University of Rhode Island

DigitalCommons@URI

Open Access Dissertations

2008

The Relationship Between Self-Efficacy and Decisional Balance for Stress Management and Exercise Behavior in an Adolescent Population: A Cross-Lagged Panel Analysis

Catherine Stephan

University of Rhode Island

Follow this and additional works at: https://digitalcommons.uri.edu/oa_diss

Recommended Citation

Stephan, Catherine, "The Relationship Between Self-Efficacy and Decisional Balance for Stress Management and Exercise Behavior in an Adolescent Population: A Cross-Lagged Panel Analysis" (2008). *Open Access Dissertations*. Paper 980.
https://digitalcommons.uri.edu/oa_diss/980

This Dissertation is brought to you for free and open access by DigitalCommons@URI. It has been accepted for inclusion in Open Access Dissertations by an authorized administrator of DigitalCommons@URI. For more information, please contact digitalcommons-group@uri.edu.

**THE RELATIONSHIP BETWEEN SELF-EFFICACY AND DECISIONAL
BALANCE FOR STRESS MANAGEMENT AND EXERCISE BEHAVIOR IN
AN ADOLESCENT POPULATION: A CROSS-LAGGED PANEL ANALYSIS**

BY

CATHERINE STEPHAN

**A DISSERTATION SUBMITTED IN PARTIAL FULLFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY**

IN

PSYCHOLOGY

UNIVERSITY OF RHODE ISLAND

2008

Abstract

In the world of increasing levels of stress and declining rates of exercise in today's youth, the development of effective intervention strategies for stress management and exercise behavior is crucial for the promotion of healthy physical and mental health lifestyles in adolescent populations. Utilizing Grant's Model of Adolescent Psychopathology and key theoretical constructs from the Transtheoretical Model of Change (TTM), this study examined the relationship between self-efficacy and decisional balance measures within and across two target behaviors (stress management, exercise). The current study included 996 high school students from the state of Rhode Island who participated in a larger four-year, multi-behavior intervention research project conducted by the Cancer Prevention Research Center at the University of Rhode Island. Students completed a series of computer administered assessments of self-efficacy and decisional balance for stress management and exercise behaviors across three time periods. A cross-lagged panel design was used to examine the longitudinal relationship between self-efficacy and decisional balance constructs. The results supported the TTM assumption that changes in decisional balance measures preceded changes in self-efficacy measures. The most compelling findings were found between decisional balance pros across exercise and stress management behavior ($\chi^2(374) = 710.491$, CFI = .976, RMSEA = .036, AASR = .032, $p < .001$). All paths within this model were significant; time 1 exercise pros to time 2 stress management pros ($\beta = .21$), time 1 stress management pros to time 2 exercise pros ($\beta = .20$, $p < .05$), time 2 exercise pros to time 3 stress management pros ($\beta = .23$, $p < .05$) and time 2 stress management pros to time 3 exercise pros ($\beta = .34$, $p < .05$).

Results also provided support for the notion that changes on either stress management or exercise behavior positively influenced changes on the other behavior. These findings provided preliminary evidence for the viability of multi-behavior interventions as well as implications for potential intervention strategies for addressing adolescent stress management behavior utilizing Grant's Model of Psychopathology. Finally, incorporating stress management strategies with other health promotion interventions was considered to be the most promising area for future studies.

Acknowledgements

I would like to thank all my committee members, Bryan Blissmer, Colleen Redding and Joe Rossi for all their time and support. I would also like to thank all of my friends and family who have provided ongoing emotional encouragement and assistance. Returning to school after so many years would not have been possible without all their understanding and support.

Table of Contents

Abstract	ii
Acknowledgements	iv
Table of Contents	v
List of Tables	vii
List of Figures	ix
Chapter 1: Theoretical Background for Study	1
Models of Stress.....	3
Adolescents and Stress.....	6
Adolescents and Stress Management Behavior	12
Physical Exercise as a Stress Management Intervention	13
Transtheoretical Model of Change.....	16
Chapter 2: Study Hypotheses	23
Specific Hypotheses.....	23
<i>Cross-construct relationships within a single behavior</i>	<i>23</i>
<i>Hypothesis 1</i>	<i>23</i>
<i>Hypothesis 2</i>	<i>23</i>
<i>Hypothesis 3</i>	<i>24</i>
<i>Hypothesis 4</i>	<i>24</i>
<i>Hypothesis 5</i>	<i>24</i>
<i>Hypothesis 6</i>	<i>25</i>
<i>Relationship of constructs across behavior</i>	<i>25</i>
<i>Hypothesis 7</i>	<i>25</i>
<i>Hypothesis 8</i>	<i>25</i>
<i>Hypothesis 9</i>	<i>26</i>
Chapter 3: Methods	27
Subjects	27
Measures	27
<i>Decisional balance for stress management behavior</i>	<i>27</i>
<i>Decisional balance for exercise behavior.....</i>	<i>28</i>
<i>Self-efficacy for stress management behavior</i>	<i>28</i>
<i>Self-efficacy for exercise behavior.....</i>	<i>29</i>
<i>Stage of change measure for stress management</i>	<i>29</i>
<i>Stage of change measure for exercise behavior</i>	<i>29</i>
Procedures.....	30
Chapter 4: Results.....	32
Stage distribution	32
Attrition analysis.....	32
Preliminary item analysis.....	33
Preliminary measurement analysis	34

<i>Confirmatory factor analysis</i>	34
Preliminary path analysis	38
Cross-lagged panel analysis models	39
<i>Base model</i>	40
<i>Within construct model</i>	41
<i>Cross-construct model</i>	41
<i>Fully cross-lagged model</i>	42
<i>Models with additional error residual paths</i>	42
Cross-construct relationships within a single behavior	43
<i>Hypothesis 1</i>	43
<i>Hypothesis 2</i>	43
<i>Hypothesis 3</i>	44
<i>Hypothesis 4</i>	44
<i>Hypothesis 5</i>	44
<i>Hypothesis 6</i>	45
Relationship of constructs across behavior	45
<i>Hypothesis 7</i>	45
<i>Hypothesis 8</i>	46
<i>Hypothesis 9</i>	46
Chapter 5: Discussion	47
Overview of study	47
Specific hypotheses	48
<i>Hypothesis 1</i>	48
<i>Hypothesis 2</i>	49
<i>Hypothesis 3</i>	50
<i>Hypothesis 4</i>	51
<i>Hypothesis 5</i>	51
<i>Hypothesis 6</i>	52
<i>Hypothesis 7</i>	53
<i>Hypothesis 8</i>	53
<i>Hypothesis 9</i>	54
Limitations of study	57
Future directions	58
Bibliography	61

LIST OF TABLES

<i>Table</i>	<i>Page</i>
Table 1 <i>Comparisons of the length of time in days between time intervals within and across behaviors.....</i>	78
Table 2 <i>Comparisons of stability and cross-lag means across high, medium and And low time intervals.....</i>	79
Table 3 <i>Stage of change for stress management behavior across times 1, 2 & 3.....</i>	80
Table 4 <i>Stage of change across time for stress management behavior.....</i>	81
Table 5 <i>Stage of change for exercise behavior across times 1, 2 & 3.....</i>	82
Table 6 <i>Stage of change across time for exercise behavior.....</i>	83
Table 7 <i>Comparison of completers and non-completers of stress management measures and exercise measures by gender, race and stage of change...</i>	84
Table 8 <i>Comparisons of completers and non-completers by scores on the stress management and exercise measures (decisional balance, self-efficacy)...</i>	85
Table 9 <i>Means and standard deviations for stress management self-efficacy and decisional balance items at time 1.....</i>	86
Table 10 <i>Means and standard deviations for exercise self-efficacy and decisional balance of all items at time 1.....</i>	87
Table 11 <i>Correlations between all six measures at time 1.....</i>	88
Table 12 <i>Comparisons of the alternative models for all measurement models with original items.....</i>	89
Table 13 <i>Means and standard deviations for the final items of the exercise self-efficacy and decisional balance measures at time 1.....</i>	90
Table 14 <i>Revised scale item factor loadings.....</i>	91
Table 15 <i>Alternative models for the exercise behavior measurement model with final items (2 items dropped from exercise scales) and the full measurement model.....</i>	92

Table 16 *Comparison of alternative models for the relationship between self-efficacy of stress management behavior and pros of stress management behavior.....*93

Table 17 *Comparison of alternative models for the relationship between self-efficacy of stress management behavior and cons of stress management behavior.....*94

Table 18 *Comparison of alternative models for the relationship between self-efficacy for exercise behavior and pros for exercise behavior.....*95

Table 19 *Comparison of alternative models for the relationship between self-efficacy for exercise behavior and cons for exercise behavior.....*96

Table 20 *Comparison of alternative models for the relationship between pros of stress management behavior and cons of stress management behavior...97*

Table 21 *Comparison of alternative models for the relationship between pros of exercise behavior and cons of exercise behavior.....*98

Table 22 *Comparison of 8 alternative models for the relationship between self-efficacy for stress management and self-efficacy for exercise behavior...99*

Table 23 *Comparison of alternative models for the relationship between pros of stress management behavior and pros of exercise behavior.....*100

Table 24 *Comparison of alternative models for the relationship between cons of stress management behavior and cons of exercise behavior.....*101

LIST OF FIGURES

<i>Figure</i>	<i>Page</i>
Figure 1 <i>Grant’s model of the role of stressors in the development of mental health problems in adolescents.....</i>	102
Figure 2 <i>The relationship between the pros of stress management behavior and self-efficacy for stress management behavior across time.....</i>	103
Figure 3 <i>The relationship between stress management self-efficacy and cons of stress management across time.....</i>	104
Figure 4 <i>The relationship between exercise behavior self-efficacy and pros of exercise behavior across time</i>	105
Figure 5 <i>The relationship between exercise behavior self-efficacy and cons of exercise behavior across time</i>	106
Figure 6 <i>The relationship between the pros of stress management behavior and the cons of stress management behavior</i>	107
Figure 7 <i>The relationship between the pros of exercise behavior and the cons of exercise behavior.....</i>	108
Figure 8 <i>The relationship between stress management behavior self-efficacy and exercise behavior self-efficacy across time.....</i>	109
Figure 9 <i>The relationship between the pros of stress management behavior and pros of exercise behavior across time.....</i>	110
Figure 10 <i>The relationship between the cons of stress management behavior and cons of exercise behavior across time.....</i>	111
Figure 11 <i>Preliminary path analysis of the relationship between the pros of stress management and self-efficacy for stress management across two time points</i>	112
Figure 12 <i>Preliminary path analysis of the relationship between the pros of stress management and self-efficacy for stress management across three time points</i>	113
Figure 13 <i>Base model alternative for self-efficacy for stress management and self-efficacy for exercise behavior model.....</i>	114

Figure 14	<i>Within-construct lags model for self-efficacy for stress management and self-efficacy for exercise behavior model</i>	115
Figure 15	<i>Cross-construct lags model alternative for self-efficacy for stress management and self-efficacy for exercise behavior model.....</i>	116
Figure 16	<i>An example of the fully cross-lagged model alternative for self-efficacy for stress management and self-efficacy for exercise behavior model....</i>	117
Figure 17	<i>An example of the fully cross-lagged model with residuals alternative for self-efficacy for stress management and self-efficacy for exercise behavior model.....</i>	118
Figure 18	<i>The relationship between self-efficacy of stress management behavior and pros for stress management behavior across time.....</i>	119
Figure 19	<i>The relationship between self-efficacy for stress management and cons of stress management behavior across time.....</i>	120
Figure 20	<i>The relationship between self-efficacy for exercise and pros of exercise behavior across time.....</i>	121
Figure 21	<i>The relationship between self-efficacy for exercise and cons of exercise behavior across time.....</i>	122
Figure 22	<i>The relationship between pros of stress management behavior and cons of stress management behavior across time.....</i>	123
Figure 23	<i>The relationship between pros of exercise behavior and cons of exercise behavior across time.....</i>	124
Figure 24	<i>The relationship between self-efficacy for stress management behavior and self-efficacy for exercise behavior across time.....</i>	125
Figure 25	<i>The relationship between pros for stress management behavior and pros for exercise behavior across time.....</i>	126
Figure 26	<i>The relationship between the cons for stress management behavior and cons for exercise behavior across time.....</i>	127

Chapter 1

Theoretical Background for the Study

Historically, adolescence is often defined as a transitional period between childhood and adulthood. It is a time filled with significant changes in physical, social and emotional functioning. Even under the best circumstances, the typical adolescent will likely perceive the process of managing all these changes as “stressful”. In the modern era, the adolescent experience of stress is further exacerbated by a number of additional social and environmental stressors such as; parental divorce/separation, economic difficulties, single-parent households, parental substance abuse, fears of terrorism, greater levels of violence in communities/families and increased academic demands. Elevated levels of stress in adolescence have been associated with increased rates of psychological problems (i.e., depression, anxiety), increased probability that “stressed-out” adolescents will engage in other risky health behaviors (i.e., smoking, alcohol use, poor eating habits) and an increased risk for the development of long-term health conditions (i.e., high blood pressure, compromised immune system) (Ames et al., 2001, Kiecolt-Glaser et al., 2002, Segerstrom & Miller, 2004).

Grant et al. (2005) proposed a theoretical model of adolescent mental health that links life stressors and psychopathology in a reciprocal relationship. Grant’s model also hypothesized that mediating factors, such as the cognitive processes utilized in many stress management techniques, can influence the relationship between stressors and psychopathology. In fact, research has provided some evidence that the incorporation of stress management techniques among adolescents can decrease self-reported levels of stress and anxiety, increase overall self-reported emotional well-

being (Keogh et al., 2006, Rausch et al., 2006), increase concentration abilities (Norlander, Moås & Archer, 2005), decrease rates of high risk health behaviors (Costakis et al., 1999) and improve academic performance (Keogh et al., 2006).

Similarly, there is also a body of research that suggests that the incorporation of light, moderate or vigorous exercise behavior can reduce symptoms of anxiety and depression (Carmack et al., 1999, Dunn, Trivedi & O'Neal, 2001, Steptoe et al., 1989). In adolescent populations, research has also found that regular exercise was related to more favorable self-image, lower levels of self-reported anxiety/depression and higher levels of physical and psychological well-being (Kirkcaldy et al, 2002). Some researchers have found evidence that regular exercise can also reduce the probability that adolescents will engage in a variety of high risk health behaviors (i.e., smoking, alcohol and substance use) (Costakis et al., 1999, Kirkcaldy et al. 2002).

Given the evidence that the incorporation of stress management strategies and regular exercise can produce positive physical and mental health outcomes, the goal of this project was to investigate the relationship between the development of stress management behavior and exercise behavior across three time periods. The Transtheoretical Model of Change (Prochaska & DiClemente, 1983) was used to conceptualize the process of change for adolescents as they develop new behaviors such as stress management and exercise behavior. Constructs, such as self-efficacy, decisional balance and stage of change, were utilized to examine the relationship between the acquisition of stress management behavior and the acquisition of exercise behavior. A positive reciprocal relationship between changes in stress management behavior and changes in exercise behavior were predicted. Thus, increases in stress

management behavior were expected to increase the probability of changes in exercise behavior. Conversely, changes in exercise behavior were expected to lead to an increased probability for changes in stress management behavior.

This study is expected to provide insight into the temporal relationship between two cognitive-behavioral constructs (i.e., self-efficacy, decisional balance) identified in the Transtheoretical Model of Change (TTM) on two target health behaviors (i.e., stress management behavior, exercise behavior). In addition, the results have implications for the viability of developing strategies that can simultaneously intervene on multiple health behaviors (i.e., stress management behavior, exercise behavior). Thus, the purpose of this study was to explore the relationships between changes in two key cognitive-behavioral constructs (i.e., self-efficacy, decisional balance) on two health behaviors; stress management behavior and exercise behavior, in an adolescent population.

Models of Stress

Over time, the concept of stress has been defined and redefined numerous times. Conceptualizations of stress have been influenced by a number of researchers who hold expertise in a wide variety of fields, such as biology, psychology, physiology, biochemistry, social sciences and epidemiology. Traditionally, stress has been viewed from one of three common perspectives; (1) stress as an external stimulus (Cannon, 1932), (2) stress as the response to an external event (Selye, 1956) and (3) stress as the interaction between an external event and an individual's perceptions and responses (Lazarus et al., 1980, Lazarus & Folkman, 1984, Selye, 1956).

Early research on stress focused upon the impact of an external stimulus on an organism. Cannon (1932) was the first to identify the “fight or flight” reaction to stress. Cannon posited that the “fight or flight” reaction could be elicited from an organism through exposure to a wide range of environmental stimuli that were either physiologically or psychologically threatening. Thus, “fight or flight” reactions triggered an arousal mechanism that readies the body for action. This arousal provides the energy for behaviors that will protect the body and return it to a state of safety and homeostasis.

