The Effects of a Self-Determination Theory Based Exercise Intervention on Physical Activity and Psychological Variables in Sedentary Overweight or Obese Women: Project CHANGE (To Being a Confident, Healthy, and Goal-Directed Exerciser)

DISSERTATION

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By

Ya-Ting Hsu

Graduate Program in Education and Human Ecology

The Ohio State University

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Dissertation Committee:

Dr. Janet Buckworth, Advisor,

Dr. Brain Focht, Dr. Ann O’Connell
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Abstract

There is epidemiological evidence for a strong association between obesity and insufficient leisure-time physical activity and low levels of occupational activity in industrialized societies. Women are more likely to be physically inactive and overweight, and thus, we need an effective approach using behavioral theories to help sedentary overweight/obese women adopt and maintain regular exercise. Project CHANGE (to being a Confident, Healthy, And Goal-directed Exerciser) is an 8-week intervention with 4-week follow-up that targeted constructs from Self-Determination Theory (SDT) and addressed both behavioral strategies and physical skills. A total of 25 eligible participants were enrolled in Project CHANGE and were randomized to two treatment conditions: Self-Determination Theory-based exercise training plus behavioral intervention (SD group) or standard care (SC group) with traditional supervised exercise training. The final sample size was 21 ($N_{SD} = 11; N_{SC} = 10$). There were 2 dropouts from each group. Participants completed fitness assessments and questionnaires to measure physical activity, quality of life, depressive symptoms, SDT constructs, and other established psychological mediators of exercise, such as self-efficacy and goal setting. The results showed that the weekly energy expenditure did not differ significantly between the groups at post-intervention when baseline PA was controlled. However, the majority of the participants in the SD group remained active at the 4-week follow-up assessment and met the public health PA recommendation. The treatment effects on the psychological
variables were limited when controlling for baseline values. For both groups, integrated regulation, perceived autonomy support, and exercise goal-setting significantly increased over time. Exercise planning had a tendency to increase, but not significantly. Scheduling self-efficacy was significantly higher in the SD group than the SC group, regardless of time. In the follow-up analysis, we categorized all the participants into two groups based upon exercise adherence, defined as exercising ≥ 150 min/week at the 4-week follow-up (i.e., adherent group and non-adherent group). Participants in the adherent group had significantly greater autonomous motivation (i.e., intrinsic motivation, integrated regulation, and identified regulation), scheduling and coping self-efficacies, and self-regulatory techniques (i.e., goal-setting and planning) compared to the non-adherent group. Confidence and ability to self-regulate were important for exercise adherence. Goal-setting was the most influential predictor among these variables. The results show promise and warrant additional testing of Project CHANGE as a method to help overweight or obese women start and further maintain exercise behavior. A higher fidelity SDT intervention with larger sample size is necessary to examine the treatment effect and the proposed SDT causal pathways.
Dedication

To my husband, Szu-Ping Lee, for his support, encouragement and love;
To my parents, Cheng-Hui Hsu and Mei-Hua Chen, for making me who I am today;
To my grandparents, Huan-Tsai Hsu and Ching-Yun Hsu-Chang, for their forever love.
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Vita

March 7, 1979 .................................. Born --- Taichung, Taiwan

2001 ........................................... B.S. Physical Therapy,
National Yang-Ming University, Taiwan

2001-2004 .................................... Physical Therapist,
Cheng-Ching Hospital, Taichung, Taiwan

2005-2007 ..................................... M.A. Health and Exercise Science
The Ohio State University

2006-2011 ..................................... Graduate Teaching Associate,
Health and Exercise Science,
The Ohio State University

Publications

practitioners and clients. American College of Sport Medicine's Health & Fitness Journal,

Fields of Study

Major Field: Education

Specialization: Health and Exercise Science
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CHAPTER 1
INTRODUCTION

