Toward an Integrated Model of Relapse from Exercise: Review, Measurement, Classification, and Prediction

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TOWARD AN INTEGRATED MODEL OF RELAPSE FROM EXERCISE: REVIEW, MEASUREMENT, CLASSIFICATION, AND PREDICTION

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN PSYCHOLOGY

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ABSTRACT

In 1982, research indicated that approximately 50% of people involved in exercise programs would drop out within six months (Dishman, 1982). Now, over a decade later, the figure remains the same. (Dishman, 1991; Marcus, et al., 1992). Though great strides have been made within the past ten years in understanding many determinants of the process of exercise acquisition, at present, very little is known about exercise relapse.

The purpose of this study was to provide a comprehensive assessment of relapse from exercise in college students through: 1) literature review; 2) psychometric assessment of a Reasons for Relapse from Exercise scale; 3) classification and external validation of types of relapsers; 4) identification of predictors of relapse from exercise drawn primarily from three models of health behavior: the Relapse Prevention Model (e.g., Marlatt & Gordon, 1985); Transtheoretical Model (e.g. Prochaska & DiClemente, 1983); and Physical Self-Perceptions from a hierarchical model of self-esteem (e.g., Fox & Corbin, 1989), and 5) to evaluate the contribution of negative psychosocial functioning and social support to frequency of relapse from exercise.

Psychometric assessment of a Reasons for Relapse from Exercise Scale indicated that reasons for relapsing can be grouped into three relatively distinct subscales encompassing situational, personal, and injury reasons, and
each with satisfactory psychometric properties. Cluster analysis revealed four types of relapsers: maintainers, occasional relapsers, frequent relapsers, and current non-exercisers. Important differences between types were observed on several external exercise-related behaviors and attitudes, providing direction for tailored interventions. Five structural equation models predicting frequency of relapse from exercise revealed that components of each of the three theories, in addition to negative psychosocial attitudes and social support explained a large proportion of the variance in frequency of relapse. Proportions of explained variance ranged from 16% (social support predictors) to 49% (Relapse Prevention predictors). An exploratory prediction model combining all significant predictors explained over half (58%) of the variance in frequency of relapse.

Results from each of these studies are drawn together to provide initial support for a proposed integrated model of relapse from exercise, and directions for future research are suggested.
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Finally, I would like to thank my mother who always encouraged me to be the person I wanted to be, and who believed in me every step of the way.
PREFACE

This dissertation is written according to the guidelines for manuscript format. Manuscripts are presented in the following order; Part I - literature review; Part II - psychometric assessment of a reasons for relapse from exercise scale; Part III - relapse from exercise: a cluster analytic approach; Part IV - predictors of frequency of relapse from exercise; and Part V - an integrated model of relapse from exercise. Finally, the dissertation concludes with a general discussion of all manuscripts.
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Statement of the Research Problem

In 1982, research indicated that approximately 50% of people involved in exercise programs would drop out within six months (Dishman, 1982). Now, over a decade later, the figure remains the same. Roughly one-half of those involved in exercise programs will relapse within six months (Dishman, 1991, 1988; Marcus, Banspach, Lefebvre, Rossi, Carleton, & Abrams, 1992). Though great strides have been made within the past ten years in understanding the process of exercise acquisition and determinants of exercise behavior, at present, very little is known about exercise relapse. Understanding relapse is important since maintaining a regular program of exercise has several health benefits including reduced risk of coronary heart disease and certain forms of cancer (Bouchard, Shephard, Stephens, Sutton, & McPherson, 1990), as well as improved psychological well-being (International Society of Sport Psychology, 1992).

A regular program of exercise has been found to have many physical benefits, including reduced risk for all-cause mortality, coronary heart disease, colon cancer in men, osteoporosis, and diabetes (Bouchard et al., 1990). In addition, regular exercise can help to decrease levels of mild to moderate depression and reduce anxiety and various kinds of stress (International Society of Sport Psychology, 1992). In this study, regular exercise is defined as the level of exercise recommended by the American College of
Sports Medicine (1990) to attain physical fitness: 3 or more days a week for 20 minutes or more without stopping at 60-90% of maximal heart rate (hard enough to make heart rate and breathing increase a large amount).

The current study has five purposes: 1) to review the literature on exercise relapse; 2) to provide a psychometric assessment of a Reasons for Relapse from Exercise Scale; 3) to classify potential types of exercise relapsers using components of three models: the relapse prevention model (Marlatt & Gordon, 1985), the transtheoretical model (Prochaska & DiClemente, 1981; Prochaska & Norcross, 1992), and physical self-perceptions from a hierarchical self-esteem model (Fox & Corbin, 1989), as well as several factors that have been associated with adherence to exercise (Sallis & Hovell, 1990); 4) to identify predictors of frequency of relapse from exercise using concepts from the above-mentioned theories of health behavior; and 5) to elaborate on overall findings from each of the studies, and propose an integrated model of relapse from exercise. Each of these five purposes will be addressed separately in the following sections.
PART I. LITERATURE REVIEW

Predictors of Exercise Adherence

Despite the importance of exercise in improving health, adherence to exercise is poor. It is estimated that only 8% to 20% of adults in the U.S. exercise frequently and vigorously (Centers for Disease Control, 1987). This figure is well below the 60% participation rate that was hoped to be acquired by 1990 as one of the 1990 national public health objectives (Sallis & Hovell, 1990). Several studies have been conducted to assess exercise acquisition and adherence, and some consistent predictors have been identified.

Sallis and Hovell (1990) summarized a number of studies assessing prediction of exercise acquisition and maintenance. Among the most important predictors listed were self-motivation, behavioral support, social support, availability of time, access to facilities, perceptions of health, exercise self-efficacy, education level, and risk for heart disease.

Relapse from Exercise

As mentioned previously, for those who have begun an exercise program, the drop-out rate at six months is approximately 50%. Several predictors of exercise drop-out were noted by Sallis et al. (1990). Blue collar workers, overweight persons, those perceiving discomfort from exercise, and those with mood disturbances were more likely to drop out of supervised exercise programs, while only mood
disturbances were consistently correlated with relapse from self-initiated exercise programs. One reason for the lack of consistent correlates of relapse from self-initiated exercise programs is the paucity of studies assessing this type of exercise program. Most community studies have measured adherence to only supervised exercise programs (Sallis et al., 1990).

Relapse has been heavily researched in the area of addictions (e.g. smoking, substance abuse, and gambling). Exercise relapse tends to follow the same negative acceleration curve that is found with the addictions. It indicates that relapse tends to increase over a period of six months with most drop-outs occurring within the first three months (Carmody, Senner, Malinow, & Matarazzo, 1980). Several models of relapse in the addictions have been proposed including the Relapse Prevention Model (Marlatt & Gordon, 1980, 1985) and the Trantheoretical Model (Prochaska & DiClemente, 1983). Both of these models have been applied to some extent in improving adherence to exercise.

**Relapse Prevention Model**

The Relapse Prevention Model (Marlatt & Gordon, 1985) proposes that relapse occurs as the result of intrapersonal and interpersonal situations that put pressure on a person to resume a negative behavior. These are referred to as high-risk situations. Of intrapersonal determinants, negative emotional states appear to be the impetus for the greatest number of lapses. Negative emotional states ref
to feelings of frustration, anger, anxiety, depression, or boredom. Among the interpersonal determinants, interpersonal conflict and social pressure are cited as the most common reasons for relapse. Interpersonal conflict results from conflict with others such as family members, friends, employers or employees. Social pressure to engage in negative behaviors can be direct (e.g., verbal persuasion) or indirect (e.g., being with others who are engaging in the behavior though no direct pressure is applied).

A person's ability to cope with high-risk situations as they arise determines whether or not a lapse occurs. A person who is able to cope with a high-risk situation is likely to have increased self-efficacy from effectively dealing with the situation, and the probability of future relapse may decrease. On the other hand, a person who is unable to effectively cope with a high-risk situation is likely to have decreased self-efficacy which may increase the chance of relapse.

Marlatt and Gordon make an important distinction between a lapse and relapse (Brownell, Marlatt, Lichenstein, & Wilson, 1986; Marlatt & Gordon 1985). A lapse is considered a single slip (e.g., a cigarette or drink for a person trying to quit), and does not necessarily lead to a full-blown relapse. How a person perceives the lapse determines the likelihood that relapse will occur. Relapse is characterized as a complete resumption of the behavior that one is attempting to change. An example would be a
person who, having smoked one cigarette (a lapse), decides to resume the habit, and no longer makes an effort to stop smoking. Marlatt & Gordon (1980, 1985) refer to the Abstinence Violation Effect (AVE) which occurs as a result of engaging in the behavior that one is trying to abstain from. The AVE has two components: cognitive dissonance and personal attribution. Cognitive dissonance (Festinger, 1964) refers to feelings of conflict and guilt that result from a disparity in a person's self-image and engaging in a behavior that goes against this self-image. The second component, personal attribution, refers to those who perceive the lapse as due to shortcomings within themselves, rather than a response to a high-risk situation such as interpersonal conflict or peer pressure. These people perceive themselves as failures, and may be more likely to suffer a full-blown relapse.

The Relapse Prevention Model has been used to design intervention procedures to promote exercise adherence (Belisle, Roskies, & Levesque, 1987; King & Frederiksen, 1984; Martin et al., 1984). Participants are taught coping responses to situations that may lead to relapse, as well as ways to minimize the AVE. This component of the Relapse Prevention Model has had modest success as an intervention method for improving adherence to exercise. However, the model as a whole has not been extensively tested in the area of exercise relapse. The model was formed from examining behaviors such as smoking and substance abuse, where the
goal is to reduce an undesirable behavior. In exercise, though, the goal is acquisition of a desirable behavior. The lack of research applying the Relapse Prevention Model to exercise raises questions as to its applicability to acquisition of health behaviors such as exercise. "This basic behavioral difference may lead to the need to modify the relapse model as applied to exercise adherence" (Knapp, 1988, p. 221).

**Transtheoretical Model**

A model that has been very successful at explaining how individuals reduce or acquire certain behaviors is the Transtheoretical Model (Prochaska & DiClemente, 1981; Prochaska, DiClemente, & Norcross, 1992). In addition to being applied to behaviors requiring cessation such as smoking (Prochaska & DiClemente, 1983), alcohol abuse (DiClemente & Hughes, 1990), cocaine use (Rosenbloom, 1991), and weight loss (O'Connell & Velicer, 1988), the Transtheoretical Model has been applied to exercise (Marcus, Rakowski, & Rossi, 1992; Marcus, Rossi, Selby, Niaura, & Abrams, 1992; Marcus, Selby, Niaura, & Rossi, 1992) as well as other health behaviors requiring acquisition with great promise (e.g., condom use: Harlow, Prochaska, et al., 1994; cocaine habit: Harlow & Minugh, 1989; mammography: Rakowski, Dube, Marcus, Prochaska, Velicer, & Abrams, 1992; smoking habit: Stern, Prochaska, & Velicer, 1987; sun exposure: Rossi, & Blais, 1991).
According to the Transtheoretical Model (e.g., Prochaska, DiClemente, & Norcross, 1992), there are five stages that people progress through in changing a problem behavior. They are precontemplation, contemplation, preparation, action, and maintenance. In precontemplation, people are not considering changing their behavior. In contemplation, people are aware that a behavior change is necessary, and intend to make a change within the next six months, but have not yet taken action. In the preparation stage, people have made a commitment to make a change within one month, and have attempted a change in the past year. In exercise, preparation also refers to those who have been exercising, but not at the level recommended by the American College of Sports Medicine (ACSM). In this study, however, preparation is limited only to those who are preparing to make a change within the next 30 days. Action is the stage where people are actively changing their behavior (e.g., exercising at the ACSM recommended level). When a behavior has successfully been altered for six months or longer, people have moved into the maintenance stage. Exercisers in the maintenance stage have exercised consistently at the ACSM recommended level for at least six months.

It appears as though people move through these stages in a spiral pattern (Prochaska, DiClemente, & Norcross, 1992). Most people are not successful at changing their behavior in the first attempt. Relapse is likely to occur most often during the action stage. In relapse, people
regress to an earlier stage. In many cases, people return to the precontemplation stage where they can remain for varying amounts of time. Often, though, people return to the contemplation or preparation stage, and soon begin to move again through the stages toward maintenance. Within the Transtheoretical Model, relapse is not considered a distinct stage, but rather a gateway to an earlier stage (Marcus, Selby, Niaura, & Rossi, 1992).

There are also 10 processes that people use to assist them in making a change. Five of these processes can be categorized as cognitive-experiential strategies: consciousness raising, dramatic relief, self-reevaluation, social liberation, and environmental reevaluation. The remaining processes are classified as behavioral strategies: self-liberation, helping relationships, reinforcement management, stimulus control, and counter conditioning. Each of the processes are used to a different extent depending upon what stage a person is in. A precontemplator uses the processes the least while those in contemplation or preparation are likely to use the cognitive-experiential strategies most often. The behavioral strategies are used most in the action and maintenance stage.

Level of self-efficacy is an important component of the Transtheoretical Model. Self-efficacy refers to confidence in one's ability to perform a behavior (Bandura, 1977), and has been closely linked to actual performance of exercise (Sallis, Hovell et al., 1986; Sallis, Haskell, et al., 1986;
Sallis, Pinski, Patterson, & Nader, 1988; Sonstroem, Harlow, Gemma, & Osborne, 1991). It is used within the model to differentiate between stages. For instance, Marcus, Selby, Niaura, & Rossi (1992) found that scores on a measure of self-efficacy for exercise were significantly related to stage. Those in the precontemplation stage scored lower in self-efficacy for exercise than those in the maintenance stage. Although level of self-efficacy has been found to differ across stages, it does not provide clear differentiation across all stages (Marcus, Selby, Niaura, & Rossi, 1992; DiClemente, Prochaska, & Gibertini, 1985).

Another measure that is related to the stages of change is decisional balance. Decisional balance refers to one's weighting of the pros and cons of making a behavior change. Decisional balance was introduced as a means to increase adherence to exercise by Janis & Hoyt (1975). They found that adherence to an exercise program could be improved by having people list all the advantages and disadvantages of attending. Janis & Mann (1968) and Janis & Hoyt (1975) had identified eight decisional balance dimensions, but more recent studies have identified only two dimensions: pros and cons (Prochaska, Velicer, Rossi, Goldstein, et al., 1992; Velicer, DiClemente, Prochaska, & Brandenburg, 1985).

Decisional balance has been applied within the Transtheoretical Model to many problem behaviors. Clear commonalities have been identified across twelve different behaviors: smoking cessation, quitting cocaine, weight
control, high fat diets, delinquent behaviors, safer sex, condom use, sun exposure, radon exposure, sedentary lifestyles, mammography screening, and physician's assistance in helping patients attempting to quit smoking (Prochaska, Velicer, Rossi, Goldstein, et al., 1992). For all twelve behaviors, the pros of the problem behavior were greater than the cons in precontemplation. In the action stage, the cons of the problem behavior outweighed the pros for all behaviors except quitting cocaine. For exercise, the cons of exercise outweighed the pros in the precontemplation and contemplation stages, but crossed-over in the preparation stage. In action and maintenance, the pros exceeded the cons.

Physical Self-Perceptions

Drawing on the work of Harter (1983, 1985), Fox and Corbin (1989) have identified a three-level hierarchy of self-perceptions. At the top of the hierarchy is global self-esteem, and at the second level is a generalized level of perceived physical competence labeled physical self-worth. Finally, Fox and Corbin also identified four subdomains of perceived physical competence: 1) sports competence, 2) physical condition, 3) attractive body, and 4) strength.

This hierarchical self-esteem model was originally proposed by Fox & Corbin to measure changes in self-esteem resulting from exercise. Recently, physical self-perceptions have been identified as good predictors of exercise behavior.
within an expanded Exercise and Self-Esteem Model (Sonstroem, Harlow, & Josephs, 1994), originally proposed by Sonstroem (1974) and Morgan (Sonstroem & Morgan, 1989). However, self-perceptions of physical ability have not yet been studied as potential determinants of relapse from exercise. In this study, potential differences in perceived physical competence among types of relapsers will be explored.

Each of the three models, the Relapse Prevention Model, The Transtheoretical Model, and Physical Self-Perceptions from Fox and Corbin's (1989) hierarchical model of self-esteem, have been applied to exercise behavior research to varying degrees. Of the three, only Physical Self-Perceptions, as measured by the Physical Self-Perception Profile scale (Fox, 1990), were developed specifically to assess exercise behavior. Both the Relapse Prevention Model and the Transtheoretical Model were initially developed to assess addictive behaviors, and include evaluation of relapse. Recently, the Transtheoretical Model has been applied to exercise adherence with great success. The Relapse Prevention Model, on the other hand, has not yet been used to assess exercise behavior, and as Knapp (1988) notes, may need to be modified for application to relapse from exercise.

Since none of the models were developed specifically as models of relapse from exercise, each model alone may not adequately assess such a complex phenomena. For this reason,
the present study will draw upon only the components of each of the models that are believed to most strongly contribute to an understanding of relapse from exercise. For example, one component of the Relapse Prevention Model, interpersonal conflict which appears to be a strong contributor to resumption of an negative addictive behavior, may not contribute strongly to relapse from exercise. Resumption of an addictive behavior such as drinking often results in relief from the negative feelings associated with interpersonal conflict. Consequently, there is a strong temptation to engage in the behavior following such conflict. Skipping exercise is not likely to bring such immediate relief from the negative feelings associated interpersonal conflict, and thus is not likely to be used as a method of coping. As a matter of fact, Marlatt & Gordon (1985) suggest adopting exercise as a coping strategy. For this reason, interpersonal conflict may not be as strong an impetus to relapse from exercise as it is to relapse in the addictions, and will not be utilized as a component of the Relapse Prevention Model in these studies.

Present Research Goals

Since relapse from exercise has not been researched extensively in the past, there are very few psychometrically established measures specifically associated with relapse from exercise. For this reason, a scale assessing Reasons for Relapse from Exercise was developed to measure perceived reasons for actual relapse from exercise. This is described
in the second section which provides initial psychometric support for this scale. It was hypothesized that from this scale, two subscales identifying personal and situational reasons for relapse would emerge.

The purpose of the third study was to classify those who relapse from exercise based upon their current level of exercise, frequency of relapse, and reasons for relapse using a cluster-analytic approach. Cluster analysis has been used in the past to identify stages of smoking acquisition (Stern et al., 1987) and to identify types of smoking relapse situations (Baer & Lichenstein, 1988; Shiffman, 1986; Shiffman, Read, & Jarvik, 1985), but has not been used to identify different types of exercise relapse situations. In addition, identified clusters of relapsers were assessed on their level of exercise-specific self-efficacy, temptations to skip exercise, judgment of the pros and cons and perceived benefits of exercise, perceived social support and pressure not to exercise, psychosocial characteristics, mood, physical self-perceptions, current stage of change, and use of the 10 processes of change. It was proposed that several different types of exercise relapsers would emerge, and that these types would differ significantly on the above-mentioned exercise-related behaviors and attitudes.

The fourth study was conducted to identify predictors of frequency of relapse from exercise. Predictors were drawn mainly from the Relapse Prevention Model (e.g., Marlatt & Gordon, 1985); the Transtheoretical Model (e.g., Prochaska &
DiClemente, 1983); and Physical Self-Perceptions from a hierarchical model of self-esteem (e.g. Fox & Corbin, 1989). It was hypothesized that components of each of the models would be identified as strong predictors of relapse from exercise, and that these components would provide initial support for an integrated model of relapse from exercise.

Finally, in the fifth study, two structural models assessing the contribution of negative psychosocial attitudes and social support to frequency of relapse from exercise were conducted. The main purpose of this study was to draw together, and elaborate on, results from each of the studies to develop an integrated model of relapse from exercise. It was believed that overall results would provide initial support for the relationships proposed within the model, as well as provide insight into progression through the process of relapse from exercise.

For all of the above-mentioned studies, the samples were drawn from a population of college students. This population is ideal for an initial assessment of relapse from exercise for two reasons. The first is that relatively few studies have evaluated relapse from self-initiated exercise programs (Sallis et al., 1990), and second, the switch to a sedentary lifestyle is believed to occur most frequently in the first few years following high school (Dishman & Steinhardt, 1988), putting college students at high-risk for long-term inactivity.
The studies are presented in manuscript format in the following order: Part II - psychometric assessment of a Reasons for Relapse from Exercise scale; Part III - relapse from exercise: a cluster analytic approach; Part IV - predictors of frequency of relapse from exercise; and Part V - an integrated model of relapse from exercise. Finally, the paper concludes in Part VI with an overall discussion of all the studies.
Despite the fact that relapse in the addictions has been studied extensively, relapse from exercise has not yet received a great deal of attention. As mentioned previously, some predictors of relapse have been noted. In addition, Sallis and his colleagues (e.g., 1986, 1989, 1990) and Amaral (1985) have identified many common barriers to exercise adherence. Examples of these barriers include: lack of time, inconvenience of facilities, and stiffness or soreness resulting from exercise. In past research, these barriers have been inquired about in terms of one's perceptions and beliefs surrounding exercise. These beliefs have been found to be related to adoption and maintenance of exercise in the above-mentioned studies.

However, at present, no research has been conducted to assess whether these barriers directly contribute to relapse from exercise. Furthermore, no psychometric tool to assess specific reasons for relapse from exercise currently exists. Consequently, in this study, a scale assessing Reasons for Relapse from Exercise was developed to measure perceived reasons for actual relapse from exercise. Items for this scale were drawn from barriers to exercise identified in previous research by Sallis and his colleagues (e.g., 1986, 1989, 1990) and Amaral (1985).

The purpose of this study was to provide initial psychometric support for this Reasons for Relapse from Exercise Scale.
Exercise scale in a sample of college students. It was hypothesized that from this scale, two subscales identifying personal and situational reasons for relapse would emerge. Several other behaviors and attitudes, many found to be related to adherence to exercise (e.g., Dishman, 1988, 1991; Sallis & Hovell, 1990), were used to provide evidence for the validity of the scale.

Methods

Participants

The sample consisted of 260 students at the University of Rhode Island and 10 members from a local fitness club (total N=270). In order to get a diverse cross-section, students at the university were recruited from several departments across campus including psychology, business, engineering, math, music, and physical education departments. The additional 10 participants, recruited from a local fitness center, voluntarily filled in the survey at home and returned it to the fitness center.

Since the 10 fitness center participants were from a population that may have differed from the college students, individual t-tests were conducted on those 10 participants and a computer-generated random selection of 13 participating college students on several demographic variables and the exercise variables examined in this study. The random sample of college participants was generated to ensure approximately equal cell sizes for statistical comparison. Individual t-tests revealed significant
differences, at \( p < .01 \) between groups, on only four variables. Fitness center participants were significantly older than the college participants \( t(12) = -2.97, \ p = .01; \) mean age = 31 years versus 21.8 years, respectively). Fitness center participants also reported beginning exercising regularly at a later age than college students \( t(20) = -3.53, \ p = .002; \) mean = 4.00: between ages 16-20 versus mean = 2.23: around or before age 10, respectively). Finally, compared to college participants, fitness center participants reported lower temptations to skip exercise in certain situations \( t(21) = 2.94, \ p = .008; \) mean = 2.10 and 2.83, respectively), and higher use of counter conditioning \( t(19) = -3.11, \ p = .006; \) mean = 4.28 and 3.08, respectively). Since these were the only variables on which the two groups significantly varied, and differences were not expected to appreciably affect analyses, the 10 fitness center participants were combined with the 260 college students for all subsequent analyses.

The combined sample \( (N = 270) \) is characterized as largely Caucasian (91%) and Catholic (62%) with a mean age of 22 years. Women comprise 64% of the sample. Most (77%) are non-smokers and over half exercise regularly (58.5%). Almost half (48.5%) of the participants belong to some kind of gym, health club, or fitness center, and 58.1% report beginning exercising regularly between ages 10 and 20. Participants exercise an average of 3 days per week for 46 minutes each day.
A total of six participants were excluded from the analyses due to inconsistent responses on relapse frequency and reasons for relapse variables. These participants indicated that they did not exercise regularly at all in the past six months, but then consistently responded that they did not stop exercising regularly in the past six months on the reasons for relapse variables. The remaining sample ($N = 264$) was randomly split into approximate halves. Sample 1, on which analyses were initially conducted, consisted of 134 participants. Analyses were then replicated on Sample 2 ($N = 130$). A preliminary MANOVA revealed that there was not enough evidence to conclude that there were significant differences between the two samples on the measures relevant to the analyses ($\text{Wilks } \Lambda = .89, \ F(38,231) = .76, \ p = .85$).

Procedure

College participants were recruited from various departments across campus including psychology, business, engineering, math, music, and physical education departments. Students from different departments were asked to participate to obtain a more representative sample of the college population. In addition, approximately 100 psychology department students completed the anonymous self-report survey at a pre-determined time. All participants were assured anonymity and confidentiality.

With the instructor's permission, voluntary participation of students in other departments was requested at the beginning of each class period. Surveys were
distributed to students during class, and were completed at home. These students were instructed to bring the completed surveys with them to class where they were collected. In addition, each survey was distributed in a manila envelope with the researcher's campus address so that students also had the option of returning the surveys through the campus mailing system. Most students received course credit for their participation. All participants were assured anonymity.

Fitness center participants picked-up the survey at the fitness center, completed it at home, and returned it to the center to be collected. They were also assured anonymity, and did not receive any compensation for completing the survey.

Measures

A set of 24 items measuring Reasons for Relapse from Exercise was examined. The items were derived from past research measuring potential barriers to exercise (e.g., Amaral, 1985; Sallis & Hovell, 1990; Sallis et al., 1989), and included items such as "not enough time" and "no one to exercise with". Participants were asked to rate how each of the 24 reasons for stopping exercise contributed to a relapse. All items used a five-point Likert scale, ranging from 1 = Did not stop exercising regularly; to 2 = Definitely did not contribute; up to 5 = Definitely contributed.
Validity Measures

In addition, several other measures related to exercise adherence were examined to assess scale validity. These measures are described below.

The Cons of Exercise measure is the average score on three items measuring the cons of exercise such as "I would probably be sore and uncomfortable if I exercised regularly" (Marcus & Owen, 1992). Coefficient α for this scale was calculated at .58.

The Temptations to Skip Exercise consists of five items adapted from Velicer, DiClemente, Rossi, and Prochaska, (1990) that lists various situations such as "when it's raining" or "when I'm in a bad mood". Participants were asked to respond how tempted they would be to skip exercise in each these situations on a 5-point Likert scale ranging from 1 = Not at all tempted, to 5 = Very tempted. Coefficient α for this scale was calculated at .65.

The Perceived Benefits of exercise measure consists of 29 items from Sechrist, Walker, & Pender's (1987) Exercise Benefits scale and three items from a scale measuring pros of exercise (Marcus & Owen, 1992). This scale assesses potential advantages of exercise by asking participants to respond on a four-point Likert scale how much they agree with statements such as "exercise makes me sleep better" and "exercising gives me a sense of personal accomplishment". A principal component analysis (PCA) conducted in this study revealed 3 components measuring Physical Benefits consisting
of 13 items (e.g., "Exercise improves my muscle tone"; $\alpha = .94$), Emotional Benefits with 13 items (e.g., "Exercise reduces stress and tension"; $\alpha = .93$), and Social Benefits with five items (e.g., "Exercise allows me to have more contact with friends"; $\alpha = .82$). Coefficient alpha for the scale as a whole was found to be quite high at .96.

**Self-Efficacy** is a composite score derived from the average of five items measuring one's confidence in being able to participate in exercise in certain situations such as when one is "tired" or "on vacation" (Marcus, Selby, et al., 1992). Coefficient $\alpha$ in this study was .76.

**Powerlessness** is an average score of five items derived from a three-item Perceived Loss of Control scale developed by Newcomb & Harlow (1986). For this study, all items were adapted to be specific to exercise. Participants were asked to rate their degree of agreement to items including "I feel I am not in control of my exercise life" and "I feel stuck where I am with my exercise situation". Coefficient $\alpha$ for the five-item scale was calculated at .70.

**Demoralization** about one's exercise situation is a composite score adapted from the average of 12 items from Harlow's (1990) Demoralization Scale, but made to be specific to exercise for this study. It consists of two subscales of six items each which measure components of distress and subjective competence related to exercise. The distress subscale, consisting of items such as "I often fail to meet my own expectations regarding exercising", was found
to have acceptable internal consistency ($\alpha = .77$). The subjective competence subscale, including items such as "when faced with a dilemma about exercising, I usually know what to do", was found to have good internal consistency ($\alpha = .84$).

The Positive and Negative Affect Schedule (PANAS Scales: Watson, Clark, & Tellegen, 1988) was used in this study to assess mood. It consists of 20 items total assessing both positive and negative general affect. Coefficient $\alpha$ for positive and negative affect (asking participants to recall over the past six months) was calculated at .90 and .86, respectively.

The Physical Self-Perception measure is from the Physical Self-Perception Profile scale (PSPP: Fox, 1990). The PSPP typically has five components measuring general Physical Self-Worth and four subdomains of Sport Competence, Physical Condition, Attractive Body and Strength. However, in this study a principal components analysis revealed four components assessing (1) Sports Competence (e.g., "some people feel that they are among the best when it comes to athletic ability"; $\alpha = .70$); (2) Attractive Body (e.g., "some people feel that compared to most, they have an attractive body"; $\alpha = .70$); (3) Strength (e.g., "some people feel that they are very strong and have well-developed muscles compared to most people $\alpha = .70$); and (4) Doubt (e.g., "some people tend to lack confidence when it comes to their physical strength"; $\alpha = .70$). Participants
are asked to choose which of two contrasting statements is most like themselves, and are then asked to rate whether that description is "sort of true" or "really true" of them. Item scores ranged from one to four.