Selye (1956) expanded Cannon’s work and made a clear distinction between the external event (i.e., stressor) and the reaction triggered by the external stressor (i.e., stress). Although Selye’s early work focused upon the external stressors, his research led him to conclude that all individuals do not necessarily interpret stressful external stimuli in a similar manner. Thus, the same external event may evoke differential responses across individuals. According to Selye’s view, stress was viewed as a global response to a variety of noxious but non-specific stimuli. Selye conceptualized the General Adaptation Syndrome (GAS) model to explain the body’s attempt to protect itself from external stressors. The General Adaptation Syndrome model consists of three stages; alarm (i.e., the immediate physiological response of “fight or flight”), resistance (i.e., body adapts to stressor stimuli) and exhaustion (i.e., resources are depleted and body processes begin to break down). According to Selye, the final stage will result in significant changes in the body’s immune and neuroendocrine systems. Selye believed that these changes increased the risk for a variety of illnesses, depression and even death. Although Selye’s theoretical model

provided a useful model for viewing the relationship between stress and illness, this approach has been criticized for its overemphasis on biological processes.

In contrast, the Biopsychosocial model incorporated all three perspectives of stress; (1) stress as an external event, (2) stress as an internal response and (3) stress as an interaction between an external event and an individual. In the Biopsychosocial model, an individual's perception or cognitive interpretation of a stressful event was considered to be the key component. Within the Biopsychosocial perspective, Richard Lazarus' Transactional Theory conceptualized stress as the complex interaction between an external stressor and an individual's cognitive appraisal of the situation. Thus, within this study, psychological stress was defined as a *"particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being"* (Lazarus & Folkman, 1984, p.19).

In the Transactional perspective, psychological stress was considered to be dependent upon how an individual appraised or understood the situation (Lazarus, 1966, Lazarus et al., 1980). Thus, an individual's cognitive appraisal of a situation or "transaction" was a core construct in the Transactional model. Lazarus defined three types of cognitive appraisals; primary appraisal, secondary appraisal and re-appraisal. In a primary appraisal, an individual made an initial judgment of their situation as positive, irrelevant or threatening. A primary appraisal of harm, threat or challenge elicited an emotional and/or physiological response. Once an individual perceived a threat, a secondary appraisal evaluated their options and coping resources to address the demands of the situation. The experience of stress occurs when an individual's

secondary appraisal interpreted the demands of the situation as outweighing their coping resources. Finally, the process of reappraisal allowed for the dynamic process of “re-thinking” and re-interpreting the situation over time.

The Transactional Model suggested that individuals are susceptible or vulnerable to the effects of stress when the demands of the situation outweigh their perceived resources to handle it. Lazarus and Folkman (1984) contend that stress can be managed through the use of coping strategies. The concept of coping or managing stress can be described as an ongoing, learned process that requires some effort to implement. Lazarus and Folkman posited that the ability to develop successful coping strategies was dependent upon a number of factors such as physical, cognitive, social and material resources. Examples of effective coping strategies include; social support, exercise, relaxation and breathing techniques and cognitive-behavior techniques (i.e., problem solving strategies, self-talk) (Printz, Shermis, & Webb, 1999).

Adolescents and Stress

The detrimental effects of chronic stress on overall physical health and quality of life have been well-documented within adult populations over the past several decades (Ames et al., 2001, 2005, Kiecolt-Glaser et al., 2002, Segerstrom & Miller, 2004). Although not all the biological processes of the stress response are fully understood, stress does produce a series of demonstrated physiological changes within a variety of human systems (e.g., autonomic nervous system, neuromuscular system, immune system). One long-term impact of chronic stress is an increase in the probability that a disease state will eventually emerge (Lazarus, 1966, Selye, 1956,

Segerstrom & Miller, 2004). The impact of stress on overall health status may have either a direct effect on the body (e.g., increase in blood pressure) or an indirect effect on the body through an increase in health risk behaviors (e.g., increased use of alcohol or smoking). Anecdotally, some individuals believe that an alcoholic drink or a cigarette at the end of a “stressful” day will take the “edge off” and help bring about a more “relaxed” state of being.

Research on the relationship between the effects of stress and adolescent functioning is in its early years of study (Cohen & Park, 1992, Compas, 1987, McMahon et al., 2003). In recent years, there has been an increased interest in the effects of stress on adolescent physical health, emotional well-being and lifestyle choices. For example, chronic stress has been shown to negatively impact adolescent academic performance (Fontana, & Dovidio, 1984, Kusché, Cook & Greenberg, 1993, Pryor-Brown & Cowen, 1989), decrease physiological immunity against illness and an increase risk for psychiatric disorders such as anxiety disorders and depression (Goodyer, Kolvin & Gatzania, 1985, Goodyer, Kolvin & Gatzania, 1987, Williamson, Birmaher, Frank, Anderson, Matty & Kupfer, 1998). Additionally, there is some literature that has suggested that chronic stressors, in part, account for the increased rates of social maladjustment (i.e., conduct disorders, substance abuse) (Arnett, 1999, Bryne & Mazanov, 1999).

Developmentally, adolescence is a time of many significant physical and psychological changes. Physiologically and emotionally, adolescents are moving away from the familiarity of childhood and into the complex world of young adulthood. This process of change across multiple areas of functioning, in itself, could

generally be described as stressful. In addition to these “normal” sources of tension, today’s adolescents encounter stress at a younger age and from a wider range of sources (i.e., family, economic difficulties, peers, academic pressures). Research completed on pre-adolescents identified school environments as considerable sources of stress (e.g., academic criticism, social rejection). Pre-adolescents identified the most significant areas of stress as peer disapproval, not passing to the next grade and losing a friend (Youngs, 1985). Additionally, Pryor-Brown and Cowen (1989) found that children who experienced higher numbers of stressful events had more serious adjustment problems and fewer social competencies (e.g., diminished attention and academic motivation) than children who experienced fewer events. Guerra et al. (1995) found that overall stress level was further exacerbated by socio-economic disadvantage, family changes and community changes. The fact that such circumstances are often beyond the control of the adolescent may lead to additional stress. Lack of control over the life circumstances and events was found to increase risk for adolescent social maladjustment (McMahon et al., 2003).

McMahon et al. (2003) provided an extensive review of the research literature on the relationship between specific life stressors and specific behavioral and emotional outcome measures. They concluded that there was little evidence that specific stressors were consistently linked with specific maladaptive outcomes, with the notable exception of the emotional distress generated through the experience of childhood sexual abuse. Thus, they concluded that childhood and adolescent stress resulted in “multifinality” or multiple related outcomes (McMahon et al., 2003). Wertlieb, Weigel and Feldstein (1987) found that not only were stressful life events

(i.e., moving, parental divorce) positively related to behavioral difficulties but that chronic minor stresses or “hassles” were even more highly associated with behavioral difficulties. Among adolescents, Printz et al (1999) and Compas (1987) found that the main source of stress appeared to be due to the accumulation of “micro-stressors” (i.e., daily stressors) rather than discrete negative life events. Thus, current studies support the notion that minor chronic stressors may have a greater negative impact on overall well-being and health outcomes than stress from a single major negative life event (Ames et al., 2001, Garrett et al., 1991).

Exposure to chronic levels of stress can lead to the development of dysfunctional or ineffective patterns of coping. Several researchers have identified associations between ongoing stress and personal adjustment problems (Grant et al., 2004, Swearingen & Cohen, 1985). Arnett (1999) indicated that increases in global stressors are influential in accounting for increased rates of mental health issues among adolescents such as depression, suicidal ideation, eating disorders, conduct disorders and substance abuse. Kim (2005) found that stressful life events experienced in early adolescence led to greater levels of sadness, fear/anxiety and antisocial behavior (e.g., externalized behavior). In turn, these maladaptive responses to stress lead to an increased likelihood of future stressful life events and a decreased probability for developing positive relationships with more well-adjusted peers.

Similar to the adult stress research, the impact of stress on adolescents included both direct physiological responses and an indirect effect through the greater likelihood of engaging in risky or unhealthy lifestyle behaviors, such as smoking or increased alcohol use (Byrne & Mazanov, 1999, Wenzel, Glantz & Lerman, 2002).

Direct physiological effects were noted between general physical health indicators (i.e., blood cholesterol levels, blood pressure) and life stress (Coleman et al, 1998, Baldwin et al., 1997). Greene et al. (1985) found that among outpatient clinic population of adolescents, there was a positive relationship between self-reported life stress and behavioral difficulties and self-reports of recurrent pain.

The indirect effect of chronic stress on adolescents refers to the increased likelihood that adolescents will engage in a variety of high risk health behaviors (i.e., alcohol, cigarette use, substance abuse). Several studies have supported the notion that increased levels of stress are positively associated with the initiation, continuation and relapse of smoking behavior in adolescents (Bryne et al., 1995, Byrne and Mazanov, 2001, Guthrie et al., 2001, Koval and Pederson, 1999, Wills et al., 2002). A study completed by Mitic et al. (1985) revealed that levels of perceived stress were highest among regular smokers while levels of perceived stress were lowest among non-smokers. Intermediate levels of perceived stress were found among occasional smokers. Byrne and Mazanov (2001) identified two core determinants of adolescent smoking: global stress and overall self-esteem levels. In a recent longitudinal study of adolescents, researchers found compelling support for the notion that “negative affect is an etiological factor for the escalation of smoking” (Willis et al., 2002, p. 128). This is particularly noteworthy because the development of health-related lifestyle patterns is often first established within the adolescent years (Nelson et al., 1998).

Studies investigating the role of stress and substance use have also revealed a positive relationship between elevated stress levels and increased alcohol use (Bray et

al., 2001, Nelson et al, 1998). Bray et al. (2001) found that overall stress and level of family conflict was predictive of increased alcohol use in adolescents over time. Increased adolescent alcohol use was identified during times of higher levels of stress (i.e., heightened family conflict) as well as lower levels of parental supervision (Bray et al., 2001). Cohen and Wills (1985) also found that the relationship between adolescence substance-use can be mediated by family factors. Thus, family supportive relations may serve as a “buffer” against alcohol use while highly conflicted family relations (i.e., stressful family interactions) were more likely to lead increases in adolescent alcohol consumption.

Given the emerging bulk of research supporting the relationships between adolescent stress and unhealthy lifestyle behaviors, Grant et al. (2003) have proposed a conceptual model to illustrate the relationship between stress and the development of mental health problems in adolescents. This model posits that unchecked adolescent stress increases the likelihood of adolescent psychopathology which results in a greater probability for dysfunctional coping mechanisms and unhealthy lifestyle choices. The relationship between stress and psychopathology can be influenced by several moderating variables (i.e., adolescent factors, environmental contexts). Mediating variables, such as cognitive and biological processes, are used to explain the relationship between the stressor and psychopathology. Finally, this model illustrates that the relationships between all factors are (i.e., stressors, moderators, mediators, symptoms of psychopathology) are both dynamic and reciprocal in nature. The reciprocal nature of the model not only predicts psychopathology but suggests psychopathology can predict further exposure to stressful circumstances. Grant’s

model of adolescent psychopathology provides a useful theoretical tool for understanding the role that chronic and/or acute stress experiences can play in development of adolescent mental health. This model underscores the need for further research to identify effective intervention strategies which bolster or enhance mediating (i.e., cognitive processes, social processes) and/or moderating factors (i.e., adolescent coping styles) that can positively influence the outcomes for adolescent stress experiences (Figure 1).

Adolescents and Stress Management Behavior

As previously stated, chronic stress has been shown to have negative impact upon the physical, social and intellectual functioning adolescents (Cohen & Park, 1992, Compas, 1987, McMahon et al., 2003). Chronic stress can impair academic performance of adolescents (Kusché, Cook & Greenberg, 1993) as well as an increase the risk for psychiatric disorders such as anxiety disorders and depression (Goodyer, Kolvin & Gatzania, 1985, Goodyer, Kolvin & Gatzania, 1987, Williamson, Birmaher, Frank, Anderson, Matty & Kupfer, 1998). However, research has suggested that the incorporation of stress management interventions can significantly reduce the impact of chronic stress upon overall physical and mental health in adult populations (Bijlani et al., 2005, Evers et al., 2006, Gaab et al, 2006, Grossman et al, 2004). Haney (2004) found that the incorporation of stress management interventions (i.e., cognitive restructuring and modified progressive muscle relaxation) resulted in significantly reduced levels of stress and anxiety in female athletes ranging from age 16 to 51.

In a study completed by Keogh, Bond and Flaxman (2006) adolescent youth were exposed to stress management interventions based upon the principles of

cognitive-behavioral therapy (CBT). The outcome of this study found that CBT stress management interventions had a significantly positive impact upon overall mental health (i.e., cognitive self-perceptions) and academic performance (i.e., on average an improvement of one-letter grade). Additionally, studies utilizing adolescent populations have provided evidence that stress management interventions can have a positive impact on adolescent mental health, academic and athletic performance (Rausch et al, 2006). Rausch and colleagues found that undergraduate students who were exposed to stress management techniques such as large group meditation and progressive relaxation training had significantly lower levels of cognitive, somatic and overall state anxiety than undergraduates that did not receive any intervention. Thus, research suggested that the incorporation of stress management behavior may provide a “buffer” or mediating factor affecting adolescent outcomes and perceptions of chronic and/or acute stress experiences.

Physical Exercise as a Stress Management Intervention

Regular exercise is an important component in developing and maintaining a healthy body, enhancing psychological well-being and preventing premature death (U.S. DHHS, 1996). The incorporation of moderate levels of physical activity into daily life can substantially improve overall health and quality of life. Exercise has been correlated with a variety of health benefits such as lower disease rates for heart disease, diabetes and colon cancer. Additionally, regular exercise has been associated with increased muscle/bone strength, the prevention of high blood pressure, improved weight control, and the reduction of depressive and anxiety symptoms (Bailey et al., 1996, Calfas & Taylor, 1994). Thayer et al. (1994) found exercise techniques to be

the most effective behavioral strategy for the self-regulation of mood. Finally, Kulbok and Cox (2002) identified exercise behavior in adolescents as a protective factor against the emergence of unhealthy or risky behavioral patterns (i.e., substance use, risky sexual behavior).

An important distinction can be made between the concept of physical activity and exercise behavior. Physical activity is simply defined as any bodily movement that is produced by skeletal muscles that results in energy expenditure (Caspersen, Powell, & Christenson, 1985). The term *exercise* refers to a sub-set of physical activity that is planned, structured and repetitive. The goal of exercise movement is to improve or maintain one or more of the ten components of physical health and fitness (e.g., cardiovascular endurance, muscular endurance, muscular strength, body composition, flexibility, agility, speed, muscular power, balance, reaction time) (Caspersen et al., 1985, U.S. DHHS, 1996). Thus, for purposes of this study, exercise is defined as an acquired and purposeful behavior that has significant potential to improve health, reduce stress and prevent or delay the onset of a disease or illness state.

Despite common knowledge that exercise is a healthful behavior, recent national statistics indicated that over 60% of American adults are not regularly active and approximately 25% of adults report not being physically active at all. Given these findings, it is not surprising that national statistics revealed that almost half of American youths (ages 12-21) are not vigorously active on a regular basis (U.S. DHHS, 1996). Research has indicated that physical activity levels dramatically decline as children reach their adolescent years. Although physical activity rates drop

for both genders in adolescence, this trend is particularly significant among females from pre-adolescent ages through early adulthood (Sallis, 1993).

These bleak figures combined with consistent findings that even moderate amounts of physical activity can provide protective physical and mental health benefits has led to recent efforts to increase exercise and physical activity rates among adolescents (Hansen, Stevens & Coast, 2001, U.S. DHHS, 1996). In fact, the *Healthy People 2010* document has proposed health objective which indicate increasing the proportion of adolescents engaging in “vigorous physical activity that promotes cardiorespiratory fitness 3 or more days per week for 20 or more minutes” (U.S. DHHS, 2000, p. 26).

Physical exercise as a coping mechanism has been long considered an effective strategy for stress reduction and anxiety in adult populations (Anshel, 1996, Bahrke & Morgan, 1978, Thayer et al., 1999). Long and Haney (1988) found that among 61 previously sedentary working women that the incorporation of either an aerobic exercise program (jogging protocol) or a progressive relaxation program resulted in an overall reduction of trait anxiety.

In fact, some research has suggested that increases in exercise behavior can indirectly lead to positive changes in other health behaviors (i.e., reduction in cigarette smoking or alcohol use) (Costakis et al., 1999). This finding is particularly noteworthy given that many health-risk behavioral patterns are developed during the adolescent years (Nelson et al., 1998). Thus, lifestyle behaviors developed during this time period can potentially have a significant long-term impact on future health and well-being. However, at this time, there is a limited amount of research completed on

the relationship between exercise behavior and the development of stress management behavior in adolescent populations.

Transtheoretical Model of Change

The Transtheoretical Model (TTM) of behavioral change consists of several conceptual dimensions; stages of change, processes of change, decisional balance and self-efficacy. Although the TTM was originally applied to smoking behavior, its application has expanded across a larger number of behaviors (Burkholder & Evers, 2002, Prochaska et al., 1994). Research has been completed on the application of TTM to a wide variety of health behaviors such as; alcohol use, sun screen use, condom use, exercise and dietary fat intake (Prochaska et al, 1994, Hall & Rossi, 2008).

The core dimension of the TTM is the *stages of change* construct. The stage of change dimension refers to the temporal nature of a behavioral change. The TTM espouses five distinct stages; precontemplation (PC), contemplation (C), preparation (P), action (A) and maintenance (M) (Prochaska, DiClemente & Norcross, 1992). An individual in the precontemplation stage would have no intention of changing their current behavior. In the contemplation stage, an individual would be thinking about changing their behavior within the next six months. During the preparation stage, individuals have a more immediate intention to change their behavior (i.e., within the next 30 days) and may have engaged in some small preparatory behaviors (e.g., small steps that allow an individual to get ready). In the action stage, an individual is actively engaging in the target behavior but has been doing so for less than six months.

