in a bad mood.	1	2	3	4	5
3. When I feel I don't have the time.	1	2	3	4	5
4. When I am on vacation.	1	2	3	4	5
5. When it is raining or snowing.	1	2	3	4	5

From “Self-efficacy and the stages of exercise behavior change,” by B. H. Marcus, V. C. Selby, R. S. Niaura, and J. S. Rossi, 1992, *Research Quarterly in Exercise and Sports, 63,* p. 65. Used with permission of the author.

Appendix G

Decisional Balance Questionnaire

This section looks at positive and negative aspects of exercise. Read the following items and indicate how important each statement is with respect to your decision to exercise or not to exercise in your leisure time by circling the appropriate number. Please answer using the following 5-point scale:

1 Not At All Important	**2 Somewhat Important**	**3 Moderately Important**	**4 Very Important**	**5 Extremely Important**

1.	I would have more energy for my family and friends if I exercised regularly…….…...	1 2 3 4 5
2.	I would feel embarrassed if people saw me exercising……...	1 2 3 4 5
3.	I would feel less stressed if I exercised regularly……..	1 2 3 4 5
4.	Exercise prevents me from spending time with my friends…….	1 2 3 4 5
5.	Exercising puts me in a better mood for the rest of the day……..…	1 2 3 4 5
6.	I feel uncomfortable or embarrassed in exercise clothes……	1 2 3 4 5
7.	I would feel more comfortable with my body if I exercised regularly….	1 2 3 4 5
8.	There is too much I would have to learn to exercise……	1 2 3 4 5
9.	Regular exercise would help me have a more positive outlook on life..	1 2 3 4 5
10.	Exercise puts an extra burden on my significant other……	1 2 3 4 5

From “The transtheoretical model: Research review of exercise behavior and older adults” by C. Nigg and D. Riebe, 2002, *Promoting exercise and behavior change in older adults: Interventions with the transtheoretical model* (p. 156), P. Burbank, and D. Riebe, (eds.), New York: Springer. Used with permission of author.

Appendix H

Processes of Change Questionnaire

The following experiences can affect the exercise habits of some people. Think of similar experiences you may be currently having or have had **during the past month**. Then rate how frequently the event occurs by circling the appropriate number. Please answer using the following 5-point scale:

1 Never 2 Seldom 3 Occasionally 4 Often 5 Repeatedly

1.	I read articles to learn more about exercise……	1	2	3	4	5
2.	I get upset when I see people who would benefit from exercise but choose not to exercise……..	1	2	3	4	5
3.	I realize that if I don't exercise regularly, I may get ill and be a burden to others……	1	2	3	4	5
4.	I feel more confident when I exercise regularly……	1	2	3	4	5
5.	I have noticed that many people know that exercise is good for them……...	1	2	3	4	5
6.	When I feel tired, I make myself exercise anyway because I know I will feel better afterwards……..	1	2	3	4	5
7.	I have a friend who encourages me to exercise when I don't feel up to it….	1	2	3	4	5
8.	One of the rewards of regular exercise is that it improves my mood……..	1	2	3	4	5
9.	I tell myself that I can keep exercising if I try hard enough……...	1	2	3	4	5
10.	I keep a set of exercise clothes with me so I can exercise whenever I get the time…….	1	2	3	4	5
11.	I look for information related to exercise……..	1	2	3	4	5
12.	I am afraid of the results to my health if I do not exercise…….....	1	2	3	4	5
13.	I think that by exercising regularly I will not be a burden to the health care system……..	1	2	3	4	5
14.	I believe that regular exercise will make me a healthier, happier person…..	1	2	3	4	5
15.	I am aware of more and more people who are making exercise a part of their lives……..	1	2	3	4	5
16.	Instead of taking a nap after work, I exercise……..	1	2	3	4	5
17.	I have someone who encourages me to exercise……..	1	2	3	4	5

18.	I try to think of exercise as a time to clear my mind as well as a workout for my body……	1	2	3	4	5
19.	I make commitments to exercise……..	1	2	3	4	5
20.	I use my calendar to schedule my exercise time……...	1	2	3	4	5
21.	I find out about new methods of exercising…….	1	2	3	4	5
22.	I get upset when I realize that people I love would have better health if they exercised……	1	2	3	4	5
23.	I think that regular exercise plays a role in reducing health care costs……..	1	2	3	4	5
24.	I feel better about myself when I exercise……..	1	2	3	4	5
25.	I notice that famous people often say that they exercise regularly……..	1	2	3	4	5
26.	Instead of relaxing by watching TV or eating, I take a walk or exercise…….	1	2	3	4	5
27.	My friends encourage me to exercise……..	1	2	3	4	5
28.	If I engage in regular exercise, I find that I get the benefit of having more energy…….	1	2	3	4	5
29.	I believe that I can exercise regularly……	1	2	3	4	5
30.	I make sure I always have a clean set of exercise clothes……	1	2	3	4	5