Though not typically considered a separate component of the PSPP, the Doubt construct has been identified in previous research (e.g., Sonstroem, Harlow, Gemma, & Osborne, 1991).

Current Exercise Level was measured by a Physical Activity Questionnaire (Sonstroem, Speliotis, & Fava, 1992) which consists of three items asking participants whether they exercise regularly, the number of days per week that they exercise, and how many minutes they exercise per day. Current exercise level was assessed by multiplying the number of days per week by how many minutes per day. In this study, regular exercise is defined as exercise performed three or more times per week for 20 minutes or more without stopping, which is hard enough to make heart rate and breathing increase a large amount.

Relapse Frequency was assessed by asking respondents to record how often they stopped exercising regularly for one week or more in the past six months. Scores on this item ranged from 1 = None to 6 = did not exercise regularly at all in the past six months. This item was created for use in this study.
For a complete list of the individual items used to derive the Reasons for Relapse from Exercise scale and the validity measures, see Appendix A.

Analyses

Several steps were taken to assess the psychometric properties of the initial pool of items assessing reasons for relapse from exercise: (1) A principal component analysis (PCA) with oblique rotation was conducted on Sample 1 to determine component structure; (2) a confirmatory factor analysis (CFA) was conducted on an independent sample (Sample 2) to verify factor structure; (3) internal consistency was determined for each of the subscales and the scale as a whole using Cronbach's (1951) coefficient alpha (α), a measure of internal consistency of the items; and (4) the relationship between reasons for relapse and other variables related to barriers to exercise was examined to assess scale validity. It was hypothesized that two components would emerge, one assessing personal reasons and another assessing situational reasons for relapse from exercise.

Results

Initial Factor Structure

A PCA, with oblique rotation, was conducted on Sample 1 (N = 134) in order to determine the number of components representing the reasons for relapse construct. Determination of the number of components to retain was made using the minimum average partial method (MAP: Velicer,
This method is based on the matrix of partial correlations, and extracts components until the minimum average squared partial correlation is reached. At this point, the matrix of partial correlations closely approximates an identity matrix. The MAP method has been identified as one of the most accurate methods for determining the number of components to retain (Zwick & Velicer, 1986). In addition, a scree plot of the eigenvalues of the components (Cattell, 1966) was examined to verify the MAP solution.

Both the MAP and scree plot results suggested that a three component solution should be retained. An examination of the loadings revealed four complex items that loaded high on more than one component (i.e., less than .20 between loadings on separate components). These items were eliminated, and a PCA was then conducted on the remaining 20 items. Once again, three components were retained. The first component consisted of ten items measuring Personal Reasons for relapse. Personal reasons represent internal attributions that non-exercisers or relapsers have for not being able to maintain a regular program of exercise (e.g., "I'm not coordinated enough to exercise"). The second component consisted of six items assessing Situational Reasons for relapse. Situational reasons are external attributions that participants make for not being able to maintain a regular program of exercise (e.g., "The exercise facilities available to me are not convenient"). The third
component, consisting of four items, represented Injury Reasons for relapse from regular exercise (e.g., "Poor health"). The proportion of variance accounted for by Personal, Situational, and Injury Reasons was 40%, 29%, and 18%, respectively.

Confirmatory Factor Analysis

In order to verify the factor structure obtained in the 20-item PCA, a confirmatory factor analysis (CFA) was conducted on the second half of the sample (Sample 2; N = 130) using maximum likelihood estimation in the EQS computer package (Bentler, 1990). Indices that were used to assess overall model fit included the chi-square ($\chi^2$), which should be low relative to degrees of freedom; the comparative fit index (CFI: Bentler, 1990) which ranges from 0-1 with values closer to one indicating good fit; and the root mean square residual (RMSR) which is a measure of deviation between a model and the data where values close to zero are preferred. In addition, the significance of t-ratios for individual parameter estimates was examined.

Overall results, based on maximum likelihood estimation, revealed an adequate, yet not especially good, fit of the model to the data ($\chi^2(167) = 409.21; \text{CFI} = .82; \text{RMSR} = .06$). T-tests for each of the individual parameter estimates showed that each of the items loaded significantly (at p<.05) on its respective factor. A complete list of items and their factor loadings is provided in Table 1.
Correlations among the factors were quite high, particularly between the Injury Reasons factor and both the Personal and Situational Reasons factors (.86 and .81, respectively). The correlation between the Situational Reasons factor and the Personal Reasons factor was .78.

The results of the overall fit indices indicated that there was some degree of model misspecification. For this reason, the model was reexamined for areas where it could be respecified. Though t-tests of the parameter estimates revealed that each of the factor loadings was significant, a few items were not exclusively representative of their respective constructs. For instance, the item "pressure from friends not to exercise" loaded on the Personal Reasons construct even though it may be considered more of a situational reason. In addition, a look at the standardized residual matrix revealed a high residual correlation between that item and the Situational Reasons item "no one to exercise with". Furthermore, the variable "I don't have enough self-discipline to exercise" loaded on the Situational Reasons construct even though it may also be considered indicative of a personal reason for relapse. It also showed a high residual correlation with the personal item "exercise is hard work". Finally, the item "exercising is too painful" loaded on the Injury Reasons factor,
however, it may also be considered a personal reason for relapse. It showed a high residual correlation with the personal reason "exercise makes me feel stiff and sore". In order to address this conceptual overlap, the residuals for each of these three sets of items were allowed to be correlated, adding three correlated residual parameters, and the analyses were rerun. Results indicated a slight improvement in fit ($\chi^2(164) = 378.69; \text{CFI} = .84; \text{RMSR} = .05$) and all parameter estimates were significant at $p<.05$. Factor loadings, shown in parentheses in Table 1, remained nearly unchanged for this model.

Even with the inclusion of correlated errors, the fit indices revealed only an adequate fit of the CFA model to the data. A CFA of a smaller model, using a subset of the four highest loading items for each of the three constructs ($p = 12$), was then conducted. No correlations among errors were specified in this model. Results with this reduced set of 12 items showed some improvement in fit over the model that had included all 20 items ($\chi^2(51) = 143.038; \text{CFI} = .87; \text{RMSR} = .06$). All parameter estimates were significant at $p<.05$ (see Table 2 for a list of items and their factor loadings for the reduced model).

Insert Table 2 about here

Correlations among the factors decreased somewhat for this model. The correlation between the Situational Reasons
construct and the Personal Reasons construct dropped from .78 to .69, and the correlation between the Injury Reasons construct and the Situational Reasons construct dropped from .81 to .64. Despite the decrease in correlation among the factors, the correlation between the Injury Reasons and Personal Reasons constructs remained quite high at .83.

It appears as though the reduced Reasons for Relapse from Exercise scale, with three subscales of four items each, may be the better scale, in terms of psychometric properties, at this point. However, an examination of the factor loadings for the injury construct indicates that this factor remains a relatively weak factor. Three of its loadings were .50 or lower. Future development of this scale should add more items to provide a more inclusive measure of this injury construct, and to make it more independent of the other subscales.

**Internal Consistency**

Cronbach's coefficient α (Cronbach, 1951), a measure of internal consistency was calculated for each of the Reasons for Relapse from Exercise subscales and for the scale as a whole, for both the 20-item and 12-item versions. Coefficient α was quite good for the 10-item Personal Reasons (α = .93) subscale and for the 6-item Situational Reasons subscale (α = .83). Internal consistency for the 4-item Injury Reasons subscale was adequate at .66. Coefficient α for the 20-item scale as a whole was .93. Coefficient α for the 4-item Personal and Situational...
Reasons subscales dropped compared to the longer subscales, but remained adequate (α = .88 and .79, respectively). Coefficient alpha for the 4-item Injury Reasons subscale remained the same since none of its items were deleted. Coefficient α for the 12-item Reasons for Relapse from Exercise scale as a whole remained high at .87.

Validity Coefficients

To assess the validity of the Reasons for Relapse from Exercise scale, correlations between the three reasons subscales, and several external variables were calculated on the full sample (N = 264). Many of the variables have been found to be predictors of exercise behavior in past research (e.g., Sallis & Hovell, 1990; Sallis, Pinski, Patterson, & Nader, 1988; Sonstroem, Harlow, Gemma, & Osborne, 1991; Sonstroem, Harlow, & Josephs, 1994; Watson, 1988). Several other items hypothesized to be related to relapse from exercise were also assessed.

The validity coefficients and associated p values are presented in Table 3.

All three subscales (Personal, Situational, and Injury Reasons for Relapse) were found to be consistent with previous research in the area of exercise behavior. Significant positive correlations were found with all three subscales for Temptations to Skip Exercise, Cons of
Exercising, Demoralization, Powerlessness, Negative Affect, and Relapse Frequency. The three reasons for relapse subscales also showed significant negative correlations with Exercise Self-Efficacy, Emotional Benefits of Exercise, Positive Affect, and Exercise Level. In addition, significant correlations were found between Personal and Situational Reasons for Relapse and four measures of Physical Self-Perceptions (Sport Competence, Physical Strength, Doubt about one's physical ability, and Body Attractiveness). However, these measures were not significantly related to Injury Reasons for Relapse. Relapse from exercise as a result of injury does not appear to be significantly related to perceived sports competence, physical strength, doubt about one's physical ability, or satisfaction with one's body. This may be due to the fact that injury results in a forced and often uncontrollable relapse, as opposed to a voluntary and potentially controllable relapse. Thus, those who are injured may not be likely to attribute their relapse to a perceived weakness on their part, and are not likely to perceive themselves as less competent exercisers.

The average absolute validity coefficients for Personal, Situational, and Injury Reasons for Relapse from Exercise were .48, .30, .18, respectively. The higher absolute value for the Personal Reasons subscale is not surprising since the external variables with which the subscales were correlated were for the most part
intrapersonal measures (e.g., self-efficacy, demoralization, affect, perceived sports competence). The few behavioral measures such as relapse frequency and exercise level showed the highest correlation with the Situational Reasons subscale. Furthermore, the lower absolute validity coefficient for the Injury Reasons may be due to the previously mentioned forced nature of the resulting relapse, and the fact that this scale was not initially hypothesized. As a result, few items were available for this subscale, and external variables were not selected to validate it. Future research on this subscale would be helpful, and could benefit from having a larger pool of initial items as well as several carefully selected variables with which to validate the Injury Reasons for Relapse from Exercise subscale.

Discussion

An assessment of factor structure and other psychometric properties of two scale versions (one longer 20-item scale and one reduced 12-item scale) assessing Reasons for Relapse from Exercise revealed three subscales of Personal Reasons, Situational Reasons, and Injury Reasons in both scales. A CFA revealed an adequate fit for both scales with the reduced 12-item scale being the better of the two in terms of fit. Despite the identification of three distinct subscales, there was some degree of both statistical and conceptual overlap among the subscales that may have contributed to the reduced fit of the model.
Correlations among the subscales were high, particularly between the Injury Reasons construct and both the Personal and Situational Reasons for Relapse constructs. Another factor that may have contributed to reduced model fit was a relatively small sample size. Ideally, when conducting a confirmatory factor analysis, sample size should exceed N=200 (e.g., Anderson & Gerbing, 1984; Marsh, Balla, & McDonald, 1988; Mulaik, James, Alstine, Bennet, Lind, & Stillwell, 1989). The sample used in this study's CFA consisted of only 130 participants. Simulation research has shown that smaller sample sizes can result in fit indices revealing a less than perfect fit even when there is a perfect match between a model and the data (e.g., Ding, 1994; La Du & Tanaka, 1989).

The identification of a separate Injury Reasons for Relapse subscale was also surprising. It was originally hypothesized that the few items measuring injury reasons would load on the Situational Reasons for Relapse construct. Consequently, there was not an ideal number of items available to comprehensively and distinctly assess the injury phenomena. Future development of the Reasons for Relapse from Exercise scale should address this problem by including more items that provide a more inclusive and specific measure of injury. Example items might include "extreme muscle soreness" and "diagnosed injury resulting from exercise". Such items would provide a more comprehensive measure of exercise-related injury while
eliminating some of the subjective nature of items such as "Exercising is painful" that may contribute to the high correlation between Injury and Personal Reasons.

Coefficient alpha indicated good to excellent internal consistency of the items in each subscale and the model as a whole. In addition, an examination of correlations between the three subscales and a set of external variables, many of which have found to be related to exercise behavior in the past, revealed strong evidence for the validity of the subscales.

Those who provided Personal and Situational Reasons for Relapse from exercise appeared to have greater levels of Temptations to Skip Exercise, Demoralization and Powerlessness about exercise, Negative Affect, Cons of Exercise, Doubt about their physical abilities, and a high frequency of relapse from exercise. They also reported lower Self-Efficacy, Positive Affect, Sports Competence, Physical Strength, perceived Body Attractiveness, a lower Exercise Level, and fewer Emotional and Social Benefits of Exercise. Those with Personal Reasons also reported fewer Physical Benefits of Exercise. While the pattern of correlations among the validity coefficients was similar for both Personal and Situational Reasons for exercise, the degree of correlation differed. Correlations were, for the most part, higher between Personal Reasons and intrapersonal measures such as Demoralization and Affect than between Situational Reasons for Relapse from exercise and the intrapersonal
measures. Thus, it would appear that even though individuals who relapse from exercise for either Personal or Situational reasons show greater intrapersonal "distress", it may be particularly acute for those who make personal attributions for their relapse.

The pattern of validity coefficients for Injury Reasons for Relapse was slightly different than that obtained for the other reasons for relapse. Validity coefficients were lower and several variables were not significantly related to Injury Reasons. For example, relapse as a result of injury was not significantly related to Social Benefits of Exercise, or any of the physical self-perceptions measures (i.e., Sport Competence, Physical Strength, Doubt, Attractive Body). As noted previously, this pattern of lower, and often nonsignificant, validity coefficients for Injury Reasons for Relapse may be due in part to both the uncontrollable nature of this type of relapse and the fact that there were fewer items in this subscale and fewer variables to ideally validate it.

Despite the lack of carefully selected external variables with which to validate the Injury reasons for Relapse from Exercise subscale, the relationships between Injury Reasons and other external variables show some consistency with previous research on psychological "distress" associated with injury that prevents regular exercise (Astle, 1986; McDonald & Hardy, 1990). Feelings of loss related to one's self-image as an exerciser as a result
of injury may have contributed to the relationships found between injury reasons for relapse and demoralization, powerlessness, and negative affect. This conclusion is tentative though since this study was not designed to explore the relationship between injury and "distress". The design of this study and the measures employed may be inadequate to properly address this issue.

In conclusion, preliminary examination of a Reasons for Relapse from Exercise revealed adequate to good psychometric properties. This scale may be useful to researchers wanting to assess relapse from exercise, an important aspect of the process of maintaining a regular program of exercise which has, for the most part, been overlooked in past exercise research. Knowing an individual's reasons for relapse from exercise may be important in planning effective interventions. For instance, those who provide mainly situational reasons for relapse may benefit most from a time management approach while those providing personal reasons may require an intervention focused on improving exercise self-efficacy and perceived physical competence. Injury relapsers may need a different approach focusing on successful rehabilitation and reduction of distress potentially associated with an inability to exercise.

However, there are several ways that this scale may be improved in future research. Additional items assessing injury are necessary to get a more comprehensive and independent assessment of this construct. Furthermore,
variables drawn specifically from research in the area of injury and exercise should be measured to provide an adequate assessment of validity. Finally, factor structure of the Reasons for Relapse from Exercise scale should be confirmed on a larger sample size to examine a potential improvement in model fit over that found in this study.
References


Watson, D. (1988). Intraindividual and interindividual analyses of positive and negative affect: Their


Table 1. Maximum Likelihood CFA Factor Pattern for 20-Item Reasons for Relapse from Exercise Scale

<table>
<thead>
<tr>
<th>Item</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Pressure from friends not to exercise</td>
<td>.57 (.56)</td>
</tr>
<tr>
<td>Exercise makes me feel stiff and sore</td>
<td>.80 (.79)</td>
</tr>
<tr>
<td>Exercise is boring</td>
<td>.72 (.72)</td>
</tr>
<tr>
<td>I'm not a good athlete</td>
<td>.70 (.70)</td>
</tr>
<tr>
<td>I don't have any interest in exercising</td>
<td>.82 (.82)</td>
</tr>
<tr>
<td>Exercise is hard work</td>
<td>.85 (.84)</td>
</tr>
<tr>
<td>I'm not coordinated enough to exercise</td>
<td>.76 (.76)</td>
</tr>
<tr>
<td>Exercise is not enjoyable</td>
<td>.84 (.83)</td>
</tr>
<tr>
<td>Exercising is too expensive</td>
<td>.51 (.51)</td>
</tr>
<tr>
<td>Exercise makes me feel too tired</td>
<td>.74 (.74)</td>
</tr>
<tr>
<td>Not enough time</td>
<td>.65 (.65)</td>
</tr>
<tr>
<td>No one to exercise with</td>
<td>.56 (.57)</td>
</tr>
<tr>
<td>It's too difficult for me to schedule a time to exercise</td>
<td>.77 (.77)</td>
</tr>
<tr>
<td>The exercise facilities that are available are not convenient</td>
<td>.68 (.70)</td>
</tr>
</tbody>
</table>

Factor loadings for the model with correlated errors: Factor 1 = Personal Reasons; Factor 2 = Situational Reasons; Factor 3 = Injury Reasons;

Note: Values in parentheses are factor loadings for the model with correlated errors; Factor 1 = Personal Reasons; Factor 2 = Situational Reasons; Factor 3 = Injury Reasons;
Table 1. Maximum Likelihood CFA Factor Pattern for 20-Item Reasons for Relapse from Exercise Scale (cont.)

<table>
<thead>
<tr>
<th>Item</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Bad weather</td>
<td>.61 (.60)</td>
</tr>
<tr>
<td>I don't have enough self-discipline to exercise</td>
<td>.63 (.64)</td>
</tr>
<tr>
<td>Injury</td>
<td></td>
</tr>
<tr>
<td>Exercising is too painful</td>
<td></td>
</tr>
<tr>
<td>Poor health</td>
<td></td>
</tr>
<tr>
<td>End of the sport season</td>
<td></td>
</tr>
</tbody>
</table>

Note: Values in parentheses are factor loadings for the model with correlated errors; Factor 1 = Personal Reasons; Factor 2 = Situational Reasons; Factor 3 = Injury Reasons;
Table 2. Maximum Likelihood CFA Factor Pattern for Reduced 12-Item Reasons for Relapse from Exercise Scale

<table>
<thead>
<tr>
<th>Item</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Exercise makes me feel stiff and sore</td>
<td>.79</td>
</tr>
<tr>
<td>I don't have any interest in exercising</td>
<td>.82</td>
</tr>
<tr>
<td>Exercise is hard work</td>
<td>.86</td>
</tr>
<tr>
<td>Exercise is not enjoyable</td>
<td>.84</td>
</tr>
<tr>
<td>Not enough time</td>
<td></td>
</tr>
<tr>
<td>It's too difficult for me to schedule a time to exercise</td>
<td></td>
</tr>
<tr>
<td>The exercise facilities that are available are not convenient</td>
<td></td>
</tr>
<tr>
<td>I don't have enough self-discipline to exercise</td>
<td></td>
</tr>
<tr>
<td>Injury</td>
<td></td>
</tr>
<tr>
<td>Exercising is too painful</td>
<td></td>
</tr>
<tr>
<td>Poor health</td>
<td></td>
</tr>
<tr>
<td>End of the sport season</td>
<td></td>
</tr>
</tbody>
</table>

Note: Factor 1 = Personal Reasons; Factor 2 = Situational Reasons; Factor 3 = Injury Reasons;
Table 3. Validity Coefficients for Reasons for Relapse from Exercise Subscales (N = 264)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Personal Reasons</th>
<th>Situational Reasons</th>
<th>Injury Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>coeff</td>
<td>p</td>
<td>coeff</td>
</tr>
<tr>
<td>Temptations to Skip Exercise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise Self-Efficacy</td>
<td>-0.44</td>
<td>****</td>
<td>-0.40</td>
</tr>
<tr>
<td>Physical Benefits of Exercise</td>
<td>-0.34</td>
<td>****</td>
<td>-0.06</td>
</tr>
<tr>
<td>Emotional Benefits of Exercise</td>
<td>-0.41</td>
<td>****</td>
<td>-0.18</td>
</tr>
<tr>
<td>Social Benefits of Exercise</td>
<td>-0.20</td>
<td>**</td>
<td>-0.16</td>
</tr>
<tr>
<td>Cons of Exercising</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demoralization</td>
<td>0.58</td>
<td>****</td>
<td>0.51</td>
</tr>
<tr>
<td>Powerlessness</td>
<td>0.29</td>
<td>****</td>
<td>0.21</td>
</tr>
<tr>
<td>Positive Affect</td>
<td>-0.34</td>
<td>****</td>
<td>-0.25</td>
</tr>
<tr>
<td>Negative Affect</td>
<td>0.24</td>
<td>****</td>
<td>0.14</td>
</tr>
<tr>
<td>Sport Competence</td>
<td>-0.32</td>
<td>****</td>
<td>-0.30</td>
</tr>
<tr>
<td>Physical Strength</td>
<td>-0.35</td>
<td>****</td>
<td>-0.29</td>
</tr>
<tr>
<td>Doubt (about physical ability)</td>
<td>0.36</td>
<td>****</td>
<td>0.39</td>
</tr>
<tr>
<td>Attractive Body</td>
<td>-0.25</td>
<td>****</td>
<td>-0.29</td>
</tr>
<tr>
<td>Relapse Frequency</td>
<td>0.53</td>
<td>****</td>
<td>0.62</td>
</tr>
<tr>
<td>Exercise Level</td>
<td>-0.38</td>
<td>****</td>
<td>-0.43</td>
</tr>
</tbody>
</table>

Note: Coeff = validity coefficient; p = probability level;  
* = p<.05; ** = p<.01; *** = p<.001; **** = p<.0001
THE PURPOSE OF THIS STUDY WAS TO CLASSIFY THOSE WHO RELAPSE FROM EXERCISE BASED UPON THEIR CURRENT LEVEL OF EXERCISE, FREQUENCY OF RELAPSE, AND REASONS FOR RELAPSE USING A CLUSTER-ANALYTIC APPROACH. CLUSTER ANALYSIS HAS BEEN USED IN THE PAST TO IDENTIFY STAGES OF SMOKING ACQUISITION (STERN, PROCHASKA, & VELICER, 1987) AND TO IDENTIFY TYPES OF SMOKING RELAPSE SITUATIONS (BAER & LICHENSTEIN, 1988; SHIFFMAN, 1986; SHIFFMAN, READ, & JARVIK, 1985), BUT HAS NOT BEEN USED TO IDENTIFY DIFFERENT TYPES OF EXERCISE RELAPSE SITUATIONS. IN ADDITION, IDENTIFIED CLUSTERS OF RELAPSERS WERE ASSESSED ON THEIR LEVEL OF EXERCISE-SPECIFIC SELF-EFFICACY, TEMPTATIONS TO SKIP EXERCISE, JUDGMENT OF THE PROS AND CONS AND PERCEIVED BENEFITS OF EXERCISE, PERCEIVED SOCIAL SUPPORT AND PRESSURE NOT TO EXERCISE, PSYCHOSOCIAL CHARACTERISTICS, MOOD, PHYSICAL SELF-PERCEPTIONS, CURRENT STAGE OF CHANGE, AND USE OF THE 10 PROCESSES OF CHANGE. THE HYPOTHESES, GROUPED BY CONCEPTUAL AREA, TESTED WHETHER FOR VARYING LEVELS OF EXERCISE PARTICIPATION, FREQUENCY OF RELAPSE, AND REASONS FOR RELAPSE:

1. Five possible clusters of relapser would emerge: repeat relapser; occasional overly busy relapser; occasional peer relapser; occasional injury relapser; and maintainer.

2. Transtheoretical Model constructs would differ on:
   a. Current stage of readiness to change;
b. Weighting of the pros and cons of exercise (decisional balance);
c. Temptations to skip exercise in certain situations;
d. Use of the processes of change.

3. Physical Self-Perception constructs would vary on:
a. Perception of sports competence;
b. Perception of doubt about one's physical abilities;
c. Perception of body attractiveness;
d. Perception of strength.

4. Psychosocial attitudes would show differences on:
a. Level of exercise self-efficacy;
b. Level of general life stress;
c. Level of exercise-specific demoralization;
d. Level of exercise-specific powerlessness;
e. Level of general positive affect;
f. Level of general negative affect.

5. Other constructs would vary on:
a. Number of perceived benefits of exercise;
b. Perceived social support (peer and family) for exercise;
c. Perceived social pressure (peer and family) to not exercise;
d. Number of cigarettes smoked per day;
e. Age at which regular exercise began.
Table 1 shows the hypothesized pattern of findings for relapse clusters. This hypothesized pattern is based upon past research on determinants of exercise adherence. Given the lack of research directly assessing relapse from exercise, though, the hypothesized pattern of relapse clusters should be considered tentative. It was also hypothesized that the obtained cluster solution would replicate in an independent sample, thus providing information on the reliability of the cluster solution in this study.

The variables chosen for this study were based upon past research that has applied the Relapse Prevention Model, the Transtheoretical Model, and Physical Self-Perceptions from Fox & Corbin's hierarchical self-esteem model to several health behaviors including exercise acquisition and adherence, as well as past research on determinants of exercise behavior (e.g., Sallis & Hovell, 1990; Sallis, Hovell, et al., 1989; Sonstroem, Harlow, & Josephs, 1989).

Measures chosen for use in this study that are not derived from the three models include benefits of exercise, social support, mood, and psychosocial characteristics. Benefits of exercise and social support have been shown by previous research to be two of the most consistent predictors of adherence to exercise, while mood has been
found to be the one consistent predictor of relapse from exercise in research conducted to date. (Sallis & Hovell, 1990). Three of the psychosocial measures, stress, powerlessness, and demoralization have not yet been studied as predictors of exercise behavior, but are included in this study to assess the relationship between more general psychosocial profiles (as opposed to more transient mood states) and relapse from exercise.

The identification of types of relapsers may allow for the tailoring of interventions to the specific needs of groups of individuals, thus improving the efficacy of current efforts to improve adherence to exercise. Therefore, potential implications for intervention are also discussed.

Methods

Participants

The sample consisted of 260 students at the University of Rhode Island and 10 members from a local fitness club (total N=270). Students at the university were recruited from several departments across campus including psychology, business, engineering, math, music, and physical education departments. The additional 10 participants, recruited from a local fitness center, voluntarily filled in the survey at home and returned it to the fitness center.

Since the 10 fitness center participants were from a population that may have differed from the college students, individual t-tests were conducted on those 10 participants and a computer-generated random selection of 13
participating college students on several demographic variables and the variables to be used in this study. The random sample of college participants was generated to ensure approximately equal cell sizes for statistical comparison. Individual t-tests revealed significant differences at p<.01 between groups on only four variables. Fitness center participants were significantly older than the college participants (t(12) = -2.97, p=.01; mean age = 31 years, and 21.8 years, respectively). Fitness center participants also reported beginning exercising regularly at a later age than college students (t(20) = -3.53, p=.002; mean = 4.00: between ages 16-20, and mean = 2.23: around or before age 10, respectively). Finally, compared to college participants, fitness center participants reported lower temptations to skip exercise in certain situations (t(21) = 2.94, p=.008; mean = 2.10 and 2.83, respectively), and higher use of counter conditioning (t(19) = -3.11, p=.006; mean = 4.28 and 3.08, respectively). Since these were the only variables on which the two groups significantly varied, and differences were not expected to appreciably affect analyses, the 10 fitness center participants were combined with the 260 college students for all subsequent analyses.

The combined sample (N = 270) is characterized as largely Caucasian (91%) and Catholic (62%) with a mean age of 22 years. Women comprise 64% of the sample. Most (77%) are non-smokers and over half exercise regularly (58.5%). Almost half (48.5%) of the participants belong to some kind
of gym, health club, or fitness center, and 58.1% report
beginning exercising regularly between ages 10 and 20.
Participants exercise an average of 3 days per week for 46
minutes each day.

A total of six participants were excluded from the
analyses due to inconsistent responses on the relapse
frequency and reasons for relapse variables. These
participants indicated that they did not exercise regularly
at all in the past six months, but then consistently
responded that they did not stop exercising regularly in the
past six months on the reasons for relapse variables. The
remaining sample (N = 264) was randomly split into
approximate halves. Sample 1, on which analyses were
initially conducted, consisted of 134 participants. Analyses
were then replicated on Sample 2 (N = 130). A preliminary
MANOVA revealed that there was not enough evidence to
conclude that there were significant differences between the
two samples on the measures relevant to the analyses (Wilks
Λ = .89, F(38,231) = .76, p = .85).

Procedure

College participants were recruited from various
departments across campus including psychology, business,
engineering, math, music, and physical education
departments. Students from different departments were asked
to participate to obtain a more representative sample of the
college population. In addition, approximately 100
psychology department students completed the anonymous self-
report survey at a pre-determined time. All participants were assured anonymity.

With the instructor's permission, voluntary participation of students in other departments was requested at the beginning of each class period. Surveys were distributed to students during class, and were completed at home. These students were instructed to bring the completed surveys with them to class where they were collected. In addition, each survey was distributed in a manila envelope with the researcher's campus address so that students also had the option of returning the surveys through the campus mailing system. Most students received course credit for their participation.

