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The Transtheoretical Model and the Initiation and Maintenance of Exercise: A Prospective Analysis

by

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Abstract

Encouraging people to initiate and maintain physical activity to achieve health benefits continues to be challenge to health professionals. The stages, decisional balance, and self-efficacy constructs of the Transtheoretical Model were used to investigate both initiating (N = 88), and continuing (N = 75) exercise for females enrolled in 12 week fitness classes. Efficacy differentiated participants in maintenance from those in preparation and action at baseline and week 12. Participants who remained in the same stage over time reported significantly higher combined efficacy scores than those who moved back stages or advanced stages. A significant interaction was found for efficacy x attendance indicating that: (a) efficacy scores declined significantly over time for low attendance, and (b) week 12 efficacy scores declined significantly over high, medium, and low attendance. The maintenance stage at baseline was the only significant predictor of adherence at week 12 and accounted for 6% of the variance adherence.

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Chapter One

Introduction

Twofold Challenge: Initiation and Maintenance of Exercise

As a health behavior, the preventive nature of physical activity and exercise has accumulated compelling evidence (Blair, Wells, Weathers, & Paffenbarger, 1994; Bouchard, Shepard, & Stephens, 1994; Bouchard, Shephard, Stephens, Sutton, & McPherson, 1990; Rothamn, 2000). Documented benefits of exercise have been consistently reported relative to coronary heart disease, osteoporosis, noninsulin dependent diabetes, hypertension, colon cancer, obesity, anxiety, and depression (Bouchard et al., 1994; Caspersen, Merritt, & Stephens, 1994; U. S. Department of Health and Human Services [USDHHS], 1996). However, adopting and maintaining physical activity appears to be stubbornly resistant to change in our society (Poag & McAuley, 1992).

Less than 20% of the adult population of North America are active at adequate levels of duration, frequency, and intensity to realize the health benefits generally associated with regular exercise participation (Armstrong, Sallis, Hovell, & Hofstetter, 1993; Caspersen, Christenson, & Pollard, 1986). Surveys of U. S. adults reported that only 8% of men and 7% of women were participating in regular exercise that either that met or exceeded the standard set by the American College of Sports Medicine (American College of Sports Medicine [ACSM], 1990; Caspersen et al., 1986). This recommendation stated that individuals needed to perform 20 minutes of rhythmic, repetitive, large muscle activity, three to four times per week, at an intensity of at least 60% of the maximal capacity (ACSM, 1990).

More recently, an alternative recommendation for the minimum level of physical activity was proposed and included 30 minutes of moderate-level accumulated activity each day for five or more days per week (Pate et al., 1995; USDHHS, 1996). Nevertheless, more than 60% of American adults are presently not consistently achieving either of the recommendations, and at least 25% of the American population are sedentary (Marcus et al., 2000; USDHHS, 1996). Canadian research found that that almost 40% of Canadians were achieving low levels of physical activity, with approximately 25% reporting moderate physical activity levels (Caspersen et al., 1994).

These circumstances present a twofold challenge to health professionals: (a) how to encourage sedentary individuals to initiate exercise, and (b) how to encourage maintenance of the exercise behavior once it has been undertaken (Dishman, 1982). The issue is further complicated by the consistent findings that even among the more active populations, interruptions in exercise programs are frequent (Rothman, 2000).

Atheoretical Research

Research into this challenging phenomenon has been ongoing for several years (Dishman, 1994). However, research applications and generalizability of findings have been hindered because of the atheoretical nature of many of the studies (Dishman, Sallis, & Orenstein, 1985; Sallis & Hovell, 1990; Sonstroem, 1988). Many of the initial studies focused on the outcomes of the interventions that had been designed with the intention of increasing initiation and/or maintenance of physical activity (Godin & Shephard, 1990). However, the interventions were designed and carried out without prior identification of the psychosocial determinants of the exercise behavior for that population (Dishman et

al., 1985). As well, the emphasis was on changing exercise behavior rather than on explaining the observed behavior.

As a result, regardless of the reported success or failure of this research, explaining the outcomes was problematic due to the lack of theory supporting the interventions (Dishman et al.,). Moreover, it was difficult to generalize from these findings to populations other than those under investigation (Sonstroem, 1988). Consequently, this literature supplied little concrete evidence and added sparse knowledge to the exercise dilemma. Accordingly, little is known about how to best intervene to effectively encourage exercise initiation and maintenance (Marcus, Rossi, Selby, Niaura, & Abrams, 1992).

In an effort to rectify the atheoretical nature of this preliminary research, it was argued that the study of exercise, similar to any scientific inquiry, would be benefited by a systematic, linear progression of investigations based on sound theoretical foundations (Dishman, 1994). Subsequently, several theoretical models (i.e., Health Belief Model, Protection Motivation Theory, Reasoned Action, and Planned Behavior) have been applied to the field of exercise research. One of the more promising models to be introduced into exercise research has been the Transtheoretical Model (TTM) (Marcus, Rossi, et al., 1992).

Chapter Two

Review of Literature

Transtheoretical Model

TTM was originally developed from research focused on changing addictive behaviors, particularly smoking (Prochaska & DiClemente, 1983). Prochaska and DiClemente interviewed numerous individuals who had successfully quit smoking. From these interviews, it was noted that changing behavior was more accurately viewed as occurring in a series of six identifiable and quantifiable stages and not simply as a one time event. The authors also identified 10 psychological processes that were believed to be used at different times and were responsible for moving changers through the series of stages. The model was further expanded to include elements of the decision making process (Velicer, DiClemente, Prochaska, & Brandenburg, 1985), and self-efficacy (DiClemente, Prochaska, & Gibertini, 1985).

Four fundamental arguments provide support for using TTM in exercise research: (a) there are similar relapse curves between recovering addicts and exercise initiates, (b) there are similar definitions relative to stopping an unhealthy behavior, (c) TTM and exercise both have dynamic structures, and (d) TTM anticipates and allows for relapse (Prochaska & Marcus, 1994).

Hunt, Barnett, and Branch (1971) compared relapse rates for total abstainers among recovering heroin, nicotine, and alcohol addicts. It was reported that the frequency of total abstainers measured over a 12 month period dropped dramatically over the first three months (55-65%), continued to decline less dramatically to six months (70 –75%), and gradually leveled off at approximately 20% of the original total abstainer group at

one year (Hunt, et al., 1971). This consistently occurring relapse curve reported with recovering/relapsing addicts was identified as very similar to relapse events observed in exercise behavior (Sonstroem, 1988). One of the most consistently reported findings in exercise literature maintains that almost 50% of participants initiating an exercise program will drop out within the first three to six months (Dishman, 1991; 1994).

It can be argued that beginning an exercise program could be defined as the adoption of a new, healthy behavior. However, an alternative perspective could also be that beginning an exercise program may be seen as the cessation of a sedentary, unhealthy lifestyle. The latter definition was reasoned to be conceptually comparable to stopping an undesirable, addictive behavior (Sonstroem, 1988). According to TTM, different individuals are at various levels of willingness to change their harmful behaviors. The stages of change model identified and sorted individuals into stages of readiness to quit an addictive behavior based both on intention to change and assessments of observable behavioral contingencies (Marcus & Simkin, 1993). Therefore, it was argued that TTM could be useful in sorting sedentary individuals into stages for intention of quitting their sedentary lifestyles.

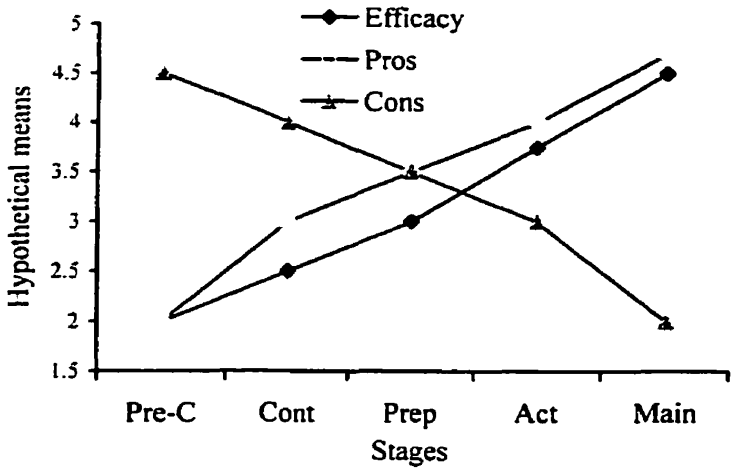
Furthermore, TTM is a dynamic, progressive model intended to capture both cross-sectional and prospective analogues of behavior change (Prochaska & DiClemente, 1983). In view of the fact that adopting exercise behavior is a dynamic process, TTM was proposed as an appropriate model for describing the different transitions involved in adopting exercise behavior (Marcus, Rossi, et al., 1992). Employing the TTM permitted researchers to sort individuals into discrete categories in between-subject designs, as well as measure movement among stages in within-subject designs. As a dynamic process,

adopting and maintaining exercise involves changing from a sedentary lifestyle to becoming more active. However, this change takes place over time, rather than as a dichotomous state of either displaying or not displaying the behavior at any given time. TTM acknowledges that most change takes place over time, and reliably identifies individuals' progressive changes as they moves through the various stages of change involved in adopting the new behavior. Therefore, it can be argued that the dynamics of exercise acquisition and maintenance is amenable to research by a model such as TTM (Armstrong et al., 1993).

Finally, TTM recognizes that changing a behavior is not an all-or-none event. The stages of change construct anticipates recycling back to earlier stages. In previous research, an additional category labeled relapse, was added to the original stages to account for the prevalence of failed attempts at change (Prochaska & DiClemente, 1983). However, this stage was later removed when it was redefined as recycling through previous stages and was no longer measured as a different stage (DiClemente et al., 1991). Recycling behavior places individuals back into earlier stages with fluctuations in levels of intention to adopt the behavior at another time. Recycling has been observed as more the rule than the exception relative to acquiring and maintaining exercise behaviors, and therefore is suited to investigations with the TTM (Marcus, Rossi, et al., 1992).

Core Constructs of TTM (See Figure 1)

Figure 1. Relationships among stages, self-efficacy, and decisional balance



Stages of change.

The stages of change construct describes the observation that there are between-subject differences in levels of intention to change exercise behavior, and quantifies levels of exercise activity over time (Prochaska & Velicer, 1997). This construct also maintains that there are within-subject differences such that participants that are measured at various times are likely to report being in different stages relative to previous and/or subsequent times. Individuals are believed to progress through a series of six stages when attempting to change a behavior, beginning with: (a) precontemplation, (b) contemplation, (c) preparation, (d) action, (e) maintenance, and ending with (f) termination (Prochaska & Velicer, 1997).

Individuals classified in the precontemplation stage are those who are not intending to take any positive action relative to their particular behavior problem within the near future (i.e., generally six months) (Prochaska & Velicer, 1997). These people are

usually not well informed about the consequences of their behavior and often exhibit an unwillingness to learn. This group may also contain individuals who have repeatedly failed at behavioral change and are demoralized about their belief that they can produce the desired outcome. This group is characterized as the most resistant to change (Prochaska & Velicer, 1997).

The stage of contemplation (also known as chronic contemplation or behavioral procrastination) is characterized by those individuals who have not yet taken any recent action relative to changing their behavior, but are intending to take action within the next six months (Prochaska, & Velicer, 1997). Contemplators are more likely than precontemplators to be actively learning about their behavioral consequences. However, this stage is characterized by an ambivalence about changing; having a greater knowledge that the behavior should be changed, but having an acute awareness of the personal cost of changing.