From “The transtheoretical model: Research review of exercise behavior and older adults” by C. Nigg and D. Riebe, 2002, *Promoting exercise and behavior change in older adults: Interventions with the transtheoretical model* (p. 153 -154), P. Burbank, and D. Riebe, (eds.), New York: Springer. Used with permission of author.

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Appendix I

7-Day Physical Activity Recall

PAR# 1 Participant _____

Interviewer _____ Today is_____ Today's Date_____

1. Were you employed in the last seven days? O. No (Skip to Q#4) 1.Yes
2. How many days of the last seven did you work? _____days
3. How many total hours did you work in the last seven days? _____hours last week
4. What two days do you consider your weekend days? _____

(mark days below with a squiggle)

WORKSHEET **DAYS**

	SLEEP	1 __	2 __	3 __	4 __	5 __	6 __	7 __
MORNING	**Moderate**							
	Hard							
	Very Hard							
AFTERNOON	**Moderate**							
	Hard							
	Very Hard							
EVENING	**Moderate**							
	Hard							
	Very Hard							
Total Min Per Day	**Strength:**	____	____	____	____	____	____	____
	Flexibility:							

4a. Compared to your physical activity over the past 3 months, was last week's physical activity more, less, or about the same?

1. More 2. Less 3. About the same

6. Do you think this was a valid PAR interview?

1. Yes 0. No
If NO, go to the back and explain.

5. Were there any problems with the PAR interview?

0. No 1. Yes
If YES, go to the back and explain.

7. Were there any special circumstances concerning this PAR?

0. No 1. Yes, If YES, what were they? (circle)

1. Injury all week 2. Illness all week 3. Illness part week
4. Injury part week 5. Pregnancy 6. Other:

7-Day Physical Activity Recall

Work sheet Key:	Rounding: 10-22 min. = .25	53-1:07 hr/min. = 1.0
An asterisk (*) denotes a work-related activity.	23-37 min. = .50	1:08-1:22 hr/min.=1.25
A squiggly line through a column (day) denotes a weekend day.	38-52 min. = .75	

5. Explain why there were problems with this PAR interview:

_____
_____
_____
_____
_____

6. If PAR interview was not valid, why was it not valid?

_____
_____
_____
_____
_____

7. Please list below any activities reported by the subject which you do not know how to classify.

_____
_____
_____
_____
_____

8. Please provide any other comments you may have.

_____
_____
_____
_____
_____

From "Project GRAD seven day physical activity recall interview manual," J. A. Sarkin, J. Campbell, L. Gross, J. Roby, S. Bazzo, J. Sallis, and K. Calfas,1997, *Medicine and Science in Sports and Exercise, 29,* S91-S92. Used with permission of the J. Sallis.

Appendix J

IRB Approval Letter

OFFICE OF RESEARCH ADMINISTRATION

Interdepartmental Correspondence

Name: Kim Astroth

Title: Healthy Lifestyles of Adults in a Work Setting

The chairperson of the Human Subjects Committee for UM-St. Louis has reviewed the above mentioned protocol for research involving human subjects and determined that the project qualifies for exemption from full committee review under Title 45 Code of Federal Regulations Part 46.101b. The time period for this approval expires one year from the date listed below. You must notify the Human Subjects Committee in advance of any proposed major changes in your approved protocol, e.g., addition of research sites or research instruments.

You must file an annual report with the committee. This report must indicate the starting date of the project and the number of subjects to date from start of project, or since last annual report, whichever is more recent.

Any consent or assent forms, must be signed in duplicate and a copy provided to the subject. The principal investigator must retain the other copy of the signed consent form for at least three years following the completion of the research activity and they must be available for inspection if there is an official review of the UM-St. Louis human subjects research proceedings by the U.S. Department of Health and Human Services Office for Protection from Research Risks.

This action is officially recorded in the minutes of the committee.

Protocol Number	Date	Signature - Chair
040315A	4/19/04	

Appendix K

Study Flyer

Nursing Research Study

Men and women who work at ISU are needed for a nursing research study. You must be 18 - 65 years of age and in good health.