Fitness center participants picked-up the survey at the fitness center, completed it at home, and returned it to the center to be collected. They were also assured anonymity, and did not receive any compensation for completing the survey.

Measures

Clustering Variables.

The variables that were used to classify exercise relapsers consisted of (1) current level of exercise, (2) frequency of relapse, and (3) reasons for relapse. Current Exercise Level was measured by a Physical Activity Questionnaire (Sonstroem, Speliotis, & Fava, 1992) which consists of three items asking participants whether they exercise regularly, the number of days per week that they
exercise, and how many minutes they exercise per day. Current exercise level was assessed by multiplying the number of days per week by how many minutes per day. In this study, regular exercise is defined as exercise performed three or more times per week for 20 minutes or more without stopping, which is hard enough to make heart rate and breathing increase a large amount.

*Relapse Frequency* was assessed by asking respondents to record how often they stopped exercising regularly for one week or more in the past six months. Scores on this item ranged from 1 = None to 6 = did not exercise regularly at all in the past six months. This item was created for use in this study.

*Reasons for Relapse* is a recently developed scale (see Section II). Participants rated, on a five-point Likert scale ranging from 1 = Did not stop exercising regularly; to 2 = Definitely did not contribute; up to 5 = Definitely contributed, how much each of 20 possible reasons for relapse contributed to their own relapse. The reasons for relapse are derived from past research measuring potential barriers to exercise (e.g., Amaral, 1985; Sallis & Hovell, 1990; Sallis et al., 1989). The 20-item scale consists of three subscales assessing *Situational Reasons* (10 items: e.g., "not enough time"; $\alpha = .83$), *Personal Reasons* (6 items: e.g., "I'm not coordinated enough to exercise"; $\alpha = .93$), and *Injury Reasons* (4 items: e.g., "poor health"; $\alpha =$
Coefficient $\alpha$ for the whole scale was calculated at .93.

To reduce the number of variables to be used in the cluster analyses, scale scores were formed from the average of the items for each of the three reasons for relapse subscales. The total number of clustering variables, then, was five and included (1) Current Exercise Level; (2) Relapse Frequency; (3) Personal Reasons For Relapse; (4) Situational Reasons for Relapse; and (5) Injury Reasons For Relapse.

**Dependent Variables**

A total of 20 dependent variables were assessed in this study. They consisted of four sets of measures from the Transtheoretical Model: stages of readiness to exercise, cons of exercise, temptations to skip exercise, and the processes of change; a measure of Physical Self-Perceptions, from Fox and Corbin's (1989) hierarchical self-esteem model, consisting of four subdomains: sports competence, attractive body, strength, and doubt; four measures of psychosocial characteristics: self-efficacy, stress, powerlessness, and demoralization; a measure assessing mood consisting of two components: general positive and negative affect; three measures found in previous research to be consistent predictors of exercise adherence: perceived benefits, social support, and social pressure; and single item general measures assessing number of cigarettes smoked per day and age at which participants began exercising regularly.
Each of the dependent variable scales, with the exception of stages of readiness to exercise, was subjected to a PCA with oblique rotation. The components retained were used as dependent variables in MANOVAs assessing mean differences between obtained clusters.

**Stages of Readiness to Exercise** is a 6-item scale with items assessing each of the five stages of change and one item assessing relapse. This scale has been used in past research to reliably assign participants to their current stage within the process of exercise acquisition (e.g. Marcus, Rossi et al., 1992; Marcus, Banspach et al., 1992; Marcus, Rakowski, & Rossi, 1992;). Participants who responded "Agree" or "Strongly Agree" to a particular item were placed in that item’s respective stage. For example, if participants responded "Agree" or "Strongly Agree" to the item "I currently exercise regularly, and have done so for longer than six months", they were classified into the Maintenance stage. This method allowed for successful staging of 127 out of 134 participants (95%) in Sample 1 and 128 out of 130 participants (98%) in Sample 2. A total of 9 participants across samples could not be staged because they failed to respond "Agree" or "Strongly Agree" to any of the six items.

The **Cons of Exercise** measure is the average score on three items measuring the cons of exercise such as "I would probably be sore and uncomfortable if I exercised regularly"
(Marcus & Owen, 1992). Coefficient α for this scale was calculated at .58.

Temptations to Skip Exercise consists of five items adapted from Velicer, DiClemente, Rossi, and Prochaska, (1990) that lists various situations such as "when it's raining" or "when I'm in a bad mood". Participants were asked to respond how tempted they would be to skip exercise in each these situations on a 5-point Likert scale ranging from 1 = Not at all tempted to 5 = Very tempted. Coefficient α for this scale was calculated at .65.

The Processes of Exercise Change consisted of ten subscales of three or four items each (Marcus, Rossi, et al., 1992). Five of the subscales, Consciousness Raising, Dramatic Relief, Self-Reevaluation, Social Liberation, and Environmental Reevaluation represented cognitive-experiential strategies. The other five subscales, Self Liberation, Helping Relationships, Reinforcement Management, Stimulus Control, and Counter Conditioning, represented behavioral strategies. The 4-item behavioral strategy assessing Self Liberation did not form a separate component in this study. Two of its items loaded on Counter Conditioning and the other two items loaded on Self-Reevaluation. However to maintain consistency with past research on the Transtheoretical Model and the processes of change as applied to exercise, which has identified Self-Liberation as a separate process (Marcus, Rossi, et al., 1992), a separate composite score was formed for this.
construct despite some overlap with other processes of change. Coefficient $\alpha$ for each of the subscales ranged from .68 for Social Liberation to .89 for Counter Conditioning. Coefficient $\alpha$ for Self-Liberation was .83.

The **Physical Self-Perception** measure is from the Physical Self-Perception Profile scale (PSPP: Fox, 1990). The PSPP typically has five components measuring general Physical Self-Worth and four subdomains of Sport Competence, Physical Condition, Attractive Body and Strength. However, in this study a principal components analysis revealed four components assessing (1) **Sports Competence** (e.g., "some people feel that they are among the best when it comes to athletic ability"; $\alpha = .70$); (2) **Attractive Body** (e.g., "some people feel that compared to most, they have an attractive body"; $\alpha = .70$); (3) **Strength** (e.g., "some people feel that they are very strong and have well-developed muscles compared to most people $\alpha = .70$); and (4) **Doubt** (e.g., "some people tend to lack confidence when it comes to their physical strength"; $\alpha = .70$). Participants are asked to choose which of two contrasting statements is most like themselves, and are then asked to rate whether that description is "sort of true" or "really true" of them. Item scores ranged from one to four.

Though not typically considered a separate component of the PSPP, the Doubt construct has been identified in previous research (e.g., Sonstroem, Harlow, Gemma, & Osborne, 1991).
Self-Efficacy is a composite score derived from the average of five items measuring one's confidence in being able to participate in exercise in certain situations such as when one is "tired" or "on vacation" (Marcus, Selby, et al., 1992). Coefficient α in this study was .76.

The measure of Stress is an average of 19 items from an adaptation of Cohen, Kamarck, & Mermelstein's Perceived Stress Scale (1983) by Fava, Grimley, & Ruggiero (1992). Participants were asked to respond on a Likert scale ranging from 1 = Never to 5 = Frequently, how often in the past 3 months they felt "unable to cope with difficult situations" or overwhelmed by their problems. Coefficient α for this scale was calculated at .80.

Demoralization about one's exercise situation is a composite score formed from the average of 12 items from Harlow's (1990) Demoralization Scale. It consists of two subscales of six items each that measure components of distress and subjective competence. The distress subscale, consisting of items such as "I often fail to meet my own expectations regarding exercising", was found to have acceptable internal consistency (α = .77). The subjective competence subscale, including items such as "when faced with a dilemma about exercising, I usually know what to do", was found to have good internal consistency (α = .84).

Powerlessness is an average score of five items derived from a three-item Perceived Loss of Control scale developed by Newcomb & Harlow (1986). For this study, all items were
adapted to be specific to exercise. Participants were asked to rate their degree of agreement with items including "I feel I am not in control of my exercise life" and "I feel stuck where I am with my exercise situation". Coefficient α for the five-item scale was calculated at .70.

The Positive and Negative Affect Schedule (PANAS Scales: Watson, Clark, & Tellegen, 1988) was used in this study to assess Mood. It consists of 20 items total assessing both positive and negative general affect. Coefficient α for positive and negative affect (asking participants to recall over the past six months) was calculated at .90 and .86, respectively.

The Perceived Benefits of exercise measure consists of 29 items from Sechrist, Walker, & Pender's (1987) Exercise Benefits scale and three items from a scale measuring pros of exercise (Marcus & Owen, 1992). This scale assesses potential advantages of exercise by asking participants to respond on a four-point Likert scale how much they agree with statements such as "exercise makes me sleep better" and "exercising gives me a sense of personal accomplishment". A PCA conducted in this study revealed 3 components measuring Physical Benefits consisting of 13 items (e.g., "Exercise improves my muscle tone"; α = .94), Emotional Benefits with 13 items (e.g., "Exercise reduces stress and tension"; α = .93), and Social Benefits with five items (e.g., "Exercise allows me to have more contact with friends"; α = .82).
Coefficient alpha for the scale as a whole was found to be quite high at .96.

**Social Support for Exercise**, adapted from Sallis, Grossman, et al. (1987), consists of three subscales: one is the average of seven items measuring Active Family Support (e.g., "exercised with me"); one is the average of five items assessing Indirect Family Support (e.g., "discussed exercise with me"); and the third is the average of five items assessing Peer Support for exercise (e.g., "gave me encouragement to stick with my exercise program"). Internal consistency, as measured by coefficient α, was found to be .91 for Active Family Support, .86 for Indirect Family Support, and .91 for Peer Support. Two other single item measures of (1) number of family members who exercise regularly and (2) number of friends who exercise regularly were included as measures of social support. Scores on these variables ranged from 1 = None, to 5 = All.

**Social Pressure** is a two component extension of the Social Support Scale, added for use in this study, that asks how often in the past six months has a friend or family member discouraged the participant from exercising, or made fun of the participant for exercising. Each component consisted of two items. Coefficient α for Peer Pressure and Family Pressure was .55 and .66, respectively.

**Number of Cigarettes Smoked Per Day** is a single item, derived for use in this study, that asks participants how
many cigarettes they smoke a day. Responses ranged from 1 = None, to 5 = 40 or more.

**Age Began Exercising** is also a single item, derived for use in this study, that asks participants at what age they began exercising regularly. Scores on this item ranged from 1 = Never exercised regularly, to 5 = Age 21 or older.

For a complete list of the individual items used to derive the clustering variables as well as the dependent variables, see Appendix A.

**Analyses**

Three sets of analyses were conducted on each half of the sample. First, descriptive statistics were provided for all measured variables.

Second, cluster analyses were conducted to determine the number of relapse "types". Clustering methods which seek to classify entities into groups, based upon their degree of similarity, first became popular in 1963 with Sokal and Sneath's publication of *Principles of Numerical Taxonomy*. Used extensively in the biological sciences, cluster analysis has recently gained popularity in the social sciences (Blashfield & Aldenderfer, 1978). In this study, cluster analysis was used to identify "types" of relapsers based upon similarities in participants' exercise level, frequency of relapse, and stated reasons for relapsing from exercise.

A hierarchical agglomerative clustering method, used most often in research employing cluster analytic procedures
Hierarchical agglomerative methods search an $N \times N$ similarity or distance matrix (where $N$ = the number of persons or entities), and combines similar cases into clusters (Aldenderfer & Blashfield, 1984). The process by which similar cases are merged can be viewed in a dendogram, a tree-like diagram in which each branch represents the combination of two cases. The clusters that are formed are non-overlapping, but each cluster may be considered part of a larger, more inclusive cluster. That is, individual cases are organized into a hierarchy of clusters.

Hierarchical agglomerative methods differ in the type of similarity measures (linkage methods) used to merge cases. Two linkage methods, Ward's (Ward, 1963) and average linkage (Sokal & Michener, 1958), were examined to verify findings. In both methods, a squared Euclidean distance measure was employed. These methods were chosen based upon their general superiority over other linkage methods in their ability to recover known cluster structure in Monte Carlo studies (e.g., Kuiper & Fisher, 1975; Milligan, 1980). Both methods tend to provide similar results since they are based upon the same algorithm that determines the distance between participants' scores and a cluster (Lance & Williams, 1967). All cluster analyses were conducted using the SAS PROC CLUSTER statistical computing package (SAS, 1985).
Third, ten MANOVAs were conducted to assess the external validity of the different types of relapsers using several sets of external variables. The independent variable was type of relapser, with several levels determined from cluster analyses. It was expected that there would be approximately five types of relapsers (see Table 1).

The dependent variables for each of the ten MANOVAs, organized into conceptually cohesive sets, included: 1) Exercise Self-Efficacy and Temptations to Skip Exercise; 2) five cognitive-experiential processes of change; 3) five behavioral processes of change; 4) physical self-perceptions of Sports Competence, Body Attractiveness, Strength, and Doubt; 5) Demoralization, Powerlessness, and Stress; 6) Positive and Negative Affect; 7) Physical, Emotional, and Social Benefits of exercise and Cons associated with exercise; 8) social support variables of Active and Indirect Family Support, Peer Support, Number of Friends Who Exercise, and Number of Family Members Who Exercise; 9) social pressure variables of Family and Peer Pressure to not exercise; and 10) Number of Cigarettes Smoked per day and Age Began Exercising. It was expected that group differences would emerge on the above-mentioned external variables.

Follow-up ANOVAs and Tukey tests were conducted for each significant MANOVA, with alpha levels set at .01 to reduce the potential for Type I error associated with multiple analyses. In addition, Discriminant function analyses (DFA) were conducted as a follow-up to significant MANOVAs in
order to assess which variables contributed most to group differences.

Finally, since typologies produced by cluster analysis may be unstable across samples, the results from the first sample were replicated in the second sample. This strengthens the reliability and validity of the resulting cluster solution.

Results

Means and standard deviations for all measured variables for both Samples 1 and 2 are provided in Table 2.

Insert Table 2 about here

Participants in both samples were characterized as being quite active on average, but appeared to have a tendency to relapse often. Across samples, participants reported having relapsed an average of 4-6 times in a six month period, and provided mainly situational reasons for their relapse.

Initial Cluster Analyses

In both samples, the five clustering variables were standardized as z-scores with a mean of zero and a standard deviation of one to prevent unequal weighting of the variables in the analysis (Aldenderfer & Blashfield, 1984). Both Ward's method and average linkage were used to obtain 2-6 cluster solutions. Assessment of the plot of the cubic clustering criterion, a numerical value calculated at each step in the clustering process (SAS, 1985), against the
number of clusters, as well as an examination of the content and patterns of means across samples indicated that a three cluster solution appeared appropriate. These clusters represented (1) maintainers; (2) relapsers; and (3) non-exercisers. No distinct types of relapsers were revealed.

With the variables used in this analysis, it appeared that all relapsers were grouped into an "average relapser" cluster. However, since it was expected that several different types of relapsers would emerge, the analyses were revised and reconducted. It was believed that a more narrow range of variables assessing relapse would provide a finer, more accurate breakdown of this group of relapsers. For this reason, Current Exercise Level, a general measure of exercise not as specific to relapse, was dropped and the analyses were conducted using four clustering variables measuring frequency of relapse, and personal, situational, and injury reasons for relapse. It was decided that Current Exercise Level would be used as a dependent variable in a general measures follow-up MANOVA, along with Number of Cigarettes Smoked Per Day and Age Began Exercising, to assess mean differences in exercise level across the obtained clusters. The results of these analyses are presented below. Results obtained using Ward's (1963) linkage method will be presented followed by the results that were obtained using the average linkage method (Sokal & Michener, 1958).
Ward's Linkage Results

Data indicated that a four cluster solution appeared appropriate. The four "types" of relapsers were labeled based upon mean levels of relapse frequency and reasons for relapse. Graphs of the means of the four clusters on the four clustering variables are presented for both samples in Figures 1 and 2, respectively.

Cluster 1 participants reported having not relapsed at all in the past 6 months on all four of the clustering variables, and were labeled as Maintainers. The average percentage of participants classified as maintainers across both Samples 1 and 2 was 10%.

Participants in Cluster 2 (39% across both samples) were characterized as Current Non-Exercisers. These participants reported having not exercised regularly in the past six months, and provided mainly situational reasons for their not being involved in a regular program of exercise.

Cluster 3 participants (41% across both samples) were labeled Occasional Relapsers. They reported relapsing 1-3 times for a week or more in the past six months. Occasional Relapsers gave both situational and injury reasons for their relapse, but were not noted by high levels of any of the three reasons for relapse.
Cluster 4 participants reported having relapsed several times (at least four times) in the past six months. They reported high situational reasons for relapsing, and unlike any of the other clusters, they also reported high personal and injury reasons for relapsing. These participants were labeled as Frequent Relapsers, and consisted of an average of 10% of the two samples.

**Staging of Exercise Relapse Types**

Crosstabulations for stage by exercise relapse type were calculated in each sample. In Sample 1, the majority of Maintainers (69%) were classified as being in the maintenance stage. Two other Maintainers reported being in action, and two others were classified as being in preparation and relapse, respectively. Most Occasional Relapsers also considered themselves to be in the maintenance stage (59%) despite reporting relapsing an average of 1-3 times for a week or more in six months. Twenty percent reported being in action, and another 20% reported being in relapse. One Occasional Relapser indicated being in Preparation. Out of the 11 Frequent Relapsers that were staged, 7 indicated that they were in relapse, two indicated that they were in action, and one reported being in the preparation stage.

Interestingly, Current Non-Exercisers were more likely to describe themselves as relapsers (71%) rather than sedentary or in preparation to begin a regular exercise program. Only 15% reported being in precontemplation,
contemplation, or preparation, and 13% described themselves as being in action or maintenance. It may be that those who are currently non-exercising prefer to view themselves as being regular exercisers who have relapsed rather than as completely sedentary individuals. However, as follow-up tests reveal below, they tended to have profiles similar to those of precontemplators or contemplators (e.g., low self-efficacy, little use of any of the processes of change).

It is also interesting to note that only 9% of Sample 1 who could be staged classified themselves as being either in precontemplation, contemplation, or preparation. This contradicts the fact that 90% of the full sample (N = 120) were in clusters distinguished by at least one relapse for a week or more in the past six months.

Crosstabulations for Sample 2 revealed a very similar staging pattern to that obtained in Sample 1. Once again, the majority of Maintainers (75%), and most Occasional Relapsers (55%), classified themselves as being in maintenance. In addition, Current Non-Exercisers were more likely to describe themselves as being in relapse (68%) as opposed to being sedentary or in preparation. Similar to Sample 1, only 11% of Sample 2 participants who could be staged classified themselves as being either in precontemplation, contemplation, or preparation. Again this occurred in light of 91% of the full sample (N = 118) being in clusters that were distinguished by at least one relapse for a week or more in the past six months.
The only difference in staging between samples occurred for Frequent Relapsers. In Sample 1, most Frequent Relapser classified themselves as relapsers, but in Sample 2, only three of 11 Frequent Relapsers considered themselves to be relapsers. Five considered themselves to be in maintenance, and two more considered themselves to be in action, despite an average of four or more relapses in the past six months. One Frequent Relapser was staged as a precontemplator.

Thus, it would appear that there is not a clear-cut staging of types of relapsers. Very few participants who could be considered sedentary or irregular exercisers, based upon the obtained clusters, actually labeled themselves as such. In addition, a large number of participants considered themselves to be in the maintenance stage despite reporting relapsing at least once. Though some caution in interpreting the staging results is advised due to the inclusion of other clustering variables (e.g., reasons for relapse) that influenced the placing of participants in different clusters, and the potential weaknesses involved in the staging items used in this study (see Reed, 1993), some interesting patterns were noted. As indicated above, relapse (especially occasional) does not seem to influence how participants perceive themselves as exercisers, and most appear reluctant to see themselves as non-exercisers.

External Validation

Several one-way MANOVAs were conducted in both samples to externally validate the four clusters resulting from the
cluster analyses. Type of exercise relapser, with four levels of 1) Maintainer, 2) Current Non-Exerciser, 3) Occasional Relapser, and 4) Frequent Relapser, served as the independent variable. The results are presented in Table 3.

The MANOVAs revealed significant differences between exercise relapse types for both samples on all but one MANOVA. The MANOVA assessing Social Pressure (to not exercise) was significant in Sample 2, but not in Sample 1. Across both samples, significant differences were found for 1) Self-Efficacy and Temptations to Skip Exercise; 2) Cognitive-Experiential Processes; 3) Behavioral Processes; 4) Physical Self-Perceptions; 5) Psychosocial Attitudes; 6) Affect; 7) Benefits and Cons of Exercise; 8) Social Support; and 9) General Measures. The proportion of explained variance (measured by 1 - Wilks lambda: Λ) by type of exercise relapser was substantial in all of the MANOVAs, ranging from 14% for Affect in Sample 2 to 64% for Behavioral Processes in Sample 1. The average effect size, in terms of proportion of variance accounted for, in both Samples 1 and 2 was 36% and 28.5%, respectively.

Follow-up ANOVAs and Tukey tests were also conducted for each significant MANOVA. Tables 4 and 5 provide these results for Samples 1 and 2, respectively.
Significant differences between exercise relapse types were found across samples for several variables. In both samples, Self-Efficacy was found to be higher in Maintainers than in the other types of relapsers. Occasional Relapsers also showed higher levels of Self-Efficacy than Current Non-Exercisers and Frequent Relapsers in Sample 1 and Current Non-Exercisers in Sample 2. In addition, Current Non-Exercisers and Frequent Relapsers reported greater Temptations to Skip Exercise in certain situations than did Maintainers or Occasional Relapsers.

Relatively few significant differences were found among relapse types in both samples in their use of cognitive-experiential strategies to assist them in maintaining a regular program of exercise. In Sample 1, both Maintainers and Occasional Relapsers report greater use of Consciousness Raising than Current Non-Exercisers and Frequent Relapsers. In addition, Occasional Relapsers indicated greater use of Dramatic Relief than Frequent Relapsers. Despite a significant overall MANOVA, none of the cognitive-experiential processes of change were significant at the p<.01 level in Sample 2.

In contrast, use of behavioral strategies to assist in maintaining a regular program of exercise varied widely across types of relapsers. Maintainers in both samples...
showed greater use of Self-Liberation than all three other exercise relapse types, and Occasional Relapsers reported using this strategy more than Current Non-Exercisers. Stimulus Control and Counter Conditioning were reportedly used to greater extent by Maintainers and Occasional Relapsers than by either Current Non-Exercisers or Frequent Relapsers. In addition, both Maintainers and Occasional Relapsers reported greater use of Reinforcement Management than Current Non-Exercisers. Finally, significantly greater use of Helping Relationships was reported by Occasional Relapsers than Current Non-Exercisers in Sample 1, but this did not replicate in Sample 2.

Thus, it would appear that both Maintainers and Occasional Relapsers use these behavioral strategies most to maintain regular exercise. Frequent Relapsers appear to use these strategies to a lesser extent, while Current Non-Exercisers report relatively little use of them at all. The lack of significant differences among relapse types in the use of the cognitive-experiential strategies relative to behavioral strategies is not surprising given that so few participants stage themselves as being precontemplators, contemplators, or in preparation to begin a regular program of exercise. Past research has found that use of the processes is related to one's current stage of change (DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, & Rossi, 1992; Prochaska, Velicer, Guadagnoli, Rossi, & DiClemente, 1991). There is less use of cognitive-

Across both samples, Current Non-Exercisers appeared to have more negative self-perceptions about their physical abilities. They reported lower Sports Competence, lower perceptions of physical Strength, and greater Doubt in their physical ability to exercise than Maintainers or Occasional Relapsers. Frequent Relapsers also reported lower perceived Sports Competence than Occasional Relapsers.

In this study, Demoralization about one's exercise situation appeared to be a strong attribute of Current Non-Exercisers and Frequent Relapsers. It accounted for a large percentage of the variance in types of relapsers across both samples (43% in Sample 1 and 31% in Sample 2). In Sample 2, Frequent Relapsers indicated greater perceived Powerlessness about their exercise situation than did Maintainers or Occasional Relapsers, however, in Sample 1, no significant differences in perceived Powerlessness were found between relapse types. General life Stress was not found to be significant in either sample. In Sample 1, those who exercise regularly show higher levels of Positive Affect than Current Non-Exercisers. Even Frequent Relapsers reported higher levels of Positive Affect than those who did not exercise regularly at all in the past six months. In Sample 2, though, Maintainers showed greater Positive Affect
than both Non-Exercisers and Frequent Relapsers, and Occasional Relapsers reported greater Positive Affect than Current Non-Exercisers, but Current Non-Exercisers were not significantly different from Frequent Relapsers.

Frequent Relapsers reported greater Cons of exercise than Occasional Relapsers, Maintainers, and even Current Non-Exercisers in both samples. In addition, in Sample 1, Frequent Relapsers and Current Non-Exercisers perceived fewer Emotional and Social Benefits of Exercise than Maintainers or Occasional Relapsers, but this did not replicate in Sample 2.

Active Family Support for regular exercise was the only variable assessing social support that was significant across both samples. In Sample 1, Occasional Relapsers reported a higher level of Active Family Support than Non-Exercisers. Interestingly, in Sample 2, Frequent Relapsers reported greater Active Family Support than did Occasional Relapsers and Current Non-Exercisers. Also of interest in Sample 2 is the fact that Frequent Relapsers also reported significantly higher pressure from family members to NOT exercise. It may be that while some family members may share their interest in exercise, others may at times discourage them from exercising.

Several social support measures, in addition to Active Family Support, were also significant in Sample 1. Both Maintainers and Occasional Relapsers reported having more friends who exercise and greater Peer Support than Frequent
Relapsers or Current Non-Exercisers. Occasional Relapsers also reported greater Indirect Family Support than Frequent Relapsers or Current Non-Exercisers.

Finally, across both samples, Maintainers reported a significantly higher Current Exercise Level than any of the other three relapse types. Occasional Relapsers reported a higher Current Exercise Level than Current Non-Exercisers, and, in Sample 2, reported beginning a regular program of exercise at an earlier age than Current Non-Exercisers. No significant differences were found between relapse types for the number of cigarettes smoked per day in either sample. The latter result may be due to a floor effect for the mean level for cigarette smoking. Means were very low across clusters indicating that, on average, participants were nonsmokers. In addition, this finding is consistent with past research that has often found little or no relationship between cigarette smoking and exercise (Blair, 1988).

**Discriminant Function Analyses (DFA)**

In order to identify which variables contributed most to significant differences among exercise relapse types, a series of follow-up DFAs were conducted for each significant MANOVA. Absolute structure coefficients, a measure of the correlation between a variable and its discriminant function, are provided for each DFA for Samples 1 and 2 in Table 6.
The absolute structure coefficients revealed that the variables that contributed most to significant difference among exercise relapse types varied somewhat across samples. Variables that differentiated best among types for each DFA in Sample 1 included Self-Efficacy, Consciousness Raising, Counter Conditioning, Sports Competence, Demoralization, Positive Affect, Emotional Benefits of exercise, Peer Support, and Current Exercise Level. In Sample 2, the variables that contributed most to significant differences among relapse types were Temptations to Skip Exercise, Self-Reevaluation, Self-Liberation, Doubt (about one's physical abilities), Demoralization, Positive Affect, Cons of exercise, Active Family Support, Family Pressure, and Current Exercise Level.

**Average Linkage Results**

The same cluster analyses that were run for both samples using Ward's (1963) method were conducted. The only difference was that average linkage (Sokal & Michener, 1958) was used as the clustering method. Assessment of the plot of the cubic clustering criterion (SAS, 1985) against the number of clusters, as well as an examination of the content and patterns of means across samples indicated that, similar to Ward's method, a four cluster solution appeared to be the most appropriate. However, the clusters did not replicate as
well across samples, and mean levels on the reasons for relapse variables differed somewhat from those found using Ward's method. These differences are noted below.

As with Ward's method, the four obtained "types" of relapsers were labeled based upon mean levels of relapse frequency and reasons for relapse. Graphs of the means of the four clusters on the four clustering variables are presented for both samples in Figures 3 and 4, respectively.

Cluster 1 was very similar to that obtained using Ward's method, and replicated well across samples. Cluster 1 participants reported having not relapsed at all in the past 6 months on all four of the clustering variables, and were labeled as Maintainers. The average percentage of participants classified as maintainers across both Samples 1 and 2 was 10%.

Participants in Cluster 2 were characterized as Personal Relapsers in Sample 1. These participants reported having relapsed an average of four or more times in the past six months, and provided mainly personal reasons for their inability to maintain a regular program of exercise. Only five participants were classified into this cluster.

In Sample 2, the Personal Relapsers cluster did not replicate. Instead, participants in Cluster 2 were labeled as Current Non-Exercisers. The four participants classified
into this cluster all reported not having exercised regularly at all in the past six months, and gave both high personal and situational reasons for not exercising.

The majority of Cluster 3 participants across both samples (73% and 84% of Samples 1 and 2, respectively) were classified into Cluster 3. These participants were labeled Frequent Relapsers. They reported relapsing an average of four or more times for a week or more in the past six months. Frequent Relapsers gave both situational and injury reasons for their relapse.