Individuals in the stage of preparation are those who are intending to take action in the immediate future (i.e., usually within one month) (Prochaska & Velicer, 1997). Those categorized in the preparation stage are more likely to have had at least one major attempt at changing their behavior over the preceding year and usually have some plan for action (i.e., joining an exercise class).

The action stage consists of those individuals who have made overt modifications to their behavior within the recent past (i.e., six months) (Prochaska & Velicer, 1997). This stage classifies those individuals who have made changes to their behavior and have attained specific, preset levels for a given behavior. For example, the action stage for smoking cessation is clearly cessation of all smoking behavior, not just hit and miss

attempts. For exercise, action may be pre-defined as exercising three times a week for a specific duration and at certain intensities.

The maintenance stage includes those individuals who have sustained the modified behavior for a period of at least six months (Prochaska & Velicer, 1997). This group is the least likely to relapse to previous stages, and are more confident in their abilities to continue to exercise under diverse conditions. Maintenance can last from one to five years, with the risk of relapse diminishing the longer the individuals remain in maintenance. For example, at one year maintenance of non-smoking behavior, the relapse rate was 43% (Prochaska & Velicer, 1997). With five years of maintenance, only 7% recycled back to previous stages. It has been reported that of the total number of exercisers who recycle from maintenance, approximately 15% recycle all the way back to precontemplation. The remaining 85% of individuals who reached maintenance levels of exercise and subsequently recycle, return to contemplation or preparation stages and will eventually try again (Prochaska & Velicer, 1997).

The stage of termination is defined by those people who have maintained the modified behavior with no temptation to return to previous behaviors and exhibit complete confidence in their abilities to sustain current levels of the present behavior for the duration of their lives (Prochaska & Velicer, 1997). When applied to exercise behavior, it was reasoned that never lapsing or relapsing for the rest of one's life was too restrictive for a dynamic behavior such as exercise. It may be more realistic to aim for a lifetime of maintenance. Therefore, this stage is not addressed in exercise research (Prochaska & Velicer, 1997).

Decisional balance.

It has been theorized that the decision making process is critical when attempting to alter behavior (Janis & Mann, 1977). Janis and Mann developed a Decisional Balance Sheet of Incentives that included both motivational and cognitive components of decision making. One of the basic assumptions of the decisional balance approach was that decisions were not made on the basis of loss alone, but rather through a comparative process involving assessments of both positive and negative consequences of behavior change. Initially, four main categories for the loss/gain model were identified as: (a) gains and losses for self, (b) gains and losses for others, (c) self-approval or self-disapproval, and (d) approval or disapproval from significant others (Janis & Mann).

Decisional balance and TTM.

The complex eight component structure was reduced into two orthogonal factors labeled simply pros and cons in research with the stages model (Velicer et al., 1985). The Decisional Balance Sheet was used to assess the benefits (pros) and costs (cons) of adopting a novel behavior (i.e., smoking cessation). Pros described the positive aspects of deciding to change and were believed to assist in altering behavior, whereas cons represented perceived barriers and were thought to hinder change (Velicer et al., 1985). An important conclusion from the simplification of the decisional balance scale was that pros and cons could be assessed independently and that any combination of pro/con scoring could emerge. This was an integral point for the assimilation of the decisional balance sheet into the TTM as it was believed that individuals would differ in their evaluation of pros and cons for changing behavior in a predictable manner relative to what stage of change was indicated (Velicer et al., 1985).

Initial research confirmed that stages of smoking behavior were related to decisional balance such that precontemplators reported greater cons than pros for quitting smoking, whereas pros and cons were nearly balanced for contemplators (Velicer et al., 1985). Action and maintenance stages reported a reverse pattern from precontemplators, with pros for quitting outweighing cons. On the basis of this research, it was suggested that the decisional balance approach would be valuable for assessing perceived advantages and disadvantages, and for describing and predicting behavior changes over a wide variety of activities. It was further advised that decisional balance scales should be constructed specifically for the behavior under investigation (Velicer et al., 1985). For example, decisional balance was developed for research into weight loss and exhibited a comparable pattern of pros and cons across stages, with the cons outweighing the pros in the early stages, and pros outweighing the cons in the later stages (O'Connell & Velicer, 1988).

Decisional balance, TTM, and exercise.

An international, cross-sectional study was conducted on a worksite sample to investigate stages and decisional balance for exercise (Marcus & Owen, 1992). This study included a six-item decisional balance scale that significantly related to some, but not all stages, and clear differentiation for stages was not found. Precontemplators showed relatively lower pro scores than con scores, and maintainance showed the opposite pattern. It was suggested on the basis of these findings that a more comprehensive decisional balance scale be developed (Marcus & Owen).

Subsequently, the decisional balance scale was adapted for exercise research (Marcus, Rakowski, et al., 1992). The simplified two-factor pro/con structure was again

supported for decisional balance and exercise when assessed by stages. In a cross-sectional analysis of a worksite sample, it was reported that for precontemplators, cons were significantly higher than pros, with pros and cons intersecting in the stage of preparation, and with pros reported as significantly higher than cons in the stage of maintenance. From this work, it was suggested that TTM could provide valuable information relative to exercise behavior change (Marcus, Rakowski, et al., 1992).

An intergated study of 12 health behaviors (including exercise) utilizing stages and decisional balance was conducted (Prochaska et al., 1994). The cons for changing exercise behavior were higher than the pros for precontemplators, intersected at prepartation, with pros somewhat higher than cons for those in maintenance. An additional investigation conducted on a worksite sample for four health behaviors (including exercise) demonstrated that, consistent with previous research, pro scores were higher for action and maintenance participation compared with precontemplators (Herrick, Stone, & Mettler, 1996). As well, Herrick, et al. (1996) found that con scores were higher for those in precontemplation compared to action and maintenance participants, with the intersection of pros and cons located between preparation and action.

In a comprehensive literature review of TTM and its applications to the study of exercise, it was reported that clear differentiation across all stages was not consistently supported (Prochaska & Marcus, 1994). Specifically, it was noted that the pro/con scale is most predictive of transitions between the first three stages. Further, it was reported that during the later stages such as maintenance and action, the decisional balance scale was not as an effective predictor of exercise progress (Prochaska & Marcus).

Self-efficacy.

Self-efficacy is defined as the confidence in one's ability to perform a specific behavior (Bandura, 1977). Self-efficacy theory derives from the broader Social Cognitive Theory (SCT) proposed by Bandura (1977). According to SCT, efficacy expectations are partly responsible for behavioral choices, effort expended on behavior, duration of perseverance, and level of self-assurance approaching a task (Bandura, 1986). Whether or not individuals approach a behavior with confidence and expect a favorable outcome, will depend on their evaluation of existing capabilities relevant to the behavior. High efficaciousness in social, intellectual, and physical pursuits leads to expectations of positive outcomes, whereas, low efficaciousness produces lowered outcome expectations (Bandura, 1986).

Perceptions of self-efficacy are influenced by at least four sources of information: (a) enactive attainment, (b) vicarious experience, (c) verbal persuasion, and (d) physiological state (Bandura, 1986). Enactive information is the most influential information source. This feedback comes from personally experiencing repeated success or failure with a given behavior. Simply, success raises efficacy judgments and failure lowers them (Bandura, 1986). In addition to direct feedback, self-efficacy information can be obtained via vicarious experience through observing relevant others. As well, others can provide verbal encouragement or be verbally discouraging. Finally, information can be derived by referencing physiological states including, aversive arousal, somatic arousal, fear reactions, and heightened emotional stages (Bandura, 1986).

Bandura (1982) believed that self-efficacy was the central cognitive mechanism and one of the most influential determinants of thought patterns, actions, and affective arousal. Therefore, self-efficacy was extensively researched to provide empirical support for the proposed centrality of self-efficacy in human agency (Bandura, 1986). An important consideration in researching perceived self-efficacy was that it be assessed with specific reference to a particular behavior, rather than as a global measure of overall perceptions of efficacy. This methodology facilitated capturing self-efficacy as it fluctuated relative to specific efficacy information. Therefore, research designs intending to describe the relationship between self-perceptions of efficacy and action were most often measures of self-efficacy relative to performing a specific behavior (Bandura, 1986).

Self-efficacy and TTM.

Self-efficacy was found to display a positive linear relationship with stages of change when assessing smoking cessation (DiClemente, Prochaska, & Gibertini, 1985). Self-efficacy scores were found to significantly differentiate between most pairings of stages. Specifically, it was reported that precontemplators and contemplators had the lowest scores for self-efficacy with the participants in maintenance reporting the highest self-efficacy scores. In a study for smoking cessation for precontemplators, contemplators and preparators, self-efficacy demonstrated significant differences among all three groups (DiClemente et al., 1991). DiClemente et al. found that participants in preparation had significantly higher levels of confidence to stop smoking, relative to those in precontemplation and contemplation.

Self-efficacy and exercise.

Independent of TTM, researchers in exercise science reported on the positive predictive value of self-efficacy for exercise, sport, and health behavior (Godin & Shephard, 1990). "The perceived ability to participate and to exercise regularly ... seems the variable of prime importance" (Godin & Shephard, 1990, p. 108). A study that included self-efficacy when examining a formal exercise program for healthy adults found that self-efficacy was a significant predictor of exercise adherence (Desharnais, Boullion, & Godin, 1986). Stanley and Maddux (1986) reported that exercise participation was positively influenced by self-efficacy. Further, Wurtele and Maddux (1987) found that self-efficacy alone related significantly to undergraduate womens' intentions to exercise. Self-efficacy was additionally reported as a powerful predictor of circuit weight training in males with coronary artery disease where both self-report and observational data were collected (Ewart, Stewart, Gillilan, & Kelemen, 1986). More recent research found that self-efficacy was the most important determinant of intended physical exercise when assessed individually for intensity, duration, and frequency (Courneya & McAuley, 1994).

Self-efficacy, TTM, and exercise.

Due to the preponderance of positive findings with self-efficacy and exercise, the self-efficacy construct associated with the TTM was adapted for exercise research (Marcus, Selby, Niaura, & Rossi, 1992). Self-efficacy was found to relate significantly with stages of change in a cross-cultural study assessing readiness to exercise (Marcus & Owen, 1992). Consistent with previous smoking cessation research (Velicer et al., 1985), it was reported that precontemplators and contemplators recorded the lowest scores on

self-efficacy with those in maintenance recording the highest scores. Herrick et al. (1996) also reported that self-efficacy scores progressed with a predominately positive linear relationship with stages of change for four health related behaviors, including exercise. Furthermore, self-efficacy scores were higher during action and maintenance stages compared to both precontemplation and contemplation (Herrick et al.).

Chapter Three

Present Study

Purpose of Present Study

The purpose of the present study was to explore the relationships among three of the four core constructs of TTM: (a) stages of change (b) self-efficacy, and (c) decisional balance to investigate both initiate and maintenance exercise behavior over a twelve-week period. The fourth TTM construct consisting of ten processes, and measured with a 39-item questionnaire, was omitted from this research. Including this questionnaire would have required additional time from the participants for completion. As well, the total number of participants required to properly analyze the 10 processes questionnaire, in addition to the other constructs, was considered to be to great for the scope of this research. In addition, the information that would have been gained was not considered to be relevant enough to the research direction of this study to warrant increasing the item load on participants.