Finally, the maintenance stage is reached when an individual has been actively engaged in the target behavior for an extended period of time (i.e., over six months).

The progression through the stages is not necessarily linear and may include several incidents of regression to an earlier stage. Relapse events are considered to be typical and not considered to be a failure of the individual or the model. Rather, relapses are conceptualized as learning opportunities that provide valuable information for future behavior change attempts. Progress through the various stages can be impacted by the utilization of a set of intervening strategies referred to as processes of change (Prochaska, & DiClemente, 1983, Prochaska et al., 1988).

Thus, the processes of change are the second key dimension in the TTM. The *processes of change* include both overt and covert strategies that individuals utilize in order to modify, adopt or eliminate a behavior (Prochaska et al., 1988). The TTM utilizes ten processes that are divided into two categories; experiential and behavioral.

The experiential category refers to processes that promote change through the use of emotional and/or cognitive strategies. The experiential processes include strategies such as; consciousness raising (i.e., educational information regarding the benefits of the behavior change), dramatic relief (i.e., messages targeted to get an emotional response such as negative consequences for not changing the targeted behavior), social liberation (i.e., environmental factors that encourage a change in the target behavior), self reevaluation (i.e., reappraisal of how the behavior affects an individual's self-view) and environmental reevaluation (i.e., consideration of the impact that the target behavior could have on others around them). The use of experiential processes is often associated with the earlier stages of change (i.e., pre-

contemplation, contemplation and preparation) (Prochaska & DiClemente, 1983, Prochaska et al., 1988).

The behavioral processes of change are thought to promote change by providing an individual with information gathered from their environment or their own actions. Behavioral processes include the following techniques; stimulus control (i.e., changing the environment to support the target behavior change), self-liberation (i.e., making a commitment to the behavior change), helping relationship (i.e., identifying and participating in social support for the target behavior change), reinforcement management (i.e., receiving rewards from self or others for engaging in the target behavior) and counter-conditioning (i.e., replacing the old behavior pattern with the newer patterns that support the target behavior). The use of behavioral processes is most often associated with the later stages of change (i.e., action, maintenance) (Prochaska & DiClemente, 1983, Prochaska et al., 1988).

Another important aspect of the TTM includes the *decisional balance* dimension. The decisional balance dimension is based upon the work of Janis and Mann (1977) which suggested that the decision-making process involves the comparisons of gains/losses within four main categories; instrumental gains/losses for self, instrumental gains/losses for others, approval/disapproval of self and approval/disapproval of others. Research completed by Velicer et al. (1985) and Marcus et al. (1992) further refined the decisional balance construct by detecting the emergence of two independent scales; pros for a target behavior and cons for a target behavior. The relative imbalance or balance between pros and cons of a behavior is associated with the stage of change. For example, in the early stages of behavior

change (i.e., precontemplation), the cons of the behavior generally outweigh the pros of the target behavior. Late in the contemplation stage, pros and cons of the behavior tend to be balanced. Throughout the later stages in a change in the target behavior, there is a cross-over that result in the pros of target behavior outweighing the cons of the behavior. There is some variation across target behaviors on the exact timing of the cross-over (Prochaska, 1994). For example, in the exercise acquisition research, the pros of exercise tend to remain high even across the maintenance stage (Nigg, Rossi, et al., 1998, Prochaska & Marcus, 1994). Thus, knowledge of an individual's level of pros and cons toward a behavior change may provide important predictive information regarding the probability of an actual change in the target behavior.

The fourth key construct of the TTM is a *self-efficacy* dimension. Self-efficacy is a construct most often associated with Social Cognitive Theory (SCT) and may be defined as the level of perceived confidence that an individual has to successfully perform a specific behavior in the future (Bandura, 1977). Self-efficacy has been identified as an important predictive variable of change for a target behavior. Evidence suggests that self-efficacy is a key factor in predicting change and has been shown to be a better predictor of change than past behavior (i.e., Bandura, 1986, DiClemente, 1981, Sallis et al, 1986, Velicer et al., 1990). Several studies have found that self-efficacy increases as an individual successfully progresses through the stages of change; with Precontemplation individuals demonstrating considerably lower levels of self-efficacy than individuals within the Maintenance stage (Prochaska, DiClemente & Norcross, 1992; Prochaska et al., 1994). Thus, understanding an individual's level

of self-efficacy on a target behavior provides valuable information on the likelihood of the change.

The application of the TTM to a target behavior would entail an assessment of the stage of change and the utilization of the individually tailored *processes of change* strategies. TTM predicts that the likelihood of changing a target behavior is dependent upon the ability to match an individual's stage of change with an appropriate process of change or strategy. This approach posits that by identifying an individual's stage of change one can predict what strategies are likely to be the most effective for moving that individual toward the targeted change.

Research on the application of TTM has revealed consistent outcome findings that support the presence of the underlying TTM constructs and the predictive properties of these constructs (i.e., self-efficacy, decisional balance) across a variety of health behaviors (Hall & Rossi, 2008, Herrick et al., 1997, Prochaska et al., 1994, Velicer et al, 1999). Evidence for the effectiveness of TTM interventions has been demonstrated for a variety of health behaviors such as; smoking (Prochaska et al., 1993, 2001a, 2001b, 2004, 2005; Velicer et al., 1996, 1999), diet (Bock et al, 1998, Rossi et al., 1994, 2001, Velicer et al., 2000), skin protection behavior (Maddock, et al., 2005, Norman et al., 2007, Weinstock et al., 2002), exercise (Marcus et al., 1992a, 1992b, 1994; Marcus & Owen, 1992, Marcus & Simkin, 1994, Nigg et al., 1998, Nigg & Courneya, 1998; Prochaska & Marcus, 1994), stress management (Evers et al., 2006, Riley & Fava, 2001) and mammography adherence (Rakowski et al., 1998).

The TTM provides a “working” format for addressing difficult behaviors by expanding the traditional behavioral model of change and incorporating a more

ecological and systematic approach to behavior change. In other words, TTM recognizes that problematic behaviors are not solely developed and maintained in an isolated manner (i.e., specific behavior-consequence contingencies). Given the complexity of changing problematic health behaviors, the TTM serves to address behavior change through recognition of a variety individual cognitive factors (i.e., self-efficacy, decisional balance) and environmental factors (i.e., cues that foster or hinder progress toward change). In this sense, the TTM approach provides a logical and useful theoretical model to conceptualize and study the potential relationship between cognitive processes (i.e., self-efficacy, decisional balance) across time (i.e., stage of change) and across behaviors (i.e., stress management behavior, exercise behavior).

Theoretically, it has been posited that decisional balance is an important factor in the early stages of change, while self-efficacy is considered to become more influential in the later stages of change (Prochaska & Marcus, 1994, Prochaska & Velicer, 1997). However, recent studies (Nigg, 2001; Velicer et al., 1996) have been unable to clearly define the temporal relationship between decisional balance and self-efficacy in behavior change. In the study completed by Velicer et al. (1996), the authors proposed that the limited predictive relationship between smoking behavior and decisional balance constructs may have been influenced by sample characteristics. The sample in this study was a naturalistic group of smokers and former smokers. Given that this study did not include an intervention plan and the tendency of smoking behavior to be relatively stable, there was a limited amount of “change” within this sample over time. Thus, smoking behavior at time 1 was the strongest predictor of

smoking behavior at time 2. Similarly, a study completed by Nigg (2001) did not reveal the presence of significant predictive relationships between TTM constructs (decisional balance, self-efficacy) and adolescent exercise behavior; however, the data trend suggested that these relationships may be “meaningful under different circumstances” (pp. 18-19). Nigg considered the presence of non-significant predictions as most likely due to the overall finding that exercise behavior had actually decreased from baseline to follow-up. The outcomes of these studies suggested that in order to provide a more sensitive view of the predictive relationship between TTM constructs (decisional balance, self-efficacy) and behavior change, future research should include the following features: (1) the incorporation of an intervention plan, (2) a reduction in the amount of time between subject assessments, (3) an increase in the frequency of assessments and (4) an increase in the sample size.

Chapter 2

Study Hypothesis

This research project was designed to investigate the relationship between the cognitive variables or constructs (i.e., self-efficacy and decisional balance) of stress management and exercise behavior. The overarching hypothesis is that changes in either exercise behavior or stress management behavior constructs will have a mutual influence across time and stage of change. This broad hypothesis was investigated through the examination of series of specific hypotheses.

Specific Hypotheses

Cross construct relationships within a single behavior

Hypothesis 1. There will be a positive direct path relationship between the pros of stress management behavior and self-efficacy for stress management behavior across time (Figure 2).

- a. As pros of stress management behavior increases, self-efficacy for stress management behavior will increase.
- b. As self-efficacy for stress management behavior increases, pros for stress management behavior will increase.

Hypothesis 2. There will be a negative direct path relationship between the cons of stress management behavior and self-efficacy for stress management behavior across time (Figure 3).

- a. As the cons for stress management behavior increases, there will be a decrease in self-efficacy for stress management behavior.

- b. As self-efficacy for stress management behavior increases, there will be a decrease in cons for stress management behavior.

Hypothesis 3. There will be a positive direct path relationship between the pros of exercise behavior and self-efficacy for exercise across time (Figure 4).

- a. As pros of exercise behavior increases, self-efficacy for exercise behavior will increase.
- b. As self-efficacy for exercise behavior increases, pros for exercise behavior will increase.

Hypothesis 4. There will be a negative direct path relationship between the cons of exercise behavior and self-efficacy for exercise behavior across time (Figure 5).

- a. As the cons for exercise behavior increases, there will be a decrease in self-efficacy for exercise behavior.
- b. As self-efficacy for exercise behavior increases, there will be an decrease in the cons for exercise behavior.

Hypothesis 5: There will be a negative direct path relationship between the pros for stress management behavior and the cons for stress management (Figure 6).

- a. As the pros for stress management behavior increases, there will be decrease in the cons for stress management behavior.
- b. As the cons for stress management behavior increase, there will be a decrease in the pros for stress management behavior.

Hypothesis 6. There will be a negative direct path relationship between the pros for exercise behavior and the cons for exercise (Figure 7).

- a. As the pros for exercise behavior increases, there will be decrease in the cons for exercise behavior.
- b. As the cons for exercise behavior increases, there will be a decrease in the pros for exercise behavior.

Relationship of constructs across behavior

Hypothesis 7. There will be a positive direct path relationship between self-efficacy for stress management behavior and self-efficacy for exercise behavior across time (Figure 8).

- a. As self-efficacy for stress management behavior increases; self-efficacy for exercise behavior will increase.
- b. As self-efficacy for exercise behavior increases, self-efficacy for stress management behavior will increase.

Hypothesis 8. There will be a positive direct path relationship between the pros of stress management behavior and the pros of exercise behavior across time (Figure 9).

- a. As pros of exercise behavior increases, pros for stress management behavior will increase.
- b. As pros for stress management behavior increase, pros for exercise behavior will increase.

Hypothesis 9. There will be a positive direct path relationship between the cons of exercise behavior and the cons of stress management behavior across time (Figure 10).

- a. As the cons for exercise behavior increases, there will be an increase in the cons of stress management behavior.
- b. As the cons for stress management increases, there will be an increase cons for exercise behavior.

Chapter 3

Methods

Subjects

Participants were 996 grade high school students recruited in the state of Rhode Island. Subjects were part of a larger 4 year, multiple-behavior intervention research project conducted by the University of Rhode Island, Cancer Prevention Research Center (CPRC). The initial sample group (N = 996) was comprised of 49.6% male students. The ethnic distribution was approximately 80.4% White, 3.9% African-American, 1.8% Asian, 1.3% American Indian and 8.6% multiracial or other. The average student age at baseline was 14.7 years of age with a standard deviation of 6.6 months.

Measures

Decisional Balance Scale for Stress Management Behavior

The Decisional Balance Scale (DB) is a 10-item measure of an individual's perception of the advantages (pros) and disadvantages (cons) of engaging in stress management behaviors. The DB scale consists of 5 items assessing an individual's perceptions of the pros of stress management behavior and 5-items assessing the perceived cons of engaging in stress management behaviors. Participants rated each item on a 5-point Likert scale (1= Not Important, 2= Slightly Important, 3= Somewhat Important, 4= Very Important, 5= Extremely Important). High scores on the Pro scale with low scale scores on the Cons scale suggest that an individual perceives stress management strategies as being advantageous. In contrast, high scores on the Con scale and low scores on the Pro scale suggest that an individual does not view stress

management strategies as beneficial in managing their stress level. The pro scale demonstrated a coefficient Alpha of .89 while the coefficient Alpha for the Cons scale was .77 (Stephan et al., 2007).

Decisional Balance Scale for Exercise Behavior

The Decisional Balance scale for exercise is a ten-item scale that assesses both the advantages or Pros (5 questions) and the disadvantages or Cons (5 questions) of exercise behavior. Participants were asked to rate each item on a 5-point Likert scale (1 = Not Important, 2 = Slightly Important, 3 = Somewhat Important, 4 = Very Important, 5 = Extremely Important). Low scores on the Cons scale combined with a high score on the Pros scale indicate that an individual generally views exercise as advantageous. Conversely, a high score on the Cons scale along with a low score on the Pros scale suggests that an individual does not view exercise personally beneficial. The coefficient Alphas for the Pros and the Cons scale were .81 and .67 respectively (Dye et al., 2007).

Self-efficacy Scale for Stress Management Behavior

The Self-efficacy Scale (SE) is a 6-item scale designed to assess an individual's perceived ability to manage stress across a variety of situations. Participants rated their level of confidence in their ability to manage stress on a 5-point Likert scale (1 = Not at All Sure, 2 = Not Very Sure, 3 = Moderately Sure, 4 = Very Sure, 5 = Extremely Sure). A high score in the SE scale suggested a high level of confidence to manage stress effectively across situations. The SE scale for stress management demonstrated a coefficient Alpha level of .90 which indicates that the internal consistency of this measure was strong (Stephan et al., 2007).

Self-efficacy for Exercise Behavior

The Self-efficacy scale for exercise is a six-item instrument that measures an individual's perceived ability to engage in exercise under a variety of different circumstances. Participants rated their level of confidence to exercise on a 5-point Likert scale (1 = Not at All Sure, 2 = Not Very Sure, 3 = Moderately Sure, 4 = Very Sure, 5 = Extremely Sure). Higher scores on this scale indicated a higher level of confidence in the ability to exercise across a range of situations. Coefficient Alpha for this scale was .61 (Dye et al., 2007).

Stages of Change Measure for Stress Management

Stages of change were based upon the Transtheoretical Model (TTM) of change (DiClemente et al, 1991). TTM espouses five distinct stages of change Precontemplation (PC), Contemplation (C), Preparation (P), Action (A) and Maintenance (M). The Stages of Change were assessed through the administration of a series of 7 questions designed to determine the level of readiness for or intention to engage in a series of stress management behaviors.

Stages of Change Measure for Exercise Behavior

Stages of change were based upon the Transtheoretical Model (TTM) of change (DiClemente et al, 1991). TTM espouses five distinct stages of change Precontemplation (PC), Contemplation (C), Preparation (P), Action (A) and Maintenance (M). The Stages of Change were assessed through a series of 7 questions designed to determine the level of readiness for change or intention to engage in exercise behavior.

Procedures

Students from approximately 13 Rhode Island school districts participated in this study. Participants in this study were part of a larger multi-behavior intervention research project coordinated by the University of Rhode Island's Cancer Prevention Center. The original study was fully reviewed and approved by the University of Rhode Island IRB. The participants of this larger study were randomly assigned into one of three intervention groups; group 1 (which included Transtheoretical Model (TTM) tailored interventions for stress management, exercise and alcohol use), Group 2 (which TTM tailored included intervention strategies for smoking, diet and sun exposure behavior) and Group 3 (which TTM tailored included integrated interventions on smoking, sun exposure, diet behaviors). The data examined in this study include subjects within group 1 only.

Students in the group 1 received a total of 6 computerized TTM tailored intervention sessions (3 in the first year and 3 in the second year). Students received a total of four intervention sessions on each behavior (2 in the first year and 2 in the second year of the study). (See Redding et al, 1999 for a description of TTM tailored interventions for adolescents) The set of measures (i.e., decisional balance measures for stress management and exercise behavior, self-efficacy measures for stress management and exercise behavior, stage of change for stress management and exercise behavior) were completed at four separate time points; baseline, at approximately 6 months (range 4-8 months), approximately 12 months (range 10-14 months) and approximately 18 months (16-20 months). However, due to significant attrition during the fourth time period, this study will focus on the analysis of the first

three time periods. Surveys were completed on laptop computers and were typically finished within a single class period (i.e., approximately 40 minutes). Analysis of the time periods between survey administrations indicated significant variability between assessments within each behavior and across behaviors (Table 1). However, a closer examination of the effect of the varied lengths of time between survey administrations revealed that the stability coefficients of both the within construct paths and the cross construct paths remained consistent across different time lengths (Table 2).