Problem Statement

Based on data from the National Health and Nutrition Examination Survey in 2007-2008, the prevalence of overweight and obesity for adults older than 20 was 68.3%, with 35.5% of women and 32.25% of men considered obese (BMI ≥ 30) (Flegal, Carroll, Ogden, & Curtin, 2010). This suggests that women are more likely to be obese and therefore, an effective weight management intervention targeting women is necessary. There have been epidemiologic studies suggesting a strong association between obesity and insufficient leisure-time physical activity and low levels of occupational activity in industrialized societies (Brock, et al., 2009; G. King, et al., 2001). Furthermore, overweight and obesity are strongly associated with diabetes, hypertension, high cholesterol, asthma, arthritis, and poor health status (Mokdad, et al., 2003). Physical activity is a modifiable behavior that can increase energy expenditure, enhance physical fitness, and improve some physiological parameters, and promotion of physical activity has been the aim of many weight management interventions. Analysis of a recent 24-month behavioral weight-loss program combining diet and exercise showed that physical activity (PA) was the most influential factor for predicting 10% weight loss at 24 months (Unick, Jakicic, & Marcus, 2010). Therefore, effective strategies to promote long-term exercise adherence could be critical for the overweight/obese population.
However, studies have shown that about 50% of participants who adopt an exercise program stop exercising within six months (Robinson & Rogers, 1994). How to keep individuals adherent to regular exercise is a challenge for researchers and practitioners. Since regular exercise is a repetitive and complex behavior that involves dynamic interactions among intrapersonal, interpersonal and environmental factors, individuals need to learn self-regulatory strategies to schedule exercise routines and overcome environmental barriers to increase adherence. An individual’s exercise behavior also is shaped by the surrounding physical and social environment. Therefore, when individuals start to exercise, they not only need to learn physical skills to help them perform exercise correctly, but also behavioral skills and supports to adhere to the exercise behavior (Lippke & Ziegelmann, 2008).

Theory-based behavioral interventions to promote PA have been shown to be effective (Kahn, et al., 2002). Thus, PA interventions are more likely to be effective if they target theoretical constructs that have been shown to mediate exercise behaviors. Consequently, theory testing and then refinement of theory could help to develop a better theory across different contexts and populations (Lippke & Ziegelmann, 2008) and subsequently improve interventions. Baranowski, Anderson, and Carmack (1998) reviewed 25 physical activity interventional studies and 45 correlational studies and summarized that the variability that could be explained by a psychosocial or behavioral theory is only 30% or less. They suggested that more physical activity research should focus on mediators of physical activity in order to increase the effectiveness of interventions. Marcus et al. (2006) reviewed this literature, and concluded that the
importance of applying theoretical interventions has been recognized in the past decade, but there is still more work to be done.

Deci and Ryan’s (1985) Self-Determination Theory (SDT) proposes that satisfying three basic psychological needs (i.e., autonomy, competence, and relatedness) will foster intrinsic motivation and therefore enhance positive behavior and mental health, as well as the persistence of healthy behavior (Deci & Ryan, 2008; Ryan & Deci, 2000). Some cross-sectional studies have shown that autonomous motivation is associated with exercise participation (Daley & Duda, 2006; Edmunds, Ntoumanis, & Duda, 2006; Landry & Solmon, 2002). However, more PA interventions with follow-up are needed to examine the intervention effects on SDT variables and which SDT variables will predict exercise adherence.

**Purpose of the Study**

The main purpose of Project CHANGE (to being a Confident, Healthy, ANd Goal-directed Exerciser) was to examine the effects of an 8-week SDT-based exercise and behavioral intervention (SD) compared to standard care (SC) on physical activity, depressive symptoms, quality of life, SDT-based constructs and other physical and psychological variables. Furthermore, we investigated the relationship among changes in physical activity and the psychological variables targeted in the intervention. Specifically, we were interested in determining which psychological variables best predict physical activity adherence after the intervention was over and in examining the mediating effects among the psychological variables.
Research Hypotheses

Part A: Examining Effects of the Intervention

Primary Behavioral Outcome Variable: Physical Activity

After 8 week of training and 1-month follow-up, controlling for baseline values:

1. Both SD and SC groups would have increased PA.
2. The increase in PA would be greater for participants in the SD group.