Several of the recent studies using TTM have relied on cross-sectional research designs (Prochasca & Marcus, 1994). Cardinal (1997) argued that due to the dynamic nature of exercise behaviors, this research design was not sufficient to explain initiation and maintenance of physical exercise over time. It was proposed that a prospective design would be more appropriate (Armstrong et al., 1993; Cardinal, 1997; Dishman, 1994). A prospective research design measures changes within the same participants over two or more time periods. A cross-sectional design measures variations between different participants measured at the same time. In order to suggest that the differences between several participants measured at the same time are reflective of the variations found

within participants measured at various times, it was necessary to design a prospective study. Therefore, the present study was responsive to this research limitation by examining participants through both acquisition and maintenance phases of exercise behavior adoption.

Research Questions

Research question 1: Did the present study find consistent patterns for: (a) stages and self-efficacy, and (b) stages and decisional balance as reported in previous research?

Research question 2: Was any additional information found through a prospective design relative to self-efficacy and decisional balance measured over time and analyzed with three distinct factors: (a) movement through stages from baseline to week 12, (b) stages at week 12, and (c) attendance?

Research question 3: Did any of the predictor variables: (a) stages, (b) self-efficacy, or (c) decisional balance account for variance in adherence rates and if so, which variable accounted for the most variance?

Chapter Four

Method

Participants

Female adults enrolled in 10 fitness classes held at the University of Calgary were invited to participate in this study. Females were specifically targeted for this study to balance exercise research that has been predominately carried out on white, affluent, males (King et al., 1992). Classes were selected based on the following criteria: (a) they were led by a certified fitness instructor, (b) the exercise was predominately aerobic, (c) they met at least twice per week, (d) classes were at least 45 minutes in length, and (d) extended over approximately the same 12-week time period. Eighty-eight participants ranging in age from 18-75 years, ($\underline{M}$ = 38) volunteered at baseline. At week 12, 75 (85.2%) participants completed questionnaires

Data collection was divided into two phases. At baseline, questionnaires were distributed to participants by the researcher in each of the ten classes. Participants completed the initial set of measures that included: (a) demographic information (Appendix A), (b) Long Vigorous 5-Choice Scale (LV-5CS) (Appendix B), (c) Decisional Balance Scale, (DBS) (Appendix C), (d) Self Efficacy for Exercise Scale, (SEES) (Appendix D), and (e) Self Efficacy Scale (SES) (Appendix E). These questionnaires were returned to a secured location by participants. The second data phase was collected through mail-outs at the end of 12 weeks and included: (a) LV-5CS (b) DBS, (c) SES/SEES, and (d) adherence (Appendix F). Questionnaires were returned to the researcher in a self-addressed, pre-stamped envelope. Participants were e-mailed a reminder about the study at the same time as the mail-out. One follow-up reminder phone

call was made to those members who had not returned the second set of responses after fourteen days.

Instruments

Long vigorous–5 choice stage scale.

The long vigorous-5 choice stage scale (LV-5CS), scale most consistently met the recommendations suggested by Reed, Velicer, Prochaska, Rossi and Marcus (1996): (a) each stage should be clearly and succinctly well-defined, (b) the definition of exercise outlining the criteria of the behavior should be complete, unambiguous and understandable and, (c) the staging algorithm should employ a true/false or 5-Choice Likert response format.

The population used to study the LV-5CS algorithm was a convenience sample of 327 (M = 48), primarily white (92%), predominately male (53%) U. S. adults. (Reed et al., 1996). Each stage of the LV-5CS is written in simple, well-defined terms that capture past, present, and intentional behavior. For example, precontemplation would be difficult to misinterpret (i.e., I currently do not exercise and I do not intend to start exercising in the next 6 months). The temporal dimension is precise and the language is free from ambiguity, overly academic language and unnecessary repetition.

Reed et al. (1996) further argued that the longer style definition of the LV-5CS leaves less room for individual interpretation. It was reported that the more concise the criteria the participant was given in order to judge their own exercise behavior, the less likely he/she was to lower the standard of the exercise definition. The longer definition resulted in different classification patterns than those that were observed with the shorter definition staging algorithms. When a shorter definition was used, it was found that more

individuals classified themselves into later stages (i.e., action and maintenance) than with the longer definition when more individuals self-classified into the earlier stages (i.e., precontemplation, contemplation, and preparation (Reed et al.)

An additional recommendation was that the response format be either a true/false or a 5-point Likert type scale (Reed et al., 1996). It was reported that either format classified people into the same stages, provided the definition was the long style format. However, it was suggested that the 5-point Likert scale might have a slight advantage over the dichotomous response format by requiring only a single response to be selected. The true/false format required that the participant responded to each item with a true/false answer. Therefore, classification depended on both a true response to one item and false responses to all other items (Reed et al.).

For example, to classify an individual into precontemlation required a true response to item (1)'I currently do not exercise and I do not intend to start exercising in the next 6 months', and a false response to item (5) 'I currently exercise regularly and have done so for longer than 6 months'. This could potentially produce errors if the respondents inadvertently selected conflicting responses for more than one stage. Therefore, the 5-Point Likert scale was argued to be the most parsimonious format, accurately classifying individuals into discrete stages with the least amount of risk for error (Reed et al.).

When different staging algorithms were incorporated with the other variables of TTM: (a) pros/cons, and (b) self-efficacy, it was reported that the LV-5CS produced the most consistent, classical pattern with those observed in previous research (Reed et al., 1996). For example, pros have been demonstrated to rise throughout the progression of

stages, while cons typically fall in a predictable pattern, with the intersection at or near the preparation stage. Self-efficacy was found to rise in the previously observed pattern across the stages, reporting the highest levels in maintenance and the lowest in precontemplation (Reed et al.).

Decisional balance scale.

The decisional balance scale (DBS) was incorporated into the TTM (Velicer et al., 1985) and further refined for exercise research by Marcus, Rakowski, and et al. (1992). Seven hundred seventy-eight predominately white (95%) US workers (54% female) with a mean age (M=41.5) were recruited from four different worksites (Marcus, Rakowski, et al., 1992). Scale development included reducing a pool of items from 75 to 23, followed by a principal components analysis with varimax rotation that resulted in two orthogonal components. The components were labeled pros and cons and retained ten and six items each respectively (Marcus, Rakowski, et al., 1992).

Participants were asked to rate how important each item was to them relative to their decision to exercise on a 5-Point Likert scale ranging from (1) not at all important to (5) extremely important. Both items: (a) 'I would feel more confident if I exercised regularly' and (b) 'I would feel good about myself if I kept my commitment to exercise' regularly loaded the strongest on the pros factor at 0.86 and were retained in the final item solution. The highest loading on the cons factor was item 4, 'Regular exercise would take too much of my time' at 0.79. The two components accounted for 60.4% of the total item variance. The internal consistencies were reported as Coefficient alpha's: (a) pros =0.95, and (b) cons = 0.79 (Marcus, Rakowski, et al., 1992).

Self-efficacy for exercise scale.

Self-Efficacy for Exercise Scale (SEES,) (Sallis, Pinski, Grossman, Patterson, & Nader, 1988) was used to assess efficacy at baseline and week 12. The SEES scale was first developed from a population of 171 participants. Ratings were marked on a 5-point Likert-type scale ranging from (1) 'sure I could not do it' to (5) 'sure I could do it'. A principal components analysis reduced a pool of forty-nine items to twelve items that subsequently produced a two-factor structure. The five item factor was named 'resisting relapse' (e.g., Stick to your exercise program when your family is demanding more time from you) and the seven item factor was named 'making time for exercise' (e.g., Get up earlier to exercise). Internal consistency values were 0.83 for 'resisting relapse' and 0.85 for 'making time for exercise' (Sallis et al., 1988).

Self-efficacy scale.

The Self-efficacy Scale (SES,) (Marcus, Selby, et al., 1992) was operationalized for TTM specifically for exercise research, and was based on the SEES (Sallis, et al., 1988). One thousand and sixty-three US government employees (77% male) with a mean age (M=41.1) were recruited for this scale development (Marcus, Selby, et al., 1992). The five-item scale was designed to measure individuals' confidence that he/she could continue in an exercise behavior regardless of certain adverse circumstances. The five items assessed two main components: (a) resisting relapse (e.g., I am confident I can exercise when I am on vacation), and (b) having sufficient time for exercise (e.g., I am confident I can exercise when I feel I don't have time). Each item was measured on an 11-point Likert scale, ranging from (1) being 'not at all confident' to (11) being 'very

confident'. A zero score indicated that the item did not apply to the respondent (Marcus, Selby, et al., 1992).

Results indicated that the self-efficacy scores significantly differentiated participants at different stages (Marcus, Selby, et al., 1992). It was particularly evident that precontemplators were significantly different from all of the other stages on their self-efficacy scores. In addition, a similar pattern was found to that observed in the smoking literature (DiClemente et al., 1985). Precontemplators had the lowest self-efficacy scores, while those in maintenance reported the highest self-efficacy scores. The internal consistency for the scale was reported as 0.76 (Marcus, Selby, et al., 1992).

Both scales were included to determine which scale performed most reliably. However, to keep the dependent measures scales compatible, both self-efficacy scales were measured on a five point Likert scale where (1) indicates a complete lack of confidence, and (5) indicates total confidence.

Adherence.

Adherence was reported at week 12. Dishman (1982) argued against using a dichotomous scale to differentiate adherers from terminators in exercise research because of the amount of behavioral information that was lost. It was suggested that a measure of the number of days in a week that an individual exercised, summed over the duration of several weeks or months retained important exercise information, and quantified the data on a continuous scale. Therefore, participants were asked to self-report the number of weeks over the duration of the study that they considered themselves to be a regular exerciser. Percentages were calculated for the number of weeks reported divided by the total number of weeks in the study.

Procedure

Permission to conduct this study was granted by the Office of Medical Bioethics, Faculty of Medicine, University of Calgary (Appendix G). Participants were drawn from ten exercise classes that met at the University of Calgary Fitness Facility, beginning January, 2001. The researcher met with the supervisors and fitness leaders to explain the research. Subsequently, the researcher attended each class to explain the research and to ask for volunteers. Data was collected at baseline and at the completion of the classes (week 12). No remuneration was offered, however, a summary of the research findings was sent to those participants who had requested the information. All participants completed, signed, and returned informed consent forms (Appendix H).

Chapter Five

Results

All statistical analyses were performed on SPSS Version 10 for Windows at an alpha level of 0.05 unless stated otherwise. Analyses were conducted for: (a) scale reliabilities (baseline and week 12), (b) cross-sectional at baseline, (c) cross-sectional at week 12, and (d) prospective from baseline to week 12.

Scale Reliabilities

Internal consistency was determined for the self-efficacy and decisional balance scales at baseline. The 5-item Self-Efficacy Scale (SES) and the 12-item Self-Efficacy for Exercise Scale (SEES) had Cronbach's alphas of 0.59 and 0.86 respectively. Consistent with the original measure, the 12 item SEES scale was divided into two factors previously labeled 'resisting relapse ' (5 items) and 'making time for exercise' (7 items). The 'resisting relapse' Cronbach's alpha at baseline was 0.76. The 'making time for exercise' Cronbach's alpha at baseline was 0.78. The decisional balance scale was divided into Pros (10 items) and Cons (6) items and assessed separately for reliability. The Cronbach's alphas were 0.81 and 0.65 respectively.