Chapter 4

Results

Stage Distribution

Stage distribution was examined for each target behavior (i.e., stress management, exercise behavior) at time 1. For this sample, the stage of change distribution for stress management behavior at time 1, was composed of approximately 45% of students in Precontemplation ($n = 443$), 17% in Contemplation ($n = 173$), 11% in Preparation ($n = 110$), 9% in Action ($n = 86$) and 19% in Maintenance ($n = 184$) (Table 3). See Table 4 to examine comparisons of stage of change across time. At time 1, the stage of change for exercise behavior distribution was approximately 9% of students in Precontemplation ($n = 98$), 6% in Contemplation ($n = 60$), 16% in Preparation ($n = 154$), 17% in Action ($n = 172$) and 51% in Maintenance ($n = 512$) (Table 5). Table 6 provides detailed information on the comparisons of stage of change for exercise over time.

Attrition Analyses

Not all students who were enrolled in this project at time 1 completed the exercise and stress management surveys at all three time periods. Completers were defined as students who answered items at all three data collection time periods for each behavior. There were 708 completers (approximately 72% of total sample) for the exercise behavior scales and 704 completers (approximately 71% of total sample) for the stress management behavior measures.

Comparisons of exercise completers/non-completers and stress management completers/non-completers, at baseline, revealed similar results across each behavior's

stage of change (see tables 3 and 5). Chi-square analyses indicated no significant gender differences between completers and non-completers (stress management; $\chi^2(1) = 1.43$, $p = .225$, exercise; $\chi^2(1) = 1.849$, $p = .174$). However, significant differences between completers and non-completers on the exercise and stress management measures were found for race and stage. A significantly higher percentage of white subjects compared to non-white subjects completed both the exercise and stress management measures (stress management; $\chi^2(1) = 20.741$, $p < .001$, exercise; $\chi^2(1) = 20.312$, $p < .001$). Additionally, significant differences were found for stage of change between completer and non-completer subjects for both behaviors (stress management; $\chi^2(4) = 13.319$, $p < .001$, exercise; $\chi^2(4) = 11.792$, $p < .05$). These findings suggested that non-completers of the stress management and exercise measures were more likely to fall within the Precontemplation stage of change (Table 8).

Further analysis indicated, at time 1, completers scored significantly higher on the Self-efficacy scale (stress management; $F(1,995) = 8.295$, $p < .05$, exercise; $F(1, 995) = 7.390$, $p < .05$) and the Pros scale (stress management, $F(1,995) = 15.157$, exercise; $F(1, 995) = 24.985$, $p < .001$). There were no significant differences noted between completers and non-completers on the Cons scale on either stress management or exercise measures (stress management; $F(1,995) = .549$, $p = .459$, exercise; $F(1, 995) = .001$, $p = .979$) (Table 5).

Preliminary Item Analyses

Prior to any statistical analyses, the entire data set was checked for accuracy and missing data points. All data from the original data set were retained for analysis.

Preliminary analyses examined the means and standard deviations for all original items for the stress management scales (Table 9) and exercise scales (Table 10). The highest item means were found on the Pros scale for both stress management behavior and exercise behavior, ranging from 3.36 to 3.78 and 3.12 to 3.42, respectively. In contrast, the lowest item means were obtained on the Cons Scale for stress management behavior and exercise behavior, ranging from 2.16 to 2.58 and 1.54 and 2.04, respectively. These findings indicated, at time 1, the students generally endorsed more advantages for stress management and exercise behavior than disadvantages.

The skewness and kurtosis of the data sets were examined across all three measures of stress management behavior and exercise behavior. The results of this examination revealed that the skewness and kurtosis values fell within acceptable limits for all items and suggested the data was normally distributed for each scale. At time 1, a review of the correlations between each of the six measures did not reveal the presence of any collinearity between measures (Table 11).

Preliminary Measurement Analyses

All analyses of the measurement models were conducted utilizing the EQS Version 6 Structural Equation Modeling (SEM) software (Bentler, 2002). Structural equation modeling was completed to determine the best fitting measurement model all three scales (i.e., Pros, Cons and Self-efficacy scales) for both the stress management and exercise behavior.

Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) is procedure that allows for the verification of a predetermined factor structure by determining how close the sample

data set resembles the hypothesized model. The conceptual models for both the stress management and exercise scales were based upon previous research completed with adolescents (Dye et al, 2007; Stephan et al, 2007).

Several indices of fit were utilized to determine the goodness of fit between the derived sample data set and the conceptualized model. First, chi-square tests were used to determine if the hypothesized model provided a good fit to the data. A small, non-significant chi-square value would indicate that there was little difference between the hypothesized model and the data (Gorsuch, 1983, Tabachnick & Fidel, 2001). The goodness of fit was assessed by the examination of the standardized root mean square residuals (SRMR), including the root mean square residual (RMSEA) and the average absolute standardized residual (AASR). All of these indices refer to the average differences of the pattern of variances and covariances between the hypothesized model and the data. Small values (.05 or less) indicate a good-fitting model (Stieger & Lind, 1980). The comparative fit index (CFI) was also utilized to determine how well the data fit the conceptualized model. The larger the CFI value, the better the fit of the hypothesized model to the data (Tabachnick & Fidel, 2001). CFI values of .90 or better generally indicate good model fit to the data (Hu & Bentler, 1990).

At time 1, three separate analyses were initially completed with all items: (1) stress management scales only, (2) exercise scales only and (3) a full model that included both stress management and exercise scales. Three possible models (null, 3 factor uncorrelated, 3 factor correlated) were constructed and tested to explore plausible alternative factor configurations of all three scales for stress management

and exercise behavior. Similarly, the three models explored for the full model included a null, a six-factor correlated model and a six-factor uncorrelated model. The null model posits that there is no relationship between scale items. This model was not considered to be a viable model; however, it is used for a baseline comparison for which the remaining two models were compared. The 1-factor model was not constructed due to the hypothesized opposing nature of the Pros and Cons scales for each behavior, thus a single underlying factor theoretically was not a viable solution. An uncorrelated factor model hypothesizes that there are separate and independent factors that can explain adolescent perceptions of stress management and exercise behavior. Finally, the correlated factor model suggests that the factors utilized to explain adolescent perceptions are related constructs and may provide evidence that there is a higher order construct for adolescent perceptions of stress management and exercise behavior.

The competing models for the stress management scales, exercise scales and the combined full model were evaluated and compared (Table 12). An initial review of the model comparisons revealed the best fit indices for the three and six-factor correlated models. Although the three-factor correlated model for the stress management scales attained good fit indices, the model fit for the exercise scales was slightly below the accepted guidelines for the goodness of fit (Bentler, 1990, Hu & Bentler, 1999, Tabachnick & Fidel, 2001).

A closer examination of the item loading on the hypothesized exercise scales revealed two weak items. The first poor loading item was item number 6 on the exercise self-efficacy scale (i.e., how sure are you that you would be able to exercise

“when I am spending time with my friends”). This item loading (.254) was below the accepted .40 value for retaining an item (Tabachnick & Fidel, 2001). The second weak loading (.365) item was noted for item 4 on the Cons scale (i.e., “exercise prevents me from spending time with my friends”). After these two items were dropped the exercise model and the full model were re-analyzed. The final item means, standard deviations and the revised coefficient values are presented in Table 13. Final factor loading are presented in Table 14.

Alternative models for the stress management and exercise scales were re-examined once the poorly loaded items were dropped. The competing models for the revised exercise scale and the full model are presented in Table 15.

In the follow-up analysis, it was determined that the three-factor correlated model was found to be the best fitting model based upon the CFI and RMSEA indices. The CFI indices of the three-factor and six-factor correlated model exceeded .90 criteria for adequate fit (Tabachnick & Fidel, 2001). Although some RMSEA values were greater than the recommended value, the lowest RMSEA values were obtained on the three and six-factor correlated models. Given that the six-factor correlated model encompasses all items, the full model was further analyzed utilizing the chi-squared difference test. The results of the chi-squared difference test suggested that the 6-factor correlated model provided a significantly better fit to the data than the 6-factor uncorrelated mode ($\chi^2_{\text{diff}} = 716.817$, $df = 15$, $p < .001$). This finding provided additional evidence that the 6-factor correlated model was the most parsimonious and best fit to the data.

Preliminary Path Analyses

As part of the model building process, a series of path analysis models were conducted. The first path analysis was a two wave model completed with a single indicator score for stress management pros and stress management self-efficacy scales. The results of the two wave path analysis indicated that all path coefficients were significant (Figure 11). However, the fit indices for this single indicator path analysis were below the accepted standard for a good fit between the hypothesized model and this data set $\chi^2(1) = 130.08$, CFI = .802, RMSEA = .392, AASR = .031 (Tabachnick & Fidel, 2001).

The next step in the model building process included a path analysis of the single indicator scores for stress management pros and stress management self-efficacy across all three time points. Although the results of the three wave path analysis indicated the presence of significant paths between and across constructs, the fit indices of a single indicator path model were also below the criteria for a good fit between the hypothesized model and this specific data set ($\chi^2(4) = 165.95$, CFI= .889, RMSEA= .237, AASR= .0346). Significant stability coefficients were found for both measurement tools (stress management pros and self-efficacy) across time. Additionally, significant path coefficients were noted on the cross lag paths stress management pros and stress management self-efficacy between time 2 and time 3 (Figure 12).

Cross-lagged Panel Analysis Models

The cross-lagged panel design applies structural equation modeling techniques in a longitudinal analysis of the data. There are several advantages of this type of longitudinal modeling; (1) it provides an opportunity to examine the pattern of covariation between targeted variables over time, (2) due to multiple time points, it allows for the examination of both directions of potential causality between variables and (3) it establishes an estimate on the relative stability of construct stability over time (Menard, 1991). See Burkholder and Harlow (2003) for a thorough illustration of the use of a cross-lagged design for the analysis of large sample longitudinal data.

This study included the examination of 9 different proposed relationships between Transtheoretical Model constructs (self-efficacy, decisional balance) and two health behaviors (exercise, stress management behavior) across three time periods. Six of the models analyzed the cross-construct relationships within a single behavior and three models explored the relationship of a single construct between behaviors. For all nine hypothesized models, at least four alternative full models were examined; base model, within-construct lags model, cross-construct lags model and fully cross-lagged model. All full models include the examination of six types of coefficient paths; factor paths, error paths, error residual paths, correlation paths between different constructs, stability paths within a construct and cross-construct residual paths. A simplified version of the full model is provided for ease of description in Figure 2. In the simplified model, there are only three paths examined; correlation paths between the two constructs, stability paths within each construct and cross-construct regression paths. These paths may simply be defined as:

- *Correlation paths between two constructs*- these paths represent the correlation between the two latent variables at a single time (i.e., correlation between stress management Self-efficacy at time 1 to stress management for Pros at time 1).
- *Within construct regression paths*- these paths represent the relative stability of the same construct across time (i.e., stress management Self-efficacy at time 1 to stress management Self-efficacy at time 2).
- *Cross-construct residual paths*- these paths provide an estimate of the relationship between two different constructs across time (i.e., stress management Self-efficacy at time 1 to stress management Pros at time 2).

Base Model. The base model may be defined as the simplest of the four proposed models and includes all six types of coefficient paths. In the base model, the factor paths from the construct predict the individual variables (i.e., measurement items). Each factor path has an associated factor loading. These factor paths may be interpreted similar to a basic factor analysis where higher factor loadings indicate stronger predictive relationship between the latent variable and individual variables. Error paths included in the base model were representative of the measurement error for each individual item. Error residual paths within this model examined the correlation between measurement errors for corresponding items across time. The base model included error residual paths for adjacent time periods only (i.e., measurement error at time 1 → measurement error time 2, measurement error time 2 → measurement error time 3). In the base model, the bi-directional path between the independent factors represented the correlation between the different latent variables.

At time 2 and time 3, these paths may be more accurately described as the correlation between the disturbance errors of each of the latent variables. The paths between a latent variable and the same latent variable across time were referred to as within-construct regression paths. These regression paths between the same construct provided an estimate of the relative stability of that construct across time. In the base model, these paths were limited to adjacent time periods, only (i.e., exercise self-efficacy at time 1 → exercise self-efficacy at time 2, exercise self-efficacy at time 2 → exercise self-efficacy at time 3). The final type of path included in base model was the cross-construct paths. The cross-construct path permitted the examination of the relationship between two different latent variables across time. Thus, the cross-construct paths provided an estimate of the explained variance not predicted from the within-construct path (i.e., prediction of a construct value based upon the value of the previous same construct value). Again, in the base model, the cross-construct paths were limited to the adjacent time period (i.e., exercise self-efficacy at time 1 → stress management self-efficacy time 2, stress management self-efficacy at time 2 → exercise self-efficacy time 3) (Figure 13).

Within-Construct Model. The first alternative model considered was the within-construct model. This model is similar to the base model with the exception of two additional paths connecting each construct from the time 1 to time 3 (i.e., exercise self-efficacy at time 1 → exercise self-efficacy at time 3, stress management self-efficacy at time 1 to stress management at time 3) (Figure 14).

Cross-construct Model. The next model considered was the cross-construct model. This model is also similar to the base model, however; it incorporates two

additional cross-construct paths between the different constructs from time 1 to time 3 (i.e., exercise self-efficacy at time 1 → stress management self-efficacy at time 3, stress management self-efficacy at time 1 → exercise self-efficacy at time 3) (Figure 15).

Fully Cross-lagged Model. The final model considered was the fully cross-lagged model. This model included both the two additional within-construct path from time 1 to time 3 and the two additional cross-construct path from time 1 to time 3 (Figure 16).

Models with Additional Error Residual Paths. Additional alternative model testing was completed for one of the hypothesized models (i.e., the relationship between self-efficacy for stress management behavior and self-efficacy for exercise behavior). These analyses explored the viability of adding additional paths between the item error variances at time 1 and the item error variances at time 3 for each of the four original alternative models (i.e., base, within-construct lags, cross-construct lags, fully cross-lagged) (Figure 17).

All eight alternative models were examined utilizing one test model (i.e., the relationship between stress management behavior self-efficacy and exercise behavior self-efficacy model). Although the within-construct lag with residuals model and the fully cross-lagged with residuals model were found to have the highest CFI values, these models resulted in coefficient paths that were similar to the base model's pattern of significance and interpretation. The additional paths provided by the more complex models did not provide any further insight into the interpretation of the model beyond what was available through the examination of the base model analysis. Thus, the

base model was considered to be the best fitting model due to both its moderate fit indices and parsimonious nature. Therefore, the base model was utilized as the principal model for examining the relationship between constructs across time (Table 15).

Cross-construct relationships within a single behavior

The first set of 6 hypotheses examined the relationship between two constructs within a single behavior. The second set of 3 hypothesis examined the relationship between the same construct across two behaviors (i.e., exercise, stress management).

Hypothesis 1. The first hypothesis of this series of analyses explored the relationship between self-efficacy for stress management and pros of stress management behavior across three time periods. A comparison of alternative models is provided (see Table 16).

The base model revealed the presence of significant stability paths between both the measures of self-efficacy for stress management behavior and the pros of stress management behavior across the three time periods. A single significant positive cross lag path was noted between the pros of stress management behavior at time 2 to self-efficacy of stress management behavior at time 3 ($\beta = .22, p < .05$) (see Figure 18).

Hypothesis 2. The next hypothesis explored the relationship between the self-efficacy of stress management behavior and the cons stress management behavior. A comparison of alternative models is provided in Table 17.

The base model identified significant stability paths between both the self-efficacy measures for stress management behavior and the cons of stress management

behavior. One significant negative cross lag paths was noted between the cons of stress management behavior at time 1 to self-efficacy of stress management behavior at time 2 ($\beta = -.08$, $p < .05$) (see Figure 19).

Hypothesis 3. Next, the relationship between the self-efficacy of exercise behavior and the pros exercise behavior was investigated. A comparison of alternative models is provided in Table 18.

The base model revealed significant stability paths across time for both scales; the self-efficacy for exercise behavior and the pros of exercise behavior. One significant positive cross lag paths noted between the pros of exercise behavior at time 1 to self-efficacy of exercise behavior at time 2 ($\beta = .13$, $p < .05$) (see Figure 20).

Hypothesis 4. The next hypothesis investigated was the relationship between the self-efficacy of exercise behavior and the cons exercise behavior. Table 19 provides comparative information on the alternative models considered.

The base model revealed the presence of significant stability paths between both the self-efficacy for exercise scale and the cons of exercise behavior scale. Two significant negative cross lag paths were noted between the cons of exercise behavior at time 1 to self-efficacy of exercise behavior at time 2 ($\beta = -.17$, $p < .05$) and the cons of exercise behavior at time 2 to self-efficacy for exercise behavior at time 3 ($\beta = -.09$, $p < .05$) (see Figure 21).

Hypothesis 5. The next hypothesis explored the relationship between the pros of stress management behavior and the cons of stress management behavior. A comparison of alternative models is provided in Table 20.

The base model identified significant stability paths across time for both measures of the pros for stress management behavior and the measures of the cons of stress management behavior. Three significant and negative cross lag paths were noted between the pros of stress management behavior across time to the cons of stress management behavior and the cons of stress management behavior to the pros of stress management behavior across time (see Figure 22).

Hypothesis 6. The next hypothesis investigated was the relationship between the pros of exercise behavior and the cons of exercise behavior across time. A comparison of alternative models is provided in Table 21.

The base model revealed the presence of significant stability paths across time for the pros for exercise behavior scale and the cons of exercise behavior scale. One significant and negative cross lag path was found between the cons of exercise behavior at time 2 to the pros of exercise behavior at time 3 ($\beta = -.13$, $p < .05$) (see Figure 23).