Cluster 4 participants reported having relapsed several times (up to seven or more times) in the past six months. Across both samples, they reported predominantly injury reasons for relapsing. These participants were labeled as Injury Relapsers, and consisted of 17 participants in Sample 1, but only 5 participants in Sample 2.

These results indicate an unreliable grouping of participants into clusters across samples. Clusters obtained using average linkage did not replicate well across samples which is of critical importance in validating cluster analysis results given the subjective nature of available methods of deciding on a final cluster solution. (Lorr, 1966). Furthermore, the average linkage method appeared to group most participants into a general high frequency relapse cluster rather than breaking them down into types of relapsers. Given these problematic results, evaluation of how these clusters were externally validated using MANOVA,
and how the obtained results compared to the MANOVA results from clusters obtained with Ward's method, was crucial to determining the most valid clustering method for this study.

**External Validation**

The MANOVAs on the clusters formed from average linkage revealed fewer significant differences between exercise relapse types in both samples than were found between the Ward's method clusters. Across both samples, significant differences were found for only five of ten MANOVAs. They included: 1) Self-Efficacy and Temptations to Skip Exercise; 2) Cognitive-Experiential Processes; 3) Behavioral Processes; 4) Psychosocial Attitudes; and 5) Affect. In Sample 1, significant differences were also found for Benefits and Cons of Exercise, and in Sample 2, significant differences were also found for Physical Self-Perceptions and Social Pressure. MANOVA results are presented in Table 7.

Insert Table 7 about here

Finally, the proportion of variance accounted for (measured by \( 1 - \text{Wilks lambda: } \Lambda \)) by type of exercise relapser was smaller than that obtained with the Ward's method clusters. It ranged from 11% for Social Pressure in Sample 2 to 33% for Behavioral Processes in both Samples 1 and 2. The average effect size, in terms of proportion of explained variance in both Samples 1 and 2 was 22%. Though
the lack of significant MANOVAs for the clusters obtained using average linkage could potentially be due to a lack of statistical power resulting from small and unequal cell sizes, effect sizes were still smaller across MANOVAs in both samples.

Follow-up ANOVA and Tukey test results for the two samples are provided in Tables 8 and 9. There were few significant ANOVAs at the p<.01 level in both samples with the average linkage clusters.

Insert Tables 8 and 9 about here

In Sample 1, significant differences were found between exercise relapse types for Emotional Benefits, Cons of Exercise, Self-Efficacy, Temptations to Skip Exercise, Demoralization, Powerlessness, Self-Liberation and Counter Conditioning. Maintainers tended to perceive greater Emotional Benefits of exercise, have greater Self-Efficacy, and greater use of Self-Liberation and Counter Conditioning strategies than other exercise relapse types. Maintainers also reported fewer Temptations to Skip Exercise, and lower Demoralization and Powerlessness than the other clusters. Though the overall MANOVA F-value for Affect and Cognitive-Experiential Processes was significant, none of the follow-up ANOVAs on the individual variables was found to be significant at the p<.01 level.
In Sample 2, significant differences were found between exercise relapse types for Self-Efficacy, Temptations to Skip Exercise, Demoralization, Doubt, Self-Liberation, Stimulus Control, and Counter Conditioning. Similar to Sample 1, Maintainers tended to use behavioral processes, including Self-Liberation, Stimulus Control, and Counter Conditioning, to a greater extent than other exercise relapse types. They also reported greater Self-Efficacy, fewer Temptations to Skip Exercise, and lower Demoralization and Doubt than the other clusters. Despite a significant overall MANOVA F-value for Affect, Social Pressure and Cognitive-Experiential Processes, none of the follow-up ANOVAs on the individual variables was found to be significant at the p<.01 level.

Ward's versus Average Linkage Methods

There are several potential reasons as to why the two clustering methods used in this study (Ward's and average linkage) did not provide identical cluster solutions. The first is based upon how individuals are assigned to clusters. Though based upon the same clustering algorithm, each method employs a slightly different criteria for assignment to a particular cluster. Ward's (1963) method attempts to minimize the within-cluster error variance by joining together only those individuals who result in the least increase in the error sum of squares. Average linkage (Sokal & Michener, 1958), on the other hand, calculates an average of the similarity of a case under consideration with
all other cases in an existing cluster, and joins that case to the cluster if the average value achieves a certain level of similarity.

A second source of different cluster solutions may be the biases inherent to each of the particular clustering methods. While both methods have been said to be superior to other methods in their ability to recover known latent cluster structure (e.g., Kuiper and Fisher, 1975; Milligan, 1980), they have been found to have some biases. Ward's linkage method tends to identify clusters of equal size, and average linkage tends to form large clusters along with several smaller heterogeneous clusters of outliers unlike other cases (Edelbrock, 1979; Williams, Clifford, and Lance, 1972). These biases are evident in the results obtained in this study. Whereas Ward's method tended to identify clusters of somewhat equal size, average linkage tended to group most individual into a large general relapse category with a few small clusters representing other relapse types.

A third factor that may affect clustering methods differentially is the degree of overlap among clusters. If overlap among clusters is present, Ward's method has been found to be the superior of the two methods in recovering known cluster structure (Milligan, 1980). Unfortunately, the only way to know for sure that clusters overlap is to know the true latent cluster structure. This is impossible in applied empirical studies, as opposed to simulation studies.
where data is generated based upon a known latent cluster structure.

Since different clustering methods can and do provide different clustering solutions, as is shown in the current study, identifying which solution is closest to the true structure is difficult. At this point, replication and external validation become important. Replication across samples, as well as external validation through the identification of meaningful differences between clusters on a number of theoretically relevant external variables, are necessary to identify the "best" cluster solution for a particular study (Blashfield, 1980; Lorr, 1966). Given that average linkage cluster results did not replicate across samples, there were fewer significant MANOVAs, and effect sizes were smaller for the average linkage cluster solution, it would appear as though Ward's (1963) linkage method provided the most reliable and meaningful cluster solution in this study. Two key requirements in determining a final cluster solution, replication and external validation, were met by the Ward's cluster solution. This provides a strong basis for choosing Ward's method over average linkage in this study. For this reason, the discussion will focus on the final cluster solution obtained using Ward's clustering method.

Discussion

Cluster analyses, using Ward's (1963) clustering method across two independent samples, revealed four exercise
relapse types representing maintainers, occasional relapsers, frequent relapsers, and current non-exercisers. Across both samples, the largest group of participants were classified as occasional relapsers (41%), followed by current non-exercisers (39%), frequent relapsers (10%), and Maintainers (10%). Occasional relapsers reported relapsing an average of 1-3 times for a week or more over a six-month period, and had mostly situational and injury reasons for relapse. Current non-exercisers indicated that they did not exercise regularly in the past six months, and cited mainly situational reasons for not exercising regularly. Frequent relapsers were noted by very high reasons for relapsing in all three categories (personal, situational, and injury). In particular, they indicated greater personal reasons for relapsing than any other type of relapser. These participants reported an extremely high frequency of relapse, indicating at least four relapses for a week or more in a six-month period. Finally, maintainers reported exercising regularly, without relapsing at all, in the past six months.

External validation on a number of attitudes and behaviors drawn mainly from three major theories of exercise behavior: 1) the Relapse Prevention Model (e.g., Marlatt & Gordon, 1985); 2) the Transtheoretical Model (e.g., Prochaska & DiClemente); 3) and Physical Self-Perceptions from Fox & Corbin's (1989) hierarchical self-esteem model; in addition to psychosocial/mood characteristics and other
theoretically meaningful variables; revealed important differences across these types of exercise relapsers. Across both samples, type of exercise relapser accounted for a substantial proportion of the variance in almost all of the behaviors and attitudes assessed.

In both samples, Maintainers and Occasional Relapsers tended to exercise more and use behavioral processes more often to help them maintain a regular program of exercise. In addition, they generally showed higher levels of self-efficacy and positive affect, lower levels of demoralization and powerlessness, perceived greater benefits and fewer cons of exercise or temptations to skip exercise, had more social support for exercise, and had more positive physical self-perceptions than either Frequent Relapsers or Current Non-Exercisers.

When they did relapse, occasional relapsers attributed it their situation, and not to some weakness within themselves. Situational reasons such as time constraints could potentially stop, for a period of time, an individual who normally exercises regularly. This may be particularly true for college students who may feel more or less pressure on their time depending upon their course load. As a result, occasional relapsers may feel forced at times to stop exercising temporarily, and may quickly return to regular exercise when their situation changes. The results of this study would indicate that occasional relapse may not be problematic. Occasional relapsers did not differ much from
maintainers in their behavior or attitudes nor did they perceive themselves to be anything less than regular exercisers despite an occasional week off.

Frequent Relapsers and Current Non-Exercisers, on the other hand, showed a greater number of problems and poorer well-being when compared to Maintainers and Occasional Relapsers. They reported fewer benefits of exercise, lower self-efficacy, greater demoralization, and greater temptations to skip exercise. They had fewer friends who exercise, less peer and indirect family support for exercise, and reported less use of both cognitive-experiential and behavioral strategies to help them exercise regularly.

Although Frequent Relapsers and Maintainers had many common characteristics, they were slightly different on some other behaviors and attitudes. Overall, it would appear as though Frequent Relapsers were making a stronger attempt at exercising regularly in terms of not being significantly different from other relapse types in their use of some of the behavioral processes, and in their exercise level. However, their tendency to relapse frequently appears to have left them discouraged. In both samples, they reported greater cons of exercise than even Current Non-Exercisers, and in Sample 2, reported greater powerlessness over their exercise situation.

Interestingly though, it also seems as though Frequent Relapsers do not appear to be quite as discouraged as
Current Non-Exercisers. In both samples Current Non-exercisers indicated significantly lower perceived physical strength and greater doubt in their physical ability than Maintainers and Occasional Relapsers. In contrast, Frequent Relapsers did not differ significantly from any of the other types of relapers on these measures. In addition, Frequent Relapsers showed significantly greater positive affect than Current Non-Exercisers. Whereas Current Non-Exercisers were significantly worse off than any of the other relapse types on virtually all significant measures across samples, Frequent Relapsers were, in some cases, not significantly different from other relapse types. This seems to indicate that even though Frequent Relapsers are unhappy with their current exercise situation, they are not quite as discouraged as Current Non-Exercisers. Most Current Non-Exercisers do not consider themselves to be totally sedentary, but rather report being in relapse for the entire six months. This represents long-term drop-out and may be a reflection of their deep discouragement. Frequent Relapsers, on the other hand, seem to relapse often, but for shorter periods of time, after which they attempt to begin exercising regularly again.

Results from this study indicate that Frequent Relapsers may be at a very high risk for longer-term relapse similar to that reported by Current Non-Exercisers. Not only do they tend to make more personal attributions for their relapse, but they also seem to be very discouraged by their
exercise situation. Each relapse experience may discourage Frequent Relapsers even more and bring them closer to giving up for longer periods of time or quitting altogether.

The finding that occasional relapsers are more like maintainers, and less like frequent relapsers or non-exercisers, in their behaviors and attitudes may have implications for how relapse from exercise, and perhaps how relapse in other behaviors, is viewed. In the addictions, relapse is often viewed as an all or nothing phenomena. For instance, in treatment of addictive behaviors such as smoking or alcohol use, the push is often for complete abstinence. Any return to smoking or alcohol use is considered highly undesirable, and those who do return for a period of time to the negative behavior are often considered, and often consider themselves, failures. It may be that advocating complete adherence to exercise is a potentially unrealistic goal, particularly since it would appear that an occasional relapse may not be a problem. Exercise is an acquisition behavior that requires almost daily effort and planning, and an occasional relapse may be inevitable. This may be particularly true when the relapse is attributed to the situation rather than to shortcomings within the individual. Perhaps then, interventions to help individuals establish a regular program of exercise should emphasize that an occasional situational relapse is acceptable and should be expected, rather than to push for absolute adherence. Instead of being considered drop-outs or
failures, occasional relapsers should be taught to accept occasional relapse as part of the process of regular exercise, and to not become discouraged. It seems as though occasional relapse does not necessarily indicate a step backward, and thus should not always be perceived as such. Implications for Intervention

The identification of different types of exercise relapsers, and the differences among these types in their endorsement of certain behaviors and attitudes relevant to exercise, indicates that different interventions may be necessary to address the specific needs of each type of relapser. Maintainers may benefit from an minimal approach that allows them to continue to deal effectively with situations that may put them at risk for relapse, and that teaches them to accept occasional relapse as a likely, but far from devastating, occurrence in the process of maintaining a regular program of exercise. Occasional relapsers may benefit from an intervention with components similar to that of maintainers, but with a slightly stronger emphasis. Occasional relapsers cited primarily situational reasons for their relapse. For this reason, an intervention may include ways to manage time and to change one's environment to make exercising an easier part of an individual's routine. This may minimize the frequency and duration of the occasional relapse. Such an intervention would also encourage individuals to strive for adherence, but to accept occasional relapse as it may occur, and to not
become discouraged by it. This is consistent with Marlatt and Gordon's (1980, 1985) Relapse Prevention Model findings for addictive behaviors. They report that relapse may even be beneficial if the individual does not view it as total failure.

Frequent relapsers may need a more intensive approach that focuses on increasing exercise self-efficacy, ways to cope with situations that may put them at risk for relapse, greater use of both cognitive-experiential and behavioral strategies to avoid relapse, and minimizing personal attribution and discouragement when relapse occurs. Of key importance is providing frequent relapsers with the skills necessary to minimize feelings of demoralization and powerlessness to maintain a regular program of exercise.

Current non-exercisers, on the other hand, may need a more motivational approach to get them involved in regular exercise again. A critical aspect in this type of intervention would be that the intervention not set goals that may seem overwhelming to participants. Most current non-exercisers seem to identify themselves as being regular exercisers in the past, but currently in long-term relapse. This group reports being extremely demoralized by their exercise situation, and at this point, see very few benefits of exercise. Furthermore, it would appear as though they have all but given up on regular exercise. Thus, current non-exercisers may benefit most from a basic motivational approach, such as motivational interviewing (DiClemente,
1991), to help them identify potential benefits of exercise, and to motivate them to try again. Other strategies for motivating individuals to begin and adhere to exercise are summarized by Brawley and Rodgers (1993). Once an attempt to work at a regular program of exercise is made, components of other more advanced interventions, such as coping with high-risk situations, and reducing feelings of discouragement associated with occasional setbacks can be added to the intervention.

It may be argued that many of the intervention components mentioned above have already been employed to reduce the probability of relapse from exercise with only modest success (e.g., King & Frederiksen, 1984; King, Taylor, Haskell, & Debusk, 1990). However, the difference, and major weakness of previous interventions, is that they have been applied uniformly to groups of individuals without addressing the specific needs of different types of relapsers. As a result, mismatches between an individual's needs and the intervention approach may occur, thus limiting the effectiveness of the intervention. The identification of types of relapsers, and the subsequent tailoring of interventions to meet their needs, may improve the likelihood of long-term adherence to regular exercise.

Study Limitations and Directions for Future Research

There are several limitations of the present study that limit generalizability. The most important is the type of analysis used to classify individuals. As mentioned before,
different clustering methods often provide different cluster solutions, and the current methods for determining the "correct" cluster solution are highly subjective. The fact that the Ward's cluster solution replicated across two samples and was externally validated in both samples is a major strength of this study, and improves confidence in the validity of the obtained cluster solution. However, cluster analysis is largely a descriptive technique, and the reader is reminded that results should be interpreted as mainly exploratory. This is especially true given the weaker findings obtained with the average linkage method.

Another limitation is that this study was conducted using mostly college students. Thus, it is unknown whether the same types of exercise relapsers would be obtained in either a younger or older population. In addition, cluster analysis was conducted on both men and women combined. Potential gender differences may have resulted in a different cluster solution if men and women had been examined separately. Future research, then, might address these issues by examining different age groups and by clustering separately by gender.
References


training, and social support. Behavior Modification, 8, 3-21.


Table 1. Hypothesized Patterns of Findings for Relapse Clusters

<table>
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<tr>
<th>Variables</th>
<th>Repeat Relapser</th>
<th>Occasional Overly Busy Relapser</th>
<th>Occasional Peer Relapser</th>
<th>Occasional Injury Relapser</th>
<th>Maintainer</th>
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(continued on next page)
### Table 1 (cont.)

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<td>moderate</td>
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<tr>
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<td>low</td>
<td>low</td>
<td>low</td>
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</tr>
<tr>
<td><strong>Age Began Exercising</strong></td>
<td>older</td>
<td>older</td>
<td>younger</td>
<td>younger</td>
<td>younger</td>
</tr>
</tbody>
</table>

*Note: Repeat Relapers would be characterized as those who repeatedly start exercising, but often stop soon after; Occasional Overly Busy relapers are those who are highly motivated to exercise, but drop out due to overcommitments; Occasional Peer Relapers would show moderate levels of commitment to exercise allowing them to be easily influenced by their peers' behavior. Occasional Injury Relapers are those who are highly committed to regular exercise, but are forced into relapse by injury. Maintainers refer to those who exercise regularly without relapsing.
Table 2. Means* and Standard Deviations for Measured Variables for Sample 1 (N = 134) and Sample 2 (N = 130)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Sample 1</th>
<th>Sample 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>sd</td>
</tr>
<tr>
<td>Personal Reasons</td>
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<tr>
<td>Situational Reasons</td>
<td>2.93</td>
<td>0.89</td>
</tr>
<tr>
<td>Injury Reasons</td>
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<td>0.73</td>
</tr>
<tr>
<td>Relapse Frequency</td>
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<td>Cons</td>
<td>2.08</td>
<td>0.81</td>
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<td>Temptations to Skip Exercise</td>
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</tr>
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<td>Dramatic Relief</td>
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<td>0.95</td>
</tr>
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<td>Self-Reevaluation</td>
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<td>1.05</td>
</tr>
<tr>
<td>Social Liberation</td>
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<td>0.93</td>
</tr>
<tr>
<td>Environmental Reevaluation</td>
<td>2.61</td>
<td>0.96</td>
</tr>
<tr>
<td>Self-Liberation</td>
<td>3.41</td>
<td>1.04</td>
</tr>
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<td>Helping Relationships</td>
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<td>1.13</td>
</tr>
<tr>
<td>Reinforcement Management</td>
<td>3.06</td>
<td>0.96</td>
</tr>
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<td>Stimulus Control</td>
<td>2.28</td>
<td>1.01</td>
</tr>
<tr>
<td>Counter Conditioning</td>
<td>3.31</td>
<td>1.08</td>
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<td>Sports Competence</td>
<td>2.49</td>
<td>0.74</td>
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<tr>
<td>Attractive Body</td>
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<td>0.72</td>
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<td>Strength</td>
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<td>0.74</td>
</tr>
<tr>
<td>Doubt</td>
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<td>0.71</td>
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</table>

* Higher scores indicate greater endorsement (continued on next page)
Table 2. Means* and Standard Deviations for Measured Variables for Sample 1 (N = 134) and Sample 2 (N = 130) cont.

<table>
<thead>
<tr>
<th>Variables</th>
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<th>Sample 2</th>
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<td>Mean</td>
<td>sd</td>
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<td>0.46</td>
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<td>0.60</td>
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<td>0.70</td>
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<td>0.78</td>
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<td>0.66</td>
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<td>0.70</td>
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<tr>
<td>Physical Benefits</td>
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<td>0.61</td>
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<td>0.69</td>
</tr>
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<td>0.65</td>
<td>4.07</td>
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</tr>
<tr>
<td>Social Benefits</td>
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<td>0.90</td>
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<td>0.85</td>
</tr>
<tr>
<td>Peer Support</td>
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<td>2.85</td>
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</tr>
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<td>1.98</td>
<td>0.89</td>
</tr>
<tr>
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<td>0.92</td>
</tr>
<tr>
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<td>2.26</td>
<td>1.02</td>
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<td>0.69</td>
<td>1.51</td>
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<tr>
<td>Family Pressure</td>
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<td>1.12</td>
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* Higher scores indicate greater endorsement
Table 3. MANOVAs for Exercise Relapse Typesa for Sample 1 (N=134) and Sample 2 (N=130)

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<tr>
<th>Variables</th>
<th>Sample 1</th>
<th>Sample 2</th>
</tr>
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<td><strong>Self-Efficacy and Temptations</strong></td>
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<td>n2</td>
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<td>0.25</td>
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<tr>
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<td>6.52</td>
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<tr>
<td>df</td>
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<td>(6,250)</td>
</tr>
<tr>
<td>Q</td>
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<td>25.62</td>
</tr>
<tr>
<td><strong>Cognitive Processes</strong></td>
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<td>(15,337)</td>
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<tr>
<td>Q</td>
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<td>15.337</td>
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<td><strong>Behavioral Processes</strong></td>
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<tr>
<td>n2</td>
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<td>0.50</td>
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<tr>
<td>E</td>
<td>7.54</td>
<td>6.37</td>
</tr>
<tr>
<td>df</td>
<td>(15,348)</td>
<td>(15,337)</td>
</tr>
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<td>Q</td>
<td>15.348</td>
<td>15.337</td>
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<tr>
<td><strong>Physical Self-Perceptions</strong></td>
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<td>(12,326)</td>
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<td>Q</td>
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<td>12.326</td>
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<td>Q</td>
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<td>6,250</td>
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<td>n2</td>
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<td>0.29</td>
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<td>df</td>
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<td>(15,348)</td>
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<td>Q</td>
<td>12.336</td>
<td>15.348</td>
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<tr>
<td><strong>Social Support</strong></td>
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<td>Q</td>
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<td><strong>Affect &amp; Cons</strong></td>
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<td>E</td>
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<tr>
<td>df</td>
<td>(12,336)</td>
<td>(15,348)</td>
</tr>
<tr>
<td>Q</td>
<td>12.336</td>
<td>15.348</td>
</tr>
<tr>
<td><strong>General Measures</strong></td>
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<td></td>
</tr>
<tr>
<td>n2</td>
<td>0.39</td>
<td>0.43</td>
</tr>
<tr>
<td>E</td>
<td>7.76</td>
<td>8.62</td>
</tr>
<tr>
<td>df</td>
<td>(9,312)</td>
<td>(6,250)</td>
</tr>
<tr>
<td>Q</td>
<td>9,312</td>
<td>6,250</td>
</tr>
</tbody>
</table>

Note: ns = nonsignificant; F = Wilks′ Lambda; F = omnibus F-value; df = degrees of freedom; p < .01; * p < .001; ** p < .0001; *** p < .00001

a Obtained using Ward′s (1963) linkage method.
Table 4\textsuperscript{a} Follow-up ANOVAs and Tukey Tests for Sample 1 (N=134)

<table>
<thead>
<tr>
<th>Variables</th>
<th>E</th>
<th>df</th>
<th>p</th>
<th>R\textsuperscript{2}</th>
<th>Cluster Signif.</th>
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<td>***</td>
<td>.23</td>
<td>1,3&gt;2,4</td>
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<td>(3,130)</td>
<td>***</td>
<td>.16</td>
<td>2,4&gt;1,3</td>
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<tr>
<td><strong>Cognitive Processes</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Consciousness Raising</td>
<td>9.16</td>
<td>(3,130)</td>
<td>***</td>
<td>.17</td>
<td>1&gt;2,4</td>
</tr>
<tr>
<td>Dramatic Relief</td>
<td>ns</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Self-Reevaluation</td>
<td>4.12</td>
<td>(3,130)</td>
<td>*</td>
<td>.43</td>
<td>3&gt;4</td>
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<tr>
<td>Social Liberation</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Reevaluation</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Behavioral Processes</strong></td>
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<td></td>
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</tr>
<tr>
<td>Self-Liberation</td>
<td>20.86</td>
<td>(3,130)</td>
<td>***</td>
<td>.32</td>
<td>1&gt;2,3,4</td>
</tr>
<tr>
<td>Helping Relationships</td>
<td>13.14</td>
<td>(3,130)</td>
<td>***</td>
<td>.23</td>
<td>3&gt;2</td>
</tr>
<tr>
<td>Reinforcement Management</td>
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<td>(3,130)</td>
<td>*</td>
<td>.11</td>
<td>3&gt;2</td>
</tr>
<tr>
<td>Stimulus Control</td>
<td>6.39</td>
<td>(3,130)</td>
<td>**</td>
<td>.13</td>
<td>1,3&gt;2</td>
</tr>
<tr>
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<td>31.40</td>
<td>(3,130)</td>
<td>***</td>
<td>.42</td>
<td>1&gt;2,4</td>
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<tr>
<td><strong>Physical Self-Perceptions</strong></td>
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<tr>
<td>Sports Competence</td>
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<td>(3,130)</td>
<td>***</td>
<td>.21</td>
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<td>(3,130)</td>
<td>***</td>
<td>.16</td>
<td>2&gt;1,3</td>
</tr>
</tbody>
</table>

(continued on next page)

\textsuperscript{a}p<.01; **p<.001; ***p<.0001; ns = nonsignificant; R\textsuperscript{2} = proportion explained variance; cluster signif. = Tukey test results showing cluster means significantly larger than others (1 = Maintainers; 2 = Current Non-Exercisers; 3 = Occasional Relapsers; 4 = Frequent Relapsers)

\textsuperscript{a}Ward's linkage method
Table 4. Follow-up ANOVAs and Tukey Tests for Sample 1 (N=134) cont.

<table>
<thead>
<tr>
<th>Variables</th>
<th>E</th>
<th>df</th>
<th>p</th>
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<th>Cluster Signif.</th>
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<tr>
<td><strong>Psychosocial Attitudes</strong></td>
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<td>***</td>
<td>.43</td>
<td>2,4&gt;1,3</td>
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<tr>
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<td>ns</td>
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<td>Stress</td>
<td>ns</td>
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<td><strong>Affect</strong></td>
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<td>1,3,4&gt;2</td>
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<td>ns</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Benefits &amp; Cons of Exercise</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Benefits</td>
<td>ns</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Emotional Benefits</td>
<td>9.19</td>
<td>(3,130)</td>
<td>***</td>
<td>.17</td>
<td>1,3&gt;2,4</td>
</tr>
<tr>
<td>Social Benefits</td>
<td>8.15</td>
<td>(3,130)</td>
<td>***</td>
<td>.16</td>
<td>3&gt;2</td>
</tr>
<tr>
<td>Cons</td>
<td>5.47</td>
<td>(3,130)</td>
<td>*</td>
<td>.11</td>
<td>4&gt;1,2,3</td>
</tr>
<tr>
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</tr>
<tr>
<td>Peer Support</td>
<td>9.54</td>
<td>(3,130)</td>
<td>***</td>
<td>.18</td>
<td>3&gt;2,4</td>
</tr>
<tr>
<td>Number of Friends Who Exercise</td>
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<td>(3,130)</td>
<td>***</td>
<td>.17</td>
<td>1,3&gt;2,4</td>
</tr>
<tr>
<td>Active Family Support</td>
<td>4.40</td>
<td>(3,130)</td>
<td>*</td>
<td>.09</td>
<td>3&gt;2</td>
</tr>
<tr>
<td>Indirect Family Support</td>
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<td>***</td>
<td>.15</td>
<td>3&gt;2,4</td>
</tr>
<tr>
<td>Number in Family Who Exercise</td>
<td>ns</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>General Measures</strong></td>
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<td>Current Exercise Level</td>
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<td>.32</td>
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*p<.01; **p<.001; ***p<.0001; ns = nonsignificant; R² = proportion explained variance; cluster signif. = Tukey test results showing cluster means significantly larger than others (1 = Maintainers; 2 = Current Non-Exercisers; 3 = Occasional Relapsers; 4 = Frequent Relapsers) a Ward's linkage method
Table 5. Follow-up ANOVAs and Tukey Tests for Sample 2 (N=130)

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<th>Cluster Signif.</th>
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<tr>
<td>Cons</td>
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<td>(3,126)</td>
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<td>.16</td>
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<td>Sports Competence</td>
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<td>Strength</td>
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(continued on next page)

*p<.01; **p<.001; ***p<.0001; ns = nonsignificant; R² = proportion explained variance; cluster signif. = Tukey test results showing cluster means significantly larger than others (1 = Maintainers; 2 = Current Non-Exercisers; 3 = Occasional Relapsers; 4 = Frequent Relapsers)

a Ward's linkage method
Table 5. Follow-up ANOVAs and Tukey Tests for Sample 2 (N=130) cont.

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<th>Cluster Signif.</th>
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<td>Active Family Support</td>
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<td><strong>Behavioral Processes</strong></td>
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*p<.01; **p<.001; ***p<.0001; ns = nonsignificant; R² = proportion explained variance; cluster signif. = Tukey test results showing cluster means significantly larger than others (1 = Maintainers; 2 = Current Non-Exercisers; 3 = Occasional Relapsers; 4 = Frequent Relapsers)

a Ward's linkage method
Table 6. Absolute Discriminant Function Structure Coefficients for Sample 1 (N = 134) and Sample 2 (N = 130)

<table>
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<tr>
<th>Variables</th>
<th>Sample 1</th>
<th>Sample 2</th>
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<td><strong>Benefits &amp; Cons of Exercise</strong></td>
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<td>Physical Benefits</td>
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<tr>
<td>Social Benefits</td>
<td>.72</td>
<td>.32</td>
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<tr>
<td>Cons</td>
<td>.43</td>
<td>.86</td>
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<td><strong>Self-Efficacy &amp; Temptations</strong></td>
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<tr>
<td>Doubt</td>
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(continued on next page)

*a Ward's linkage method*
Table 6. Absolute Discriminant Function Structure Coefficients for Sample 1 (N = 134) and Sample 2 (N=130) cont.