Reliability indices were calculated again at week 12. The Cronbach's alphas for the 5-item SES and the 12-item SEES at week 12 were 0.69 and 0.89 respectively. The SEES was split into five items labeled 'resisting relapse' and seven items labeled 'making time'. The Cronbach's alphas were 0.79 and 0.84. The decisional balance scale was assessed as two separate subscales, labeled 'pros' and 'cons'. The Chronbach's alphas were 0.83 and 0.70 respectively.

One of the purposes of this study was to compare two exercise related self-efficacy scales: (a) the 12-item Self-Efficacy Exercise Scale (Sallis et al., 1988), and (b) the 5-item Self-Efficacy Scale (Marcus, Selby et al., 1992) to determine if one of the scales was more reliable than the other. Both scales have identically labeled factors: (a) 'resisting relapse' and (b)'making time for exercise'. The authors of the SES (Marcus, Selby, et al.,1992) reported that the scale construction was based on the longer SEES (Sallis, et al., 1988). However, it was further reported that clear differentiation between stages was not found for physical activity using the SES. It was suggested that future research should include creating an instrument where clear differentiation between stages was possible (Marcus, Selby, et al., 1992). While creating a new scale was beyond the scope of this research, comparative analyses were performed.

Participants responded to both scales on a 5-point Likert response format with (1) meaning 'complete lack of confidence' to (5) meaning 'total confidence'. Subsequent to data collection, the scales were separated and the respective Chronbach's alphas were calculated. In order to determine if the 12-item scale was a more reliable measure of efficacy than the 5-item scale, it was necessary to use the Spearman-Brown formula (Ferguson, 1981). Given that reliability is a function of the test length, direct comparisons of the reliability coefficients from test of different lengths is not appropriate. The Spearman-Brown formula takes into account that increasing the number of items in a scale will generally increase the alpha of that scale.

Therefore, it was necessary to predict the alpha for the 5-item scale as if it had an equal number of items (12) to the SEES in order to perform a standardized comparison. It was found that the predicted Chronbach's alpha for the SES was 0.77 and produced a

somewhat less accurate measure of reliability than the SEES (Chronbach's alpha = 0.86) at baseline. This procedure was repeated with the week 12 scales. The predicted Cronbach's alpha for the 5-item scale was 0.84 compared to 0.89 for the 12 item SEES, suggesting that the SEES was accounting for an additional 5% of the variability in the scores. Therefore, based on the comparative results of this study, all subsequent analyses were conducted on the SEES only.

Baseline Demographics

At baseline, participants were administered a demographic questionnaire. It was found that 89.8% (n = 79) participants indicated previous participation in an exercise class. Of those, 95% (n = 75) reported completing at least one exercise class prior to this study. The entire sample (n = 88) anticipated completing the current class. Only three participants (3.4%) reported either strong or moderately strong disagreement with the statement 'I believe that I am ready at this time to make lifestyle changes'. Eighteen participants (25.5%) indicated neither agreement nor disagreement with the same statement, whereas 33 (37.5 %) were in moderate agreement, and 32 (36.4%) agreed strongly with readiness to make lifestyle changes.

Two participants (2.3%) moderately disagreed with the statement 'I believe that I can perform the exercises in the class'. Three individuals (3.4%) neither agreed nor disagreed, 25 (28.4%) moderately agreed, and 58 participants (65.9%) strongly agreed with the statement. The two statements 'I believe that I can perform the exercises in the class' and 'I believe that I am ready at this time to make lifestyle changes' were significantly correlated, r = .452, $p < 0.001$.

Cross-Sectional Results

Baseline.

Relative to the condition that all participants were registered in a fitness class at baseline, it was anticipated that no one would score in the precontemplation stage (i.e., I currently do not exercise and I do not intend to start exercising in the next 6 months). As expected, none of the participants were in the precontemplation stage, and six (6.8%) selected the contemplation stage. Twenty-five participants (28.4%) selected the preparation stage, 12 participants (13.6%) were in action, and over half of the sample (51.1%, $n = 58$) were in the maintenance stage.

In order to determine if the current research exhibited similar relationships to previous research, two separate ANOVA's were conducted with the baseline data. Efficacy and decisional balance (pros and cons) variables were analyzed with the stages variable as the factor.

Efficacy x stages.

A one-way ANOVA for one between-subjects factor (stages) with four levels (contemplation, preparation, action, maintenance) was performed on efficacy at baseline. A significant group effect was found, $F (3, 84) = 5.424$, $p = 0.002$, indicating that efficacy significantly differs from stage to stage (see Table 1). Post hoc HSD Tukey analysis revealed two significantly different sets of means. Participants in the stage of maintenance ($M = 3.76$) scored significantly higher on efficacy than those in the action stage ($M = 3.17$, $p = 0.041$). As well, participants in the stage of maintenance ($M = 3.76$) scored significantly higher on efficacy than participants in the preparation stage ($M = 3.15$, $p = 0.003$).

Table 1

Mean Efficacy Scores for Stages at Baseline

Stage of change	n	M	SD
Contemplation	6	3.53	.61
Preparation	25	3.15	.72
Action	12	3.17	.78
Maintenance	45	3.76	.62
Total	88	3.49	.72

Decisional Balance x stages.

A two-way ANOVA for one between-subjects factor (stages) with four levels (contemplation, preparation, action, maintenance) and one within-subjects factor (decisional balance) with two levels (pros, cons) was conducted. No significant interaction effect was found for decisional balance x stages, F (3, 84) = 1.427, p = 0.241. There was a significant within subject effect for decisional balance, F (1, 84) = 73.761, p < 0.001, demonstrating that the mean of the pro scores (M = 4.51) was significantly higher than the mean of the con scores (M = 3.69) (see Table 2). However, there was no significant stage effect, F (1, 84) = 0.452, p = 0.717 suggesting that the stages variable was unable to significantly differentiate participants based on the decisional balance scores.

Table 2

Mean Decisional Balance Scores for Stages at Baseline

Stage of change	n	M pro	M con	SD pro	SD con
Contemplation	6	4.32	3.50	.71	1.05
Preparation	25	4.41	3.81	.47	.53
Action	12	4.59	3.74	.26	.59
Maintenance	45	4.57	3.64	.38	.70
Total	88	4.51	3.69	.42	.66

Week 12.

At the completion of the fitness classes (week 12), 85.2% of the original 88 participants completed and returned questionnaires (N = 75). Participants were subsequently classified into the following stages: (a) contemplation (n = 1, 1.3%) (b) preparation (n = 11, 14.6%) (c) action (n = 23, 30.6%) and (d) maintenance (n = 40, 53.3%). Two independent ANOVAs were conducted on efficacy and decisional balance (pros and cons) with stages as the factor at week 12.

Efficacy x stages.

A one-way ANOVA for one between-subjects factor (stages) with four levels (contemplation, preparation, action, maintenance) was performed with efficacy. Initial analysis revealed that there was a single case in the stage of contemplation. This level was deleted and the analysis was repeated for one between-subjects factor (stages) with three levels (preparation, action, maintenance) and efficacy. There was a significant efficacy effect, $F(2, 71) = 10.86$, $p < 0.001$, suggesting that the efficacy scores were significantly different from stage to stage. Post hoc Tukey HSD analysis revealed two sets of significantly different means. Consistent with the findings at baseline, participants in maintenance (M = 3.69) scored higher on efficacy than those in preparation (M = 2.71, $p < 0.001$) and higher than those in action (M = 3.14, $p = 0.008$) (see Table 3).

Table 3

Mean Efficacy Scores with Stages at Week 12

Stage of change	n	M	SD
Preparation	11	2.71	.52
Action	23	3.14	.70
Maintenance	40	3.69	.70
Total	74	3.37	.76

Decisional Balance x stages.

A two-way ANOVA for one between-subjects factor (stages) with four levels (contemplation, preparation, action, maintenance) and one within-subjects factor (decisional balance) with two levels (pros, cons) was completed at week 12. The single case in contemplation was removed and the analysis was repeated with stages (preparation, action, maintenance) and decisional balance (pros, cons). No significant interaction effect was found, F (2, 71) = 2.607, p = 0.081. There was a significant within subject effect for decisional balance, F (1, 71) = 61.482, $p < 0.001$, demonstrating that the mean of the pro scores (M = 4.51) was significantly higher than the mean of the con scores (M = 3.56) (See Table 4). There was no significant stage effect, F (1, 71) = 2.607, p = 0.081, suggesting that the stages variable was unable to significantly differentiate participants based on either the pro or con scores.

Table 4
Mean Decisional Balance Scores with Stage at Week 12

Stage of change	n	M pro	M con	SD pro	SD con
Preparation	11	4.51	3.91	.49	.55
Action	23	4.29	3.51	.52	.74
Maintenance	40	4.63	3.50	.35	.75
Total	74	4.51	3.56	.45	.73

Prospective Results

In addition to analyzing the data independently at baseline and week 12, the data was also assessed prospectively between baseline and week 12. As previously stated, TTM is a dynamic model intended to capture changes in stages, self-efficacy, and decisional balance over time. The prospective analysis included a crosstabulation analysis comparing the stage of change variable measured at both baseline and week 12 to

determine the nature of the relationship over time. As well, three separate ANOVAs were performed for efficacy with three distinct factors in order to determine if efficacy changed in any significant pattern over time for any of the factors. The three factors were: (a) movement between stages from baseline to week 12 categorized into three levels labeled 'ahead', 'same' and 'back', (b) stage of readiness to change exercise behavior at week 12, and (c) attendance at week 12 categorized into three levels labeled 'high attendance, 11-12 weeks', 'medium attendance, 9-10 weeks', and 'low attendance, 8 or fewer weeks'.

In order to assess the changes in decisional balance over time with the same three factors as efficacy, it was necessary to perform three 3-way ANOVAs. It was determined that given the sample size, individual cells did not have an adequate number of participants to reliably detect differences in means among the cells. Therefore, these analyses were not reported.

A final analysis was performed to assess the predictive power of the variables of the TTM. Given that the ratio of participants to variables in the equation should be approximately twenty to one, this analysis was exploratory in nature.

Stages.

Crosstabs analysis of the stage of change variable measured at baseline compared to the stage of change variable at week 12 rejected the null hypothesis of independence between the two variables, χ^2 (9, $\underline{N}$ = 75) = 44.65, $\underline{p}$ <0.001. Therefore, it can be proposed that the stages variable at baseline and week 12 are significantly related in a systematic way.

The movement between stages was calculated from the stage selected at baseline compared with the stage selected at week 12. It was determined that 33% (n = 25) of the participants had moved ahead at least one stage, 55% (n = 41) remained in the same stage, and 12% (n = 9) moved back at least one stage (see Table 5).

Table 5

Crosstabulation of Frequencies for Stages, Baseline and Week 12

		Stage at week 12			
Stage at baseline	Total	Contemplation	Preparation	Action	Maintenance
Contemplation	5			5	
Preparation	20		4	12	4
Action	12	1	2	5	4
Maintenance	38		5	1	32
Total	75	1	11	23	40

Efficacy by movement through stages of change.