Relationship of constructs across behavior

The second set of hypotheses examined the relationship between the same construct across two behaviors (i.e., exercise, stress management).

Hypothesis 7. The next hypothesis examined was the relationship between self-efficacy for stress management behavior and self-efficacy for exercise behavior across time. All model alternatives are provided in Table 22.

A review of the base model revealed the presence of several significant paths across time. Significant stability paths were noted between the self-efficacy measures for both stress management and exercise behavior across time. In addition, two

significant and positive cross lag regression paths were found; stress management self-efficacy at time 1 to exercise self efficacy at time 2 ($\beta = .20$, $p < .05$) and exercise self-efficacy at time 2 to stress management at time 3 ($\beta = .11$, $p < .05$) (see Figure 24).

Hypothesis 8. Hypothesis 8 explored the relationship between the pros of stress management behavior and the pros of exercise behavior across time. A comparison of alternative models is provided in Table 23.

The base model revealed the presence of significant stability paths between both the measures of the pros of stress management behavior and the pros of exercise behavior across time. Four significant and positive cross lag paths were identified between the pros of stress management behavior to pros of exercise behavior across both time periods and the pros of exercise behavior to pros of stress management behavior across both time periods (see Figure 25).

Hypothesis 9. The final hypothesis explored the relationship between the measures of cons of stress management behavior and the cons of exercise behavior. A comparison of alternative models is provided in Table 24.

The base model indicated the presence of significant stability paths between both the measures of the cons of stress management behavior across time and the cons of exercise behavior across time. Additionally, all cross lag paths were found to be significant and positive between the cons of stress management behavior to cons of exercise behavior and the cons of exercise behavior to cons of stress management behavior across time (see Figure 26).

Chapter 5: Discussion

Overview of Study

The first goal of this study was to explore the temporal relationship between the internal constructs of the Transtheoretical Model of Change (i.e., self-efficacy, decisional balance) across time and two behaviors (exercise and stress management). The cross-lagged panel modeling procedure provided valuable longitudinal insight into the relationship between the self-efficacy and decisional balance constructs both within and across behaviors. A second goal of this study was to investigate the viability that changes in either self-efficacy or decisional balance scores on one target behavior would positively influence change on the another health behavior (i.e., changes in self-efficacy scores for stress management behavior would lead to changes in either self-efficacy or decisional balance scores for exercise behavior). A final goal of this study was to consider the possibility that relationship between TTM constructs for stress management behavior would have some important implications for the application of Grant's Model of Psychopathology (Figure 1). Grant's model posits that there are mediating factors (i.e., cognitive processes) and coping strategies that can be crucial in reducing the impact of chronic stress on the development of adolescent psychopathology or unhealthy lifestyle choices.

All hypotheses examined were based upon theoretical expectations derived from the Transtheoretical Model of Change. Each hypothesis was tested and found to be partially or strongly supported by the data analyses conducted. Although positive relationships were found between Self-efficacy and the Decisional Balance-Pros both within each behavior and across behaviors, there were a greater number of positive

significant paths leading from the Decisional Balance-pros to Self-efficacy than the reverse (i.e., Self-efficacy to Decisional Balance-Pros). These findings indicated that there was a positive relationship between self-efficacy and decisional balance pros. The results also suggested that Decisional Balance-Pros scores were a stronger influence on the Self-efficacy scores for a behavior change than the reverse (i.e., Self-efficacy scores for a behavior change were less influential on later Decisional Balance-Pros scores).

Not surprisingly, the data supported the theoretical notion that there would be a negative relationship between Self-efficacy scores and the Decisional Balance-Cons scores. Additionally, data analyses supported the assumption that there should be a negative relationship between the Decisional Balance-Pros scores and Decisional Balance-Cons across and within each of the targeted behaviors. Each specific hypothesis will be reviewed and discussed in relation to the overall findings of this study.

Specific Hypotheses

Cross-construct relationships within a single behavior

Hypothesis 1. The first hypothesis proposed a positive relationship between stress management behavior Self-efficacy scores and stress management behavior Decisional Balance-Pros scores. Consistent throughout all analyses, the base model was considered to be the most parsimonious and the best fit to the data. Although not all cross-construct paths (i.e., paths between Self-efficacy scores and Decisional Balance-Pros scores) were found to be significant, all paths were found to be in a positive direction. As expected, Self-efficacy scores for stress management behavior,

at time 1, were found to be significantly predictive of Self-efficacy scores for stress management behavior at later time points. Similarly, scores at time 1 for the Decisional Balance- Pros of stress management behavior were also predictive of scores at time 2 and 3 for the Decisional Balance-Pros of stress management behavior. This provided evidence of the strong predictive nature of each measurement instrument across time. Although there was only one significant path noted between the Decisional Balance-Pros of stress management behavior and Self-efficacy for stress management behavior, all paths were found to be in a positive direction. This suggested a generally positive relationship between self-reported levels of Self-efficacy for stress management behavior and the Decisional Balance-Pros of the stress management behavior across time. Thus, higher scores for the Self-efficacy of stress management behavior were generally associated with higher scores on the Decisional Balance- Pros for stress management behavior. Interestingly, at the later time points (between time 2 and time 3), the Decisional Balance-Pros of stress management were a significantly stronger influence on Self-efficacy scores than the reverse relationship.

Hypothesis 2. The second hypothesis proposed that there would be a negative relationship between scores for the self-efficacy of stress management behavior and scores on the Decisional Balance-Cons scale for stress management behavior. As expected, there was a positive and significant relationship within each measure across all time periods. Although only one path between the Self-efficacy scores of stress management and the Cons of stress management was significant, all paths were found to be in the expected negative direction. The identified significant path indicated that within the early stages of change (i.e., between time 1 and time 2) that scores for the

Cons for stress management significantly and negatively influenced scores on the Self-efficacy for stress management scale at time 2. Thus, high scores for the Cons of stress management behavior were associated with lower scores for the Self-efficacy for stress management behavior. Similarly, low scores on the Cons of stress management behavior were associated with higher scores on the self-efficacy for stress management behavior. These findings were consistent with the TTM theoretical tenet that individuals with high levels of cons for behavior (i.e., reasons to not engage in a new behavior) would be expected to have lower self-efficacy scores for the behavior change particularly in the earlier stages of change (Prochaska & Marcus, 1994, Prochaska & Velicer, 1997).

Hypothesis 3. The third hypothesis posited that there would be a positive association between the Self-efficacy scores for exercise behavior and the scores for Decisional Balance- Pros for exercise behavior. Similar to the previous cross-lagged models, there was a positive and significant relationship within each measure across all time periods. The one significant path within this model identified a positive relationship between the Decisional Balance-Pros of exercise behavior score at time 1 and Self-efficacy for exercise behavior scores at time 2. This supported the finding that the Decisional Balance-Pros of exercise behavior was more influential on the Self-efficacy scores for exercise behavior during the early stages of change than during the later stages of change. This findings added support to the notion that the Decisional Balance-Pros scores of exercise were more influential and predictive of Self-efficacy scores than the reverse relationship (i.e., self-efficacy scores for exercise behavior on the Pros scores for exercise behavior).

Hypothesis 4. The next hypothesis proposed that there would be a negative relationship between the Self-efficacy scores of exercise behavior and the Decisional Balance-Cons scores for exercise behavior. Consistent with previous models, there was a positive and significant relationship within each measure across all time periods. Although all cross-constructs paths were found to be negative, only two paths were significant. In both the early (time 1-time 2) and later (time 2-time 3) time periods, a significantly negative relationship was found between the scores for the Decisional Balance-Cons of exercise behavior and Self-efficacy scores for exercise behavior. This provided support for the finding that the Decisional Balance-Cons scores for exercise behavior were a more significant influence on the Self-efficacy scores for exercise behavior than the reverse relationship (i.e., the relationship between the scores on the Self-efficacy for exercise behavior scale and the scores on the Decisional Balance-Cons for exercise behavior). Thus, it could be predicted that students with high Decisional Balance-Cons scores would generally have low scores on Self-efficacy scale for exercise behavior across time. These students would be considered to be less likely to engage in an exercise behavior change than students with lower Decisional Balance-Cons scores. Similarly, low scores on the Decisional Balance-Con scale would generally result in higher scores on the Self-efficacy for exercise behavior across time and a higher probability for a change in exercise behavior.

Hypothesis 5. The fifth hypothesis projected that there would be a negative relationship between the Decisional Balance-Pros scores for stress management behavior and the Decisional Balance-Cons for stress management behavior. Given that both measures were utilized in previous models, the positive and significant

relationship within each measure across all time periods was reconfirmed. Although all relationships between the Decisional Balance-Pros scores and Cons scores for stress management behavior were found to be negative, only three paths were found to be significant. In the early time period (time 1-time 2), both cross-construct paths were significantly negative and supported the theoretically expected inverse relationship between the Decisional Balance-Pros and Cons for stress management behavior. During the later time periods (i.e., time 2 to time 3), the path between the score for the Decisional Balance-Cons of stress management behavior at time 2 and the Decisional Balance-Pros of stress management behavior, at time 3, maintained statistical significance. Thus, high scores on either Decisional Balance-Pros or Cons predicted lower scores on the other decisional balance construct.

Hypothesis 6. The sixth proposed hypothesis posited that there would be a negative relationship between the scores on the Decisional Balance-Pros of exercise behavior and scores on the Decisional Balance-Cons scale of exercise behavior. Since both measures were utilized in previous models, a positive and significant relationship within each measure was maintained across all time periods. Although all pathways between the constructs were in a negative direction, there was only one significant pathway noted during a later time period (i.e., time 2 to time 3). Again these findings were consistent with previous research and TTM theoretical expectations that the scores on the Decisional Balance-Pros and Cons of behavior change would be negatively associated (Prochaska, 1994).

Relationships between constructs across behavior

Hypothesis 7. The next hypothesis tested the relationship between the same construct across both behaviors (i.e., stress management behavior, exercise behavior). It was predicted that there would be a positive relationship between the Self-efficacy scores for stress management behavior and the Self-efficacy scores for exercise behavior. As expected from previous models, there was a positive and significant relationship within each measure across all time periods. Although all pathways between the constructs were found to be positive, only two pathways were significant. In the earlier time period (time 1 to time 2), there was a significant relationship between the Self-efficacy score for stress management behavior at time 1 and the Self-efficacy scores for exercise behavior at time 2. Conversely, the later time period, there was a significant association between the Self-efficacy scores for exercise behavior at time 2 and the Self-efficacy scores for stress management behavior at time 3. These mixed findings for self-efficacy scores across behavior did not identify a consistent pattern of influence. It seems that in earlier time periods that stress management self-efficacy was a positive influence on self-efficacy for exercise behavior while at the later time periods, exercise self-efficacy was a stronger influence on stress management behavior rather than the reverse relationship.

Hypothesis 8. The eighth hypothesis predicted that there would be a positive relationship between the Decisional Balance-Pros score for stress management behavior and the Decisional Balance-Pros for exercise behavior. Again, as expected from previous models, there was a positive and significant relationship within each measure across all time periods. All pathways between the Pros scores of stress

management behavior and the Pros scores of exercise behavior were found to be positive and significant. These findings supported the notion that the relationship between the pros for each behavior (i.e., stress management and exercise) was both positive and reciprocal in nature. Thus, high scores for the Decisional Balance-Pros of stress management behavior were strongly associated with high scores for Decisional Balance-Pros of exercise behavior across all time periods. Similarly, high scores for the Pros of exercise behavior generally led to high scores for the Pros of stress management behavior. This finding has implications for the possibility of developing interventions that can influence change across multiple health behaviors by providing evidence that the pros of one target behavior (i.e., stress management behavior) will influence the pros of another target behavior (i.e., exercise behavior).

Hypothesis 9. The final hypothesis projected that there would be a positive relationship between the Decisional Balance-Cons score for stress management behavior and the Decisional Balance-Cons score for exercise behavior. As with all previous models, there was a positive and significant relationship within each measure across all time periods. All cross-construct pathways between the scores on the Cons scale for stress management behavior and the Cons scores for exercise behavior were found to be positive and significant. This finding suggested that scores on the Decisional Balance-Cons scale for stress management were positively associated with the Decisional Balance- Cons score for exercise behavior. This relationship also appeared to be reciprocal in nature, such that, high scores on the Cons scale for exercise behavior predicted high scores on the Cons scale for stress management behavior. This finding provided additional evidence for the viability of developing

interventions that address multiple health-related behaviors by suggesting that if an intervention can influence the Cons scores on one behavior (i.e., stress management behavior) by influencing the Cons scores of another related behavior (i.e., exercise behavior).

Overall, this study provided further support for two theoretical assumptions associated with the Transtheoretical model of change. First, despite some support that Decisional Balance and Self-efficacy constructs are reciprocally related, Decisional Balance constructs were generally found to be a stronger influence on the development of self-efficacy for a behavior change than the reverse relationship (i.e., self-efficacy influencing decisional balance constructs). Thus, decisional balance cognitive processes appeared to precede the development of self-efficacy for a specific behavior. These findings provided support for the notion that there is a specific sequence of cognitive processes that influence change across both stress management and exercise behaviors. This additional insight into the internal functioning of TTM constructs suggested that during the early stages of change, intervention strategies need to focus more strongly on cognitive strategies that influence Decisional Balance (i.e., experiential strategies such as conscious raising, self-reevaluation, dramatic relief) rather than self-efficacy raising strategies. Strategies to develop and strengthen self-efficacy would be more effective during later stages of change.

A second important implication of this study was that a change on either self-efficacy or decisional balance constructs on one behavior positively influenced self-efficacy and/or decisional balance constructs on the other health behavior. This finding was consistent with other research (King et al., 1996) which, also found that

changes in self-efficacy for smoking was significantly related to similar changes in self-efficacy for exercise. This suggested that individuals may develop an overall general sense of motivation that can influence behavior change on another health behavior. These findings provided preliminary support for the viability of intervening on multiple behaviors by clustering groups of related health behaviors. The outcome of this study, for example, found that changes in self-efficacy and/or decisional balance on either stress management or exercise behavior positively affected changes in self-efficacy and decisional balance on the other behavior. Although the findings of this study may have occurred due to a pre-existing relationship between stress management and exercise behaviors (i.e., exercise behavior can physiologically result in an overall reduction in stress level), the results do support the viability or at least the need for further research for the efficacy of multi-behavior health promotion interventions. Thus, there is reason to further explore the possibility that a change on a target behavior may have incidental positive effects on other related health behaviors. For example, interventions designed to address stress management may indirectly impact smoking and/or alcohol consumption behaviors, or smoking intervention programs may indirectly influence exercise behavior, stress management behavior.

Finally, these findings provided implications for the development of intervention strategies in Grant's Model of Adolescent Psychopathology (Figure 1). Grant's model hypothesized that the effects of chronic stress on the development of either adolescent psychopathology or unhealthy lifestyle choices could be mediated by an individual's cognitive processes or coping styles (i.e., stress management behavior). The results of

this study identified two potential strategies for intervention. First, given the current evidence that indicated changes in stress management behavior appear to follow a cognitive sequence in which decisional balance cognitions for stress management behavior precede thoughts of self-efficacy for stress management behavior, intervention strategies should directly focus upon cognitions that emphasize advantages of stress management behavior (i.e., Decisional Balance Pros). Secondly, there is evidence to suggest that stress management behavior could be indirectly influenced through changes in another related health behavior, such as exercise. Thus, stress management behavior could be positively influenced by the incorporation of strategies to change exercise behavior. This indirect approach to stress management behavior provides an additional creative option for mental health professionals looking to interrupt the cycle of chronic stress and psychopathology.

Limitations of Study

There were three main areas of limitation for this study. The first limitation concerned the representativeness of the sample group. The sample utilized consisted of predominately white adolescents (over 80% of the sample) from a northeastern state. Thus, results may be less applicable to non-white adolescents from other regions of the United States. Additionally, the sample does not address adolescents placed in less traditional secondary educational placements (i.e., Private School students, Home Taught students, vocational school programs).

A second limitation involved the unequal time periods between survey administrations across the three time periods. This limitation was primarily due to several factors such as the large number of subjects and schools involved in the study

as well as the occurrence of a 10-week summer break in the school schedule. These unequal intervals do not allow for an exact prediction of the length of time need for change in TTM constructs. Thus, the findings of this study provide information about an approximate sequence and temporal of the influence of TTM constructs across time rather than estimates of exact time periods for changes in constructs.

The next limitation involved the lack of a behavioral outcome variable.

Measures of attitude toward a behavior change were utilized as an indirect measure of actual behavior change. Thus, a major limitation of this study was that the measures utilized could be categorized as assessments of cognitive intention or cognitive confidence in the ability to change rather than an actual behavioral change. Although there is prior research to support the use of these indirect measures to predict behavior change (Bandura, 1986, DiClemente, 1986, Prochaska et al., 1994, Sallis et al, 1986, Velicer et al, 1999), the accuracy of these results was dependent upon the predictive validity of the measures. Thus, the interpretations of this study were based upon the assumption that the measures of self-efficacy and decisional balance were valid and reliable predictors of future behavior change.