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<td>Peer Pressure</td>
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<td>Family Pressure</td>
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<td><strong>Cognitive Processes</strong></td>
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<tr>
<td>Consciousness Raising</td>
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<td>.09</td>
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<td>Dramatic Relief</td>
<td>.52</td>
<td>.06</td>
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<td>.51</td>
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<td><strong>Behavioral Processes</strong></td>
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<td>Self-Liberation</td>
<td>.72</td>
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<td>.41</td>
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*Ward's linkage method*
Table 7. MANOVAs for Exercise Relapse Types for Sample 1 (N=134) and Sample 2 (N=130)

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<td>3.67 (9.302)</td>
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<td>3.67 (9.302)</td>
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<td>2.43 (12.326)</td>
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<td>.11</td>
<td>2.48 (6.250)</td>
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</table>

Note: ns = nonsignificant; F = omnibus F-value; df = degrees of freedom; *p<.05; **p<.01; ***p<.001; ****p<.0001; a obtained using average linkage method (Sokal & Michener, 1985)
### Table 8. Follow-up ANOVAs and Tukey Tests for Sample 1 (N=134)

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<th>$R^2$</th>
<th>Cluster Signif.</th>
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<td>Physical Benefits</td>
<td>ns</td>
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<td></td>
</tr>
<tr>
<td>Emotional Benefits</td>
<td>9.98</td>
<td>(3,130)</td>
<td>*</td>
<td>.08</td>
<td>1&gt;3,4</td>
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<tr>
<td>Cons</td>
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<td>(3,130)</td>
<td>**</td>
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<td>.11</td>
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<td>Demoralization</td>
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<td>(3,130)</td>
<td>*</td>
<td>.08</td>
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<td><strong>Affect</strong></td>
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<td>Negative Affect</td>
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*p<.01; **p<.001; ***p<.0001; ns = nonsignificant; $R^2$ = proportion explained variance; cluster signif. = Tukey test results showing cluster means significantly larger than others (1 = Maintainers; 2 = Personal Relapsers; 3 = Frequent Relapsers; 4 = Injury Relapsers)

*Average linkage method*
Table 8. Follow-up ANOVAs and Tukey Tests for Sample 1 (N=134) cont.

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<td>ns</td>
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</tr>
<tr>
<td><strong>Behavioral Processes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Liberation</td>
<td>8.28</td>
<td>(3,130)</td>
<td>***</td>
<td>.16</td>
<td>1&gt;2,3</td>
</tr>
<tr>
<td>Helping Relationships</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinforcement Management</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stimulus Control</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Counter Conditioning</td>
<td>6.85</td>
<td>(3,130)</td>
<td>**</td>
<td>.14</td>
<td>1&gt;2,3,4</td>
</tr>
</tbody>
</table>

*p<.01; **p<.001; ***p<.0001; ns = nonsignificant; R² = proportion explained variance; cluster signif. = Tukey test results showing cluster means significantly larger than others (1 = Maintainers; 2 = Personal Relapsers; 3 = Frequent Relapsers; 4 = Injury Relapsers)

aAverage linkage method
Table 9. Follow-up ANOVAs and Tukey Tests for Sample 2 (N=130)

<table>
<thead>
<tr>
<th>Variables</th>
<th>F</th>
<th>df</th>
<th>p</th>
<th>R²</th>
<th>Cluster Signif.</th>
</tr>
</thead>
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<tr>
<td><strong>Self-Efficacy &amp; Temptations</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td>9.42</td>
<td>(3,126)</td>
<td>***</td>
<td>.18</td>
<td>1&gt;2,3,4</td>
</tr>
<tr>
<td>Temptations to Skip Exercise</td>
<td>10.36</td>
<td>(3,126)</td>
<td>***</td>
<td>.20</td>
<td>4&gt;1,2 2&gt;1</td>
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<td><strong>Psychosocial Attitudes</strong></td>
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<tr>
<td>Demoralization</td>
<td>10.78</td>
<td>(3,126)</td>
<td>***</td>
<td>.20</td>
<td>2,3,4&gt;1</td>
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<tr>
<td>Powerlessness</td>
<td>ns</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Stress</td>
<td>ns</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Affect</strong></td>
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<td></td>
</tr>
<tr>
<td>Positive Affect</td>
<td>ns</td>
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<td>Negative Affect</td>
<td>ns</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Physical Self-Perceptions</strong></td>
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</tr>
<tr>
<td>Sports Competence</td>
<td>ns</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attractive Body</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strength</td>
<td>ns</td>
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<td></td>
</tr>
<tr>
<td>Doubt</td>
<td>4.80</td>
<td>(3,126)</td>
<td>*</td>
<td>.10</td>
<td>2,4&gt;1</td>
</tr>
</tbody>
</table>

(continued on next page)

*p<.01; **p<.001; ***p<.0001; ns = nonsignificant; R² = proportion explained variance; cluster signif. = Tukey test results showing cluster means significantly larger than others (1 = Maintainers; 2 = Current Non-Exercisers; 3 = Frequent Relapsers; 4 = Injury Relapsers)

aAverage linkage method
Table 9. Follow-up ANOVAs and Tukey Tests for Sample 2 (N=130) cont.

<table>
<thead>
<tr>
<th>Variables</th>
<th>E</th>
<th>df</th>
<th>p</th>
<th>R²</th>
<th>Cluster Signif.</th>
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<tbody>
<tr>
<td><strong>Social Pressure</strong></td>
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<td></td>
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<td>Peer Pressure</td>
<td>ns</td>
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<td></td>
</tr>
<tr>
<td>Family Pressure</td>
<td>ns</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Cognitive Processes</strong></td>
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</tr>
<tr>
<td>Consciousness Raising</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dramatic Relief</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Reevaluation</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social Liberation</td>
<td>ns</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Environmental Reevaluation</td>
<td>ns</td>
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<tr>
<td><strong>Behavioral Processes</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Liberation</td>
<td>9.44</td>
<td>(3,126)</td>
<td>***</td>
<td>.18</td>
<td>1&gt;2,3,4</td>
</tr>
<tr>
<td>Helping Relationships</td>
<td>ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Reinforcement Management</td>
<td>ns</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Stimulus Control</td>
<td>5.42</td>
<td>(3,126)</td>
<td>*</td>
<td>.11</td>
<td>1&gt;2,4</td>
</tr>
<tr>
<td>Counter Conditioning</td>
<td>12.44</td>
<td>(3,126)</td>
<td>***</td>
<td>.23</td>
<td>1&gt;2,3,4; 2&gt;3,4</td>
</tr>
</tbody>
</table>

*p<.01; **p<.001; ***p<.0001; ns = nonsignificant; R² = proportion explained variance; cluster signif. = Tukey test results showing cluster means significantly larger than others (1 = Maintainers; 2 = Current Non-Exercisers; 3 = Frequent Relapsers; 4 = Injury Relapsers)

aAverage linkage method
FIGURE 1. WARD'S LINKAGE FOUR CLUSTER SOLUTION FOR SAMPLE 1 (N = 134)
Figure 2. Ward's Linkage Four Cluster Solution for Sample 2 (N = 130)

<table>
<thead>
<tr>
<th>Personal Reasons</th>
<th>Situational Reasons</th>
<th>Injury Frequency</th>
<th>Relapse Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintainers</td>
<td></td>
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</tr>
<tr>
<td>3.36</td>
<td>3.37</td>
<td></td>
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<tr>
<td>2.96</td>
<td>2.17</td>
<td>2.53</td>
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<tr>
<td>3.29</td>
<td>2.62</td>
<td>2.47</td>
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</tr>
<tr>
<td>1.10</td>
<td>1.08</td>
<td>1.12</td>
<td></td>
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<tr>
<td>Current Non-Exercisers</td>
<td></td>
<td>3.91</td>
<td></td>
</tr>
<tr>
<td>5.91</td>
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<tr>
<td>Occasional Relapsers</td>
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<td></td>
</tr>
<tr>
<td>4.08</td>
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<td></td>
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<tr>
<td>Frequent Relapsers</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4.08</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Relapse Types:
- Maintainers
- Current Non-Exercisers
- Occasional Relapsers
- Frequent Relapsers
FIGURE 3. AVERAGE LINKAGE FOUR CLUSTER SOLUTION FOR SAMPLE 1 (N = 134)

<table>
<thead>
<tr>
<th></th>
<th>Maintainers</th>
<th>Personal Relapsers</th>
<th>Frequent Relapsers</th>
<th>Injury Relapsers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relapse Types</td>
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<td>Clustering Variables</td>
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<td>Reasons</td>
<td>Reasons</td>
<td>Reasons</td>
<td>Reasons</td>
<td>Reasons</td>
</tr>
<tr>
<td>Personal</td>
<td>Injury</td>
<td>Frequency</td>
<td>Relapse</td>
<td></td>
</tr>
<tr>
<td>Situational</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency</td>
<td>3.68</td>
<td>2.73</td>
<td>2.37</td>
<td>4.51</td>
</tr>
<tr>
<td>Relapse</td>
<td>2.60</td>
<td>2.35</td>
<td>2.26</td>
<td>4.80</td>
</tr>
<tr>
<td>Maintainers</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.29</td>
</tr>
</tbody>
</table>

(2) N = 17
(3) N = 5
(4) N = 14

FIGURE 3. AVERAGE LINKAGE FOUR CLUSTER SOLUTION FOR SAMPLE 1 (N = 134)
### Figure 4. Average Linkage Four Cluster Solution for Sample 2 (N = 130)

<table>
<thead>
<tr>
<th>Injury Relapses</th>
<th>Frequent Relapses</th>
<th>Current Non-Exercisers</th>
<th>Maintainers</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.43</td>
<td>3.08</td>
<td>4.33</td>
<td>1.88</td>
</tr>
<tr>
<td>3.60</td>
<td>2.39</td>
<td>3.58</td>
<td>1.01</td>
</tr>
<tr>
<td>4.05</td>
<td>2.53</td>
<td>2.44</td>
<td>1.12</td>
</tr>
<tr>
<td>5.80</td>
<td>4.18</td>
<td>4.00</td>
<td>1.33</td>
</tr>
</tbody>
</table>

**CLUSTERING VARIABLES**
- RELAPSE TYPES
- FREQUENCY
- PERSONAL REASONS
- INJURY REASONS

**Means**
- *N = 5*
- *N = 109*
- *N = 41*
- *N = 12*

---

*Figure 4. Average Linkage Four Cluster Solution for Sample 2 (N = 130)*
PART IV. PREDICTORS OF FREQUENCY OF RELAPSE FROM EXERCISE

The purpose of this paper was to identify predictors of relapse from exercise using structural equation modeling. Predictors were drawn primarily from concepts representing three models of health behavior: the Relapse Prevention Model (e.g., Marlatt & Gordon, 1985); the Transtheoretical Model (e.g., Prochaska & DiClemente, 1983); and Physical Self-Perceptions from a hierarchical self-esteem model (e.g., Fox & Corbin, 1989). Structural models were compared individually on their ability to predict frequency of relapse from exercise. It was hypothesized that several components representative of each of the models would prove to be important predictors of relapse frequency, and would be useful in providing preliminary evidence for an integrated model of the process of relapse from exercise. It is important to note, however, that since not all measures of each of the theoretical models were available for analysis in this study, any comparison of these models should be considered exploratory.

These models were chosen since they share a similar focus on the process of health behavior change, while also contributing something unique. Both the Relapse Prevention Model and the Transtheoretical model have measures that overlap, although they diverge in their application to different components of the process of change. Whereas the Transtheoretical Model assesses overall change and movement
towards maintenance of health behavior, the Relapse Prevention Model focuses on the relapse process itself.

Components of both the Relapse Prevention Model and the Transtheoretical Model have been applied to exercise in past research. Application of the Relapse Prevention Model has been investigated mostly in the area of testing interventions to promote exercise adherence (Belisle, Roskies, & Levesque, 1987; King & Frederiksen, 1984; King, Taylor, Haskell, & Debusk, 1988, 1990; Martin et al., 1984). Participants are taught coping responses to situations that may lead to relapse, as well as ways to minimize the Abstinence Violation Effect through time management training, relaxation training, confidence building, and learning ways to reduce potential barriers to exercise. These components of the Relapse Prevention Model have had modest success as intervention methods for improving adherence to exercise. However, the model as a whole has not yet been used to assess relapse from exercise.

The Transtheoretical Model has been recently used to identify movement through stages of exercise from complete sedentary behavior to maintenance of a regular program of exercise (Marcus, Eaton, Rossi, & Harlow, 1993; Marcus, Rakowski, & Rossi, 1992; Marcus, Rossi, Selby, Niaura, & Abrams, 1992; Marcus, Selby, Niaura, & Rossi, 1992) with promising results. At present, though, it has not been directly applied to the phenomena of relapse from exercise.
Fox and Corbin's (1989) hierarchical model of self-esteem differs from the Relapse Prevention and Transtheoretical model in that it was developed initially to examine changes in self-esteem related to exercise. Though Physical Self-Perceptions have not been applied to the process of behavior change, they have been used to predict exercise behavior within an expanded Exercise and Self-Esteem Model (e.g., Sonstroem & Morgan, 1989) with some success (Sonstroem, Harlow, & Josephs, 1994). Physical Self-Perceptions have not yet been used to predict relapse from exercise. Thus, it remains unclear as to whether components of this model are successful in the prediction of relapse from exercise.

The Relapse Prevention and Transtheoretical models share in common the central role of self-efficacy in exercise behavior. Although self-efficacy, in terms of confidence in one's ability to exercise in high risk situations, has not been examined within Fox and Corbin's (1989) hierarchical model of self-esteem, it has been identified as extremely important to the process of exercise behavior change (see Part I). Since the ultimate goal of this study was to identify predictors related to the process of relapse from exercise, exercise self-efficacy was included in the test of the relationship between Physical Self-Perceptions and frequency of relapse from exercise. In this study, the role of exercise-specific self-efficacy as a mediator of relapse frequency, as opposed to a predictor,
was assessed in a comparison of several structural equation models for each of the three exercise behavior models.

Methods

Participants

The sample consisted of 260 students at the University of Rhode Island and 10 members from a local fitness club (total N=270). Students at the university were recruited from several departments across campus including psychology, business, engineering, math, music, and physical education departments. The additional 10 participants, recruited from a local fitness center, voluntarily filled in the survey at home and returned it to the fitness center.

Since the 10 fitness center participants were from a population that may have differed from the college students, individual t-tests were conducted on those 10 participants and a computer-generated random selection of 13 college participants students on several demographic variables and the variables to be used in this study. The random sample of college participants was generated to ensure approximately equal cell sizes for statistical comparison. Individual t-tests revealed significant differences at p<.01 between groups on only four variables. Fitness center participants were significantly older than the college participants (t(12) = -2.97, p=.01; mean age = 31 years, and 21.8 years, respectively). Fitness center participants also reported beginning exercising regularly at a later age than college students (t(20) = -3.53, p=.002; mean = 4.00; between ages
Finally, compared to college participants, fitness center participants reported lower temptations to skip exercise in certain situations ($t(21) = 2.94, p=.008; \text{mean} = 2.10$ and $2.83$, respectively), and higher use of counter conditioning ($t(19) = -3.11, p=.006; \text{mean} = 4.28$ and $3.08$, respectively). Since these were the only variables on which the two groups significantly varied, and differences were not expected to appreciably affect analyses, the 10 fitness center participants were combined with the 260 college students for all subsequent analyses.

The combined sample ($N = 270$) is characterized as largely Caucasian ($91\%$) and Catholic ($62\%$) with a mean age of 22 years. Women comprise $64\%$ of the sample. Most ($77\%$) are non-smokers and over half exercise regularly ($58.5\%$). Almost half ($48.5\%$) of the participants belong to some kind of gym, health club, or fitness center, and $58.1\%$ report beginning exercising regularly between ages 10 and 20. Participants exercise an average of 3 days per week for 46 minutes each day.

A total of six participants were excluded from the analyses due to inconsistent responses on the relapse frequency and reasons for relapse variables. These participants indicated that they did not exercise regularly at all in the past six months, but then consistently responded that they did not stop exercising regularly in the past six months on the reasons for relapse variables. The
total number on which the analyses were conducted, then, was \( N=264 \).

**Procedure**

College participants were recruited from various departments across campus including psychology, business, engineering, math, music, and physical education departments. Students from different departments were asked to participate to obtain a more representative sample of the college population. In addition, approximately 100 psychology department students completed the anonymous self-report survey at a pre-determined time. All participants were assured anonymity.

With the instructor's permission, voluntary participation of students in other departments was requested at the beginning of each class period. Surveys were distributed to students during class, and were completed at home. These students were instructed to bring the completed surveys with them to class where they were collected. In addition, each survey was distributed in a manila envelope with the researcher's campus address so that students also had the option of returning the surveys through the campus mailing system. Most students received course credit for their participation.

Fitness center participants picked-up the survey at the fitness center, completed it at home, and returned it to the center to be collected. They were also assured anonymity,
and did not receive any compensation for completing the survey.

Measures

Measures for each of the models were selected so that an equal number of measured and latent variables existed for each model. This was done to facilitate comparison between models representing each of the three theories.

Relapse Prevention Model

A total of five latent variables representing concepts from the Relapse Prevention Model (Marlatt & Gordon, 1985) were used to predict relapse frequency. They consisted of three reasons for relapse (personal, situational, and injury reasons) assessing both intrapersonal and interpersonal high-risk situations, decisional balance, and self-efficacy. Brief descriptions of the criterion and five predictors are given below.

Relapse Frequency was assessed by asking respondents to record how often they stopped exercising regularly for one week or more in the past six months. Scores on this item ranged from 1 = "None" to 6 = "Did not exercise regularly at all in the past six months". The Relapse frequency item was created for use in this study.

Reasons for Relapse is the shortened version of a recently developed scale (see Part II). Participants rate, on a five-point Likert scale ranging from 1 = "Did not stop exercising regularly"; to 2 = "Definitely did not contribute"; up to 5 = "Definitely contributed", how much
each of 12 possible reasons for relapse contributed to their own relapse. The reasons for relapse are derived from past research measuring potential barriers to exercise (e.g., Amaral, 1985; Sallis & Hovell, 1990; Sallis et al., 1989). The 12-item scale consisted of three subscales, each with four items, assessing Situational Reasons (e.g., "not enough time": $\alpha = .79$), Personal Reasons (e.g., "I'm not coordinated enough to exercise": $\alpha = .88$), and Injury Reasons (e.g., "injury": $\alpha = .66$). Coefficient $\alpha$ for the whole scale was calculated at .87.

The Decisional Balance construct was composed of a total of three measures. Each measure was a composite score obtained from averaging one reverse-scored con item (e.g., "I would probably be sore and uncomfortable if I exercised regularly"), from a 6-item scale measuring pros and cons of exercise (Marcus & Owen, 1992), and one item measuring pros (e.g., "I would feel better about myself if I exercised regularly"). The reason for calculating an average score, instead of using the six items assessing pros and cons as separate indicators, was to remain consistent with how decisional balance has been measured in the past within the Relapse Prevention Model (e.g., Marlatt & Gordon, 1985). Coefficient $\alpha$ for these three items was .62.

Self-Efficacy consisted of five items measuring one's confidence in being able to participate in exercise in certain situations such as when one is "tired" or "on
vacation" (Marcus, Selby, et al., 1992). In this study, coefficient $\alpha$ for the 5-item scale was .76.

**Transtheoretical Model**

Five latent constructs representing concepts of the Transtheoretical Model (e.g., Prochaska & DiClemente, 1983) were used to predict relapse frequency. They were pros and cons for exercise, self-efficacy, and use of consciousness raising, a cognitive-experiential change process, and self-liberation, a behavioral process of change. Consciousness Raising and Self-Liberation were chosen from the ten processes of change, since each was shown to be superior to other processes in differentiating between types of relapsers in previous research (see Part III Results), and each represented one of the two groups of strategies.

The **Pros of Exercise** measure consists of three items measuring the pros of exercise such as "I would feel better about myself if I exercised regularly" (Marcus & Owen, 1992). Coefficient $\alpha$ for this scale was low in this study ($\alpha = .55$).

The **Cons of Exercise** measure consists of three items measuring the cons of exercise such as "I would probably be sore and uncomfortable if I exercised regularly" (Marcus & Owen, 1992). Coefficient $\alpha$ for this scale was calculated at .58.

**Self-Efficacy** consists of five items measuring one's confidence in being able to participate in exercise in certain situations such as when one is "tired" or "on
vacation" (Marcus, Selby, et al., 1992). In addition, a sixth item, derived from a composite score of five items assessing Temptations to Skip Exercise (adapted from Velicer, DiClemente, Rossi, & Prochaska, 1990), was included. The Temptations scale lists various situations such as "when it's raining" or "when I'm in a bad mood". Participants are asked to respond how tempted they would be to skip exercise in each of these situations on a 5-point Likert scale ranging from 1 = 'Not all tempted" to 5 = "Very tempted". Coefficient α for the six measures was calculated at .65.

**Consciousness Raising and Self-Liberation** were two subscales drawn from the Processes of Exercise Change scale (Marcus, Rossi, et al., 1992). Consciousness Raising, consisting of four items, refers to an individual's efforts to seek information about exercise and to gain understanding and feedback about current exercise behavior. Coefficient α for this subscale was .81. Self-Liberation, also consisting of four items, refers to the individual's choice and commitment to exercise regularly, and the belief that one is capable of exercising regularly. Coefficient α for Self-Liberation was .83.

**Physical Self-Perceptions**

Four latent measures of physical self-perceptions, each consisting of four items and representing concepts from Fox and Corbin's (1989) hierarchical self-esteem model, were used in addition to exercise self-efficacy to predict
frequency of relapse from exercise. The physical self-perceptions measures were derived from the Physical Self-Perception Profile scale (PSPP: Fox, 1990). The PSPP typically has five components measuring general Physical Self-Worth and four subdomains of Sports Competence, Physical Condition, Attractive Body, and Strength. However, in this study, a principal components analysis with oblique rotation revealed four subscales assessing (1) Sports Competence (e.g., "some people feel that they are among the best when it comes to athletic ability": $\alpha = .70$); (2) Attractive Body (e.g., "some people feel that compared to most, they have an attractive body": $\alpha = .70$); (3) Strength (e.g., "some people feel that they are very strong and have well-developed muscles compared to most people": $\alpha = .70$); and (4) Doubt (e.g., "some people tend to lack confidence when it comes to their physical strength": $\alpha = .70$). Participants were asked to choose which of two contrasting statements was most like themselves, and were then asked to rate whether that description was "sort of true" or "really true" of them. Subscale scores ranged from one to four.

Self-Efficacy consisted of the four highest loading items of a 5-item scale measuring one's confidence in being able to participate in exercise in certain situations such as when one is "tired" or "on vacation" (Marcus, Selby, et al., 1992). In this study, coefficient $\alpha$ for the 4-item scale was .75.
Analyses

The proposed structural equation models for the Relapse Prevention Model, the Transtheoretical Model, and Physical Self-Perceptions, are shown in Figures 1-3, respectively. All analyses were conducted on the full sample of 264 participants.

Each of the models consists of four latent predictors and a single measured relapse frequency outcome variable. The total number of measured indicators for the four latent constructs was 20 for all three models. In all models, the role of self-efficacy as a mediator was tested. In the figures, levels are provided to ensure clarity in reporting of results for each of the structural models. Level I refers to the four predictor constructs, level II refers to the Self-Efficacy mediator construct, and level III refers to the Relapse Frequency outcome variable.

For each of the three models (i.e., Relapse Prevention Model; Transtheoretical Model; Physical Self-Perceptions), a total of five analyses (labeled Models A to E), using structural equation modeling with maximum likelihood estimation within the EQS (Bentler, 1989) computer package, were conducted to predict frequency of relapse from exercise.
In Model A, a confirmatory factor analysis (CFA) was conducted to assess measurement model fit. In Model B, both direct (from level I to level III: shown as dotted lines in the figures) and indirect paths from the latent variables to relapse frequency were estimated. In addition, covariances among level I latent constructs are specified. In Model C, the relationship between the four level I latent constructs and relapse frequency through the mediating variable self-efficacy was assessed by fixing all direct paths from the four latent constructs to relapse frequency (level I to level III) at zero. In Model D, the paths from the four measured latent variables to self-efficacy (level I to level II) were fixed at zero to examine model fit with self-efficacy as an independent predictor of relapse frequency rather than a mediator. In addition, covariances among all five of the latent predictors were specified. Finally, in Model E, the importance of self-efficacy as a mediator to model fit was assessed by excluding the direct paths from level I to level III, and specifying covariances among only the four latent predictors at level I.

Models were compared on degree of overall fit, examination of model parameters, and by the proportion of variance in relapse frequency accounted for by the predictor constructs. Indices that were used to assess overall model fit included the chi-square ($\chi^2$), which should be low relative to degrees of freedom; the comparative fit index (CFI: Bentler, 1990) which ranges from 0-1 with values
closer to one indicating good fit; and the root mean square residual (RMSR), which is a measure of deviation between a model and the data, and where values close to zero are preferred. In addition, a chi-square difference test between Model B and Model E was conducted to assess the role of self-efficacy as a mediator.

**Results**

**Relapse Prevention Model**

Fit indices for the Relapse Prevention Model CFA and the four structural models predicting relapse frequency are presented in Table 1.

---

Insert Table 1 about here

---

The CFA indicated a relatively good fit of the measurement model to the data. Individual t-tests for the parameter estimates revealed that all factor loadings were significant at $p<.05$. Table 2 shows the standardized factor structure for the Relapse Prevention measurement model. Intercorrelations among the five factors ranged from -.03 between Situational Reasons and Decisional Balance to .72 between Injury Reasons and Personal Reasons.

---

Insert Table 2 about here

---

Model B, where both direct paths from level I to level III and indirect paths through the mediator were specified,
also showed a good fit of the model to the data. Of the four regression paths from level I to level II (self-efficacy) only the path coefficient for Situational Reasons to Self-Efficacy was significant ($\beta = -.27$). Significant direct paths to Relapse Frequency were found for Situational Reasons and Self-Efficacy ($\beta = .46$ and -.23, respectively). Intercorrelations among the four level I independent constructs ranged from .72 between Injury Reasons and Personal Reasons to -.03 between Situational Reasons and Decisional Balance. All were significant except for the latter intercorrelation. The proportion of variance accounted for in Relapse Frequency by this model was 49%.

Fit indices for Model C, on the other hand, indicated a worse fit. In this model, no direct paths from level I to level III were specified. The relationship between the four level I predictors and relapse frequency was hypothesized only to occur through the Self-Efficacy mediating variable. Overall fit indices revealed a high $\chi^2$ relative to degrees of freedom, a relatively low CFI, and a relatively high RMSR. In addition, Model C accounted for the smallest proportion of variance in Relapse Frequency ($R^2 = .36$) than any of the other three structural models representing the Relapse Prevention Model. This suggests that Self-Efficacy did not play a mediational role in the prediction of Relapse Frequency using concepts of the Relapse Prevention Model in this study.
Model D, hypothesizing only direct paths from all five predictor constructs and covariances among all five predictors, provided an identical fit to that obtained in Model B. Similar to Model B, significant path coefficients were found between Situational Reasons and Relapse Frequency ($\beta = .46$) and between Self-Efficacy and Relapse Frequency ($\beta = -.24$). As with Model B, Model D accounted for 49% of the variance in Relapse frequency. The fact that Models B and D are equivalent also provides evidence that Self-Efficacy does not play a mediational role in this study's Relapse Prevention Model prediction of relapse frequency. Though fit indices for Models B and D were equivalent, Model D may be the better of the two since it is the most parsimonious, requiring fewer directional paths to achieve the same fit and amount of explained variance in Relapse Frequency as Model B. In addition, the fact that only one path from level I to level II (from Personal Reasons to Self-Efficacy) was significant also suggests that these paths were unimportant to the model.

Finally, Model E, which tested the importance of the Self-Efficacy construct as a mediator in the prediction of relapse frequency, provided the worst fit of all the Relapse Prevention models. Though the $\chi^2$ was only slightly higher and the CFI only slightly lower than those found in Model C, the RMSR was quite high at .10, indicating a good degree of model misspecification. A chi-square difference test between Models B and E was significant suggesting that Self-Efficacy
was an important component in the prediction of relapse frequency, but its role was as a direct predictor, not a mediator. In addition, Model E accounted for 44% of the variance in Relapse Frequency, 5% less than Model B.

In summary, it would appear that Self-Efficacy is not likely to be a mediator between reasons for relapse, decisional balance, and relapse frequency within the models tested in the current study. Furthermore, a model hypothesizing only direct paths from the five Relapse Prevention predictors to Relapse Frequency, appeared to be the best model in terms of model fit and parsimony. Although not seemingly a mediator, exercise Self-Efficacy does play a significant role in the prediction of relapse frequency. Of the five Relapse Prevention predictor constructs, only Situational Reasons and Self-Efficacy were significantly related to frequency of relapse from exercise. These two constructs alone accounted for 49% of the variance in relapse frequency.

**Transtheoretical Model**

Fit indices for the Transtheoretical Model CFA and the four structural models predicting relapse frequency are presented in Table 3. As is shown in Table 3, the pattern of results for the Transtheoretical Model were similar to those found for the Relapse Prevention structural models with the exception that overall fit for each of the five models was slightly lower, though still satisfactory.
The Transtheoretical Model CFA indicated a relatively good fit of the measurement model to the data. Individual t-tests for the parameter estimates revealed that all factor loadings were significant at p<.05. Table 4 shows the standardized factor structure for the Transtheoretical measurement model. Intercorrelations among the five factors were significant, and ranged from .21 between Pros and Self-Efficacy to .49 between Self-Liberation and Self-Efficacy.