A 2-way ANOVA for one between-subject factor (movement) with three levels (ahead, back, same), and one within-subject factor (efficacy) with two levels (baseline, week 12) was performed (see Table 6). There was no significant movement x time interaction effect found, $F(2, 72) = .976$, $p = 0.382$. There was a significant time effect, F, $(1, 72) = 4.872$, $p = 0.03$, suggesting that efficacy scores at baseline ($M = 3.48$) were significantly higher than efficacy scores at week 12 ($M = 3.36$) (See Table 7). There was also a significant movement effect, F, $(2, 72) = 8.079$, $p = 0.001$. Post hoc Tukey HSD analysis showed that those participants who remained in the same group ($M = 3.65$) reported significantly higher combined efficacy scores than those who had moved back to an earlier stage ($M = 2.82$, $p = 0.001$). In addition, the participants who remained in the

same group (M = 3.65) also reported significantly higher combined efficacy scores than those who moved ahead (M = 3.25, p = 0.034) (see Figure 2).

Table 6

Analysis of Variance for Efficacy (baseline, week 12) x Movement

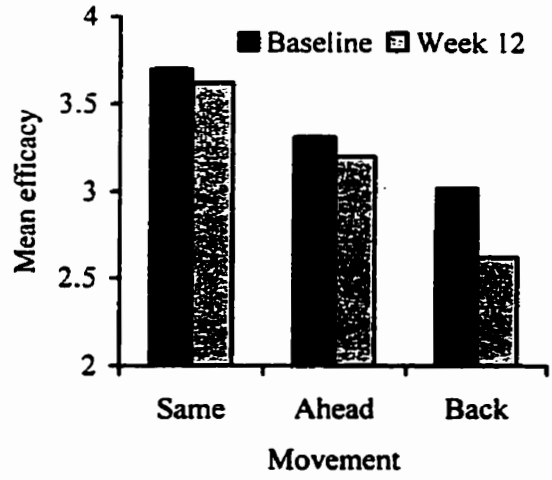
Source	df	F	p
Within subjects			
Time	1, 72	4.872	0.3
Time x Movement	2, 72	0.976	0.38
Between Subjects			
Movement	2, 72	8.079	0.001

Table 7

Mean Efficacy Scores (baseline, week 12) x Movement

		Baseline		Week 12		Combined	
	n	M	SD	M	SD	M	SD
Same	41	3.70	.69	3.62	.72	3.65	.66
Ahead	25	3.31	.72	3.20	.75	3.25	.62
Back	9	3.02	.45	2.62	.43	2.82	.68
Total	75	3.49	.72	3.36	.77	3.42	.68

Figure 2. Mean efficacy scores (baseline, week 12) for movement among stages



Efficacy by stage of change.

A 2-way ANOVA for one between-subject factor (stage) with four levels (contemplation, preparation, action, maintenance) and one within-subject factor (efficacy) with two levels (baseline, week 12) was performed. A single case in contemplation was deleted and the analysis was repeated for one between-subject factor (stage) with three levels (preparation, action, maintenance) and one within-subject factor (efficacy) with two levels (baseline and week 12) (see Table 8). No significant interaction effect was found for time x stage, F (2, 71) = 1.571, p = 0.215. A significant time effect was found, F (1, 71) = 5.622, p = 0.02 indicating that the overall efficacy scores were greater at baseline (M = 3.506) than at week 12 (M = 3.374) (see Table 9). There was also a significant stage effect at week 12 F (2, 71) = 11.513, p < 0.001. Follow up Tukey HSD analysis showed significant group differences between maintenance (M = 3.732) and action (M = 3.176, p = .001). An additional significant group difference was noted between maintenance (M = 3.732) and preparation (M = 2.932, p <0.001) (see Figure 3).

Table 8

Analysis of Variance for Efficacy (baseline, week 12) x Stage (week 12)

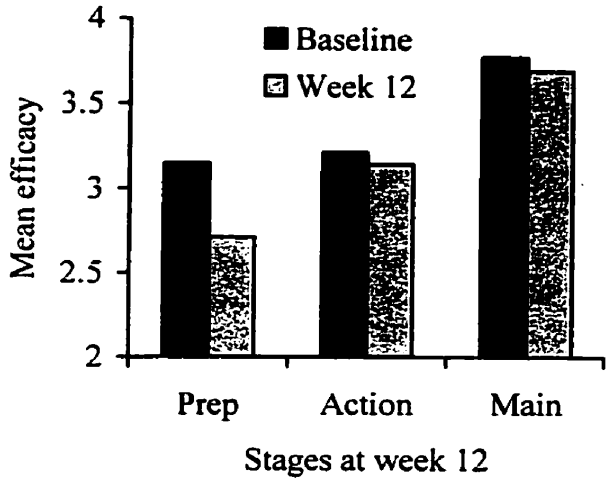
Source	df	F	p
Within Subjects			
Time	1, 71	5.622	0.02
Time x stage	2 ,71	1.571	0.215
Between Subjects			
Stage	2, 71	11.513	0.001

Table 9

Mean Efficacy Scores (baseline, week 12) x Stage (week 12)

		Baseline		Week 12		Combined	
	n	M	SD	M	SD	M	SD
Preparation	11	3.15	.36	2.71	.52	2.93	.35
Action	23	3.21	.71	3.14	.70	3.18	.56
Maintenance	40	3.77	.66	3.69	.70	3.73	.64
Total	74	3.51	.69	3.37	.77	3.44	.66

Figure 3. Mean efficacy (baseline, week 12) for stages of preparation, action, and maintenance at week 12.



Efficacy by attendance.

The adherence variable was categorized into three levels: (a) 11 to 12 weeks attendance was labeled 'high attendance' (n = 27), (b) 9 to 10 weeks (n = 25) was labeled 'medium attendance' and (c) 8 or fewer weeks attendance was labeled 'poor attendance' (n = 23). A two-way ANOVA for one between-subject factor (attendance) with three levels (high, medium, low) and one within-subject factor (efficacy) with two levels (baseline, week 12) was performed. (Table 10) There was a significant attendance x time

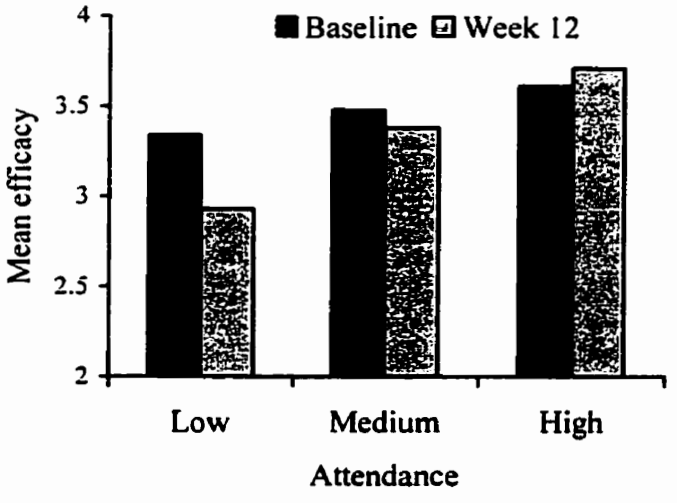
interaction effect, F (2, 72) = 4.548, p = 0.014, that indicates that the time effect changes for different levels of attendance or attendance effects changes from time to time (see Figure 4). However, on the average, there was a significant attendance effect, F (2, 72) = 3.998, p = 0.023. Additionally, on the average, there was a significant time effect, F (1, 72) = 4.019, p = 0.049.

Table 10

Analysis of Variance for Efficacy (baseline, Week 12) x Attendance

Source	df	F	p
Within Subjects			
Time	1, 72	4.019	0.049
Time x attendance	2 ,72	4.548	0.014
Between Subjects			
Attendance	2, 72	3.998	0.023

Figure 4. Mean efficacy (baseline, week 12) for low medium, and high attendance



Simple effects testing were performed following the significant interaction to further examine the data. Results of simple effects testing showed no significant time effect for high attenders, F (1, 72) = 0.66, p = 0.42 or for medium attenders, F (1, 72) = 0.62, p = 0.435. However, there was a significant time effect for low attenders, F (1, 72) = 11.11, p = 0.001, demonstrating that efficacy declined significantly from baseline (M = 3.34) to week 12 (M = 2.93) (see Table 11).

Additionally, simple effects testing established that there was not a significant attendance effect for efficacy measured at baseline, F (2, 72) = 0.86, p = 0.429. There was however, a significant attendance effect at week 12, F (2, 72) = 7.38, p = 0.001, indicating that the efficacy scores significantly decreased across high attenders (M = 3.71), medium attenders (M = 3.38), and low attenders (M = 2.93) (see Table 11).

Table 11
Mean Efficacy Scores (baseline, Week 12) x Attendance

		Baseline		Week 12	
	n	M	SD	M	SD
High	27	3.61	.78	3.71	.81
Medium	25	3.48	.63	3.38	.61
Low	23	3.34	.72	2.93	.68
Total	75	3.48	.78	3.36	.77

TTM variables on adherence.

An exploratory stepwise multiple regression analysis was conducted with the baseline predictor variables: (a) contemplation, (b) preparation, (c) action, (d) maintenance, (e) efficacy, (f) pros, and (g) cons on adherence rates. For the purposes of this analysis, the stages variable was transformed from a categorical variable to a continuous variable through the process of dummy coding. The value for entry into the

regression equation was set at $p \leq 0.05$. The value for removal was set at of $p \geq 0.10$. It was found that stage of contemplation was a significant predictor of adherence t (73) = 24.580, $p < .001$. As well, it was found that the maintenance level of stages was a significant predictor of adherence, t (73) = 2.284, $p = 0.025$ (see Table 12).

Table 12

Summary of Stepwise Multiple Regression Analysis for Variables Predicting Adherence

Variable	B	SE B	t	p
Constant	8.892	.362	3.287	.002
Included				
In maintenance baseline	1.161	.508	2.284	.025
Excluded				
preparation baseline	.068	1.146	.472	.444
action baseline	-.175	1.24	-1.398	.152
efficacy baseline	.058	.512	.461	.855
pro baseline	-.032	.759	-.281	.951
con baseline	-.048	.442	-.422	.771

Note. $R^2 = .067$

Chapter Six

Discussion

Determining effective interventions for the initiation and maintenance of regular exercise for both sedentary and active populations continues to prove to be a considerable challenge to health professionals (Pate et al., 1995, USDHHS, 1996; King et al., 2000; Marcus et al., 2000; Orleans, 2000; Rothman, 2000). It has been recently noted that the 'exercise revolution' has peaked, resulting in ever decreasing numbers of physically active populations (Orleans, 2000). Given that physical inactivity remains one of the most prevalent chronic disease risk factors (USDHHS, 1996), it is disheartening that no significant improvements in encouraging long-term maintenance have been achieved over the past 20 years (Orleans, 2000).

Therefore, this prospective study was undertaken with a sample of females enrolled in several fitness classes over a twelve-week period to investigate initiating and maintaining exercise behavior. The Transtheoretical Model (Prochaska & DiClemente, 1983) was selected to provide the theoretical foundation for this research due to the abundance of positive results reported from various studies conducted around this model (Herrick et al., 1996; Marcus & Owen, 1992; Prochaska & Marcus, 1994; Prochaska, Norcross, & DiClemente, 1994). Emphasis was given to self-efficacy, decisional balance, and stages of change constructs of the TTM.

This research was designed to assess three areas: (a) cross-sectional analyses at baseline and week 12 to compare between-subject differences for efficacy and decisional balance for the stages variable with previous research, (b) efficacy, decisional balance, and stages over the 12 week study for both between- and within subject-differences to

determine if the previous cross-sectional patterns were consistent within-subjects, and (c) the TTM variables were investigated for predictability of adherence.