Future Directions

Although this study was limited by several factors, the findings were able to provide insight in the temporal order of TTM constructs within an adolescent sample. In an adolescent sample, there was ample support for the notion that Decisional Balance-Pros for a behavior change were a precursor to changes in Self-efficacy scores for a behavior change. Future research could further clarify the internal relationships between TTM constructs by restricting time periods between survey

administration to more stringent and consistent time periods. It would also be informative for future research to compare the measures across the stages of change. Thus, the comparison of the relationship between measures at the different stages of change would explore the robustness of the current findings (i.e., Decisional Balance-Pros score for a behavior change preceded the changes in Self-efficacy scores for a behavior change).

Additionally, this study found preliminary evidence that changes in the decisional balance and self-efficacy constructs on one behavior (i.e., stress management behavior) has the potential to influence the decisional balance and self-efficacy constructs of another related health behavior (i.e., exercise behavior). The incorporation of a behavioral outcome variable at baseline, each survey administration and at the end of the study for both stress management behavior and exercise behavior would provide a more comprehensive understanding of the relationship between the constructs and behavior change across time.

Finally, additional studies to further explore the viability of clustering several health behaviors within a single intervention program. Based upon this study, stress management behavior would seem to be the most promising behavior to cluster with other health behaviors (i.e., smoking, alcohol consumption, eating behavior) due to its tendency to be consistently identified as one of the underlying factors influencing many high-risk health behaviors (Bray et al., 2001, Bryne et al., 1995, Byrne & Mazanov, 1999, Byrne and Mazanov, 2001, Gutherie et al., 2001, Koval and Pederson, 1999, Mitic et al., 1985, Nelson et al., 1998, Wenzel, Glantz & Lerman, 2002, Wills et al., 2002). Further research would be needed to further explore the

relationships between health behaviors and their potential for concurrent changes within both adolescent and adult populations.

Bibliography

- Ames, S. C., Jones, G. N., Howe, J. T., & Brantley, P. J. (2001). A prospective study of the impact of stress on quality of life: An investigation of low-income individuals with hypertension. *Annual of Behavioral Medicine*, 23 (2), 112-119.
- Ames, S. C., Offord, K. P., Nirelli, L. M., Patten, C. A., Friedrich, Decker, P. A., & Hurt, R. D. (2005). Initial development of a new measure of minor stress for adolescents: The adolescent minor stress inventory. *Journal of Youth and Adolescence*, 34 (3), 207- 219.
- Anshel, M. H., (1996). Effect of chronic aerobic exercise and progressive relaxation on motor performance and affect following acute stress. *Behavioral Medicine*, 21(4), 186- 197.
- Arnett, J. J. (1999). Adolescent storm and stress, reconsidered. *American Psychologist*, 54, 317- 326.
- Bahrke, M. S., & Morgan, W. P. (1978). Anxiety reduction following exercise and meditation, *Cognitive Therapy and Research*, 2(4), 323- 333.
- Bailey, D. A., Faulkner, R. A., & McKay, H. A. (1996). Growth, physical activity, and bone mineral acquisition. *Exercise and Sport Sciences Reviews*, 24, 233- 266.
- Baldwin, D. R., Harris, S. M. & Chambliss, L. N. (1997). Stress and illness in adolescence: Issues of race and gender. *Adolescence*, 32, 839- 853.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychology Review*, 84 (2), 191-215.

- Bandura, A. (1986). *Social Foundations of thought and action*. Englewood, NJ: Prentice-Hall.
- Bentler, P. M. (1990). Comparative fit indices in structural models. *Psychological Bulletin*, 107, 238- 246.
- Bentler, P. M. (2002). EQS Version 6. Encino, CA: Multivariate Software.
- Bijlanni, R. L., Vempati, R. P., Yadav, R. K., Ray, R. B., Gupta, V., Sharma, R., Mehta, N., & Mahapatra, S. C. (2005). A brief but comprehensive lifestyle education program based on Yoga reduces risk factors for cardiovascular disease and diabetes mellitus. *The Journal of Alternative and Complementary Medicine*, 11 (2), 267- 274.
- Bock, B. C., Marcus, B. H., Rossi, J. S., & Redding, C. (1998). Motivational readiness for change: Diet, exercise, and smoking. *American Journal of Health Promotion*, 22(4), 248-258.
- Burkholder, G. J. & Evers, K. A. (2002). Application of the Transtheoretical model to several problem behaviors. In P. M. Burbank & D. Riebe (Eds.). *Promoting exercise and behavior change in older adults: Interventions with the Transtheoretical model*, (pp. 85- 145). New York, NY: Springer Publishing Company.
- Burkholder, G. J. & Harlow, L. L. (2003). An illustration of a longitudinal cross-Lagged design for larger structural equation models. *Structural Equation Modeling*, 10(3), 465-486.

- Bray, J., Adams, G. J., & Stovall, T. (2001). Interactive effects of individuation, family factors, and stress on adolescent alcohol use. *American Journal of Orthopsychiatry*, 71 (4), 436- 449.
- Byrne, D. G., Bryne, A. E. & Reinhart, M. I. (1995). Personality stress and the decision to commence cigarette smoking in adolescence. *Journal of Psychosomatic Research*, 39, 53- 60.
- Byrne, D. G. & Mazanov, J. (1999). Sources of adolescent stress, smoking and use of other drugs. *Stress Medicine*, 15(4), 215-227.
- Byrne, D. G. & Mazanov, J. (2001). Self-esteem, stress and cigarette smoking in adolescents. *Stress and Health*, 17, 105- 110.
- Calfas, K. J. & Taylor, W. C. (1994). Effects of physical activity on psychological variables in adolescents. *Pediatric Exercise Science*, 6, 406-423.
- Cannon, W. B. (1932). *Wisdom of the body*. New York: Norton.
- Carmack, C. L., Boudreaux, E., Amaral-Melendez, M., Brantley, P. J., & de Moor, C. (1999). Aerobic fitness and leisure physical activity as moderators of the stress-illness relation. *Annals of Behavioral Medicine*, 3, 251-257.
- Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health- related research. *Public Health Reports*, 100, 126-131.

- Cohen, L. H., & Park, C. (1992). Life stress in children and adolescents: An overview of conceptual and methodological issues. In A. M. LaGraca, L. J. Siegel, J. L. Wallander & C. E. Walker (Eds.). *Stress and coping in child health*. New York: Guilford.
- Cohen, S., & Wills, T. A. (1985). Stress, social support and the buffering hypothesis. *Psychological Bulletin*, 98, 310- 357.
- Coleman, C. A., Friedman, A. G., & Burright, R. G. (1998). The relationship of daily stress and health-related behaviors to adolescents' cholesterol levels. *Adolescence*, 33, 447- 461.
- Compas, B. E. (1987). Stress and life events during childhood and adolescence. *Clinical Psychology Review*, 7, 275- 302.
- Costakis, C. E., Dunnagan, T., & Haynes, G. (1999). The relationship between the stages of exercise adoption and other health behaviors. *American Journal of Health Promotion*, 14(1), 22-30.
- DiClemente, C. C. (1981). Self-efficacy and smoking cessation maintenance: A Preliminary report. *Cognitive Therapy and Research*, 5, 175- 187.
- Dunn, A. L., Trivedi, M. H., & O'Neal, H. A. (2001). Physical exercise dose-response effects on outcomes of depression and anxiety. *Medicine & Science in Sports & Exercise*, 33(6), 587-597.
- Dye, G., Velicer, W. F., Redding, Blissmer, B. & C. A., Prochaska, J. O. (2007). Validation and reliability of the decisional balance, self-efficacy, and Godin Exercise Measures in an adolescent sample. *Manuscript in preparation*.

- Evers, K. E., Prochaska, J. O., Mauriello, L. M., Padula, J. A., & Prochaska, J. M. (2006). A randomized clinical trial of a population and transtheoretical-based stress management intervention, *Health Psychology, 25*(4), 521- 529.
- Fontana, A., & Dovidio, J. F. (1984). The relationship between stressful life events and school-related performances of Type A and Type B adolescents. *Journal of Human Stress, 10*, 50- 55.
- Gaab, J., Sonderegger, L., Scherrer, S. & Ehler, U. (2006). Psychoneuroendocrine effects of cognitive-behavioral stress management in a naturalistic setting- a randomized controlled trial. *Psychoneuroendocrinology, 31*, 428-438.
- Garrett, V. D., Brantley, P. J., Jones, G. N. & McKnight, G. T. (1991). The relation between daily stress and Crohn's disease. *Journal of Behavioral Medicine, 14*, 87- 96.
- Goodyer, I.M., Kolvin, I., & Gatzania, S. (1985). Recent undesirable life events on psychiatric and psychiatric disorder in child and adolescence. *British Journal of Psychiatry, 147*, 517- 523.
- Goodyer, I.M., Kolvin, I., & Gatzania, S. (1987). The impact of recent undesirable life events on psychiatric disorders in childhood and adolescence. *British Journal of Psychiatry, 151*, 179- 184.
- Gorsuch, R. L. (1983). *Factor analysis. (2nd ed.)*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Grant, K. E., Behling, S., Gipson, P. Y. & Ford, R. E. (2005). Adolescent stress: The relationship between stress and mental health problems. *The Prevention Researcher, 12*(3), 3- 6.

- Grant, K. E., Compas, B. E., Stuhlmacher, A., Thurm, A. E., McMahon, S., & Halpert, J. (2003). Stressors and child/adolescent psychopathology: Moving from markers to mechanisms of risk. *Psychological Bulletin*, 129, 447- 466.
- Grant, K. E., Compas, B. E., Thurm, A. E., McMahon, S. D., & Gipson, P. Y. (2004). Stressors and child and adolescent psychopathology: Measurement issues and prospective effects. *Journal of Clinical Child and Adolescent Psychology*, 33 (2), 412-425.
- Greene, J. W., Walker, L. S., Hickson, G., & Thompson, J. (1985). Stressful life events and somatic complaints in adolescents. *Pediatrics*, 75, 19- 23.
- Grossman, P., Niemann, L., Schnidt, S. & Walach, H. (2004). Mindfulness-based stress reduction and health benefits: A meta-analysis. *Journal of Psychosomatic Research*, 57, 35- 43.
- Guerra, N. G., Huesmann, L. R., Tolan, P. H., Van Acker, R., & Eron, L. D. (1995). Stressful events and individual beliefs as correlates of economic disadvantage and aggression among urban children. Special Section: Prediction and prevention of child and adolescent antisocial behavior, *Journal of Consulting and Clinical Psychology*, 63 (4), 518- 528.
- Guthrie, B. J., Young, A. M., Boyd, C. J., & Kintner, E. K. (2001). Dealing with daily hassles: Smoking and African-American adolescent girls. *Journal of Adolescent Health*, 29, 109- 115.
- Hall, K. L. & Rossi, J. S. (2008). Meta-analytic examination of the strong and weak principles across 48 health behaviors. *Preventive Medicine*, 46, 266-274.

- Haney, C. J. (2004). Stress-management interventions of female athletes: Relaxation and cognitive restructuring. *International Journal of Sport Psychology*, 35 (2), 109- 118.
- Hansen, C. L., Stevens, L. C., & Coast, J. R. (2001). Exercise duration and mood state: How much is enough to feel better? *Health Psychology*, 20 (4), 267-275.
- Herrick, A. B., Stone, W. J., & Mettler, M. (1997). Stages of change, decisional balance and self-efficacy across four health behaviors in a worksite environment. *American Journal of Health Promotion*, 12(1), 49-56.
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), 1-55.
- Janis, I.L., & Mann, L. (1977). *Decision-making: A psychological analysis of conflict choice and commitment*. New York: Free Press.
- Keogh, E., Bond, F. W., & Flaxman, P. E. (2006). Improving academic performance and mental health through a stress management intervention: Outcomes and mediators of change. *Behaviour Research and Therapy*, 44, 339- 357.
- Kiecolt-Glaser, J.K., McGuire, I., Robles, T. F., & Glaser, R. (2002). Psychoneuroimmunology: Psychological influences on immune function and health, *Journal of Consulting and Clinical Psychology*, 70, 537-547.
- Kim, J. K. (2005). Interconnected accumulation of life stresses and adolescent maladjustment. *The Prevention Researcher*, 12 (3), 13- 16.

- King, T. K., Marcus, B. H., Pinto, B. M., Emmons, K. M., & Abrams, D. B. (1996). Cognitive-behavioral mediators of changing multiple behaviors: Smoking and a sedentary lifestyle. *Preventive Medicine, 25*, 684- 691.
- Kirkcaldy, D., Shephard, R. J., & Siefen, R. G. (2002). The relationship between Physical activity and self-image and problem behavior among adolescents. *Social Psychiatry and Psychiatric Epidemiology, 37*(11), 544-550.
- Kline, R. B. (1998). Principles and practice of structural equation modeling. New York: Guilford.
- Koval, J. J., & Pederson, L. L. (1999). Stress-coping and other psychosocial risk factors: A model for smoking in grade 6 students. *Addictive Behavior, 24*, 207- 218.
- Kulbok, P. A., & Cox, C. L. (2002). Dimensions of adolescent health behavior. *Journal of Adolescent Health Behavior, 31*, 394-400.
- Kusché, C. A., Cook, E. T., & Greenberg, M. T. (1993). Neuropsychological and cognitive functioning in children with anxiety, externalizing and comorbid psychopathology. *Journal of Clinical Child Psychology, 22* (2), 172- 195.
- Lazarus, R. W. (1966). *Psychological stress and the coping process*. New York: McGraw-Hill.
- Lazarus, R. S., Cohen, J. B., Folkman, S., Kanner, A., & Schaefer, C. (1980). Psychological stress and adaptation: Some unresolved issues. In H. Selye (Ed.). *Selye's guide to stress research (Vol. 1)*. (pp. 90- 117). New York: Van Nostrand Reinhold Company.

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

Long, B. C., & Haney, C. J. (1988). Coping strategies for working women: Aerobic exercise and relaxation interventions. *Behavior Therapy*, 19(1), 75- 83.

Maddock, J. E., Redding, C. A., Rossi, J. S., & Weinstock, M. A. (2005). Development and validation of an appearance motivation attitudes scale for Sun protection. *Psychology & Health*, 20(6), 775-788.

Marcus, B. H., Eaton, C. A., Rossi, J. S. & Harlow, L. L. (1994). Self-efficacy and stages of change: An integrative model of physical exercise. *Journal of Applied Social Psychology*, 24,489- 508.

Marcus, B. H., & Owen, N. (1992). Motivational readiness, self-efficacy and decision-making for exercise. *Journal of Applied Social Psychology*, 22 (3), 3-16.

Marcus, B. H., Rakowski, W., & Rossi, J. S. (1992a). Assessing motivational readiness and decisional balance for exercise. *Health Psychology*, 11, 257-261.

Marcus, B. H., Rossi, J. S., Selby, V. C., Niaura, R. S., & Abrams, D. B. (1992a). The stages and processes of exercise adoption and maintenance in a worksite sample. *Health Psychology*, 11 (16), 386- 395.

Marcus, B.H., Selby, V.C., Niaura, R.S., & Rossi, J.S. (1992b). Self-efficacy and the stages of exercise behaviors of change. *Research Quarterly for Exercise and Sport*, 63, 60- 66.

- Marcus, B. H., & Simkin, L. R. (1994). The transtheoretical model: Applications to exercise behavior. *Medicine and Science in Sports and Exercise*, 11, 1400-1404.
- McMahon, S. D., Grant, K. E., Compas, B. E., Thurm, A. E., & Ey, S. (2003). Stress and psychopathology in children and adolescents: Is there evidence of specificity? *Journal of Child Psychology and Psychiatry*, 44(1), 107- 133.
- Menard, S. (1991). *Longitudinal Research: Quantitative Applications in the Social Sciences*, 76, Thousand Oaks, CA: Sage.
- Mitic, W. R., McGuire, D. P., & Neuman, B. (1985). Perceived stress and adolescents' cigarette use. *Psychological Reports*, 57, 1043- 1048.
- Nelson, C. B., Heath, A. C., & Kessler, R. C., (1998). Temporal progression of alcohol dependence symptoms in the United States household populations: Results from the National Comorbidity Survey. *Journal of Consulting and Clinical Psychology*, 66, 474- 483.
- Nigg, C. R. (2001). Explaining adolescent exercise behavior change: A longitudinal application of the transtheoretical model. *Annual of Behavioral Medicine*, 23(1), 11-20.
- Nigg, C. R., & Courneya, K. S. (1998). Transtheoretical model: Examining adolescent exercise behavior. *Journal of Adolescent Health*, 22, 214- 224.
- Nigg, C.R., Rossi, J.S., Norman, G.J. & Benisovich, S.V. (1998). Structure of decisional balance for exercise adoption. *Annals of Behavioral Medicine*, 20 (Supplement), S211.

- Norlander, T., Moås, L. & Archer, T. (2005). Noise and stress in primary and secondary school children: Noise reduction and increased concentration ability through a short but regular exercise and relaxation program. *School Effectiveness and School Improvement*, 16 (1), 91- 99.
- Printz, B. L., Shermis, M. D., & Webb, P. M. (1999). Stress-buffering factor related to adolescent coping: A path analysis. *Adolescence*, 24 (136), 715- 734.
- Prochaska, J. O. (1994). Strong and weak principles for progressing from precontemplation to action on the basis of twelve problem behaviors. *Health Psychology*, 13, 47- 51.
- Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51, 390- 395.
- Prochaska, J. O., DiClemente, C. C., Velicer, W. F., & Rossi, J. S. (1993). Standardized, individualized, interactive and personalized self-help programs for smoking cessation. *Health Psychology*, 12, 399- 405.
- Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist*, 47, 1102-1111.
- Prochaska, J. O., & Marcus, B. H. (1994). The transtheoretical model: Applications to exercise. In R. K. Dishman (Ed.), *Advances in exercise adherence* (pp. 161- 180). Champaign, IL: Human Kinetics.
- Prochaska, J. O., & Velicer, W. F. (1997). The Transtheoretical Model of behavior Change. *American Journal of Health Promotion*, 12, 38-48.