Model B, where both direct paths from level I to level III and indirect paths through the mediator were specified, also showed a satisfactory fit of the model to the data. Of the four regression paths from level I to level II (Self-Efficacy) only two were significant. The path coefficients representing the two processes of change, Consciousness Raising and Self-Liberation, were significantly related to Self-Efficacy (β = .18 and .40, respectively). Significant direct paths to Relapse Frequency were found for Pros (β = .23), Consciousness Raising (β = -.16), Self-Liberation (β = -.28), and Self-Efficacy (β = -.39). All intercorrelations among the four level I independent constructs were significant, and ranged from .23 between
Consciousness Raising and Pros to .48 between Self-Liberation and Pros. The proportion of variance explained in Relapse Frequency by this model was 39%.

Note that the relationship between Pros and Relapse Frequency was positive, and not negative as was expected. This may be indicative of the presence of a suppression effect. A suppression effect can occur when a predictor variable that is relatively uncorrelated with the outcome variable suppresses, through its correlation with other predictors, a portion of the variance in the other predictors that is unrelated to the outcome variable (Cohen & Cohen, 1975; Tabachnick & Fidell, 1989). Classic indicators of the presence of suppression include the case where a regression coefficient is substantially larger than the zero order correlation between that predictor and an outcome, or when the sign of a standardized regression coefficient for a predictor is opposite to the predictor's zero order correlation with an outcome variable. In this study, the zero order correlation between Pros and Relapse Frequency was $r = -.03$, but the standardized regression coefficient was $\beta = .23$. In addition, the zero order correlation between Cons and Relapse Frequency was $r = .16$, but its standardized regression coefficient in the structural model was only $\beta = -.01$. The correlation between Pros and Cons constructs was $r = -.27$. Thus, the inflated value and opposite sign for Pros, the deflated, negative regression coefficient for Cons, and the presence of a
correlation between the two indicates a probable suppression effect occurring between these two constructs. It would appear that Pros, which was relatively uncorrelated with Relapse Frequency, "removed" the portion of variance associated with it and the Cons of exercise, thus inflating its own relationship with Relapse Frequency while reducing the relationship between Cons and Relapse Frequency in the structural model. This effect was found throughout Models B to E representing the Transtheoretical Model.

Similar to Relapse Prevention results, Model C fit indices indicated a worse fit. In this model, no direct paths from level I to level III were specified. The relationship between the four level I predictors and relapse frequency was hypothesized only to occur through the Self-Efficacy mediating variable. Overall fit indices revealed a high $\chi^2$ relative to degrees of freedom, a relatively low CFI, and a relatively high RMSR. In addition, Model C accounted for a smaller proportion of variance in Relapse Frequency ($R^2 = .34$) than Model B. This suggests that, similar to Relapse Prevention Model results, Self-Efficacy does not play a mediational role in the prediction of Relapse Frequency using concepts from the Transtheoretical Model.

Model D, hypothesizing only direct paths from all five predictor constructs and covariances among all five predictors, provided an identical fit to that obtained in Model B. Similar to Model B, significant negative paths to
Relapse Frequency were found for Self-Efficacy ($\beta = -0.39$); Consciousness Raising ($\beta = -0.16$); and Self-Liberation ($\beta = -0.28$). In addition, a significant positive path coefficient for the relationship between Pros of exercise and Relapse frequency was found ($\beta = 0.23$), once again indicating the presence of a suppression effect. As with Model B, Model D accounted for 39% of the variance in Relapse Frequency. The fact that Models B and D are equivalent provides further evidence that Self-Efficacy does not play a mediational role in this study's Transtheoretical Model prediction of relapse frequency.

Finally, Model E, which tested the importance of the Self-Efficacy construct as a mediator in the prediction of relapse frequency, provided the worst fit of all the Transtheoretical structural models. It possessed the highest $\chi^2$ and lowest CFI value of the five models. In addition, the RMSR was extremely high at .09, indicating a good degree of model misspecification. A chi-square difference test between Models B and E was significant suggesting that Self-Efficacy was an important component in the prediction of relapse frequency, but its role was as a direct predictor, not a mediator. In addition, Model E accounted for 32% of the variance in Relapse Frequency, which was lower than all the other structural models and 7% less than Model B.

It would appear from Models B through E, then, that Self-Efficacy is not likely to be a mediator between the concepts of the Transtheoretical Model (i.e., pros, cons,
consciousness raising, and self-liberation) and relapse frequency within the models tested in the current study. Furthermore, similar to the Relapse Prevention model, a model hypothesizing only direct paths from the five Transtheoretical predictor constructs to Relapse Frequency, appeared to be the best model in terms of model fit and parsimony. As with the Relapse Prevention Model, exercise Self-Efficacy does play a significant role in the prediction of relapse frequency. Of the five Transtheoretical Model predictor constructs, only cons of exercise was not significantly related to frequency of relapse from exercise. The other three predictors - pros, consciousness raising, and self-liberation, were significantly related to relapse frequency, however, the relationship between pros and relapse frequency was not in the anticipated direction, indicating a probable suppression effect.

**Physical Self-Perceptions**

Fit indices for the Physical Self-Perceptions CFA and the four structural models predicting relapse frequency are presented in Table 5. Once again, the pattern of overall fit indices for the models was similar to that found for the structural models examining the relationship of concepts from both the Relapse Prevention Model and the Transtheoretical Model to frequency of relapse from exercise. The only difference was that fit indices for all the Physical Self-Perception models revealed a slightly
better overall fit than any of the models assessing concepts from the other two theories.

The Physical Self-Perceptions CFA indicated a good fit of the measurement model to the data. Individual t-tests for the parameter estimates revealed that all factor loadings were significant at p<.05. Table 6 shows the standardized factor structure for the Physical Self-Perceptions measurement model. Intercorrelations among the five factors were significant, and ranged from .29 between Self-Efficacy and Body Attractiveness to -.76 between Strength and Doubt.

Model B, where both direct paths from level I to level III and indirect paths through the mediator were specified, also showed a good fit of the model to the data. None of the four regression paths from level I to level II (Self-Efficacy) were significant. However, significant direct paths to Relapse Frequency were found for Doubt and Self-Efficacy (β = .37 and -.36, respectively). All intercorrelations among the four level I independent constructs were significant and ranged from .49 between Body Attractiveness and Sports Competence to -.75 between Body...
Attractiveness and Doubt. The proportion of variance in Relapse Frequency explained by this model was 31%.

Fit indices for Model C indicated a worse fit, but the difference was not as dramatic as that found for Model C in both the Relapse Prevention and Transtheoretical Model analyses. In this model, no direct paths from level I to level III were specified. The relationship between the four level I predictors and relapse frequency was hypothesized only to occur through the Self-Efficacy mediating variable. Overall fit indices revealed a fairly high $\chi^2$ relative to degrees of freedom, but a good CFI and a relatively low RMSR. This seems to indicate that even though fit was lower in Model C, it was not unreasonable. However, Model C accounted for the smallest proportion of variance in Relapse Frequency ($R^2 = .26$) than either Model B or Model D in which hypothesized direct relationships to Relapse Frequency were included. This suggests that Self-Efficacy also does not play a mediational role in the prediction of Relapse Frequency using Physical Self-Perceptions.

Model D, hypothesizing only direct paths from all five predictor constructs and covariances among all five predictors, provided an identical fit to that obtained in Model B. Similar to Model B, significant path coefficients were found between Doubt and Relapse Frequency ($\beta = .37$) and between Self-Efficacy and Relapse Frequency ($\beta = -.36$). As with Model B, Model D accounted for 31% of the variance in Relapse Frequency. The fact that Models B and D are
equivalent also provides evidence that Self-Efficacy does not play a mediational role in this study's Physical Self-Perceptions prediction of relapse frequency. For the same reasons proposed for the Relapse Prevention and Transtheoretical models (e.g., overall fit and parsimony), Model D was identified to be the best structural model of the four in this study.

Finally, Model E, which tested the importance of the Self-Efficacy construct as a mediator in the prediction of Relapse Frequency, provided the worst fit of all the Physical Self-Perception models. Although the $\chi^2$ and CFI values indicated only slightly worse fit than those found in Model C, the RMSR was high at .08, indicating some degree of model misspecification. A chi-square difference test between Models B and E was significant suggesting that Self-Efficacy was an important component in the prediction of relapse frequency, but its role was as a direct predictor, not a mediator. In addition, Model E accounted for only 26% of the variance in Relapse Frequency, 5% less than Model B.

Discussion

In this study, concepts from three models of health behavior the Relapse Prevention Model, the Transtheoretical Model, and Physical Self-Perceptions from a hierarchical model of self-esteem (Fox & Corbin, 1989), were examined for their contribution to frequency of relapse from exercise. In addition, several structural equation models of concepts within each theory were tested to assess the role of
exercise-specific self-efficacy in the prediction of relapse frequency within each theory. From these analyses, several predictors of frequency of relapse from exercise, representing concepts from each of the three theoretical models, were identified.

Across all three theories, the model that was best in terms of model fit and parsimony seemed to represent the relationship between the predictors and relapse frequency as one in which there were no mediational paths. Self-efficacy was important to the prediction of relapse frequency in all of the models but not as a mediator between other predictors and relapse frequency. An examination of overall fit revealed that the models representing each of the theories did not differ much from each other. The Transtheoretical structural models provided a slightly lower fit, whereas the Physical Self-Perceptions structural models provided a slightly higher fit. Low internal consistency for Pros and Cons and the likely presence of a suppression effect may have contributed to the reduced fit of the Transtheoretical structural models.

In terms of the proportion of explained variance in relapse frequency, concepts from the Relapse Prevention Model appeared superior to the concepts from the other two theoretical models in this study. Relapse Prevention constructs explained 49% of the variance in relapse frequency, compared to 39% for the Transtheoretical Model, and 31% for the Physical Self-Perceptions model. Once again,
though, these results must be interpreted cautiously since the models that were tested were only partially representative of the full theoretical models.

Consistent with evidence gathered by Marlatt & Gordon (e.g., 1980, 1985) in predicting relapse in the addictions, a greater number of situational reasons, representing high-risk situations that may result in relapse, and lower self-efficacy were related to frequency of relapse from exercise. Predictors of relapse frequency from the Transtheoretical Model included lower self-efficacy, less use of consciousness raising, a cognitive strategy which involves efforts to obtain information and feedback about exercise, and less use of self-liberation, a behavioral process where individuals make a commitment to exercise and believe in their ability to exercise regularly. Finally, within Physical Self-Perceptions, doubt about one's physical ability and lower self-efficacy were strong predictors of relapse frequency. Since Physical Self-Perceptions have never been applied to relapse before, it is interesting to note that neither self-perceptions of sports competence, strength, nor body attractiveness were predictive of relapse in this study. The significant relationship between doubt and relapse frequency may be due to the more general nature of the construct. Though still specific to exercise, it may be more descriptive of what Ryckman, Robbins, Thornton, and Cantrell (1982) termed "physical self-presentation confidence". The doubt construct is not typically considered
a separate construct within the Physical Self-Perception Profile (Fox, 1990), but it has been identified in previous research (Ryckman, et al., 1982; Sonstroem, Harlow, Gemma, & Osborne, 1991).

There are several different theoretical models that attempt to explain many health behaviors including exercise. However, these models are rarely pitted against each other to determine which may be better at predicting a certain health behavior, and more importantly, what factors within each theory contribute most to an understanding of the process of health behavior change. As a result, there is a strong need for research comparing such models (Weinstein, 1993). The present study has made a preliminary, yet important, step towards an understanding of the process of relapse from exercise by identifying predictors of relapse frequency through exploratory comparison of concepts from the Relapse Prevention Model, the Transtheoretical Model, and a hierarchical model of self-esteem (Fox & Corbin, 1989). In terms of explained variance, concepts from the Relapse Prevention Model appeared to be superior, but this is not a conclusion that can be drawn with full certainty. It could rightfully be argued that this was not a complete comparison of each model, that measurement of some constructs was not entirely consistent with particular theoretical models, or that varying internal consistency of the measures could have influenced the predictive ability of certain constructs. In any study, there may always be an
arguable reason why one model appears superior to another in its ability to predict a certain behavior. Perhaps then, as noted by Weinstein (1993), the most important question in a comparison of models is not which model is best, but what are the individual contributions of each model to an overall understanding of the process of health behavior change? In this study, factors from each of the three theoretical models were identified to be important predictors of relapse from exercise. Each of these factors could potentially be drawn together, and expanded upon, to support an integrated model of relapse from exercise.
References


multivariate study of determinants of vigorous exercise in a community sample. *Preventative Medicine, 18*, 20-34.


Table 1
Fit Indices for Relapse Prevention Structural Models A to E

<table>
<thead>
<tr>
<th>Model(^a)</th>
<th>(\chi^2)</th>
<th>df</th>
<th>CFI</th>
<th>RMSR</th>
<th>(R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model A</td>
<td>365.91</td>
<td>160</td>
<td>.89</td>
<td>.0500</td>
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</tr>
<tr>
<td>Model B</td>
<td>393.45</td>
<td>175</td>
<td>.90</td>
<td>.0480</td>
<td>.49</td>
</tr>
<tr>
<td>Model C</td>
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<td>179</td>
<td>.86</td>
<td>.0567</td>
<td>.36</td>
</tr>
<tr>
<td>Model D</td>
<td>393.45</td>
<td>175</td>
<td>.90</td>
<td>.0480</td>
<td>.49</td>
</tr>
<tr>
<td>Model E</td>
<td>459.73</td>
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<td>.87</td>
<td>.0960</td>
<td>.44</td>
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\(\chi^2\) Difference Test

<table>
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<th>Model Test</th>
<th>(\chi^2)</th>
<th>df</th>
<th>(p)</th>
<th>Change in (R^2)</th>
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</thead>
<tbody>
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<td>Models E-B</td>
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<td>-.05</td>
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</table>

Note: \(\chi^2\) = maximum likelihood chi-square; df = degrees of freedom; CFI = comparative fit index; RMSR = root mean square residual.

\(^a\)Model A: CFA for measurement model; Model B: both direct and indirect paths estimated; Model C: no direct paths from level I to level III (relapse frequency) specified; Model D: No paths from level I to level II (self-efficacy) specified and covariances among all five latent constructs; Model E: No paths from level I to level II (self-efficacy) specified and covariances among four level I latent constructs.
Table 2. Standardized Factor Structure for the Relapse Prevention Measurement Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor Loading</th>
<th>Error Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Reasons</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Makes me feel stiff and sore</td>
<td>.78</td>
<td>.63</td>
</tr>
<tr>
<td>No interest in exercising</td>
<td>.79</td>
<td>.61</td>
</tr>
<tr>
<td>Exercise is hard work</td>
<td>.82</td>
<td>.57</td>
</tr>
<tr>
<td>Exercise is not enjoyable</td>
<td>.82</td>
<td>.58</td>
</tr>
<tr>
<td><strong>Situational Reasons</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not enough time</td>
<td>.78</td>
<td>.62</td>
</tr>
<tr>
<td>Difficult to schedule time</td>
<td>.87</td>
<td>.49</td>
</tr>
<tr>
<td>Facilities not convenient</td>
<td>.61</td>
<td>.79</td>
</tr>
<tr>
<td>Not enough self-discipline</td>
<td>.59</td>
<td>.81</td>
</tr>
<tr>
<td><strong>Injury Reasons</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Injury</td>
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<td>.89</td>
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<tr>
<td>Exercising is too painful</td>
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<td>.62</td>
</tr>
<tr>
<td>Poor health</td>
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<td>.83</td>
</tr>
<tr>
<td>End of sport season</td>
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<td>.90</td>
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<tr>
<td><strong>Decisional Balance</strong></td>
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<td></td>
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<tr>
<td>Health</td>
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<td>.77</td>
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<tr>
<td>Social Support</td>
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<tr>
<td>Well-Being</td>
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<td><strong>Self-Efficacy</strong></td>
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<tr>
<td>(to exercise when...)</td>
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<tr>
<td>Tired</td>
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<tr>
<td>In a bad mood</td>
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<td>.78</td>
</tr>
<tr>
<td>Not enough time</td>
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<td>.77</td>
</tr>
<tr>
<td>On vacation</td>
<td>.59</td>
<td>.81</td>
</tr>
<tr>
<td>It's raining or snowing</td>
<td>.57</td>
<td>.82</td>
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Table 3
Fit Indices for Transtheoretical Structural Models A to E

<table>
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<th>Modela</th>
<th>$\chi^2$</th>
<th>df</th>
<th>CFI</th>
<th>RMSR</th>
<th>$R^2$</th>
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$\chi^2$ Difference Test

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<tr>
<th>Model Test</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
<th>Change in $R^2$</th>
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<td>Models E-B</td>
<td>63.54</td>
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<td>&lt;.0001</td>
<td>-.07</td>
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</table>

Note: $\chi^2$ = maximum likelihood chi-square; df = degrees of freedom; CFI = comparative fit index; RMSR = root mean square residual.

*aModel A: CFA for measurement model; Model B: both direct and indirect paths estimated; Model C: no direct paths from level I to level III (relapse frequency) specified; Model D: No paths from level I to level II (self-efficacy) specified and covariances among all five latent constructs; Model E: No paths from level I to level II (self-efficacy) specified and covariances among four level I latent constructs
Table 4. Standardized Factor Structure for the Transtheoretical Measurement Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor Loading</th>
<th>Error Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pros</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would be healthier</td>
<td>.50</td>
<td>.87</td>
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<tr>
<td>Others would respect me more</td>
<td>.35</td>
<td>.94</td>
</tr>
<tr>
<td>I would feel better about myself</td>
<td>.91</td>
<td>.42</td>
</tr>
<tr>
<td><strong>Cons</strong></td>
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<td></td>
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<tr>
<td>Soreness and discomfort</td>
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<td>.81</td>
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<tr>
<td>Less time for family &amp; friends</td>
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<tr>
<td>Waste of time</td>
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<tr>
<td><strong>Consciousness Raising</strong></td>
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<td></td>
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<tr>
<td>Recall info on benefits</td>
<td>.49</td>
<td>.87</td>
</tr>
<tr>
<td>Think about information</td>
<td>.67</td>
<td>.75</td>
</tr>
<tr>
<td>Try to learn more</td>
<td>.86</td>
<td>.51</td>
</tr>
<tr>
<td>Look for exercise-related info</td>
<td>.84</td>
<td>.55</td>
</tr>
<tr>
<td><strong>Self-Liberation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(I tell myself...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am able to keep exercising</td>
<td>.88</td>
<td>.48</td>
</tr>
<tr>
<td>I can exercise regularly if I try</td>
<td>.92</td>
<td>.39</td>
</tr>
<tr>
<td>I make commitments to exercise</td>
<td>.65</td>
<td>.76</td>
</tr>
<tr>
<td>Only I am responsible</td>
<td>.54</td>
<td>.84</td>
</tr>
<tr>
<td><strong>Self-Efficacy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(to exercise when...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tired</td>
<td>.70</td>
<td>.71</td>
</tr>
<tr>
<td>In a bad mood</td>
<td>.62</td>
<td>.78</td>
</tr>
<tr>
<td>Not enough time</td>
<td>.63</td>
<td>.78</td>
</tr>
<tr>
<td>On vacation</td>
<td>.58</td>
<td>.81</td>
</tr>
<tr>
<td>It's raining or snowing</td>
<td>.61</td>
<td>.80</td>
</tr>
<tr>
<td>Temptations to skip exercise</td>
<td>-.64</td>
<td>.77</td>
</tr>
</tbody>
</table>
Table 5
Fit Indices for Physical Self-Perceptions Structural Models A - E

<table>
<thead>
<tr>
<th>Model&lt;sup&gt;a&lt;/sup&gt;</th>
<th>$\chi^2$</th>
<th>df</th>
<th>CFI</th>
<th>RMSR</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model A</td>
<td>350.14</td>
<td>160</td>
<td>.93</td>
<td>.0420</td>
<td>--</td>
</tr>
<tr>
<td>Model B</td>
<td>382.19</td>
<td>175</td>
<td>.92</td>
<td>.0410</td>
<td>.31</td>
</tr>
<tr>
<td>Model C</td>
<td>402.41</td>
<td>179</td>
<td>.92</td>
<td>.0473</td>
<td>.26</td>
</tr>
<tr>
<td>Model D</td>
<td>382.18</td>
<td>175</td>
<td>.92</td>
<td>.0415</td>
<td>.31</td>
</tr>
<tr>
<td>Model E</td>
<td>418.35</td>
<td>179</td>
<td>.91</td>
<td>.0806</td>
<td>.26</td>
</tr>
</tbody>
</table>

$\chi^2$ Difference Test

<table>
<thead>
<tr>
<th>Model Test</th>
<th>$\chi^2$</th>
<th>df</th>
<th>p</th>
<th>Change in $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Models E-B</td>
<td>36.16</td>
<td>4</td>
<td>&lt;.0001</td>
<td>-.05</td>
</tr>
</tbody>
</table>

Note: $\chi^2$ = maximum likelihood chi-square; df = degrees of freedom; CFI = comparative fit index; RMSR = root mean square residual.

<sup>a</sup>Model A: CFA for measurement model; Model B: both direct and indirect paths estimated; Model C: no direct paths from level I to level III (relapse frequency) specified; Model D: No paths from level I to level II (self-efficacy) specified and covariances among all five latent constructs; Model E: No paths from level I to level II (self-efficacy) specified and covariances among four level I latent constructs.
Table 6. Standardized Factor Structure for the Physical Self-Perceptions Measurement Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor Loading</th>
<th>Error Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sports Competence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good at sports</td>
<td>.63</td>
<td>.78</td>
</tr>
<tr>
<td>Confidence in sports ability</td>
<td>.82</td>
<td>.57</td>
</tr>
<tr>
<td>Able &amp; quick to learn sports</td>
<td>.82</td>
<td>.57</td>
</tr>
<tr>
<td>First to join in sports</td>
<td>.74</td>
<td>.67</td>
</tr>
<tr>
<td>Doubt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low level of stamina/fitness</td>
<td>.58</td>
<td>.82</td>
</tr>
<tr>
<td>Not good at sports</td>
<td>.78</td>
<td>.62</td>
</tr>
<tr>
<td>No confidence in strength/ability</td>
<td>.82</td>
<td>.57</td>
</tr>
<tr>
<td>Uncomfortable in exercise settings</td>
<td>.77</td>
<td>.64</td>
</tr>
<tr>
<td><strong>Strength</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pride in strength &amp; condition</td>
<td>.82</td>
<td>.58</td>
</tr>
<tr>
<td>Physically stronger than others</td>
<td>.70</td>
<td>.72</td>
</tr>
<tr>
<td>Stronger muscles than others</td>
<td>.69</td>
<td>.73</td>
</tr>
<tr>
<td>Confidence in strength</td>
<td>.68</td>
<td>.74</td>
</tr>
<tr>
<td><strong>Body Attractiveness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Satisfaction with physical side</td>
<td>.84</td>
<td>.54</td>
</tr>
<tr>
<td>Admired for attractive physique</td>
<td>.82</td>
<td>.58</td>
</tr>
<tr>
<td>Have &amp; maintain attractive body</td>
<td>.77</td>
<td>.64</td>
</tr>
<tr>
<td>Confidence in well-toned physique</td>
<td>.88</td>
<td>.47</td>
</tr>
<tr>
<td><strong>Self-Efficacy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(to exercise when...)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tired</td>
<td>.74</td>
<td>.66</td>
</tr>
<tr>
<td>In a bad mood</td>
<td>.55</td>
<td>.84</td>
</tr>
<tr>
<td>Not enough time</td>
<td>.65</td>
<td>.76</td>
</tr>
<tr>
<td>On vacation</td>
<td>.65</td>
<td>.76</td>
</tr>
</tbody>
</table>
FIGURE 1. PROPOSED RELAPSE PREVENTION MODEL OF FREQUENCY OF RELAPSE FROM EXERCISE

Note: + = positive relationship; - = negative relationship
Figure 2. Proposed transtheoretical model of frequency of relapse from exercise.

**Pros**

**Cons**

Note: + = positive relationship; - = negative relationship.
FIGURE 3. PROPOSED PHYSICAL SELF-PERCEPTIONS MODEL OF FREQUENCY OF RELAPSE FROM EXERCISE LEVEL

Note: + = positive relationship; - = negative relationship

LEVEL III LEVEL II LEVEL I

RELAPSE FROM EXERCISE

SELF-EFFICACY

ATTRACTIVENESS

BODY

STRENGTH

DOUBT

COMPETENCE

SPORTS
PART V. AN INTEGRATED MODEL OF RELAPSE FROM EXERCISE

In Part IV of the larger study, several important predictors of relapse from exercise, representing concepts drawn from the Relapse Prevention Model, the Transtheoretical Model, and Physical Self-Perceptions, were identified through structural equation modeling. Significant contributions from Relapse Prevention Model concepts included situational reasons for relapse, representing high-risk situations, and self-efficacy. Pros associated with exercise, self-efficacy, and the two behavioral change processes of consciousness raising and self-liberation were significant Transtheoretical Model predictors of relapse frequency. Finally, doubt about one's physical abilities, a concept representing Physical Self-Perceptions, and self-efficacy, were significantly related to relapse from exercise.

Despite the important contributions these models make toward an understanding of relapse from exercise, they are somewhat limited in their consideration of other predictors of relapse from exercise that have been identified within the larger study. For instance, factors that have been found to distinguish among types of exercise relapsers, such as psychosocial attitudes and affect, have been largely ignored within the three theories. In Part III of the larger study, psychosocial attitudes, particularly demoralization about one's exercise situation, were found to vary a great deal across types of exercise relapsers. Frequent relapsers, and
current non-exercisers appeared to have higher levels of demoralization and powerlessness, and lower levels of positive affect than occasional relapsers or maintainers. Since very little is known about relapse from exercise, and since none of these models were developed specifically to address relapse from exercise, they may need to be modified or expanded when applied to relapse from exercise (e.g., Knapp, 1988). For this reason, evaluation of the ability of constructs such as demoralization, powerlessness, and affect, and their subsequent inclusion in a model of relapse from exercise, can make an important contribution to a further understanding of the process of relapse from exercise.

In addition, social support, which was not addressed within the structural equation models comparing the three theories in Part IV, was found to distinguish between types of relapsers in the cluster analyses (see Part III). Both the Relapse Prevention Model and the Transtheoretical Model consider the importance of social support to health behavior change to some degree. In the Relapse Prevention Model, enlistment of social support is recommended to make the process of acquiring and maintaining a health behavior easier for the individual (Marlatt & Gordon, 1980, 1985). Social support is represented as a behavioral strategy (Helping Relationships) within the Transtheoretical Model. Thus, similar to the Relapse Prevention Model, social support is believed to be important in successfully
acquiring and maintaining exercise (Marcus, Rossi, Selby, Niaura, & Abrams, 1992) within the Transtheoretical Model.

The purpose of this paper is to draw on findings from previous sections of this comprehensive study of relapse from exercise, and to expand these findings through the identification of other factors that may be influential in the process of relapse from exercise. More specifically, the relationship between relapse frequency and psychosocial attitudes such as demoralization and powerless; affect; and social support will be examined within a structural modeling framework. As mentioned previously, these constructs have been found to differentiate among types of relapsers in previous research (see Part III), and were not examined within the structural models assessing predictors from the Relapse Prevention Model, the Transtheoretical Model, and Physical Self-Perceptions. It was hypothesized that negative psychosocial attitudes and lack of social support would be related to greater frequency of relapse from exercise.

Furthermore, a structural equation model, conducted in stepwise fashion, that combines significant predictors drawn from Part IV results (i.e., situational reasons for relapse, self-efficacy, pros associated with exercise, consciousness raising, self-liberation, and doubt), along with significant predictors identified in structural models representing negative psychosocial attitudes and social support, can provide an initial exploration of, and support for, relationships within a proposed integrated model of relapse.
from exercise. In addition, information can be obtained from this analysis regarding which predictors remain significant when all are analyzed simultaneously, and whether all predictors combined explain more of the variance in relapse frequency than each of the five structural models alone. It was hypothesized that there would be fewer significant paths in the combined structural model since some overlap among constructs may exist. It was also hypothesized that the combined model would explain a greater proportion of variance in relapse frequency despite the possibility of fewer significant directional paths.

It is important to note, however, that this final model must be viewed as exploratory since the constructs to be analyzed have already been examined in individual structural models within the same sample. Replication in an independent sample would be necessary to draw more definitive conclusions from obtained results.