Self-Efficacy Scales

An additional purpose of this study was to statistically compare the two self-efficacy scales that are most often used in exercise research: (a) the Self-Efficacy Exercise Scale (SEES) (Sallis et al., 1988), and (b) the Self-Efficacy Scale (SES) (Marcus, Selby, et al., 1992). Reliability tends to improve simply by increasing the number of items in the scale (Ferguson, 1981). In this study, the 12-item measure produced a higher Cronbach's alpha than the 5-item scale, and it was important to determine if the increased reliability was an indication of reduced error due to the instrument itself, or a function of the total number of items in the scale. After controlling for test length, it was found that the SEES produced a somewhat higher Cronbach's alpha and accounted for 9% more of the variability in the score. Therefore, it may be more useful to use the longer 12-item SEES to ensure that the parameters of the self-efficacy construct are adequately measured.

Baseline Demographics

The 88 participants who volunteered for the study were categorized into the appropriate stage of readiness to change exercise behavior based on responses to the five-level stages variable at baseline. Unlike most previous research that has focused on the less active portion of the populations, (Prochaska & Marcus, 1994), over half of the sample for this study consisted of maintainers. TTM has been proposed along a continuum of exercise behavior suggesting that the constructs can differentiate and predict exercise behavior from those who do not intend to exercise (precontemplation),

through various combinations of intention and regularity of exercise (contemplation, preparation, and action), all the way to those who do not intend to stop (maintainers) (Prochaska & Marcus, 1994). Reasonably, the constructs should perform consistently regardless of the sample demographics.

Consistency of Findings

One of the purposes of this research was to determine if there were consistent patterns for: (a) stages and self-efficacy and (b) stages and decisional balance as reported in previous studies. Previous research has suggested that there are both stable and predictable relationships for self-efficacy with stages (Prochaska & Marcus, 1994). Specifically, it has been suggested that self-efficacy typically rises across stages in between subject designs.

Baseline efficacy and stages.

The present study attempted to replicate these findings through two cross-sectional analyses of the data at both baseline and week 12. It was anticipated that efficacy scores would be lowest for those participants in contemplation and highest for those in maintenance with a positive linear relationship differentiating the stages in between.

Results of this study indicated that the baseline efficacy scores did significantly differ between some, but not all, stages. As anticipated and consistent with previous studies, the participants in maintenance scored significantly higher than participants in either action or preparation. However, no significant difference was found for efficacy between the action (recent regular exercise) and preparation (not regular exercise) stages.

An additional finding was that the mean scores of the participants in contemplation were marginally but not significantly higher than both action and preparation and not significantly lower from those in maintenance. For this sample, efficacy did not differentiate the participants in contemplation from any of the other stages, including those in maintenance. That may be due to the circumstance that the contemplators in this sample were already signed up for and anticipating participating in an exercise class in the immediate future. Referring to the actual stages measure, contemplation is defined as 'I currently do not exercise but I am thinking about starting to exercise in the next 6 months'. The next stage (preparation) is defined as 'I currently exercise some, but not regularly'. For this sample, those who selected contemplation were not actually exercising at that time but were imminently intending to start. Unfortunately, the staging algorithm used in this study does not have a stage for this portion of the population. It may be that self-efficacy is relatively high just prior to starting a new behavior as one's confidence in one's ability to perform an immediate future behavior may be quite optimistic without the experience of efficacy information relative to that behavior. Participants in the preparation and action may have had more experience in previous and/or current attempts to become regular exercisers.

Baseline decisional balance and stages.

Previous research has not provided consistent results with decisional balance and stages of change for exercise (Marcus & Owen, 1992; O'Connell & Velicer, 1988; Prochaska & Marcus, 1994). Some research suggested that cons for the precontemplation and contemplation stages are higher than the pros for those stages (Prochaska & Marcus, 1994). This difference diminishes across stages and at some point at or near the

contemplation or preparation stage, the pros and cons intersect, continuing to separate in opposite directions through to maintenance, where the cons are generally significantly lower than the pros.

A number of studies have found significant differences between pros and cons for the different stages (Herrick, et al., 1996; O'Connell & Velicer, 1988; Prochaska, Norcross, & DiClemente, 1994), whereas other research, particularly for chronic exercisers, has not (Marcus & Owen, 1992; Prochaska & Marcus, 1994). According to Prochaska and Marcus (1994), the pros and cons are more relevant for understanding transitional exercise behavior over the first three stages of precontemplation, contemplation, and preparation. However, the decisional balance variables are not as effective in predicting exercise behavior for chronic exercisers, such as the majority of the sample in this study. This lack of consistency for the decisional balance variable across all exercise stages was not explained (Prochaska & Marcus, 1994).

The results of this study revealed that there was no significant interaction for decisional balance and stages suggesting that the pros and cons were not significantly different for any of the stages. However, the overall mean of the pro scores was significantly higher than the mean of the con scores for all of the participants regardless of the stage. This finding may be due to the preponderance of participants who were in more active stages of change and/or the absence of any participants in precontemplation. As previously stated, if the pros and cons typically intersect at or near contemplation or preparation, it would follow that given the demographics of this sample, the majority of the participants were already past this point and would therefore be expected to generate overall higher pro scores relative to cons.

Week 12 demographics.

Results at week 12 are reported on the 75 of the original 88 participants who returned questionnaires. Participants were again classified into stages. Over half of the sample was in maintenance and almost a third were in action. Therefore, at week 12, the sample had become even more concentrated in the upper levels of the exercise stages. Similar to baseline results, efficacy was expected to significantly differ between stages, but decisional balance was not.

Week 12 efficacy and stages.

The results of the analysis at week 12 were consistent with those at baseline, and consistent with previous research. However, the single participant who scored in contemplation was removed from this analysis as post hoc analysis could not be performed when one group had less than two cases. Efficacy scores differed significantly from stage to stage. Specifically, those participants in maintenance scored significantly higher than those in action or preparation. Again, there was no difference found between efficacy scores for action or preparation. This may be due in part to the length of the program. There may not have been sufficient time for those participants in action and preparation to realize a significant change in self-efficacy scores relative to acquiring a new skill set for regular exercise.

Week 12 decisional balance and stages.

The results of this analysis revealed similar findings to baseline with the only significant result being that the overall pro scores were significantly higher than the overall con scores. The lack of an interaction suggested that again, the decisional balance variable did not differ significantly from stage to stage. With even more of the sample in

action and maintenance, this finding supports the caveat from Prochaska and Marcus (1994) that the decisional balance scale does not differentiate exercise behavior in the more active stages.

Differentiating Change

One of the most important purposes of this research was to examine the variables of TTM in a prospective design in order to maximize the investigation of the dynamic nature of exercise with a model based on change (TTM). Even though a consistent criticism of the use of TTM has been the reliance on cross-sectional versus prospective designs (Dishman, 1994), current research has once again reiterated that there continues to be a dependence on cross-sectional designs (Sullam, Clark, & King, 2000). Therefore, it would be important to advancing prospective research in exercise with TTM to indicate what, if any, additional information could be found prospectively. A limited number of studies were available for comparative purposes and each of the studies differed from each other and from the present research (Armstrong et al., 1993; Cardinal, 1997; & Sullam et al., 2000).

For example, a prospective analysis of the stages of change, self-efficacy, and the adoption of vigorous exercise (Armstrong et al., 1993) used a unique staging variable based on interest in exercise rather than intention to exercise and focused on precontemplators and contemplators. Additionally, self-efficacy was measured with a 3-item scale that did not include the word 'confidence'. Finally, the time frame was 24 months. The major finding of this study was that baseline stage of change was equally predictive as self-efficacy for future exercise (Armstrong et al., 1993).

The second study (Cardinal, 1997) also differed from the previous and current studies. For example, the study focused on the adoption of naturally occurring exercise over a seven-month period rather than enrollment in a discrete exercise class with a fixed duration. Also, efficacy and decisional balance were not assessed. There were no major findings of this study (Cardinal, 1997).

The third study (Sullum et al., 2000) investigated a physically active college sample. The study included the processes of change, the SES, and the Decisional Balance Scale to explore exercise relapse behavior between October and December of 1996 (total number of weeks not reported). Relapsers were defined by those participants who reported regular exercise (20 minutes three times per week) at baseline, but did not meet these criteria at time two. This research reported that relapsers (13%) relative to maintainers (87%) reported: (a) significantly lower baseline efficacy scores, (b) significantly lower baseline pro scores, and (c) significantly decreased pro scores over time. No differences were found for self-efficacy (Sullum et al., 2000).

Stages.

One of the applications of the stages variable has been to determine if knowledge of participant's stage of change measured at one time might be related to a future stage of change. Results indicated a significant relationship between participants' baseline stage of change and 12 week stage of change. This finding illustrates that stages are not independent, but are statistically related over time. Therefore, it may be argued that baseline stage of change could be predictive of postbaseline stage of change and offers support for a prospective analysis such that there are both significant between and within subject differences.

Efficacy with movement factor.

One of the most persistent exercise research findings has been the recycling phenomenon (i.e., moving back to an earlier stage) (Marcus, Rossi, et al., 1992). For example, this may result from reductions in actual exercise frequency to stopping exercise and having no intentions to try again in the near future (Marcus et al., 2000). Research has continued to demonstrate that people do begin and quit exercising repeatedly (Marcus et al., 2000). The most accurate assessment of this phenomenon is with a prospective analysis that follows individuals over a period of time rather than to rely on recall from the past.

The participants in this study were categorized into groups depending on the stage of change at baseline relative to the stage of change at week 12. The majority of the sample remained in the same stage at both time periods, one-third of the sample had moved ahead in stage, and slightly over 12% had recycled to an earlier stage. The between subject variable 'movement between stages' was then analyzed relative to changes in the within subject variable efficacy.

The results of this analysis did not identify a significant interaction between efficacy and movement. However, efficacy scores were statistically lower at week 12 than at baseline. A closer look at the data showed that this loss of efficacy at week 12 was being influenced by both groups (almost half of the sample) who had moved either ahead or back relative to the more stable efficacy of those who did not move a stage. According to TTM, it would have been expected that those who had moved ahead would have a higher efficacy score because between subjects analysis generally exhibits a positive linear progression for efficacy across stages.

For example, a cross-sectional design that shows a positive linear relationship for self-efficacy with stages is a between subject measure. If the self-efficacy for those who score in the precontemplation stage is generally statistically lower than for those in the maintenance, it might be expected that this linear relationship measured one time is similar to a within subject difference measured over time. While it is known that self-efficacy fluctuates overtime relative to a specific behavior depending on relevant efficacy information (Bandura, 1982), it may not be accurate to assume that these fluctuations mirror those measured with a cross sectional design.

A limitation of a cross-sectional design is that by nature it captures only a brief and nondynamic representation of present levels for a given variable (Dishman, 1994). Therefore, the participants' previous intentions and confidence levels remains outside of the research scope. For example, it is impossible to determine from a cross-sectional design if a contemplative participant's self-efficacy is higher, lower, or the same as it was in a previous stage. It may be erroneous to assume that within subjects' self-efficacy will continue to climb as participants progress through the stages. It may in fact, rise, fall, or remain stable as influenced by actual efficacy information relative to the behavior in question at any point along the stages continuum.