This study will include:

- ***Answering questions about healthy lifestyles for about 1 hour***
- ***Flexible scheduling on campus***
- ***Free parking***
- ***Cash payment***

If interested in participating in this study, contact

Kim Astroth at (309) 438-2367 or kmastro@ilstu.edu

Barnes College of Nursing and Health Studies,
University of Missouri – St. Louis
Illinois State University

Appendix L

Healthy Lifestyles Study Telephone Script: Screening Potential Subjects and Making Appointments

Hello, this is Kim Astroth and I am a doctoral student at Barnes College of Nursing and Health Studies at the University of Missouri- St. Louis and on the faculty at ISU Mennonite College of Nursing.
I would like to speak to _____.

Hello _____. This is Kim Astroth and I am a doctoral student at Barnes College of Nursing and Health Studies at the University of Missouri- St. Louis and am on the faculty here at ISU Mennonite College of Nursing. In response to your phone call (or e-mail), I am calling to talk with you about the nursing research study on healthy lifestyles that is going on at ISU. I am the person who will be conducting this study.

First, do you have an interest in talking with me further about the study?
IF YES:
I would like to ask you a few questions to determine if you are eligible to participate in this study. This should only take about five minutes. This information will be kept confidential. Would it be OK if I ask you a few questions?

1. Are you 18 to 65 years of age?	Yes or No
2. I am not allowed to study pregnant women; would you tell me, are you pregnant?	Yes or No
3. Do you think clearly?	Yes or No
4. Is your memory good?	
5. Do you have at least a sixth grade education?	Yes or No
6. Can you read English?	
7. Can you speak English?	Yes or No
8. Do you have any mobility or balance problems?	Yes or No
9. Do you use assistive devices, such as a wheelchair, cane or walker?	Yes or No
10. Do you have health concerns such as chest pain, dizziness, or bone or joint problems that cause you any physical limitations?	Yes or No
11. Have you been told by a physician that you have physical limitations?	Yes or No

Note: Potential subject is eligible for participation in this study if answers YES to questions 1, 3-7 and NO to questions 2, 8-11.

IF ELIGIBLE: You are eligible to participate in this study. I would like to set up a time to meet with you at ISU. This meeting will take 1 hour and will consist of you answering several questions about healthy lifestyles. The meeting will take place in a quiet place at Mennonite College of Nursing, located in Edwards Hall. When will you be available to meet? *Note: after setting up appointment time, give more specific directions to Edwards hall and determine parking needs.*
Do you have any questions for me about the study?
Thank you for your time and interest. I will see you on_____.
If you need to reach me, my phone number is 309-438-2367 and my e-mail is kmastro@ilstu.edu
Would you like a reminder call?
Good bye.

IF NOT ELIGIBLE: I am sorry, but you are not eligible to participate in the study at this time, but I thank you for your time and interest. Goodbye.

Appendix M

Information Sheet for Visit 1 of the Study

You are invited to participate in a nursing research study about healthy lifestyles, conducted by Kim Astroth, a doctoral student at Barnes College of Nursing and Health Studies at the University of Missouri-St. Louis and faculty member of Mennonite College of Nursing at Illinois State University. You have been asked to participate in the research because you have met the study requirements, as determined by our previous phone conversation. Please read this information sheet and ask any questions you may have. Your participation in this research is voluntary. Your decision whether to participate will not affect your current or future relations with the University of Missouri-St. Louis or Illinois State University. If you decide to participate, you are free to withdraw at any time without affecting these relationships.

If you agree to participate in this research, you will complete six questionnaires and two interviews about healthy lifestyles. You will also be asked to complete questions about your age, sex, race, education, family income range, and evaluation of the study. This study visit will last approximately 1 hour. You will receive $10. In addition you will be provided with free parking for the duration of the study visit.

There is little risk associated with this research. The only people who will know that you are a research subject is the person conducting the research. When the results of the research are published or discussed at conferences, no information will be included that would reveal your identity.

All of your responses will be kept confidential and stored in a locked file cabinet in the researcher's home. Your responses will be identified using a code number.

Contact information, your first name and phone number, will be written down by the researcher for purposes of the study. Your responses will be recorded using a code number and not your first name. Then your first name and phone number will be removed.

If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You also may refuse to answer any questions you do not want to answer and still remain in the study.

If you have questions later, you may contact the researcher at 309-438-2367 or by e-mail at kmastro@ilstu.edu.

If you have any questions about your rights as a research subject, you may call the Chairperson of the Institutional Review Board of the University of Missouri-St. Louis at (314) 516-5897 or the Research and Sponsored Programs Office at Illinois State University at (309) 438-2528.