Methods

Participants

The sample consisted of 260 students at the University of Rhode Island and 10 members from a local fitness club (total N=270). Students at the university were recruited from several departments across campus including psychology, business, engineering, math, music, and physical education departments. The additional 10 participants, recruited from a local fitness center, voluntarily filled in the survey at home and returned it to the fitness center.
Since the 10 fitness center participants were from a population that may have differed from the college students, individual t-tests were conducted on those 10 participants and a computer-generated random selection of 13 college participants students on several demographic variables and the variables to be used in this study. The random sample of college participants was generated to ensure approximately equal cell sizes for statistical comparison. Individual t-tests revealed significant differences at p<.01 between groups on only four variables. Fitness center participants were significantly older than the college participants (t(12) = -2.97, p=.01; mean age = 31 years, and 21.8 years, respectively). Fitness center participants also reported beginning exercising regularly at a later age than college students (t(20) = -3.53, p=.002; mean = 4.00: between ages 16-20, and mean = 2.23: around or before age 10, respectively). Finally, compared to college participants, fitness center participants reported lower temptations to skip exercise in certain situations (t(21) = 2.94, p=.008; mean = 2.10 and 2.83, respectively), and higher use of counter conditioning (t(19) = -3.11, p=.006; mean = 4.28 and 3.08, respectively). Since these were the only variables that the two groups significantly varied on, and differences were not expected to appreciably affect analyses, the 10 fitness center participants were combined with the 260 college students for all subsequent analyses.
The combined sample (N = 270) is characterized as largely Caucasian (91%) and Catholic (62%) with a mean age of 22 years. Women comprise 64% of the sample. Most (77%) are non-smokers and over half exercise regularly (58.5%). Almost half (48.5%) of the participants belong to some kind of gym, health club, or fitness center, and 58.1% report beginning exercising regularly between ages 10 and 20. Participants exercise an average of 3 days per week for 46 minutes each day.

A total of six participants were excluded from the analyses due to inconsistent responses on the relapse frequency and reasons for relapse variables. These participants indicated that they did not exercise regularly at all in the past six months, but then consistently responded that they did not stop exercising regularly in the past six months on the reasons for relapse variables. The total number on which the analyses were conducted, then, was N=264.

Procedure

College participants were recruited from various departments across campus including psychology, business, engineering, math, music, and physical education departments. Students from different departments were asked to participate to obtain a more representative sample of the college population. In addition, approximately 100 psychology department students completed the anonymous self-
report survey at a pre-determined time. All participants were assured anonymity.

With the instructor's permission, voluntary participation of students in other departments was requested at the beginning of each class period. Surveys were distributed to students during class, and were completed at home. These students were instructed to bring the completed surveys with them to class where they were collected. In addition, each survey was distributed in a manila envelope with the researcher's campus address so that students also had the option of returning the surveys through the campus mailing system. Most students received course credit for their participation.

Fitness center participants picked-up the survey at the fitness center, completed it at home, and returned it to the center to be collected. They were also assured anonymity, and did not receive any compensation for completing the survey.

**Measures**

**Demoralization** about one's exercise situation is a composite score adapted from the average of 12 items from Harlow's (1990) Demoralization Scale, but made specific to exercise for this study. It consists of two subscales of six items each which measure components of distress and subjective competence related to exercise. The distress subscale, consisting of items such as "I often fail to meet my own expectations regarding exercise" was found to have
acceptable internal consistency (α = .77). The subjective competence subscale including items such as "when faced with a dilemma about exercising, I usually know what to do", was found to have good internal consistency (α = .84).

Powerlessness is an average score of five items derived from a three-item Perceived Loss of Control scale developed by Newcomb and Harlow (1986). For this study, all items were adapted to be specific to exercise. Participants were asked to rate their degree of agreement to items including "I feel I am not in control of my exercise life" and "I feel stuck where I am with my exercise situation". Coefficient α for the five-item scale was calculated at .70.

The measure of Positive Affect consisted of four composite scores of two items each, formed from the 10-item general positive affect subscale of the Positive and Negative Affect Schedule (PANAS: Watson, Clark, & Tellegen, 1988). The four measures represented enthusiastic (three items), alert (2 items), active (three items) and strong (2 items) affective states. Coefficient α for the 10-item subscale was .90.

The measure of Negative Affect consisted of four composite scores of two items each, formed from the 10-item general negative affect subscale of the Positive and Negative Affect Schedule (PANAS: Watson, Clark, & Tellegen, 1988). The four measures represented nervous (three items), guilt (2 items), afraid (three items) and upset (2 items)
affective states. Coefficient α for the 10-item subscale was .86.

**Peer Support** consisted of two composite scores from a 5-item peer support subscale adapted from the Sallis, Grossman, et al. (1987) Social Support for Exercise scale. The first composite score consisted of an average of three items assessing Active Peer Support (e.g., "exercised with me"). The second composite score was an average of two items measuring Indirect Peer Support (e.g., "gave me encouragement to stick with my exercise program"). Coefficient α for the 5-item Peer Support subscale was .91. In addition, a single item, created for use in this study, that asked participants to indicate how many of their friends are involved in regular exercise, was used as a measure of Peer Support.

**Family Support** consisted of two subscales adapted from the Sallis, Grossman, et al. (1987) Social Support for Exercise scale. One was the average of seven items measuring Active Family Support (e.g., "exercised with me"), and the second was the average of five items assessing Indirect Family Support (e.g., "gave me encouragement to stick with my exercise program"). Coefficient α for the Active and Indirect Family Support subscales was .91 and .86, respectively. In addition, a single item, created for use in this study, that asked participants to indicate how many of their family members are involved in regular exercise, was used as a measure of Family Support.
Social Pressure is a two measure extension of the Social Support for Exercise scale, added for use in this study, that asks how often in the past six months has a friend or family member discouraged the participant from exercising, or made fun of the participant for exercising. Each measure consisted of the average of two items. Coefficient $\alpha$ for Peer Pressure and Family Pressure was .55 and .66, respectively.

Analyses

In the first step, two confirmatory factor analyses (CFA) were conducted to assess the fit of the measurement models for the latent intrapersonal and social support constructs, respectively. Second, two structural equation models assessing the relationship between 1) exercise relapse frequency and intrapersonal predictors; and 2) exercise relapse frequency and social support were conducted. The proposed models are shown in Figures 1 and 2. All analyses were conducted on the full sample of 264 participants using maximum likelihood estimation in the EQS computer program (Bentler, 1989).

The first model consisted of three latent predictors representing Negative Psychosocial Attitudes (Demoralization and Powerlessness), Positive Affect, and Negative Affect, and a single measured Relapse Frequency outcome variable.
The second model assessed the relationship between three social support latent predictors (Peer Support, Family Support, and Social Pressure) and the single measured Relapse Frequency outcome variable.

Finally, an exploratory structural model, combining all significant latent predictors from the Relapse Prevention, Transtheoretical, Physical Self-Perceptions, Psychosocial, and Social Support structural models, was conducted. The purpose of this model was to identify the most important predictors, and the proportion of explained variance in relapse frequency, when all significant predictors were analyzed simultaneously.

Models were evaluated in terms of degree of overall fit, examination of model parameters, and by the proportion of variance in relapse frequency accounted for by the predictor constructs. Indices that were used to assess overall model fit included the chi-square ($\chi^2$), which should be low relative to degrees of freedom; the comparative fit index (CFI: Bentler, 1990) which ranges from 0-1 with values closer to one indicating good fit; and the root mean square residual (RMSR) which is a measure of deviation between a model and the data where values close to zero are preferred.

**Results**

**Intrapersonal Predictors**

A CFA of the intrapersonal measurement model revealed a good fit of the model to the data ($\chi^2(32) = 87.99; \ CFI = .96; \ RMSR = .0394$). All parameter estimates were significant.
at p<.05, and loadings for most measured variables on their respective constructs were quite high. Factor loadings and error variances for the measured variables are reported in Table 1.

Insert Table 1 about here

Intercorrelations among the latent predictors were significant, and ranged from -.24 between Positive and Negative Affect to -.57 between Negative Psychosocial Attitudes and Positive Affect.

Results of the structural equation model assessing the relationship between the intrapersonal predictors and relapse frequency also indicated good model fit (χ²(39) = 104.90; CFI = .95; RMSR = .0400). As with the CFA, all factor loadings and factor intercorrelations were significant. Of the three predictors (Negative Psychosocial Attitudes, Positive Affect, and Negative Affect), only Negative Psychosocial Attitudes was significantly related to Relapse Frequency (β = .60). However, the model accounted for a substantial proportion of the variance in Relapse Frequency (R² = .37).

The nonsignificant relationship between Positive and Negative Affect and Relapse Frequency is not entirely surprising, given that past research has found little or no relationship between Negative Affect and actual exercise behavior, and that Positive Affect, though showing a
somewhat higher correlation with exercise behavior than Negative Affect (Watson, 1988), was not significantly related to exercise behavior. Although the transient mood states that positive and negative affect represent do not appear to be related to overall exercise habits, they, particularly negative affect, may be related to temporary lapses in exercise behavior (e.g., taking an unscheduled day off).

**Social Support**

Results from the CFA of the social support measurement model also revealed a relatively good fit of the model to the data ($\chi^2(17) = 79.64; \text{CFI} = .91; \text{RMSR} = .0324$). All parameter estimates were significant at $p<.05$, and loadings for most measured variables on their respective constructs were quite high. Factor loadings and error variances for the measured variables are reported in Table 2.

---

Insert Table 2 about here

---

Intercorrelations among the latent predictors were significant, and ranged from .20 between Social Pressure and Peer Support, to .53 between Peer Support and Family Support. It is interesting to note that the correlation between Peer Support and Social Pressure was positive. The same was found for the correlation between Family Support and Social Pressure ($r = .41$). It may be that an individual's family and peer group may consist of members
who both encourage, and at times discourage, that individual from exercising. In addition, even those who typically provide support for exercise may occasionally put pressure on an individual to skip exercise in favor of doing something else. This has also been supported in previous research identifying types of exercise relapsers where frequent relapsers reported high levels of both family support and family pressure (see Part III).

Overall fit indices for the structural equation model assessing the relationship between the social support predictors and relapse frequency indicated good fit of the model to the data ($\chi^2(22) = 88.75; \text{CFI} = .91; \text{RMSR} = .0324$). As with the CFA, all factor loadings and factor intercorrelations were significant. Of the three predictors (Peer Support, Family Support, and Social Pressure), only Peer Support was found to be significantly related to Relapse Frequency ($\beta = -.32$). Though the proportion of variance in Relapse Frequency explained by Social Support predictors was smaller than that found for predictors in previous models, it was still a fairly large effect size ($R^2 = .16$). Although Family Support was not significant in this sample, it is possible that it may be more influential in an older, or younger, population where family members may be more proximal, resulting in greater contact. Many college students live away from home, and as a result, family members may exert less of an influence on students' daily activities.
From the results of the two structural models, it would appear that feelings of demoralization and powerlessness about one's exercise situation, which have largely been ignored in theories of health behavior change, are strongly related to frequency of relapse from exercise. This is also consistent with previous research that has found significantly higher levels of demoralization and powerlessness in frequent relapsers than in those who reported no relapses or only an occasional relapse within a six month period (see Part III). In addition, peer support for exercise, in terms of both active participation and indirect encouragement, was identified as an important predictor. This is consistent with both the Relapse Prevention and Transtheoretical Model where social support is believed to play a less central, yet important, role in health behavior change by making the change process easier for the individual. (e.g., Marlatt & Gordon, 1980, 1985; Marcus, Selby, et al., 1992).

**Combined Prediction Model**

From the five structural models, a total of eight significant predictors of frequency of relapse from exercise were identified. They included: 1) Situational Reasons; 2) Self-Efficacy; 3) Pros; 4) Consciousness Raising; 5) Self-Liberation; 6) Doubt; 7) Negative Psychosocial Functioning; and 8) Peer Support. Results of the structural model combining these eight latent variables to predict
frequency of relapse from exercise revealed an adequate fit of the model to the data ($\chi^2(399) = 859.24; \text{CFI} = .86; \text{RMSR} = .0587$). All factor loadings and most factor intercorrelations were significant with the exception of correlations between Pros and Negative Psychosocial Attitudes, and between Pros and Situational Reasons. Of the eight predictors, only Negative Psychosocial Attitudes ($\beta = .28$), Situational Reasons ($\beta = .40$), and Self-Liberation ($\beta = -.19$) were found to be significantly related to Relapse Frequency in this model. However, the combined prediction model explained a substantial proportion of the variance in relapse frequency (58%).

The reduced number of significant paths for the combined prediction model may be due in part to overlap among many of the constructs. For example, Doubt and Self-Efficacy, which were significant predictors of relapse frequency in individual models, were no longer significant when analyzed with Negative Psychosocial Attitudes. An examination the correlations among these factors revealed that Self-Efficacy and Doubt were highly correlated with Negative Psychosocial Attitudes ($r = -.62$, and $r = .63$, respectively).

A nonsignificant path from pros was not surprising in this study, and suggests that its significant relationship within the Transtheoretical structural models was due to a suppression effect, especially since its zero order correlation with Relapse Frequency was so low ($r = -.03$). In
addition, Peer Support was no longer significant when analyzed with predictors from the other structural models. Peer Support may be a weaker predictor when compared to predictors from other models since the Social Support model explained less variance in Relapse Frequency than the other prediction models.

Finally, the nonsignificant path from Consciousness Raising to Relapse Frequency, may potentially explained by the differential use of the processes of change within different stages. Consciousness Raising, a cognitive-experiential strategy, may be used to greater extent in earlier stages such as precontemplation, contemplation, and preparation, than in the later stages (e.g., action and maintenance). Prediction of frequency of relapse implies active involvement in exercise. For this reason, Consciousness Raising may be used to lesser extent, and may therefore have a weaker relationship to relapse frequency, especially when so many other predictors are included.

**An Integrated Model of Relapse from Exercise**

Summarizing across the five structural equation models predicting frequency of relapse from exercise (Relapse Prevention, Transtheoretical, Physical Self-Perceptions, Intrapersonal, and Social Support), eight important predictors of exercise relapse frequency were identified. They included: 1) Situational Reasons for relapse, 2) Pros of exercise, 3) Consciousness Raising, 4) Self-Liberation,
5) Doubt about one's physical abilities, 6) Exercise Self-Efficacy, 7) Psychosocial Attitudes, and 8) Peer Support.

The results of these prediction models provide evidence for the validity of many of the relationships identified in an integrated model of relapse from exercise. A combined prediction model revealed significant relationships with relapse frequency for only three of these predictors, but results from this model must be interpreted with caution since it was clearly an exploratory analysis. The conclusions drawn from the combined model alone are not strong enough to warrant exclusion of the other five predictors from an integrated model of relapse from exercise described below, particularly since the proportion of variance in relapse frequency explained by all eight predictors combined was greater than that explained by any of the five individual models. In addition, the prediction models that were tested only examined a single phase of the relapse process, whereas relapse from exercise may be viewed as a complex phenomena involving many stages. Thus, different variables may be more influential at different stages.

In Figure 3, a much more complex model is proposed to provide a more thorough description of the process of relapse from exercise. The proposed model is based, in part, on findings from the structural models predicting relapse frequency, cluster analytic results, and a theoretical integration of the three models examined in the larger
study. This model also includes factors not found to be related to frequency of relapse from exercise in the five structural equation models. It is believed that, since the model proposes many stages in the relapse process, different factors may predict progression through different stages. For example, as noted above, even though negative affect was not significantly related to frequency of relapse from exercise, it be may hypothesized as increasing the likelihood of lapses which are defined by shorter breaks from exercise such as an occasional unplanned day off. Consciousness raising, used to a greater extent in earlier stages in the exercise process, is another example. In addition, many of the constructs not found to be related to relapse frequency in this study have been found to be important to the process change for many behaviors (including exercise) in other studies, and therefore are included within the model as potentially relevant to the process of relapse from exercise.

Finally, results from the cluster analyses identifying types of exercise relapsers are used to provide preliminary support for hypothesized progression through the stages identified within the model. Within the proposed model, types of relapsers (i.e., maintainers, occasional relapsers, frequent relapsers, and current non-exercisers) may be thought of as different people at different stages within the model. Though not as ideal as a longitudinal design that would follow an individual's progression over time, these
types of relapsers provide some insight into the process of relapse from exercise, and thus provide some initial validation of the hypotheses proposed within the model.

Within this model, exercise behavior begins with acquisition of a regular program of exercise (free-living or supervised). This stage is referred to as the action stage within the Transtheoretical Model. Following the Transtheoretical Model, maintenance is achieved after exercising regularly for six months. Maintainers, as identified by cluster analysis, report greater pros than cons for exercise, make greater use of behavioral strategies to keep them exercising regularly, and report low levels of powerlessness and demoralization about their exercise situation. In addition, those who have reached maintenance report high levels of positive affect and self-efficacy, and have positive self-perceptions of their physical abilities.

However, at any time during action or maintenance, a high-risk situation may arise that threatens one's ability to exercise. High-risk situations represent possible barriers to exercise that have been previously researched (e.g., Amaral, 1985; Sallis & Hovell, 1990; Sallis, Hovell, et al., 1989; Sallis, Haskell et al., 1986). Such high-risk situations may include lack of time, bad weather, injury, or
pressure from family or peers not to exercise. High-risk situations may also be intrapersonal. For example, individuals may identify a lack of motivation, or a belief that exercise is not enjoyable, or perceptions about not being a good athlete as reasons for relapsing from exercise. What constitutes a barrier to exercise is specific to the individual, meaning that a situation that one individual perceives as high-risk may not be perceived as such by another individual.

The presence of a high-risk situation results in temptation to skip exercise, and elicits a coping response from the individual. As proposed by the Relapse Prevention Model, an effective coping response may result in increased self-efficacy for having dealt with the high-risk situation successfully which in turn may lead to continued maintenance or adherence to exercise. An effective coping response may result from successful use of both cognitive-experiential and behavioral processes to avoid a lapse in exercise behavior. However, if the individual is unable to cope effectively, a lapse may occur. Similar to the Relapse Prevention Model, the current integrated model defines a lapse as a single slip. In exercise, a lapse indicates a single slip from regular exercise (e.g., not exercising on a planned exercise day). If a high-risk situation occurs at the same time a person is experiencing a high level of negative affect (e.g., nervousness, irritability), the
likelihood of an ineffective coping response and subsequent lapse may increase.

Consistent with the Relapse Prevention Model, a lapse may lead to feelings of guilt and personal attributions for failure to exercise regularly. These feelings are referred to as the Abstinence Violation Effect (AVE) in the Relapse Prevention Model. Within the current model of relapse from exercise, it is referred to as the Maintenance Violation Effect (MVE) since a lapse represents a slip from a behavior requiring maintenance rather than abstinence. The feelings associated with the MVE may result in lowered self-efficacy which in turn may lead to relapse. An occasional relapse may not be problematic, and many exercisers may quickly return to a regular program of exercise. Evidence for the relative harmlessness of occasional relapse has been provided in previous research where those reporting relapsing occasionally for a week or more in a six month period did not differ significantly from maintainers on several behaviors and attitudes related to exercise adherence. Furthermore, occasional relapsers most often identified themselves as maintainers and provided mainly situational reasons for their relapse (see Part III). Although they may experience the MVE to some degree, and may experience a lowering of self-efficacy related to the perceived inability to exercise in certain situations, this reduced self-efficacy may be alleviated when the situation that keeps them from exercising changes. An example may be a college
student, who during final exam week, feels that there is not enough time to exercise, and subsequently does not exercise for the entire week. The student may feel guilty for not exercising, and may feel some loss of confidence in the ability to exercise in this particular high-risk situation, but these feelings may be likely to disappear when exam week is over. Thus, occasional, situational relapsers may feel more control over their ability to exercise than relapsers who attribute their relapse to some weakness within themselves. The potential for many individuals to move from relapse directly back into a regular program of exercise is indicated in Figure 5 by broken-line arrow from Relapse to Continued Maintenance/Adherence.

Depending upon the strength of the MVE in terms of guilt and personal attribution for relapse, the extent of the reduction in the individual's self-confidence for maintaining a regular program of exercise, and feelings of demoralization, powerlessness, and doubt about one's physical abilities, a complete collapse may occur. The breakdown of the exercise relapse process into three stages (lapse, relapse, and collapse) is a slight deviation from the two stages (lapse and relapse) originally proposed by Marlatt & Gordon (1985) in the Relapse Prevention Model. The three distinctions were originally proposed by researchers in the area of obesity (Brownell, 1991). Relapse is characterized by engaging in an undesirable behavior for a longer period of time (e.g., not exercising for a week), and
in collapse, an individual stops exercising completely with no intention of resuming a regular program of exercise in the immediate future. Having three stages may be better suited to behaviors such as dieting and exercise that require regular performance of behavior rather than abstinence. This may improve the ability to distinguish between those who simply "took a day off" and those who are in danger of quitting or who have quit exercising.

The current model emphasizes the identification of relapsers and collapsers by the assessment of the stage of readiness to change that they have regressed to. Occasional relapsers, particularly those who attribute their relapse to their current situation, may immediately continue regular exercise, and are likely to identify themselves as being in action or maintenance. More frequent relapsers, on the other hand, may view their drop-out from exercise as temporary, but may make more personal attributions for their relapse (see Part III). Frequent relapsers may feel demoralized and powerless to change their exercise situation, and begin to doubt their physical abilities. However, they may be planning to begin exercising regularly again in the near future. According to the Transtheoretical Model, this would put them in either the contemplation or preparation stage of readiness to change.

Those who relapse often may be in danger of collapsing as frequent relapse leaves them more discouraged each time. This may be particularly true since frequent relapsers have
been found to differ very little from current non-exercisers on a number of behaviors and attitudes relevant to exercise. Current non-exercisers may be thought of as having collapsed within this model. This is further validated by the fact that those classified as current non-exercisers by cluster analysis report being relapsers rather than non-exercisers even though they had not exercised regularly at all in the past six months. This is indicative of long-term, and potentially indefinite, relapse. Furthermore, frequent relapsers are very much like precontemplators in the sense that they have low self-efficacy, perceive numerous cons and very few benefits of exercise, and make very little use of the processes of change. In addition, they report high levels of powerlessness and demoralization relating to their ability to exercise, and also report a great deal of doubt in their physical abilities. Within this model, those who have collapsed may have dropped back to the precontemplation stage, and may have no intention of beginning an exercise program in the near future. Since not all who relapse or collapse may begin to progress toward action again, the arrows representing movement from precontemplation to action are marked by broken lines.

In addition to other components of the Transtheoretical Model used to identify current stage of change (e.g. use of the processes, decisional balance, and self-efficacy), those in the preparation stage within this model may be differentiated from contemplators or precontemplators by
their level of intention to resume exercise. Those who relapse to preparation have high intention to resume exercise in the near future while contemplators intend to begin exercising again, but have not made a commitment to do so in the near future. As mentioned above, those who collapse into precontemplation have or little or no intention of resuming exercise.

Implications of the Integrated Model for Intervention

This model, by viewing relapse from exercise as a complex but predictable process, allows for intervention planning for different stages of the process. Interventions can be tailored to the individual needs of exercisers based upon their current level of readiness for change and what type of relapser they may be. Examples of possible intervention strategies may include identification of high-risk situations and development of coping skills to avoid relapse for those who are in action or maintenance and motivational approaches such as motivational interviewing (DiClemente, 1991), increasing exercise self-efficacy (Sonstroem, 1988) and goal-setting (Rejeski, 1992) for those who become so discouraged by their inability to exercise regularly that they have returned to the precontemplation or contemplation stages. Other strategies for motivating individuals to begin and adhere to exercise are summarized by Brawley & Rodgers (1993).

It may be argued that these interventions have already been employed to reduce the probability of relapse from
exercise with only modest success, but the difference, and major strength of this approach is the acknowledgment that individuals are at different stages in the exercise process. In general, global intervention approaches designed for individuals in the preparation and action stages have been used across all types of health behaviors (Prochaska, 1991; Prochaska, DiClemente, & Norcross, 1992). Therefore, mismatches between the individual's stage of change and the intervention approach likely contribute to the limited success of many interventions. The current model allows for the identification of current stage of change in relapsers, and thus, the proper customizing of interventions to the particular needs of those within each stage. The success of intervention programs for smoking cessation is evidence of the Transtheoretical Model's superior ability to identify one's current location within the process of health behavior change, and, with the use of an expert computer system, to adjust interventions accordingly (Velicer et al., 1993). Similar programs may be created for those attempting to adhere to a regular program of exercise. This contribution of the Transtheoretical Model takes the proposed integrated model of relapse from exercise a step beyond current models of exercise relapse.

Discussion

In this study, a model of relapse from exercise was proposed that integrates the major components of the Relapse Prevention Model, the Transtheoretical Model, and Physical
Self-Perceptions, in addition to intrapersonal psychosocial attitudes and social support. The current model captures the cyclical nature of exercise behavior change by noting movement from action to maintenance, relapse to earlier stages (precontemplation, contemplation, preparation), and eventual progression again toward action and maintenance. In addition, preliminary evidence for the validity of some of the relationships proposed within this model was provided through an exploratory comparison, and elaboration, of several prediction models of relapse from exercise.

Future research might involve a more comprehensive evaluation of the model by including more constructs representing the respective theories. A full test of the integrated model employing a longitudinal design is also important to properly assess progression within the model, and to draw stronger conclusions about the validity of the model.
References


meeting of the American Psychological Association,
Boston, MA.


Table 1. Standardized Factor Structure for the Intrapersonal Measurement Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Factor Loading</th>
<th>Error Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Psychosocial Attitudes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demoralization</td>
<td>.79</td>
<td>.61</td>
</tr>
<tr>
<td>Powerlessness</td>
<td>.56</td>
<td>.83</td>
</tr>
<tr>
<td><strong>Positive Affect</strong></td>
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<td></td>
</tr>
<tr>
<td>Enthusiastic</td>
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<td>.49</td>
</tr>
<tr>
<td>Alert</td>
<td>.82</td>
<td>.58</td>
</tr>
<tr>
<td>Active</td>
<td>.87</td>
<td>.50</td>
</tr>
<tr>
<td>Strong</td>
<td>.80</td>
<td>.61</td>
</tr>
<tr>
<td><strong>Negative Affect</strong></td>
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<td></td>
</tr>
<tr>
<td>Nervous</td>
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<td>.62</td>
</tr>
<tr>
<td>Guilt</td>
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<td>.80</td>
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<tr>
<td>Afraid</td>
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<td>.54</td>
</tr>
<tr>
<td>Upset</td>
<td>.70</td>
<td>.62</td>
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Table 2. Standardized Factor Structure for the Social Support Measurement Model

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Error Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peer Support</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Peer Support</td>
<td>.85</td>
<td>.53</td>
</tr>
<tr>
<td>Indirect Peer Support</td>
<td>.87</td>
<td>.50</td>
</tr>
<tr>
<td>Number Friends Exercise</td>
<td>.53</td>
<td>.85</td>
</tr>
<tr>
<td><strong>Family Support</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Family Support</td>
<td>.78</td>
<td>.63</td>
</tr>
<tr>
<td>Indirect Family Support</td>
<td>.86</td>
<td>.51</td>
</tr>
<tr>
<td>Number Family Members Exercise</td>
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<td>.85</td>
</tr>
<tr>
<td><strong>Social Pressure</strong></td>
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<td></td>
</tr>
<tr>
<td>Peer Pressure</td>
<td>.65</td>
<td>.76</td>
</tr>
<tr>
<td>Family Pressure</td>
<td>.65</td>
<td>.76</td>
</tr>
</tbody>
</table>
FIGURE 1. PROPOSED INTRAPERSONAL MODEL OF FREQUENCY OF RELAPSE FROM EXERCISE

NEGATIVE PSYCHOSOCIAL ATTITUDES

+ —— —— > RELAPSE FREQUENCY

POSITIVE AFFECT

— —— > RELAPSE FREQUENCY

NEGATIVE AFFECT

FIGURE 2. PROPOSED SOCIAL SUPPORT MODEL OF FREQUENCY OF RELAPSE FROM EXERCISE

PEER SUPPORT

— —— > RELAPSE FREQUENCY

FAMILY SUPPORT

+ —— > RELAPSE FREQUENCY

SOCIAL PRESSURE

Note: + = positive relationship; - = negative relationship
FIGURE 3. PROPOSED INTEGRATED MODEL OF RELAPSE FROM EXERCISE
PART VI. GENERAL DISCUSSION

This study has provided a comprehensive assessment of relapse from exercise through: 1) literature review, 2) development of a scale to measure reasons for relapse from exercise; 3) classification of types of exercise relapsers; 4) identification of predictors of frequency of relapse from exercise; and 5) proposal of an integrated model of relapse from exercise. In this study, a wide variety of measures derived primarily from three major models of health behavior were examined. This provided a very rich and comprehensive assessment of relapse in exercise behavior.

Though information on the frequency of relapse from regular exercise is available, and most researchers would agree that relapse is a serious problem, very little research has been conducted that focuses on the relapse process itself. This study has taken a large step toward understanding this issue. It has provided a scale to measure specific reasons for relapse in individuals; it has identified types of exercise relapsers, and assessed differences among these types on several exercise-related behaviors and attitudes; it has tested the ability of concepts representing three preexisting theories of health behavior, to predict relapse from exercise; and it has elaborated on these models with an assessment of the relationship between intrapersonal characteristics, social support, and relapse frequency.
Perhaps the most important contribution of this study has been its drawing together of the findings from each of these parts of the larger study to provide preliminary evidence for an integrated model of relapse from exercise. Specific contributions to a beginning understanding of relapse made by each part of the larger study are summarized below.

The lack of research specifically assessing relapse from exercise has resulted in a corresponding lack of measures to examine relapse. Since this study was designed to assess this particular facet of exercise behavior, a scale to measure actual reasons for relapse from exercise was developed. This scale differs from other scales assessing barriers to exercise in that it identifies specific, as opposed to hypothetical, reasons for relapse. Evaluation of psychometric properties indicated that the reasons given for relapsing can be grouped into three components encompassing situational, personal, and injury reasons for exercise. These components appear to be relatively distinct, but have a good deal of both statistical and conceptual overlap. This appears to have contributed to satisfactory, yet not especially good, factor structure fit. However, the scale showed excellent internal consistency, and evidence was provided for its validity.