This is an important distinction to make because it may not be only the relative strength of the efficacy score that predicts future exercise behavior, but the stability or flexibility of the scores may also influence behavior. In this study, those participants who remained in the same stage, regardless of what that stage was, reported stable efficacy scores over time. However, both of the groups who showed movement through stages, regardless if the movement was ahead or back, displayed declining efficacy over time.

This information could be valuable to health professionals who might mistakenly infer that a declining self-efficacy score is an indication of impending relapse behavior. It is therefore imperative that self-efficacy be measured over time as a within subject variable to determine if the patterns previously found in the cross-sectional literature are in fact those determined for prospective designs.

Efficacy with stages factor.

The stage variable at week 12 was assessed with efficacy across time to determine if stages could discriminate participants based on efficacy scores over time. Analysis did not find a significant interaction, however, it was again found that efficacy scores at baseline were significantly higher than at week 12. In addition, participants in maintenance at week 12 reported greater efficacy than either those in action or preparation. This finding is similar to previous cross-sectional research.

Efficacy with attendance factor.

In addition to recycling behavior, it has also been observed and reported consistently that adherence generally decays over time (Marcus et al., 2000). This behavioral tendency to display sporadic consistency in exercise has been found in most subgroups studied to date (Marcus et al., 2000) and can only most accurately be assessed through a prospective model. Adherence has been measured in the past both as a dichotomous variable with arbitrary classification schemes for both adherers and dropouts, and as a continuous variable generally reported as percentages (Marcus et al., 2000). Participants in this study were not categorized into adhereres and dropouts in order to avoid ambiguities relative to classification schemes and value judgements relative to labels. Rather, the continuous adherence variable was categorized into an attendance

variable according to number of weeks of regular attendance. Three discrete groups were assigned descriptive labels: (a) high, (b) medium, and (c) low attendance.

Analysis revealed a significant interaction between efficacy and attendance and was subsequently further investigated for clarification. When participants were categorized according to attendance, it was found that those who were in the low attendance group reported a significant drop in self-efficacy from baseline to week 12. This finding may be reflective of the influence of actual efficacy information relative to the behavior. At baseline, the confidence ratings were projected over the future, whereas at week 12, the participants had 12 weeks of experience from which to draw efficacy information.

An additional significant finding demonstrated that efficacy scores significantly declined between participants at week 12 from high attenders, to medium attenders, and to low attenders. This finding is consistent with previous research indicating that relative efficacy is strongly related to actual behavior, and that as attendance declined, so did efficacy, or as efficacy declined, so did attendance.

Predicting Adherence

TTM variables with adherence.

One of the major goals of exercise research has been to identify determinants of exercise behavior and to plan interventions aimed at influencing these determinants and ultimately, to positively and persistently influence adherence to exercise behavior (Dishman, 1994). Whereas some of the TTM variables may be related, the real value of the model would be the accuracy of prediction of exercise behavior over time. Therefore,

the variables of TTM were regressed on adherence. This analysis was exploratory due to the small sample size.

Results indicated that both baseline contemplation and maintenance were significant predictors of adherence at week 12 in this study. Taken together, the two significant predictors explained 6% of the variance in adherence at week 12. That contemplation was a greater predictor of adherence than either preparation or action was not an anticipated result. However, Cardinal (1997) also found that contemplators at baseline were more likely to become active than participants in preparation when studied over a seven-month period. In the present study, the efficacy of the contemplative group was somewhat higher than preparation and action at baseline and only slightly lower than those in maintenance. Further, 5 of the 6 participants in contemplation at baseline had moved to action by week 12.

This finding is consistent with self-efficacy theory suggesting that higher self-efficacy scores would predict higher levels of performance achievements (Bandura, 1982). Further Bandura (1982) suggested that self-efficacy theory could also explain rate of change, with higher levels of efficacy accelerating the rate of change. Therefore, it could be argued that the higher levels of self-efficacy for contemplators relative to preparation and action, could account for both the movement to higher stages and for the rapid attainment of regular exercise. While it is acknowledged that this analysis was exploratory, it may be suggested that highly efficacious contemplators and chronic exercisers are more likely to have high adherence to exercise than those with lower levels of efficacy.

TTM Constructs

As previously stated, most of the previous research with the TTM has been focused on the less active subpopulations (Prochaska & Marcus, 1994). However, TTM suggests that it is a broad spectrum theory, and that the constructs can explain and predict exercise behavior from those who never intend exercise, to those who never intend to stop. Reasonably then, all of the constructs should do an adequate job of sorting participants into stages, levels of attendance, movement through stages, and predict with some consistency future exercise behavior regardless of the sample demographics.

However, the decisional balance scale seemed to be particularly troublesome in this study, as found with previous active populations (Prochaska & Marcus, 1994). The decisional balance scale did not differentiate participants in any meaningful way other than for the pros to outweigh the cons. The questions of the decisional balance scale could be confusing to chronic exercisers. For example, a con item from the scale suggests that somatic feedback, such as a fast heart beat, or labored breathing may deter an exerciser because the sensation would be uncomfortable. This item would not be applicable to someone who regularly experiences these sensations during exercise, but does not experience the negative affect that this item assumes and implies. In order to answer the item, the participant must first agree that these somatic sensations are uncomfortable, and then respond if that discomfort is important or not. A participant who is less active may fully identify with the item and may in fact experience negative affect from the somatic feedback associated with increased physical activity.

An additional con item 'if at the end of the day, I am too exhausted to exercise' was rated from not important to extremely important. This item could be confusing to a

chronic exercisers because it is not clear from the perspective of chronic exercisers if the item is implying that being tired would prevent them from exercising, or that if being too tired to exercise was important. A less active participant may interpret exhaustion as a 'reason' not to exercise.

This lack of consistency with the decisional balance may be attributed to the different perspectives that may be inherent in individuals that are not exercising from those that exercise regularly. It may be that maintainers do make decisions relative to persisting with exercise, and that those criteria may differ from those who are just intending to start (Rothman, 2000).

An additional difficulty with TTM is that it may appear confusing to use TTM for studies shorter than 6 months (i.e., this study was 12 weeks). Prochaska and DiClemente (1983) have arbitrarily separated most of the individual stages in increments of six months. It could be argued then, that there cannot be any movement between stages in a study with any time line less than six months. A careful examination of the stages of change scale shows that this scale measures three concepts: (a) quantifies intentions to initiate exercise (b) distinguishes between no exercise, non-regular exercise, and regular exercise, and (c) fits this information into a time line.

For example, precontemplators do not exercise (identifies the level of behavior) and are not intending to exercise (identifies the level of intention) for six months (identifies the time frame). Contemplators are also not exercising (identifies the level of behavior), but are thinking about starting (identifies level of intention) within the next six months (identifies the time frame). The confusion arises from the transition period between stages. A participant may have been in precontemplation for many years, but

start to think about exercising, and move quickly to preparation or even to action, all within a few weeks or months. It does not necessarily follow that this participant will remain in contemplation for the required six months. In fact, the participant could briefly enter the contemplation stage, skip stage of preparation altogether (no identifying time frame, only defined by regularity of exercise) and move directly to the action stage by exercising regularly from the beginning.

Participants could also move from action to maintenance depending on long how he/she was in action. For example, if the participant had been in action for five months prior to being assessed for stage, then it would require just over one month of regular exercise for that participant to score in maintenance. Movement in the opposite direction can also occur and be captured by TTM over a short time. For example, a relapse of a few weeks could reasonable shift a participant all the way back to preparation, particularly if that exerciser had been a chronic exerciser for many years. This is due to the condition that the stage of action (regular exerciser beginning in the last six months) would not necessarily apply to maintainers who briefly relapsed. Therefore, while it may appear confusing, the stage variable does capture some movement between stages in time increments of less than six months.

Limitations

This study was limited in some analyses relative to the sample size. Specifically, the decisional balance scale was not analyzed for differences over time with: (a) stages, (b) movement between stages, and (c) attendance. There were not sufficient numbers of cases per cell to justify ANOVA analysis. As well, the non significant finding of the

regression analysis may have been due, in part, to the inadequate ratio of participants to independent variables.

An additional limitation of this study was the reliance on self-report measures. In most of the exercise classses, attendance was not recorded by the instructors and neither baseline weight or height was not recorded. Therefore, attendance could not be verified and an unbiased measurement for physical changes (i.e., BMI) could not be calculated.

A final limitation of this study was that there were no precontemplators because all of the participants were already enrolled in a fitness class. It would have been more complete to have had a group of precontemplators in order to have a representation from all stages. In particular, it would have been interesting to have assessed self-efficacy for exercise participation over time for those participants in precontemplation. Defining characteristics of the stage of precontemplation is a lack of both intention to exercise over the next six months, and an absence of current exercise participation. Therefore, participants who remained in precontemplation over the course of the study could have been assessed for: (a) relative magnitude of efficacy compared to other stages, and (b) stability versus fluctuating efficacy. It may have provided some additional evidence for a finding of this study that the stability of efficacy scores over time were related to stability of behavior and that unstable efficacy scores were related to movement.

Future Considerations

It may be less confusing and more realistic to eliminate the stages time frame altogether and to allow that part of the scale to fluctuate naturally, having the participants select the time frame that most accurately describes their own experience of change. Changing exercise behavior does occur over time, but it may not be useful to assign an

arbitrary time value unless it can be shown that six months is the real time it takes for lasting changes to occur. It is difficult to conceive that all populations relative to exercise would advance, regress, or remain in the same stage for exactly the same amount of time. However, intentions to initiate behavior and regularity of behavior are elements of the stage variable that could distinguish participants into the existing stages. Maintenance could remain as the only stage that would be defined by exercise behavior and time. Maintenance, by definition, must be sustained over a specified period.

Further research is needed to establish if TTM can be utilized in both cross-sectional and prospective designs over the entire range of subpopulations. While previous research has shown consistent findings for the more inactive subpopulations, research with the more active subpopulations has not been as clear (Prochaska & Marcus, 1994). Whether or not TTM can be utilized effectively for action and maintenance needs to be investigated. As well, it would be important to investigate if there are differences between those in maintenance compared with less active populations (Wing, 2000). The poor performance of the pro/con scales suggests that the decision making processes for continuing in a behavior may be qualitatively different from decision making processes relative to initiating and attempting to establish a behavior. Recent research addresses the issue of the possibility of different psychological mechanisms influencing decisions relative to initiating versus maintaining exercise behavior (Rothman, 2000).

Additional research is also needed for self-efficacy and exercise research in prospective designs. Cross-sectionally, efficacy has been found to climb predictably across stages. However, it would be useful to determine if efficacy fluctuates for participants who are actively changing the target behavior in either direction. It would

also be of interest to determine if a stable efficacy score (regardless of absolute value) would indicate stability of behavior. For example, in addition to reporting a moderate efficacy score, could a stable efficacy score for those in preparation be indicative of a lack of movement to the next stage? The relationship between absolute value and fluctuations over time for efficacy could be assessed for each stage.

It would be of particular interest to repeat this study for participants who move ahead in stage compared to participants who move back. Efficacy could be measured more frequently (e.g., monthly for six months) to identify both the direction and the magnitude of efficacy fluctuations. This would give exercise professionals valuable information about what effects efficacy was having over several short periods of time during the course of a prospective study.

The ultimate aim of all exercise research is to plan effective interventions to encourage our ever increasing sedentary population to start moving and to encourage all exercisers to continue once he/she has started. It is therefore, of extreme importance that models of exercise behavior used in exercise research be sensitive to all populations. It is hoped that this study has added in some way to our understanding of this most perplexing challenge and will encourage researchers to continue to search for answers that are so needed in our society today.