Remember: Your participation in this research is voluntary. Your decision whether to participate will not affect your current or future relations with either University. If you decide to participate, you are free to withdraw at any time without affecting these relationships.

You will be given a copy of this sheet for your information and to keep for your records. Completion of the questionnaires and interviews indicates your consent to participate in the study.

Thank you for you willingness to participate in this nursing research project.

Appendix N

Participant Information Sheet

Please complete the following information about yourself.

1. Age:_____ years

2. Gender:

   _____female

   _____male

3. Race:
   _____ African American
   _____ Asian
   _____ Caucasian
   _____ Other (describe)_____

4. Ethnicity:
   _____ Hispanic
   _____ Non-Hispanic

5. Number of years of education completed: _____ years

   (for example: completion of high school equals 12 years)

6. What is your annual family income range? Select one.
   _____ 0 - $9,999
   _____ $10,000 - 19,999
   _____ $20,000 - 29,999
   _____ $30,000 - 39,999
   _____ $40,000 - 49,999
   _____ $50,000 - 59,999
   _____ $60,000 - 69,999
   _____ $70,000 - 79,999
   _____ $80,000 or more

Appendix O

Study Evaluation Questions

[After participant has completed all study questionnaires and interviews, SAY:]

We are almost finished. Now I would like to ask you a couple of questions regarding the study itself.

1. Was the wording of the items clear and understandable?
    a. Yes
    b. No (Ask to explain) _____

2. Were the directions clear and understandable?
    a. Yes
    b. No (Ask to explain) _____

Appendix P

Training for Expert: Scoring of PAR Interview

INTRODUCTION

The interviewer asks the participant to recall time spent sleeping and doing physical activities for the past 7 days. The interviewer guides the participant through the recall process, day-by-day, to determine duration and intensity of the physical activities.

Although the PAR is designed to include a variety of physical activities, such as aerobic exercise, work-related activities, gardening, walking, recreation, and leisure-time physical activities, only physical activities of moderate intensity and greater are counted. From hours spent in moderate, hard, and very hard intensity physical activities, total kilocalories/kilogram/week can be estimated

PHYSICAL ACTIVITY

The PAR interview focuses on collecting data on intensity, time or duration, and type of activity. Intensity and time will be discussed in detail later. Although the specific type of activity is not recorded, the PAR differentiates between occupational physical activities, such as stocking shelves, waitressing, and construction work, and recreational/ leisure activity (i.e., all other physical activities that are not done during paid work hours.) I am not considering light activities, such as desk work, standing, light housework, softball, bowling, strolling, and stop-and-go walking such as grocery or window shopping. Most participants spend the majority of their waking hours in light activity. I am interested in occupational, household, recreational, and sports activities that make the participant feel similar to how they feel when walking at a normal pace.

DEVELOPING SCORING SKILLS

Guidelines for Scoring PAR Worksheet: PAR Score Sheet

1. Refer to last page for examples of score sheets. Use the calculator provided to do computations.
2. I.D. number. Record the participant's I.D. number on the score sheet.
3. Work. Record total hours and number of days worked in the last 7 days under the appropriate columns on the score sheet.
4. Sleep. Record total hours slept per day and per week. Record hours spent in bed to the nearest quarter hour under the appropriate columns on the score sheet.
5. Physical activity. When scoring physical activity, be sensitive to walking. Although people walk many times during the day, not all walks are counted. For example, we will not add up each time a person walks to

the refrigerator. The specific rule for walking is that only walks of 5 min or longer are considered; count, then, only walks of a 5-min duration. However, that 5-min bout of walking can only be counted if another 5-min bout occurs in the same segment of the day in the same intensity category. The general rule is that a participant must do 15 min in a given intensity category in a given segment of the day. However, if the individual does any activity that adds up to at least 10 min in one intensity category for one segment of the day this amount is recorded and rounded to 15 min.

a. Rounding Rules (from worksheet): 10-22 min = .25 hr; 23-37 min = .50 hr; 38-52 min = .75 hr; 53-67 min = 1.0 hr; 68-82 min = 1.25 hr
b. Intermittently or continuously: The physical activity can be performed intermittently or continuously during one segment of the day, whether morning, afternoon, or evening. For example, if their activities add up to at least 10 min in one intensity category (e.g., hard) for one segment of the day (e.g., Wednesday afternoon), then that activity is recorded. If 10 min of physical activity is spread out over two or more segments of the day, it is not recorded.
c. Tally each day's activity hours by intensity levels and segment of the day and record all totals in the appropriate columns on the score sheet.
d. Report the final calculation to the nearest one decimal place, rounding at 5 and up to the next highest number.
e. Recheck to ensure that no mathematical or other errors have been made.