Major contributions of the development of this scale include establishment of a measure of specific reasons for relapse from exercise, as well as identification of three
major types of high risk situations. This allows for measurement of actual situations that put an individual at risk for relapse in testing an integrated model of relapse from exercise. Future research on this scale might involve inclusion of more items, particularly assessing injury reasons, to identify more comprehensive and independent subscales, and assessment of factor structure with a larger sample. In addition, evaluation of the scale's psychometric properties in different age groups, within gender, and across a broader range of exercise levels is warranted to further validate this scale in several different populations.

There has also been no attempt in the past to classify types of relapsers within a cluster-analytic framework in previous exercise research. This study identified four distinct types of relapsers representing maintainers, occasional relapers, frequent relapers, and current non-exercisers. In addition, important differences between types of relapsers were observed. Few differences were identified between Maintainers and occasional exercisers, providing important evidence that an occasional relapse may not be problematic in maintaining a regular program of exercise. Furthermore, those who relapse occasionally identify themselves as being in maintenance, and thus, may not perceive an occasional week or two off within a six month period as relapse. Frequent relapers, on the other hand, appear to be extremely demoralized and often feel powerless
to exercise regularly. Their self-efficacy is low, and they may be in danger of collapsing into long-term relapse. Interestingly, the group labeled current non-exercisers do not perceive themselves as sedentary. Instead, they report themselves as being in relapse even though they haven't exercised regularly at all within a six month period. However, they appear to be the most discouraged of the four types of relapsers, and may have collapsed after many unsuccessful attempts to exercise regularly.

A major contribution of the identification of types of relapsers and the evaluation of their exercise-related behavior and attitudes is the preliminary information it provided about movement through the integrated model of relapse from exercise. For example, results from this study suggest direct movement from relapse back to continued maintenance/adherence for some. It has also led to the hypothesis that collapse may be most likely to occur after frequent relapse. Finally, it provided evidence for identifying those who may be most at risk for frequent relapse or collapse.

It is important to state that these particular hypotheses, drawn from the cluster analysis about movement through the integrated model of relapse from exercise, have not been clearly tested within the current study. They are merely proposed ideas about how one may progress through the relapse process. Ideally, evaluation of movement through this process should be conducted within a longitudinal
framework. This would allow for tracking individual progression through the stages of relapse over time, as well as the effect of relapse on one's stage of readiness to exercise. Such a design would potentially allow researchers to draw stronger conclusions about this complex process.

A more direct contribution of the cluster study is the information it provides about developing interventions that are tailored to an individual's needs. This study has shown that different types of relapsers may have different needs in maintaining regular exercise. As noted previously, a few different interventions may be designed that effectively meet the needs of particular types of relapsers. This may increase the efficacy of current interventions without resorting to more costly individual counseling.

The four clusters identified in this study were obtained in a sample consisting primarily of male and female college students. Therefore, caution is advised in generalizing to other populations. The current sample was young and appeared to be quite active in general. It is very possible that different types of relapsers may be identified in an older, potentially more sedentary, populations. In addition, possible gender differences may result in different cluster solutions for men and women. In addition, this study examined relapse from vigorous exercise. It may be that different types of relapsers exist for relapse from varying levels of exercise intensity. For this reason, future research should also include more moderate levels of
exercise to evaluate whether different types of relapsers exist for moderate exercise.

The third study investigated the ability of concepts representing three models of health behavior to predict frequency of relapse from exercise. Concepts representing components of the Relapse Prevention Model (e.g., Marlatt & Gordon, 1985), the Transtheoretical Model (e.g., Prochaska & DiClemente, 1983), and Physical Self-Perceptions from a hierarchical model of self-esteem (e.g., Fox & Corbin, 1989), were tested in a series of structural equation models for each theory. Results indicated a satisfactory fit for models representing each of the theories. Several predictors of frequency of relapse from exercise were identified, and all of the models accounted for a substantial proportion of the variance in relapse frequency, with the concepts from the Relapse Prevention Model explaining the most (49%). A consistent finding across structural models was that exercise self-efficacy did not serve as a mediator between other predictors and relapse frequency. However, it was an important direct predictor of relapse frequency within each of the theoretical models.

The comparison among models in this study must be considered exploratory since each structural model was only a partial test of each of the theories. In addition, reliability of the measures for each theoretical model varied which may have influenced predictive ability across models. However, this study did provide strong evidence for
the existence of several proposed relationships within the integrated model of relapse from exercise. For example, relationships between relapse frequency and situational reasons for relapse (representing high-risk situations), exercise self-efficacy, consciousness raising (a cognitive-experiential strategy), self-liberation (a behavioral process), and doubt about one's physical abilities were identified. Future research that includes more comprehensive and reliable measures from each of the three theoretical models, and that tests these relationships within a longitudinal framework, may provide information about the unique contributions of each theoretical model, temporal ordering, and the presence of potential mediating relationships.

Finally, the fourth study provided an elaboration of current theories of health behavior by testing the contribution of intrapersonal characteristics such as demoralization, powerlessness, and affect, as well as social support, to the prediction of frequency of relapse from exercise. Results revealed that, despite being largely ignored in current theoretical models of health behavior change, negative psychosocial attitudes were strongly related to greater frequency of relapse from exercise, explaining 37% of the variance. In addition, having friends to exercise with and provide encouragement was significantly related to a lower frequency of relapse from exercise. Finally, an exploratory prediction model, combining
significant predictors from each of the five individual models, explained over half (58%) of the variance in relapse frequency.

Each of the studies mentioned above provided evidence for many of the relationships within a proposed integrated model of relapse from exercise. The five prediction models that were conducted and the combined prediction model contributed preliminary support for the proposed relationships, and the cluster analysis results allowed insight into movement through the stages of relapse from exercise.

In conclusion, the present study has made a powerful contribution toward understanding the process of relapse of exercise. Another major strength of this study is that it provides many directions for future research. Among the most important directions for future research are conducting a more comprehensive test of the integrated model of relapse from exercise within a longitudinal framework, and including more moderate levels of exercise in the evaluation of the relapse process. A cross-sectional study such as this provides important information about the relationships among factors influencing relapse, and is extremely important when so little is known about relapse from exercise. That results were replicated across independent samples further strengthens the validity of the scale development and cluster analysis results. Nevertheless, cross-sectional designs cannot adequately evaluate the process of relapse.
full test of a model of relapse from exercise may require evaluation at several time points. In addition, with new guidelines for the amount of exercise necessary to achieve certain health benefits, investigation of potentially different factors contributing to relapse from moderate exercise, as opposed to more vigorous exercise, has become important.

Other directions for future research include examining relapse in other populations. A college population is an ideal age-group in which to measure relapse from exercise since physical activity tends to decline most rapidly in the years following high school, and interventions directed at college students may have great potential for promoting life-long exercise behavior (Dishman & Steinhardt, 1988). However, generalization to other populations is limited. Finally, future analyses may be conducted within gender to explore potential differences.
APPENDIX A

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In this survey, regular exercise is defined as exercise performed three or more times per week for 20 minutes or more without stopping, which is hard enough to make your heart rate and breathing increase a large amount. (from Sallis, Hovell, Hofstetter et al., 1990)

For the first 5 questions, please fill in the blanks

**Current Exercise Level**

(Physical Activity Questionnaire; Sonstroem, Speliotis, & Fava, 1992)

1. Do you exercise regularly (check one) ___ Yes ___ No
2. How many days per week do you exercise? ___
3. About how many minutes per day do you exercise? ___

**Background Information**

4. What is your height? ___ feet ___ inches
5. What is your weight? ___ lbs
6. Race or cultural group:
   1 = White
   2 = African-American
   3 = Asian-American
   4 = Hispanic-American
   5 = Other
7. Occupation: In what type of work are you currently employed?
   1 = Not earning/Student
   2 = Clerical/Manual
   3 = Service/Sales
   4 = Business/Technical/Professional
   5 = Other
8. Income: In the past year, about how much gross income did you earn?
   1 = less than $5,000
   2 = $5,000 to $14,999
   3 = $15,000 to $24,999
   4 = $25,000 to $34,999
   5 = $35,000 or above
9. Religious affiliation:
   1 = Catholic
   2 = Protestant
   3 = Jewish
   4 = Eastern
   5 = Other

10. How religious would you say you are?
   1 = Not at all
   2 = Slightly
   3 = Moderately
   4 = Fairly
   5 = Very

11. Number of cigarettes smoked per day?
   1 = None, I don't smoke
   2 = 0 to 10
   3 = 10 to 20
   4 = 20 to 40
   5 = 40+

12. At what age did you start exercising regularly?
   1 = Before age 10
   2 = Age 10 - 13
   3 = Age 14 - 17
   4 = Age 18 - 21
   5 = Age 22 or older

13. Do you belong to a health club, gym, or any other type of fitness center?
   1 = No
   2 = Yes

14. How many of your friends are involved in regular exercise?
   1 = None
   2 = A few
   3 = About half
   4 = Most
   5 = All
15. How many of your immediate family members are involved in regular exercise?

1 = None
2 = A few
3 = About half
4 = Most
5 = All

Stages of Exercise Change

Stages of Exercise Change scale (Marcus, Selby, Niaura, & Rossi, 1992)

Please indicate how much you agree or disagree with each statement. Think about how you feel right now, not how you have felt in the past or would like to feel. **Regular exercise** = 3 times or more per week for 20 minutes or longer without stopping, which is hard enough to make your heart rate and breathing increase a large amount.

1 = Strongly disagree
2 = Disagree
3 = Undecided
4 = Agree
5 = Strongly Agree

1. I currently do not exercise and I do not intend to start exercising in the next 6 months.

2. I currently do not exercise, but I am thinking about starting to exercise in the next 6 months.

3. I am prepared to begin exercising regularly with the next 30 days.

4. I currently exercise regularly, but I have only begun doing so within the past 6 months.

5. I currently exercise regularly, and have done so for longer than 6 months.

6. I have exercised regularly in the past, but I am not doing so currently.

Decisional Balance

Exercise Decisional Balance scale (Marcus, Rakowski, & Rossi, 1992; Marcus & Owen, 1992)
Please indicate how much you agree or disagree with each statement below.

1 = Strongly disagree
2 = Disagree
3 = Undecided
4 = Agree
5 = Strongly Agree

1. I would be healthier if I exercised regularly.
2. I would probably be sore and uncomfortable if I exercised regularly.
3. If I exercised regularly, my family and friends would get to spend less time with me.
4. I would feel better about myself if I exercised regularly.
5. Other people would respect me more if I exercised regularly.
6. I would feel that I was wasting my time if I exercised regularly.

Temptations to Skip Exercise

Please indicate how tempted you would be to skip exercising regularly in the following situations using the scale provided.

1 = Not at all tempted
2 = Slightly tempted
3 = Moderately tempted
4 = Fairly tempted
5 = Very tempted

1. When I am tired.
2. When I am in a bad mood.
3. When I feel I don't have time.
4. When I am on vacation.
5. When it is raining or snowing.
Exercise Self-Efficacy

Exercise Self-Efficacy scale (Marcus, Selby, Niaura, & Rossi, 1992)

I am confident I can participate in regular exercise when:

1 = Not at all confident
2 = Slightly confident
3 = Moderately confident
4 = Fairly confident
5 = Very confident

1. I am tired.
2. I am in a bad mood.
3. I feel I don't have time.
4. I am on vacation.
5. It is raining or snowing.

Processes of Change

Processes of Exercise Change scale (Marcus, Rossi, Selby, Niaura, Abrams, 1992)

Remember that Regular exercise = 3 times or more per week for 20 minutes or longer without stopping, which is hard enough to make your heart rate and breathing increase a large amount.

Think back over the past month and indicate how frequently each of the following has occurred:

1 = Never
2 = Rarely
3 = Sometimes
4 = Often
5 = Repeatedly

Consciousness Raising

1. I recall information people have personally given me on the benefits of exercise.
2. I think about information from articles and advertisements on how to make exercise a regular part of my life.
3. I read articles about exercise in an attempt to learn more about it.

4. I look for information related to exercise.

Dramatic Relief

5. Warnings about health hazards of inactivity move me emotionally.

6. Dramatic portrayals of the evils of inactivity move me emotionally.

7. I react emotionally to warnings about an inactive lifestyle.

Environmental Reevaluation

8. I feel I would be a better role model for others if I exercised regularly.

9. I wonder how my inactivity affects those people that are close to me.
10. I realize that I might be able to influence others to be healthier if I would exercise more.

11. Some of my close friends might exercise more if I would.

Self-Reevaluation

12. I am considering the idea that regular exercise would make me a healthier, happier person to be around.

13. I think about the type of person I will be if I keep exercising.

14. I get frustrated with myself when I don't exercise.

15. I consider the fact that I would feel more confident in myself if I exercised regularly.

Social Liberation

16. I find society changing in ways that make it easier for the exerciser.

17. I am aware of more and more people encouraging me to exercise these days.
18. I notice that more businesses are encouraging their employees to exercise by offering fitness courses and time off to work out.

19. I am aware that many health clubs now provide free babysitting to their members.

Counterconditioning

20. Instead of remaining inactive, I engage in some physical activity.

21. Rather than viewing exercise as simply another task to get out of the way, I try to use it as my special time to relax and recover from the day's worries.

22. When I feel tired, I make myself exercise anyway because I know I will feel better afterwards.

23. When I'm feeling tense, I find exercise a great way to relieve my worries.

Helping Relationships

24. I have someone on whom I can depend when I am having problems with exercising.

25. I have a healthy friend that encourages me to exercise when I don't feel up to it.

26. I have someone who points out my rationalizations for not exercising.

27. I have someone who provides feedback about my exercising.

Reinforcement Management

28. I reward myself when I exercise.

29. I try to set realistic goals for myself rather than setting myself up for failure by expecting too much.

30. When I exercise, I tell myself that I am being good to myself by taking care of my body in this way.

31. I do something nice for myself for making efforts to exercise more.
Self-Liberation

32. I tell myself I am able to keep exercising if I want to.

33. I tell myself that if I try hard enough I can keep exercising.

34. I make commitments to exercise.

35. I remind myself that I am the only one who is responsible for my health and well-being, and that only I can decide whether or not I will exercise.

Stimulus Control

36. I put things around my home to remind me of exercising.

37. I keep things around my place of work that remind me of exercise.

38. I remove things that contribute to my inactivity.

39. I avoid spending long periods of time in environments that promote inactivity.

Perceived Benefits of Exercise

Exercise Benefits Scale (Sechrist, Walker, & Pender, 1987)

Listed below are some possible benefits of regular exercise. Please indicate how much you agree or disagree with the following statements.

1 = Strongly Disagree
2 = Disagree
3 = Undecided
4 = Agree
5 = Strongly Agree

1. Exercise puts me in a better mood.

2. I sleep better when I exercise.

3. Exercise makes me less tired.

4. Exercise makes me feel better about myself.

5. Exercise makes me more alert.
6. When I exercise, I am able to carry out normal activities without getting tired.

7. The quality of my work improves when I exercise.

8. My overall body functioning improves when I exercise.

9. Exercise increases the strength of my muscles.

10. Exercise increases my level of physical fitness.

11. Exercise improves my muscle tone.

12. Exercise improves my cardiovascular functioning.

13. Exercise increases my stamina.

14. Exercise increases my flexibility.

15. Exercise improves my physical endurance.

16. Exercise improves the way my body looks.

17. I enjoy exercising.

18. Exercise reduces stress and tension.

19. My overall mental health is improved when I exercise.

20. Exercise gives me a sense of personal accomplishment.

21. Exercise helps me to relax.

22. Exercise improves feelings of well-being.

23. Exercise allows me to have more contact with friends.

24. Exercise allows me to meet people.

25. Exercise is entertaining.

26. I feel more accepted by others when I exercise.

27. Exercise can help to prevent heart attacks.

28. Exercise can help to prevent high blood pressure.

29. Exercise will help me to live longer.
Social Support for Exercise Behaviors

Friend Support for Exercise Habits Scale (Sallis et al., 1987) and Pressure Not to Exercise

How often has one or more of your friends done the following in the past 6 months?

1. Exercised with me.
2. Offered to exercise with me.
3. Tried to discourage me from exercising.
4. Gave me helpful reminders to exercise.
5. Gave me encouragement to stick with my exercise program.
6. Made fun of me because I exercise.
7. Changed their schedule so we could exercise together.

Family Support for Exercise Habits Scale: Participation and Involvement subscale (Sallis et al., 1987), and Pressure Not to Exercise

How often has one or more of your immediate family members done the following in the past 6 months?

1. Exercised with me.
2. Gave me encouragement to stick with my exercise program.
3. Changed their schedule so we could exercise together.
4. Tried to discourage me from exercising.
5. Offered to exercise with me.
6. Gave me helpful reminders to exercise.
7. Planned for exercise on recreational outings.
8. Made fun of me because I exercise.
9. Discussed exercise with me.
10. Talked about how much they liked to exercise.
11. Helped plan activities around my exercise.
12. Asked me for ideas on how they could get more exercise.
13. Took over chores so I had more time to exercise.
14. Made positive comments about my physical appearance.

**Powerlessness**
Perceived Loss of Control Scale (Newcomb & Harlow, 1986)

The following are 5 statements that you may or may not agree with. Please think about the past 6 months and state how much you agree with each statement using the following choices.

1 = Strongly Disagree
2 = Disagree
3 = Don't Know
4 = Agree
5 = Strongly Agree

1. I feel I am not in control of my exercise life.
2. I feel that whether or not I am successful with an exercise program is just a matter of luck and chance rather than my own doing.
3. I feel like others are running my exercise life for me.
4. I feel that opportunities for exercise just happen to me.
5. I feel stuck where I am with my exercise situation.
Stress

RISC Inventory (Fava, Grimley, & Ruggiero, 1992)

Please read the following statements. In the past 6 months, HOW OFTEN was each statement true of your own life? Please rate the frequency using the 5-point scale below.

1 = Never
2 = Seldom
3 = Occasionally
4 = Often
5 = Frequently

1. I was able to cope with difficult situations.
2. I felt overwhelmed.
3. I was able to cope with unexpected problems.
4. I felt a lot of extra tension.
5. I successfully solved problems that came up.
6. I took on more than I could handle.
7. I stayed relaxed in the face of demands.
8. I felt stressed by unexpected events.
9. I was able to make daily decisions.
10. I had no time to relax.
11. I felt able to cope with stress.
12. I felt I had more stress than usual.
13. I felt able to meet demands.
14. I felt there was not a lot of time to complete my daily tasks.
15. I was able to deal with uncertainty.
16. I was pressured by others.
17. I felt able to control events in my life.
18. I felt stressed by simple things.
19. Do you feel that you are under a great deal of stress?

Demoralization

Demoralization Scale (Harlow, 1990)

For the following items, indicate how frequently each experience has occurred in the last 6 months using the following scale:

1 = Never
2 = Rarely
3 = Sometimes
4 = Often
5 = Always

1. I feel puzzled about my level of exercise.
2. When faced with a dilemma about exercising, I usually know what to do.
3. I feel confused and bewildered about how much I exercise.
4. I can cope with pressing problems about exercising.
5. I feel as though there's no way to fit exercise into my schedule.
6. I can exercise in stressful situations.
7. My situation with exercise appears threatening to me.
8. When necessary, I am able to turn an exercise situation around for the better.
9. I find myself preoccupied with merely trying to get by with my level of exercise.
10. I can take action to correct an exercise situation when necessary.
11. I often fail to meet my own expectations regarding exercise.
12. I possess a degree of self-determination about exercising.
Relapse Frequency

Please answer the next question using the scale provided.

1 = Never
2 = Once
3 = 2-3 times
4 = 4-6 times
5 = 7 or more times

How often in the past six months did you stop exercising regularly (3 or more times per week for 20-60 minutes per exercise session without stopping, which is hard enough to make your heart rate and breathing increase a large amount) for a period of one week or longer?

Reasons for Relapse
(adapted from Sallis et al., 1989)

The following are a list of reasons that some people give for why they stop exercising. If you stopped exercising regularly (3 or more times per week for 20 or more minutes per exercise session without stopping, and hard enough to make your heart rate and breathing increase a large amount) for a period of one week or more in the past 6 months, please rate how much each of the following contributed your lapse using the following scale.

1 = Never Contributed
2 = Contributed Very Little
3 = Contributed Somewhat
4 = Contributed Strongly

1. Not enough time.
2. No one to exercise with.
3. Injury.
4. Exercising is too painful.
5. Pressure from friends not to exercise.
6. It's too difficult for me to schedule a time to exercise.
7. The exercise facilities that are available are not convenient (too far away, too crowded, etc.)
8. I'm self-conscious about the way I look when I exercise.
10. Exercise makes me feel stiff and sore.
11. Exercise is boring.
12. I'm not a good athlete.
13. I don't have enough energy.
14. Exercise interferes with my lifestyle.
15. I don't have enough self-discipline to exercise.
16. I don't have any interest in exercising.
17. Poor health.
18. Exercise is hard work.
19. I'm not coordinated enough to exercise.
20. Exercise is not enjoyable.
21. End of the sport season.
22. Exercising is too expensive.
23. Exercising takes too much time from my responsibilities.
24. Exercise makes me feel too tired.

Mood
(PANAS Scales; Watson, Clark, & Tellegen, 1988)

This next set of items consists of a number of words that describe different feelings and emotions. Please read each item and fill in the appropriate answer using the scale provided below. Indicate to what extent you have felt this way during the last 6 months.

1 = Not at all
2 = A little
3 = Moderately
4 = Quite a bit
5 = Extremely

1. Interested
2. Distressed
3. Excited
4. Upset
5. Strong
6. Guilty
7. Scared
8. Hostile
9. Enthusiastic
10. Proud
11. Irritable
12. Alert
13. Ashamed
14. Inspired
15. Nervous
16. Determined
17. Attentive
18. Jittery
19. Active
20. Afraid

**Physical Self-Perceptions**

Physical Self-Perception Profile (Fox, 1990)

**WHAT AM I LIKE?**

The following are statements which allow people to describe themselves. There are no right or wrong answers since people differ a lot.

First, decide which one of the two statements best describes you. Then, go to that side of the statement and choose if it is "sort of true" or "really true" FOR YOU. Fill in the answer sheet with the number of the best answer for you using the scale provided below.

**EXAMPLE**

<table>
<thead>
<tr>
<th>Really true for me</th>
<th>Sort of true for me</th>
<th>Really true for me</th>
<th>Sort of true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2</td>
<td>Some people are 3 4</td>
<td>Others are not</td>
<td>very competitive 4</td>
</tr>
<tr>
<td>Others are not</td>
<td>so competitive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you think that the second statement best describes you and is sort of true for you, then you would fill in the number 3 on your answer sheet.
REMEMBER to select only ONE of the four numbers.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Really true</td>
<td>Sort of true</td>
<td>Really true</td>
<td>Sort of true</td>
</tr>
<tr>
<td>for me</td>
<td>for me</td>
<td>for me</td>
<td>for me</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Some people feel that they are not very good when it comes to playing sports</td>
<td>Others feel that they are really good at just about every sport</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Some people are not very confident about their level of physical conditioning and fitness</td>
<td>Others always feel confident that they maintain excellent conditioning and fitness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Some people feel that compared to most, they have an attractive body</td>
<td>Others feel that compared to most, their body is not quite so attractive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Some people feel that they are physically stronger than most people of their sex</td>
<td>Others feel that they lack physical strength compared to most others of their sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Some people feel extremely proud of who they are and what they can do physically</td>
<td>Other are sometimes not quite so proud of who they are physically</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Some people feel that they are among the best when it comes to athletic ability</td>
<td>Others feel that they are not among the most able when it comes to athletics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Some people make certain they take</td>
<td>Others don't often manage to keep up</td>
<td></td>
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</tbody>
</table>

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part in some form but regular vigorous physical activity

8. Some people feel that they have difficulty maintaining an attractive body. Others feel that they are easily able to keep their bodies looking attractive.

9. Some people feel that their muscles are much stronger than others of their sex. Others feel that on the whole their muscles are not quite so strong as most others of their sex.

10. Some people are sometimes not so happy with the way they are or what they can do physically. Others always feel happy about the kind of person they are physically.

11. Some people are not quite so confident when it comes to taking part in sports activities. Others are among the most confident when it comes to taking part in sports activities.

12. Some people do not usually have a high level of stamina and fitness. Others always maintain a high level of stamina and fitness.

13. Some people feel embarrassed by their bodies when it comes to wearing few clothes. Others do not feel embarrassed by their bodies when it comes to wearing few clothes.

14. When it comes to situations requiring strength some people are one of the first to step forward. Others seem to have a real sense of confidence in the physical side of themselves.

15. When it comes to the physical side of themselves some people do not feel very confident.
16. Some people feel that they are always one of the best when it comes to joining in sports activities. Others feel that they are not one of the best when it comes to joining in sports activities.

17. Some people tend to feel a little uneasy in fitness and exercise settings. Others feel confident and at ease at all times in fitness and exercise settings.

18. Some people feel that they are often admired because their physique or figure is considered attractive. Others rarely feel that they receive admiration for the way their body looks.

19. Some people tend to lack confidence when it comes to their physical strength. Others are extremely confident when it comes to their physical strength.

20. Some people always have a really positive feeling about the physical side of themselves. Others sometimes do not feel positive about the physical side of themselves.

21. Some people are sometimes a little slower than most when it comes to learning new skills in a sports situation. Others have always seemed to be among the quickest when it comes to learning new sports skills.

22. Some people feel extremely confident about their ability to maintain regular exercise and physical condition. Others don't feel quite so confident about their ability to maintain regular exercise and physical condition.

23. Some people feel that compared to most...
most, their bodies do not look in the best of shape. BUT their bodies always look in excellent physical shape.

24. 1 2 Some people feel that they are very strong and have well developed muscles compared to most people. Others feel that they are not so strong and their muscles are not very well developed.

25. 1 2 Some people wish that they could have more respect for their physical selves. Others always have great respect for their physical selves.

26. 1 2 Given the chance, some people are always one of the first to join in sports activities. Other people sometimes hold back and are not usually among the first to join in sports activities.

27. 1 2 Some people feel that compared to most they always maintain a high level of physical conditioning. Others feel that their level of physical conditioning is not usually so high.

28. 1 2 Some people are extremely confident about the appearance of their body. Others are a little self-conscious about the appearance of their body.

29. 1 2 Some people feel that they are not as good as most at dealing with situations requiring physical strength. Others feel that they are among the best at dealing with situations which require physical strength.

30. 1 2 Some people feel extremely satisfied with the kind of person they are physically. Others sometimes feel a little dissatisfied with their physical appearance.

HOW IMPORTANT ARE THINGS TO YOU?

31.
<table>
<thead>
<tr>
<th>Really</th>
<th>Sort of</th>
<th>True</th>
<th>True</th>
<th>Sort of</th>
<th>Really</th>
<th>True</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td>for me</td>
<td>for me</td>
<td>for me</td>
<td>for me</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Some people feel that being good at sports is vitally important to them</td>
<td>Others feel that being good at sports is not so important to them</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>32.</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Some people do not feel that maintaining a high level of physical conditioning is very important to them</td>
<td>Others feel that maintaining a high level of physical conditioning is extremely important to them</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>33.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Some people believe that having an attractive physique or figure is vitally important to them</td>
<td>Others believe that having an attractive physique or figure is not all that important in their lives</td>
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<tr>
<td>34.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Some people believe that being physically strong is not so important to them</td>
<td>Others feel that it is extremely important to them to be physically strong</td>
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<td>35.</td>
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</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Some people feel that having very good sports ability and skill is not so important to them</td>
<td>Others feel that having a high level of sports ability is really important to them</td>
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<td>36.</td>
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</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Some people feel that maintaining regular vigorous exercise is vitally important to them</td>
<td>Others feel that keeping up regular vigorous exercise is not of prime importance to them</td>
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<td>37.</td>
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</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Some people do not feel it so important to them to spend a lot of time and effort maintaining an attractive body</td>
<td>Others think that it is vitally important to spend time and effort maintaining an attractive body</td>
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<td>38.</td>
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</tr>
<tr>
<td>1</td>
<td>2</td>
<td>Some people feel that being strong is</td>
<td>Others feel that being strong and</td>
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</tbody>
</table>
and having well developed/toned muscles is vitally important to them

BUT

having well developed/toned muscles is not so important to them
Seven-Day Recall

7-Day Recall Scale (adapted from Sallis et al, 1985)

If you did not exercise at all in the past 7 days, please answer only question #1 on this page. If you did exercise, please answer all the questions on this page.

1. Did you exercise at all during the past week?
   ____ Yes  ____ No

2a & 2b. During the last 7 days, how much total time did you spend doing VIGOROUS physical activity and MODERATE physical activity? Record the time actually engaged in the activity (ignore breaks, rest periods, etc.). Please do not record any LIGHT activity (office work, light housework, very light sports such as bowling, or any activities involving sitting).

VIGOROUS ACTIVITY (jogging or running, swimming, strenuous sports such as singles tennis or racquetball, etc.)

Total hours for the last 7 days to the nearest ¼ hour: ___

MODERATE ACTIVITY (sports such as golf, doubles tennis, brisk walking, etc.)

Total hours for the last 7 days to the nearest ¼ hour: ___

On average, how would you rate your level of exertion when you exercised in the past 7 days using the following scale. Circle the number that best represents the average intensity of your workouts in the past 7 days.

1 = Very light
2 = Light
3 = Moderate
4 = Heavy
5 = Very heavy

Please list any physical activity you have participated in during the past week: ____________________________
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review). *Stages of condom use in a high HIV-risk sample.*