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Appendix A

Demographic Questionnaire

Name: _____
Mailing Address:_____ _____ Postal Code: _____
e-mail: _____
Phone: Day _____-_____ Evening _____-_____ Age: ___
Have you ever participated in an exercise class before? Yes____ No____
Have you ever completed an exercise class before? Yes_____ No ____
Do you anticipate that you will complete this class? Yes_____ No_____
I believe that I am ready at this time to make lifestyle changes: Strongly Disagree Strongly Agree 1----------2----------3----------4----------5
I believe that I can perform the exercises in the class: Strongly Disagree Strongly Agree 1----------2----------3----------4----------5

Appendix B

Long Vigorous-5 Stage Scale (LV-5CS)

Exercise includes activities such as brisk walking, jogging, swimming, aerobic dancing, biking, rowing, etc. Activities that are primarily sedentary, such as bowling, or playing golf with a cart, would not be considered exercise.

Regular exercise = meeting the goals of your class

Please check off only **ONE** of the following items that **best describes** your current level of exercise:

- ☐ I currently do not exercise and I do not intend to start exercising in the next **6** months.
- ☐ I currently do not exercise but I am thinking about starting to exercise in the next **6** months.
- ☐ I currently exercise some, but not **regularly.**
- ☐ I currently exercise **regularly**, but have only begun doing so within the last **6** months.
- ☐ I currently exercise **regularly** and have done so for longer than **6** months.

Appendix C

Decisional Balance Scale (DBS)

REGULAR EXERCISE = Meeting the goals of your class.

Please respond to each of the following items on a scale of 1 – 5 with (1) meaning "not at all important" and (5) meaning "extremely important". Please respond to each item with **ONE** selection.

1. If I had more energy for my family and friends when I exercised regularly that would be

1----------2----------3----------4----------5

Not important at all Extremely important

2. If I were too tired to do my daily work after exercising that would be

1----------2----------3----------4----------5

Not important at all Extremely important

3. If regular exercise helped me to relieve tension that would be

1----------2----------3----------4----------5

Not important at all Extremely important

4. If I felt more confident from regular exercise that would be

1----------2----------3----------4----------5

Not important at all Extremely important

5. If it was difficult to find an exercise activity that I enjoy that is not affected by bad weather that would be

1----------2----------3----------4----------5

Not important at all Extremely important

6. If I slept more soundly when I exercised regularly that would be

1----------2----------3----------4----------5

Not important at all Extremely important

7. If I felt uncomfortable when I exercised because I got out of breath and my heart beat very fast that would be

1----------2----------3----------4----------5

Not important at all Extremely important

8. If I felt good about myself because I kept my commitment to exercise regularly that would be

1----------2----------3----------4----------5

Not important at all Extremely important

9. If I liked my body better because I exercised regularly that would be

1----------2----------3----------4----------5

Not important at all Extremely important

10. If regular exercise took too much of my time that would be

1----------2----------3----------4----------5

Not important at all Extremely important

11. If it would be easier for me to perform routine physical tasks when I exercised regularly that would be

1----------2----------3----------4----------5

Not important at all Extremely important

12. If I felt less stressed when I exercised regularly that would be

1----------2----------3----------4----------5

Not important at all Extremely important

13. If I had less time for my family and friends because of regular exercise that would be

1----------2----------3----------4----------5

Not important at all Extremely important

14. If I felt more comfortable with my body when I exercised regularly that would be

1----------2----------3----------4----------5

Not important at all Extremely important

15. If at the end of the day, I felt too exhausted to exercise, that would be

1----------2----------3----------4----------5

Not important at all Extremely important

16. If regular exercise helps me have a more positive outlook on life that would be

1----------2----------3----------4----------5

Not important at all Extremely important

Appendix D

Self-Efficacy for Exercise Scale (SEES)

1. My family is demanding more time from me.

1----------2----------3----------4----------5

not confident at all very confident

2. I have household chores to do

1----------2----------3----------4----------5

not confident at all very confident

3. I have excessive demands at work.

1----------2----------3----------4----------5

not confident at all very confident

4. Social obligations are very time consuming.

1----------2----------3----------4----------5

not confident at all very confident

5. I am feeling depressed.

1----------2----------3----------4----------5

not confident at all very confident

6. I exercise with others and it seems too fast or too slow for me.

1----------2----------3----------4----------5

not confident at all very confident

7. I may be undergoing a stressful life change (e.g., divorce, death in the family, moving).

1----------2----------3----------4----------5

not confident at all very confident

I am confident I can:

8. Read or study less in order to exercise more.

1----------2----------3----------4----------5

not confident at all very confident

9. Get up early, even on weekends, to exercise.

1----------2----------3----------4----------5

not confident at all very confident

10. Get up earlier to exercise.

1----------2----------3----------4----------5

not confident at all very confident

11. Set aside time for a regular, physical activity program.

1----------2----------3----------4----------5

not confident at all very confident

12. Stick to my exercise program after a long, tiring day at work.

1----------2----------3----------4----------5

not confident at all very confident

Appendix E

Self-Efficacy Scale (SES)

REGULAR EXERCISE = Meeting the goals of your class.

Please respond to each of the following items that complete the sentence stem. Only give one response for each item on a scale from 1 to 5 where (1) means 'not confident at all and (5) means ' very confident'.

I am confident I can participate in regular exercise when:

1. I am tired.

1----------2----------3----------4----------5

not confident at all very confident

2. I am in a bad mood.

1----------2----------3----------4----------5

not confident at all very confident

3. I feel I don't have the time.

1----------2----------3----------4----------5

not confident at all very confident

4. I am on vacation.

1----------2----------3----------4----------5

not confident at all very confident

5. It is raining or snowing.

1----------2----------3----------4----------5

not confident at all very confident

Appendix F

Adherence-Week 12

Please indicate the number of weeks out of your classes that you would consider yourself a regular exerciser. (For example, if you attended regularly for 8 of the 12 weeks, please circle 8)

1 ------- 2 ------- 3 ------- 4 ------- 5 ------- 6 ------- 7 ------- 8 ------- 9 ------- 10 ------- 11 ------12

Appendix G

Ethical Approval

2000-03-23

Dr. D. Paskevich
Faculty of Kinesiology
University of Calgary
KN B 267
Calgary, Alberta.

Dear Dr. Paskevich:

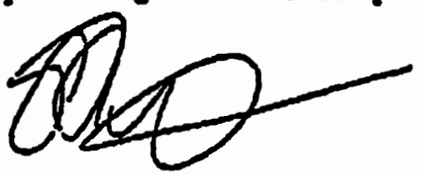
Re: The Trans-Theoretical Model and the Initiation and Maintenance of Vigorous Exercise: A Prospective Anhalysis
Student : Terry L. Hansen Degree: MSc

The above-noted thesis proposal has been submitted for Committee review and found to be ethically acceptable. Please note that this approval is subject to the following conditions:

(1) a copy of the informed consent form must have been given to each research subject, if required for this study;
(2) a Progress Report must be submitted by 2001-03-23, containing the following information:
    (i) the number of subjects recruited;
    (ii) a description of any protocol modification;
    (iii) any unusual and/or severe complications, adverse events or unanticipated problems involving risks to subjects or others, withdrawal of subjects from the research, or complaints about the research;
    (iv) a summary of any recent literature, finding, or other relevant information, especially information about risks associated with the research;
    (v) a copy of the current informed consent form;
    (vi) the expected date of termination of this project;
(3) a Final Report must be submitted at the termination of the project.

Please note that you have been named as a principal collaborator on this study because students are not permitted to serve as principal investigators. Please accept the Board's best wishes for success in your research.

Yours sincerely,



Ian Mitchell, MB, FRCPC
Chair, Conjoint Health Research Ethics Board

cc: Dr. W. Herzog (information)
Terry L. Hansen

Appendix H

Informed Consent

Research Project Title: The Transtheoretical Model and the Initiation and Maintenance of Physical Exercise: A Prospective Analysis

Investigator: Terry Hansen
Funding Agency: Not Applicable

This consent form, a copy of which has been given to you, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information no included here, please ask. Please take the time to read this form carefully and to understand any accompanying information.

A. **Purpose, usefulness, and participants of this project:**
   i. The purpose of this research is: (a) to classify perspective exercisers into a stage of readiness to engage in physical exercise, and (b) to assess various motivational indicators that could be informative for identifying those participants most likely to continue with an exercise program.
   ii. This information would be useful for exercise professionals who are responsible for designing realistic and effective exercise programs and for those individuals wishing to start and continue with exercise.
   iii. Participants needed for this research are: (a) beginning exercisers, (b) those who have been active in the past, but are not currently exercising, and (c) those who are currently exercising but not on a regular basis. Participants who meet these specifications are the most likely to be in the position to provide relevant information that this research was designed to assess.

B. **Description of experimental agents and procedures:**
   i. *Agents:* The principal investigator is Dr. Dave Paskevich, Sport and Exercise Psychologist, University of Calgary. The research will be conducted by Terry Hansen, Master of Science Graduate Student, Faculty of Kinesiology, University of Calgary. This research is also under the approval of Dr. T. Fung, Math Sciences, University of Calgary, Dr. T. Gabrielle, Faculty of Kinesiology, University of Calgary, and Dr. J. Meuller, Educational Psychology, University of Calgary.
   ii. *Procedures:* Participants will be offered an opportunity to volunteer in this research prior to the beginning of class. Participants will be asked to provide information about readiness to exercise and decisions and beliefs regarding exercise. This procedure will be repeated twice: (a) at the beginning of classes, (b) at the end of classes. Those who may choose to discontinue attending class are still **VITALLY** important to the study and will be contacted for the questionnaire information at both times.

C. **Risk to Participants:**

There are no known or anticipated discomforts associated with participation in this research. The questionnaires will require approximately ten minutes to complete each time.

D. **Requirements of Participants:**

Participants will be asked to fill out the research questionnaires and submit that information to the researcher: (a) personally, (b) mail, (c) through the class instructor.

E. **Confidentiality, anonymity and data storage:**
   i. *Confidentiality:* All materials will be kept strictly confidential and private and will be known only to the researcher.
   ii. *Anonymity:* Participants will be assigned an identification number and will identifiable only through that number.

iii. *Data storage:* Questionnaires will be stored for a period of 5 years in a locked storage unit that is accessible only to the researcher and principal investigator. At the end of the required storage time, shredding will destroy the documents.

(Please turn over)

F. **Feedback to Participant:**

Participants may receive a copy of the research results by providing regular and/or email addresses at the end of this consent form. A summary of the results will be sent free of charge in appreciation of the contribution to this project.

G. **Cost to Participant:**

There will be no cost to volunteer for the study.

Your signature on this from indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study any time. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. If you have further questions concerning matters related to this research, please contact:

Dr. David Paskevich: 220:3434 email dpaskevi@ucalgary.ca
Terry Hansen: 239-6048 email terryhansen@home.com

If you have any questions concerning your participation in this project you may also contact the office of Research Services and ask for Patricia Evans: 220-3782

Participant Date

Researcher, Terry Hansen Date

Please retain the second enclosed copy of this consent form for your reference.

Apt or house #, Street Address

City/Town and Postal Code

email

*Please note that this consent form **Will Not** be stored with your information from the questionnaires.