- Prochaska, J. O., Velicer, W.F., DiClemente, C. C., & Fava, J. L. (1988). Measuring the processes of change: Applications to the cessation of smoking. *Journal of Consulting and Clinical Psychology*, 56, 520-528.
- Prochaska, J.O., Velicer, W. F., Fava, J. L., Rossi, J. S., & Tosh, J. Y. (2001a). Evaluating a population-based recruitment approach and a stage-based expert system intervention for smoking. *Addictive Behaviors*, 26, 583-602.
- Prochaska, J. O., Velicer, W. F., Fava, J. L., Ruggiero, L., LaForge, R. G., Rossi, J. S., Johnson, S. S., & Lee, P. A. (2001b). Counselor and stimulus control enhancements of a stage-matched expert system intervention for smokers in a managed care setting. *Preventive Medicine*, 32, 23- 32.
- Prochaska, J. O., Velicer, W. F., Redding, C. A., Rossi, J. S., Goldsteing, M., Depue, J., Greene, G. W., Rossi, S. R., Sun, X., Fava, J. L., LaForge, R., Rakowski, W. & Plummer, B. A. (2005). Stage-based expert systems to guide a population of primary care patients to quit smoking, eat healthier, prevent skills cancer and receive regular mammograms. *Preventive Medicine*, 41, 406-416.
- Prochaska, J.O., Velicer, W.F., Rossi, J.S., Goldstein, M.G., Marcus, B.H., Rakowski, W., Fiore, C., Harlow, L.L., Redding, C.A., Rosenbloom, D. & Rossi, S.R. (1994). Stages of change and decisional balance for twelve problem behaviors. *Health Psychology*, 13, 39-46.

- Prochaska, J. O., Velicer, W. F., Rossi, J. S., Redding, C. A., Greene, G. W., Rossi, S. R., Sun, X., Fava, J. L., LaForge, R. & Plummer, B. A. (2004). Multiple risk expert systems interventions: Impact of simultaneous stage-matched expert system interventions smoking, high fat diet and sun exposure in a population of parents. *Health Psychology, 23*, 503- 516.
- Pryor-Brown, L., & Cowen, E. L. (1989). Stressful life events, support and children's school adjustment. *Journal of Clinical Child Psychology, 18*(3), 214-220.
- Rakowski, W. R., Ehrlich, B., Goldstein, M. G., Rimer, B. K., Pearlman, D. N., Clark, M. A., Velicer, W. F., & Woolverton, H. (1998). Increasing mammography among women age 40- 74 by use of a stage-matched, tailored intervention. *Preventive Medicine, 27*, 748- 756.
- Rausch, S. M., Gramling, S. E., & Auerbach, S. M. (2006). Effects of a single session of large-group meditation and progressive muscle relaxation training on stress reduction, reactivity and recovery. *International Journal of Stress Management, 13*(3), 273- 290.
- Redding, C. A., Prochaska, J. O., Pallonen, U. O., Rossi, J. S., Velicer, W. F., Rossi, S. R., Greene, G. W., Meier, K. S., Evers, K. E., Plummer, B. A., Maddock, J. E. (1999). Transtheoretical individualized multimedia expert systems targeting adolescents' health behaviors. *Cognitive and Behavioral Practice, 6*(2), 144- 153.
- Riley, T. A. & Fava, J. L. (2001). Stress and Transtheoretical model indicators of stress management behaviors in HIV-positive women. *Journal Psychosomatic Research, 54*, 245-252.

- Rossi, S. R., Greene, H. W., Rossi, J. S., Plummer, B. A., Benisovich, S. V., Keller, S., Velicer, W. F., Redding, C. A., Prochaska, J. O., Pallonen, U. E., & Meier, K. S. (2001). Validation of decisional balance and situational temptations measures for dietary fat reduction in a large school-based population of adolescents. *Eating Behaviors, 2*(1), 1-18.
- Rossi, S. R., Rossi, J. S., Rossi-DelPrete, L. M., Prochaska, J. O., Banspach, S. W. Carleton, R. A. (1994). A process of change model for weight control for participants in community-based weight loss programs. *The International Journal of the Addictions, 29*(2), 161- 177.
- Sallis, J. F. (1993). Epidemiology of physical activity and fitness in children and adolescents. *Critical Reviews in Food Science and Nutrition, 33*(4/5), 403-405.
- Sallis, J. F., Haskell, W. F., Fortmann, S. P., Vranizan, K. M., Taylor, C. B., Solomon, D. S. (1986). Predictors of adoption and maintenance of physical activity in a community sample. *Preventive Medicine, 15*, 331-341.
- Sallis, J. F., Haskell, W. L., Wood, P. D., Fortmann, S. P., Rogers, T., Blair, S. N. & Paffenbarger, R. S. (1985). Physical activity assessment methodology in the five-city project. *American Journal of Epidemiology. 121*, 91-106.
- Sallis, J. F., & Owen, N. (1999). *Physical Activity & Behavioral Medicine*. Sage Publications Inc., Thousand Oaks, California.
- Segerstrom, S. C. & Miller, G. E. (2004). The psychological stress and the human immune system: A meta-analytic study of 30 years of inquiry. *Psychological Bulletin, 130*(4), 601- 630.

- Selye, H. (1956). *The stress of life*. New York: McGraw-Hill.
- Steiger, J. H. & Lind, C. (1980, May). *Statistically based tests for the number of common factors*. Paper presented at the annual meeting of the Psychometric Society, Iowa City, IA.
- Stephan, C. M., Rossi, J. S., Redding, & C. A., Prochaska, J. O. (2008). Validation and reliability of the decisional balance and self-efficacy measures for stress management in an adolescent sample. *Manuscript in preparation*.
- Stephoe, A., Edwards, S. Moses, J., & Mathews, A. (1989). The effects of exercise training on mood and perceived coping ability in anxious adults from the general population. *Journal of Psychosomatic Research*, 33(5), 537-547.
- Swearingen, E. M., & Cohen, L. H. (1985). Life events and psychological distress: A prospective study of young adolescents. *Developmental Psychology*, 21(6), 1045- 1054.
- Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. (4th Ed.). Boston: Allyn & Beacon.
- Thayer, R. E., Newman, R. & McClain, T. M. (1994). Self-regulation of mood: strategies for changing a bad mood, raising energy and reducing tension. *Journal of Personality and Social Psychology*, 67 (5), 910- 925.
- United States Department of Health and Human Services. (1996). *Physical activity and Health: A report of the Surgeon General*. Atlanta, Georgia: Centers for Disease Control. United States Department of Health and Human Services. (2000). *Healthy People 2010 Understanding and Improving Health*, 2nd ed. Washington, D.C.: U.S. Government Printing Office.

- Velicer, W. F., DiClemente, C. C., Prochaska, J. O., & Brandenburg, N. (1985). A decisional balance measure for assessing and predicting smoking status. *Journal of Personality and Social Psychology*, 48, 390- 395.
- Velicer, W. F., DiClemente, C. C., Rossi, J. S., & Prochaska, J. O. (1990). Relapse situations and self-efficacy: An integrative model. *Addictive Behaviors*, 15, 271- 283.
- Velicer, W. F., Norman, G. J., Fava, J. L. & Prochaska, J. O. (1999). Testing 40 predictions from the Transtheoretical Model. *Addictive Behaviors*, 24, 455-469.
- Velicer, W. F., Prochaska, J. O., Fava, J. L., Norman, G. J. & Redding, C. A. (1998). Smoking cessation and stress management: Applications of the Transtheoretical model of behavior change. *Homeostasis in Health and Disease*, 38 (5-6), 216-233.
- Velicer, W. F., Prochaska, J. O., Fava, J. L., LaForge, R. G., & Rossi, J. S. (1999). Interactive versus noninteractive interventions and dose-response relationships for stage-matched smoking cessation programs in a managed care setting. *Health Psychology*, 18(1), 21-28.
- Velicer, W. F., Rossi, J. S., Prochaska, J. O. & DiClemente, C. C. (1996). A criterion Measurement model for health behavior change. *Addictive Behaviors*, 21 (5), 555-584.

Weinstock, M. A., Rossi, J. S., Redding, C. A., & Maddock, J. E. (2002).

Randomized controlled community trial of the efficacy of a multicomponent
Stage-matched intervention to increase sun protection among beachgoers.

Preventive Medicine, 35(6), 584- 592.

Wenzel, L., Glanz, K. & Lerman, C. (2002). Stress, coping, and health behavior. In

K. Glanz, B. K. Rimer & F. M. Lewis (Eds.), *Health behavior and health
education: Theory, research and practice* (3rd ed.), (pp. 210- 239). San
Francisco, CA: Jossey-Bass.

Wertlieb, D., Weigel, C. & Feldstein, M. (1987). Stress, social support and behavior
symptoms in middle childhood. *Journal of Clinical Psychology*,
16, 204- 211.

Williamson, D.E., Birmaher, B.A., Frank, E., Anderson, B.P., Matty, M. & Kupfer,
D.J. (1998). Nature of life events and difficulties in depressed adolescents.
Journal of American Academy of Child Adolescence Psychology, 37, 1049-
1057.

Wills, T. A., Sandy, J. M., & Yaeger, A. M. (2002). Stress and smoking in
adolescence: A test of directional hypotheses. *Health Psychology*, 21 (2),
122- 130.

Youngs, B. B. (1985). *Stress in children*. New York: Arbor House.

Table 1 Comparisons of the length of time in days between time intervals within and across behaviors

	N	Mean	SD	Significance Test
Stress:				
Time 1 to Time 2 & Time 2 to Time 3	709	194.13 178.45	80.38 78.92	t(708) = 2.807, p < .05
Exercise:				
Time 1 to Time 2 & Time 2 to Time 3	713	87.06 285.39	40.50 62.86	t(712) = 59.289, p < .001
Stress-Exercise				
Stress Time 1-2 & Exercise Time 1-2	709	194.13 87.06	80.37 40.50	t(707) = 37.333, p < .001
Stress Time 2- 3& Exercise Time 2-3	709	178.45 285.39	78.92 62.86	t(707) = 36.899, p < .001

Table 2 Comparisons of stability and cross-lag means across high, medium and low time intervals

Time Interval	Mean	SD	Stability Mean	Cross lag Mean
Low	87.06	40.50	.49	-.03
Medium	178.45	78.92	.53	.01
High	285.39	62.86	.52	-.05

Table 3 Stage of change for stress management behavior across times 1, 2 & 3

Stage		Time 1	Time 2	Time 3
Precontemplation	N=	443	407	292
	%=	44.5	48.4	41.2
Contemplation	N=	173	102	55
	%=	17.4	12.1	7.8
Preparation	N=	110	100	79
	%=	11	11.9	11.1
Action	N=	86	135	187
	%=	8.6	16.1	26.4
Maintenance	N=	184	97	96
	%	18.5	11.5	13.5
Total	N=	996	841	709
	%=	100	100	100

Table 4 Stage of change across time for stress management behavior

		Stage at Time 2					Total
		PC	Cont	Prep	Action	Main	
Stage at Time 1							
PC	N	255	39	28	38	0	360
	%	70.8	10.8	7.8	10.6	0	100
Cont	N	70	25	20	31	0	146
	%	47.9	17.1	13.7	21.4	0	100
Prep	N	26	14	24	31	0	95
	%	27.4	14.7	25.3	32.6	0	100
Action	N	27	9	8	35	0	79
	%	34.2	11.4	10.1	44.3	0	100
Main	N	29	15	20	0	97	161
	%	18	9.3	12.4	0	60.2	100
Total	N	407	102	100	135	97	841
	%	48.4	12.1	11.9	16.1	11.5	100
		Stage at		Time 3			
		PC	Cont	Prep	Action	Main	Total
Stage at Time 2							
PC	N	212	27	32	70	0	341
	%	62.2	7.9	9.4	20.5	0	100
Cont	N	38	11	17	24	0	90
	%	42.2	12.2	18.9	26.7	0	100
Prep	N	16	6	17	46	0	85
	%	18.8	7.1	20	54.1	0	100
Action	N	22	9	8	47	24	110
	%	20	8.2	7.3	42.7	21.8	100
Main	N	4	2	5	0	72	83
	%	4.8	2.4	6	0	86.7	100
Total	N	292	55	79	187	96	709
	%	41.2	7.8	11.1	26.4	13.5	100
		Stage at		Time 3			
		PC	Cont	Prep	Action	Main	Total
Stage at Time 1							
PC	N	187	21	29	56	4	297
	%	63	7.1	9.8	18.9	1.3	100
Cont	N	47	16	17	37	5	122
	%	38.5	13.1	13.9	30.3	4.1	100
Prep	N	22	4	12	34	6	78
	%	28.2	5.1	15.4	43.6	7.7	100
Action	N	21	6	6	31	9	73
	%	28.8	8.2	8.2	42.5	12.3	100
Main	N	15	8	15	29	72	139
	%	10.8	5.8	10.8	20.9	51.8	100
Total	N	292	55	79	187	96	709
	%	41.2	7.8	11.1	26.4	13.5	100

Table 5 Stage of change for exercise behavior across times 1, 2 & 3

Stage		Time 1	Time 2	Time 3
Precontemplation	N=	98	97	85
	%=	9.8	10.4	11.9
Contemplation	N=	60	23	15
	%=	6	2.5	2.1
Preparation	N=	154	126	93
	%=	15.5	13.6	13
Action	N=	172	26.1	210
	%=	17.3	28.1	29.5
Maintenance	N=	512	422	310
	%	51.4	45.4	43.5
Total	N=	996	929	713
	%=	100	100	100

Table 6 Stage of change across time for exercise behavior

		Stage at Time 2					
		PC	Cont	Prep	Action	Main	Total
Stage at Time 1							
PC	N	44	4	12	28	0	88
	%	50	4.5	13.6	31.8	0	100
Cont	N	5	6	25	24	0	60
	%	8.3	10	41.7	40	0	100
Prep	N	14	7	54	66	0	141
	%	9.9	5	38.3	46.8	0	100
Action	N	13	2	11	134	0	160
	%	8.1	1.3	6.9	83.8	0	100
Main	N	21	4	24	9	422	480
	%	4.4	.8	5	1.9	87.9	100
Total	N	97	23	126	261	422	929
	%	10.4	2.5	13.6	28.1	45.4	100
		Stage at Time 3					
		PC	Cont	Prep	Action	Main	Total
Stage at Time 2							
PC	N	34	3	10	19	0	66
	%	51.5	4.5	15.2	28.8	0	100
Cont	N	5	1	7	4	0	17
	%	29.4	5.9	41.2	23.5	0	100
Prep	N	18	5	43	36	0	102
	%	17.6	4.9	42.2	35.3	0	100
Action	N	18	4	25	146	3	196
	%	9.2	2	12.8	74.5	1.5	100
Main	N	10	2	8	5	307	332
	%	3	.6	2.4	1.5	92.5	100
Total	N	85	15	93	210	310	713
	%	11.9	2.1	13	29.5	43.5	100
		Stage at Time 3					
		PC	Cont	Prep	Action	Main	Total
Stage at Time 1							
PC	N	30	2	9	16	1	58
	%	51.7	3.4	15.5	27.6	1.7	100
Cont	N	10	5	13	21	0	49
	%	20.4	10.2	26.5	42.9	0	100
Prep	N	12	5	40	51	1	109
	%	11	4.6	36.7	46.8	.9	100
Action	N	10	0	14	95	1	120
	%	8.3	0	11.7	79.2	.8	100
Main	N	23	3	17	27	307	377
	%	6.1	.8	4.5	7.2	81.4	100
Total	N	85	15	93	210	310	713
	%	11.9	2.1	13	29.5	43.5	100

Table 7 Comparison of completers and non-completers for stress management measures and exercise measures by gender, race and stage of change

	N	% Completers	Significance Test
Stress:			
Gender			
Female	495	72.9	$\chi^2(1) = 1.473, p=.225$
Male	494	69.4	
Race			
White	801	74.4	$\chi^2(1) = 20.741, p<.001$
Non-white	156	56.4	
Stage			
PC	443	67.0	$\chi^2(4) = 13.319, p<.001$
Con	173	70.5	
Prep	110	70.9	
Action	86	84.9	
Main	184	75.6	
Exercise:			
Gender			
Female	495	73.5	$\chi^2(1) = 1.849, p=.174$
Male	494	69.6	
Race			
White	801	74.8	$\chi^2(1) = 20.312, p<.001$
Non-white	156	57.1	
Stage			
PC	98	59.2	$\chi^2(4) = 11.792, p=.019$
Con	60	81.7	
Prep	154	70.8	
Action	172	69.8	
Main	377	73.6	

Table 8 Comparisons of completers and non-completers by scores on the stress management and exercise measures (decisional balance, self-efficacy)