2. Strength and flexibility. After each day of physical activity has been recorded, the subject will be asked about how many minutes of strength training and/or flexibility he or she did. To avoid double-counting activities, the strength and flexibility exercises are recorded under strength and flexibility only. Do not count them anywhere else on the PAR worksheet.

3. Using the worksheet
    a. Remember the purpose of the PAR is to estimate energy expenditure, so an activity does not have to be continuous to be coded. Activities are counted if they add up to at least 10 min in one intensity category (e.g., hard) for one segment of the day (e.g., Wednesday afternoon). If 10 min of activity is spread out over two or more segments of the day, it is not counted. This rule allows for scoring sporadic activities, but it does not force one to score every single minute of activity during the day, which would be too time consuming.

Example #1: Blank 7-DAY PAR SCORE SHEET

ID #

	Day1 Hours	Day 2 Hours	Day 3 Hours	Day 4 Hours	Day 5 Hours	Day6 Hours	Day 7 Hours	7-Day Total Hours	Multiply by METS	Total Kcal/kg
Sleep									X1	
*Light									X1.5	
Moderate									X4	
Hard									X6	
Very hard									X10	
**Total kcal/kg/week										

Note:
24hrs x 7 days = 168 hrs/ week
*Light (7-day total hours) = 168 hrs/ week – 7-day total hours for: (sleep + moderate + hard + very hard)
**Total kcal/kg/week = total kcal/kg for: (sleep + light + moderate + hard + very hard); i.e., add first five numbers in last column

Example #2: Completed 7-DAY PAR SCORE SHEET

ID # 001

	Day1 Hours	Day 2 Hours	Day 3 Hours	Day 4 Hours	Day 5 Hours	Day6 Hours	Day 7 Hours	7-Day Total Hours	Multiply by METS	Total Kcal/kg
Sleep	8.5	7.75	8	9	5.5	8	5.25	53	X1	53
*Light								110.75	X1.5	165.125
Moderate	0	1.25	.25	0	.75	0	0	2.25	X4	9
Hard	0	.25	.25	.5	.25	0	0	1.25	X6	7.5
Very hard	0	.25	0	.25	.25	0	0	.75	X10	7.5
**Total kcal/kg/week										242.125

Appendix Q

Information Sheet for Visit 2 of the Study

Now that you have completed Visit 1 of the study about healthy lifestyles, there is a second opportunity for participation, which is separate from the visit you just completed.

Are you interested in hearing more about a second visit in one week?

Visit 2 will also be conducted by Kim Astroth, a doctoral student at Barnes College of Nursing and Health Studies at the University of Missouri-St. Louis and faculty member of Mennonite College of Nursing at Illinois State University. Please read this information sheet and ask any questions you may have. Your participation in this research is voluntary. Your decision whether to participate in Visit 2 will not affect your current or future relations with the University of Missouri-St. Louis or Illinois State University. If you decide to participate, you are free to withdraw at any time without affecting these relationships**.**

If you agree to continue to participate in Visit 2, you will be asked to set up an appointment to be held in one week. At Visit 2, you will answer questions aloud about healthy lifestyles. Visit 2 will last approximately 5-10 minutes. You will receive $10 for Visit 2. In addition, you will be provided with free parking for the duration of the study visit.

There is little risk associated with this research. The only people who will know that you are a research subject is the person conducting the research. When the results of the research are published or discussed at conferences, no information will be included that would reveal your identity.

All of your responses will be kept confidential and stored in a locked file cabinet in the researcher's home. Contact information, your first name and phone number, will be written down by the researcher for purposes of the study. Your responses will be recorded using a code number and not your first name. Then your first name and phone number will be removed.

If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You also may refuse to answer any questions you do not want to answer and still remain in the study.

If you have questions later, you may contact the researcher at 309-438-2367 or by e-mail at kmastro@ilstu.edu.

If you have any questions about your rights as a research subject, you may call the Chairperson of the Institutional Review Board of the University of Missouri-St. Louis at (314) 516-5897 or the Research and Sponsored Programs Office of Illinois State University at (309) 438-2528.

Remember: Your participation in this research is voluntary. Your decision whether to participate will not affect your current or future relations with either University. If you decide to participate, you are free to withdraw at any time without affecting these relationships.

You will be given a copy of this sheet for your information and to keep for your records. Completion of the interview indicates your consent to participate in Visit 2 of the study.

Thank you for you willingness to participate in this nursing research project.