	Subjects	Mean	S.D.	Significance Test
Stress:				
Self-efficacy	Com.	17.36	6.02	F(1,995)= 8.295, p= .004 $\eta^2 = .008$
	Non-com.	16.13	6.30	
	Total	17.00	6.12	
Pros	Com.	18.06	5.41	F(1,995)= 15.157, p<.001 $\eta^2 = .015$
	Non-com.	16.55	5.90	
	Total	17.63	5.49	
Cons	Com.	11.70	4.66	F(1,995)= .047, p= .829
	Non-com.	11.63	4.77	
	Total	11.68	4.69	
Self-efficacy for exercise	Com.	17.50	4.68	F(1,995)= 5.974, p= .015 $\eta^2 = .006$
	Non-com.	16.68	5.13	
	Total	17.27	4.82	
Pros of Exercise	Com.	16.65	4.52	F(1,995)= 24.734, p< .001 $\eta^2 = .024$
	Non-com.	15.06	4.74	
	Total	16.19	4.64	
Cons of Exercise	Com.	8.53	3.40	F(1,995)= .549, p= .459
	Non-com.	8.70	3.50	
	Total	8.58	3.43	
Exercise:				
Self-efficacy	Com.	17.53	4.70	F(1,995)= 7.390, p= .007 $\eta^2 = .007$
	Non-com.	16.61	5.07	
	Total	17.27	4.82	
Pros	Com.	16.65	4.52	F(1,995)= 24.985, p<.001 $\eta^2 = .024$
	Non-com.	15.04	4.74	
	Total	16.19	4.64	
Cons	Com.	8.55	3.43	F(1,995)= .215, p= .643
	Non-com.	8.66	3.43	
	Total	8.58	3.43	
Self-efficacy for stress management	Com.	17.35	6.04	F(1,995)= 7.967, p= .005 $\eta^2 = .008$
	Non-com.	16.14	6.26	
	Total	17.00	6.12	
Pros for stress management	Com.	18.04	5.44	F(1,995)= 13.865, p< .001 $\eta^2 = .014$
	Non-com.	16.59	5.84	
	Total	17.63	5.59	
Cons for stress management	Com.	11.68	4.66	F(1,995)= .001, p= .979
	Non-com.	11.67	4.77	
	Total	11.68	4.69	

Note: For Stress Management, Completers N= 709 and Non-completers N= 287

For Exercise, Completers N= 713 and Non-completers N= 283

Table 9 Means and standard deviations for stress management self-efficacy and decisional balance items at time 1 (N= 996)

Items	Alpha	Mean	Standard Deviation
Decisional Balance- Pro Scale Items:	$\alpha = .895$		
How important are each one to you in your decision to manage stress?			
I can concentrate better in class when I am less stressed.		3.78	1.267
Managing my stress would allow me to be more effective in working towards important goals in my life.		3.48	1.293
I would be a more pleasant person if I managed the stress in my life		3.50	1.345
It is easier to deal with my parents and family when I am less stressed		3.51	1.368
I feel healthier when I manage my stress		3.36	1.389
Decisional Balance- Con Scale Items:	$\alpha = .772$		
How important are each one to you in your decision to manage stress?			
It takes too much effort to deal with stress		2.58	1.305
Efforts to manage my stress would be disruptive to my daily life		2.42	1.312
I would be ashamed to seek help from others to manage my stress		2.21	1.310
I'll find out that I can't manage my stress		2.32	1.301
I don't see any benefits to managing my stress		2.16	1.250
Self-Efficacy Scale:	$\alpha = .901$		
How sure are you that you would be able to manage your stress in these situations?			
When I have an argument with someone		2.75	1.223
When I do poorly on a test		2.92	1.235
When I am treated unfairly		2.79	1.231
When I think about failure		2.85	1.244
When I am feeling sad		2.86	1.296
When I am not able to handle negative feelings		2.82	1.253

Table 10 Means and standard deviations for exercise self-efficacy and decisional balance of all items at time 1 (N= 996)

Items	Alpha	Mean	Standard Deviation
Decisional Balance- Pro Scale Items:	$\alpha = .808$		
How important are each one to you in your decision to exercise?			
I would have more energy for family/friends if I exercised regularly.		3.27	1.086
I would feel less stressed if I exercised regularly.		3.16	1.198
Exercising puts me in a better mood for the rest of the day.		3.22	1.231
I would feel more comfortable with my body if I exercised regularly.		3.42	1.366
Regular exercise would help me have a more positive outlook on life.		3.12	1.271
Decisional Balance- Con Scale Items:	$\alpha = .661$		
How important are each one to you in your decision to exercise?			
I would feel embarrassed if people saw me exercising.		1.47	.907
Exercise prevents me from spending time with my friends.		2.04	1.176
I feel uncomfortable or embarrassed in exercise clothes.		1.73	1.137
There is too much I would have to learn to exercise.		1.54	.881
Exercise is too boring to do it regularly.		1.80	1.126
Self-Efficacy Scale:	$\alpha = .635$		
How sure are you that you would be able to exercise in these situations?			
When it is raining or snowing or icy.		3.14	1.249
When I am under a lot of stress.		2.84	1.313
When I feel I don't have the time.		2.57	1.226
When I have to exercise alone.		2.70	1.505
When I don't have access to a place for exercise.		2.51	1.448
When I am spending time with my friends.		3.51	1.340

Table 11 Correlations between all six measures at time 1

	Stress SE	Stress Pros	Stress Cons	Ex. SE	Ex. Pros	Ex. Cons
Stress SE	---	.437*	.033	.216*	.323*	-.121*
Stress Pros		---	.283*	.189*	.483*	.044
Stress Cons			---	.109*	.121*	.248*
Ex. SE				---	.209*	.049
Ex. Pros					---	.032
Ex. Cons						---

*Indicated a significant correlation at the $p < 0.01$ level (2-tailed)

Table 12 Comparisons of the alternative models for all measurement models with original items

Model	χ^2	df	AASR	RMSEA	CFI	p
Stress Models						
Null	7855.339	117	.2473	.258	---	p < .001
3 Factor Uncorrelated	673.774	104	.1099	.074	.926	P < .001
3 Factor Correlated	382.011	101	.0289	.053	.964	p < .001
Exercise Models						
Null	3194.844	117	.1252	.163	---	p < .001
3 Factor Uncorrelated	458.768	104	.0533	.059	.885	P < .001
3 Factor Correlated	414.754	101	.0380	.056	.898	p < .001
Full Measurement Model						
Null	10825.383	490	.1521	.15	---	p < .001
6 Factor Uncorrelated	1907.748	464	.0982	.056	.873	P < .001
6 Factor Correlated	1175.925	449	.0357	.040	.936	P < .001

Table 13 Means and standard deviations for the final items of the exercise self-efficacy and decisional balance measures at time 1 (N= 996)

Items	Alpha	Mean	Standard Deviation
Decisional Balance- Pro Scale Items:	$\alpha = .808$		
How important are each one to you in your decision to exercise?			
I would have more energy for family/friends if I exercised regularly.		3.27	1.086
I would feel less stressed if I exercised regularly.		3.16	1.198
Exercising puts me in a better mood for the rest of the day.		3.22	1.231
I would feel more comfortable with my body if I exercised regularly.		3.42	1.366
Regular exercise would help me have a more positive outlook on life.		3.12	1.271
Decisional Balance- Con Scale Items:	$\alpha = .663$		
How important are each one to you in your decision to exercise?			
I would feel embarrassed if people saw me exercising.		1.47	.907
I feel uncomfortable or embarrassed in exercise clothes.		1.73	1.137
There is too much I would have to learn to exercise.		1.54	.881
Exercise is too boring to do it regularly.		1.80	1.126
Self-Efficacy Scale:	$\alpha = .648$		
How sure are you that you would be able to exercise in these situations?			
When it is raining or snowing or icy.		3.14	1.249
When I am under a lot of stress.		2.84	1.313
When I feel I don't have the time.		2.57	1.226
When I have to exercise alone.		2.70	1.505
When I don't have access to a place for exercise.		2.51	1.448

Table 14 Revised scale item factor loadings

	Scale	Loading	Scale	Loading	Scale	Loading
Stress						
	Pros		Cons		Self-efficacy	
	Item 1	.75	Item 1	.60	Item 1	.68
	Item 2	.84	Item 2	.67	Item 2	.75
	Item 3	.83	Item 3	.62	Item 3	.78
	Item 4	.76	Item 4	.70	Item 4	.82
	Item 5	.80	Item 5	.58	Item 5	.84
					Item 6	.80
Exercise						
	Pros		Cons		Self-efficacy	
	Item 1	.64	Item 1	.57	Item 1	.42
	Item 2	.71	Item 2	.71	Item 2	.56
	Item 3	.72	Item 3	.58	Item 3	.57
	Item 4	.56	Item 4	.47	Item 4	.53
	Item 5	.77			Item 5	.53

Table 15- Alternative models for the exercise behavior measurement model with final items (2 items dropped from exercise scales) and the full measurement model

Model	χ^2	df	AASR	RMSEA	CFI	p
Final Exercise Model						
Null	2996.934	88	.1580	.182	---	p < .001
3 Factor Uncorrelated	395.279	77	.0554	.079	.890	P < .001
3 Factor Correlated	355.212	74	.0393	.062	.903	p < .001
Final Full Model						
Null	11561.705	429	.1618	.161	---	p < .001
6 Factor Uncorrelated	1778.484	405	.1032	.058	.877	P < .001
6 Factor Correlated	1061.667	390	.0333	.042	.940	P < .001

Table 16 Comparison of alternative models for the relationship between self-efficacy of stress management behavior and pros of stress management behavior

Model	χ^2	df	AASR	RMSEA	CFI	χ^2 Test
Base	1184.704	462	.0498	.047	.957	---
Within-construct lags	1053.050	460	.0311	.043	.965	$\chi^2(2)=131.654$
Cross-construct lags	1180.349	460	.0454	.047	.957	$\chi^2(2)= 4.355$
Fully cross-lagged	1048.885	458	.0305	.043	.965	$\chi^2(4)=135.819$

Table 17 Comparison of alternative models for the relationship between self-efficacy of stress management behavior and cons of stress management behavior

Model	χ^2	df	AASR	RMSEA	CFI	χ^2 Test
Base	1008.461	462	.0356	.041	.955	---
Within-construct lags	926.364	460	.0249	.038	.962	$\chi^2(2)=82.097$
Cross-construct lags	1007.245	460	.0350	.041	.955	$\chi^2(2)= 1.216$
Fully cross-lagged	925.264	458	.0245	.038	.962	$\chi^2(4)=83.197$

Table 18 Comparison of alternative models for the relationship between self-efficacy for exercise behavior and pros for exercise behavior

Model	χ^2	df	AASR	RMSEA	CFI	χ^2 Test
Base	933.475	374	.0386	.046	.937	-----
Within-construct lags	875.430	372	.0329	.044	.943	$\chi^2(2)=58.045$
Cross-construct lags	929.540	372	.0373	.046	.937	$\chi^2(2)= 3.935$
Fully cross-lagged	874.251	370	.0328	.044	.953	$\chi^2(4)=59.224$

Table 19 Comparison of alternative models for the relationship between self-efficacy for exercise behavior and cons for exercise behavior

Model	χ^2	df	AASR	RMSEA	CFI	χ^2 Test
Base	814.174	295	.0414	.050	.900	---
Within-construct lags	765.612	293	.0382	.048	.909	$\chi^2(2)= 48.562$
Cross-construct lags	814.089	293	.0414	.050	.900	$\chi^2(2)= 0.085$
Fully cross-lagged	764.534	291	.0380	.048	.909	$\chi^2(4)= 49.64$

Table 20 Comparison of alternative models for the relationship between pros of stress management behavior and cons of stress management behavior

Model	χ^2	df	AASR	RMSEA	CFI	χ^2 Test
Base	867.266	374	.0462	.043	.957	---
Within-construct lags	761.812	372	.0336	.038	.966	$\chi^2(2)=105.454$
Cross-construct lags	853.270	372	.0420	.043	.958	$\chi^2(2)= 13.996$
Fully cross-lagged	761.621	370	.0336	.039	.966	$\chi^2(4)=105.645$

Table 21 Comparison of alternative models for the relationship between pros of exercise behavior and cons of exercise behavior

Model	χ^2	df	AASR	RMSEA	CFI	χ^2 Test
Base	728.188	295	.0441	.045	.950	---
Within-construct lags	657.785	293	.0364	.042	.958	$\chi^2(2)=70.403$
Cross-construct lags	727.967	293	.0443	.046	.950	$\chi^2(2)= 0.221$
Fully crossed-lagged	657.771	291	.0364	.042	.958	$\chi^2(4)=70.417$

Table 22 Comparison of 8 alternative models for the relationship between self-efficacy for stress management and self-efficacy for exercise behavior

Model	χ^2	df	AASR	RMSEA	CFI	χ^2 Test
Base	1231.074	462	.0418	.049	.933	--
Within-construct lags	1156.958	460	.0338	.048	.936	$\chi^2(2)=74.116$
Cross-construct lags	1228.927	460	.0421	.049	.933	$\chi^2(2)= 2.147$
Fully crossed-lagged	1156.626	458	.0338	.046	.939	$\chi^2(4)=74.448$
Base-Residuals	1110.259	451	.0409	.045	.942	--
Within-construct lags-Residuals	1043.822	449	.0329	.043	.948	$\chi^2(2)=66.437$
Cross-construct lags-Residuals	1108.435	449	.0411	.046	.942	$\chi^2(2)= 1.824$
Fully crossed-lagged-Residuals	1043.434	447	.0328	.043	.948	$\chi^2(4)=66.825$

Table 23 Comparison of alternative models for the relationship between pros of stress management behavior and pros of exercise behavior

Model	χ^2	df	AASR	RMSEA	CFI	χ^2 Test
Base	710.491	374	.0320	.036	.976	-----
Within-construct lags	618.623	372	.0206	.031	.982	$\chi^2(2)=91.686$
Cross-construct lags	708.035	372	.0301	.036	.976	$\chi^2(2)= 2.456$
Fully cross-lagged	617.153	370	.0201	.031	.982	$\chi^2(4)=93.338$

Table 24 Comparison of alternative models for the relationship between cons of stress management behavior and cons of exercise behavior

Model	χ^2	df	AASR	RMSEA	CFI	χ^2 Test
Base	601.359	295	.0332	.038	.951	-----
Within-construct lags	552.361	293	.0280	.035	.958	$\chi^2(2)=48.998$
Cross-construct lags	597.845	293	.0331	.038	.951	$\chi^2(2)= 3.514$
Fully Cross-lagged	549.456	291	.0273	.035	.959	$\chi^2(4)=51.903$

Figure 1 Grant’s model of the role of stressors in the development of mental health problems in adolescents

Figure 2 The relationship between the pros of stress management behavior and self-efficacy for stress management behavior across time

Figure 3 The relationship between stress management self-efficacy and cons of stress management across time

Figure 4 The relationship between exercise behavior self-efficacy and pros of exercise behavior across time

Figure 5 The relationship between exercise behavior self-efficacy and cons of exercise behavior across time

Figure 6 The relationship between the pros of stress management behavior and the cons of stress management behavior

Figure 7 The relationship between the pros of exercise behavior and the cons of exercise behavior

Figure 8 The relationship between stress management behavior self-efficacy and exercise behavior self-efficacy across time

Figure 9 The relationship between the pros of stress management behavior and pros of exercise behavior across time

Figure 10 The relationship between the cons of stress management behavior and cons of exercise behavior across time

Figure 11 Preliminary path analysis of the relationship between the pros of stress management and self-efficacy for stress management across two time points

*Indicated an significant path coefficient at the $p < .05$ level

Figure 12 Preliminary path analysis of the relationship between the pros of stress management and self-efficacy for stress management across three time points

Figure 13 Base model alternative for self-efficacy for stress management and self-efficacy for exercise behavior model

Figure 14 Within-construct lags model for self-efficacy for stress management and self-efficacy for exercise behavior model

Figure 15 Cross-construct lags model alternative for self-efficacy for stress management and self-efficacy for exercise behavior model

Figure 16 An example of the fully cross-lagged model alternative for self-efficacy for stress management and self-efficacy for exercise behavior model

Figure 17 An example of the fully cross-lagged model with residuals alternative for self-efficacy for stress management and self-efficacy for exercise behavior model

Figure 18 The relationship between self-efficacy of stress management behavior and pros for stress management behavior across time

*Indicated an significant path coefficient at the $p < .05$ level

Figure 19 The relationship between self-efficacy for stress management and cons of stress management behavior across time

*Indicated an significant path coefficient at the $p < .05$ level

Figure 20 The relationship between self-efficacy for exercise and pros of exercise behavior across time

*Indicated an significant path coefficient at the $p < .05$ level

Figure 21 The relationship between self-efficacy for exercise and cons of exercise behavior across time

Figure 22 The relationship between pros of stress management behavior and cons of stress management behavior across time

Figure 23 The relationship between pros of exercise behavior and cons of exercise behavior across time

*Indicated an significant path coefficient at the $p < .05$ level

Figure 24 The relationship between self-efficacy for stress management behavior and self-efficacy for exercise behavior across time

*Indicated an significant path coefficient at the p< .05 level

Figure 25 The relationship between pros for stress management behavior and pros for exercise behavior across time

*Indicated an significant path coefficient at the $p < .05$ level

Figure 26 The relationship between the cons for stress management behavior and cons for exercise behavior across time

*Indicated an significant path coefficient at the $p < .05$ level