Fitness Variables:

The SD group would improve more than the SC group on the fitness variables (Hypotheses 3-6):

3. Body measurements (i.e., BMI and waist/hip ratio): same or lower scores for the SD group.
4. Muscular strength (i.e., 1RM on machine chest press and 1RM on machine leg press): higher scores for the SD group.
5. Aerobic fitness (i.e., maximal oxygen consumption predicted using a submax treadmill test): higher scores for the SD group.
6. Stair climbing: less time for the SD group.

SDT Psychological Variables:

The SD group would improve more than the SC group on SDT variables (Hypotheses 7-11):

7. Autonomous regulation (i.e., intrinsic motivation, integrated regulation and identified regulation): higher scores for the SD group.
8. Controlling regulation (i.e., introjected regulation and external regulation): lower scores for the SD group.

9. Relative autonomy index: higher scores for the SD group.

10. Psychological needs satisfaction (i.e., autonomy, competence and relatedness): higher scores for the SD group.

11. Perceived autonomy support: higher scores for the SD group.

**Other Psychological Variables:**

The SD group would improve more than the SC group on other psychological variables (Hypotheses 12-15):

12. Self-efficacy (i.e., task, coping and scheduling self-efficacy): higher scores for the SD group.

13. Self-regulation (i.e., goal setting and planning): higher scores for the SD group.

14. Depressive symptoms: same or lower scores for the SD group.

15. Quality of life (i.e., physical functioning, role limitations due to physical health problems, social functioning, bodily pain, general mental health, role limitations due to emotional problems, vitality, and general health perceptions): same or higher scores for the SD group.

**Part B: Examining the Relationship among Psychological Variables and Physical Activity**

**Physical Activity and Scores of SDT Psychological Variables:**

There would be a linear relationship between follow-up PA and scores of the SDT variables at end-point and follow-up (Hypotheses 16-20):
These SDT variables include:

16. Autonomous regulation (i.e., integrated regulation and identified regulation.): positive relationship.

17. Controlling regulation (i.e., introjected regulation and extrinsic regulation.): negative relationship.

18. Relative autonomy index: positive relationship.

19. Psychological needs satisfaction (i.e., autonomy, competence and relatedness): positive relationship.


Physical Activity and Change Scores of SDT Psychological Variables:

There would be a linear relationship between follow-up PA and change scores of the variables from baseline to end-point and baseline to follow-up (Hypotheses 21-25):

These SDT variables include:

21. Autonomous regulation (i.e., integrated regulation and identified regulation): positive relationship.

22. Controlling regulation (i.e., introjected regulation and extrinsic regulation): negative relationship.

23. Relative autonomy index: positive relationship.

24. Psychological needs satisfaction (i.e., autonomy, competence and relatedness): positive relationship.

Physical Activity and Scores of the Other Psychological Variables:
There would be a linear relationship between follow-up PA and scores of the other psychological variables at end-point and follow-up (Hypotheses 26-28.) The psychological variables include:
26. Self-efficacy (i.e., task, coping and scheduling self-efficacy): positive relationship.
27. Self-regulation (i.e., goal setting and planning): positive relationship.

Physical Activity and Change Scores of the Other Psychological Variables:
There would be a linear relationship between follow-up PA and change scores of the other psychological variables from baseline to end-point and baseline to follow-up (Hypotheses 29-31.) The psychological variables include:
29. Self-efficacy (i.e., task, coping and scheduling self-efficacy): positive relationship.
30. Self-regulation (i.e., goal setting and planning): positive relationship.
31. Depressive symptoms: negative relationship.

Intervention, Psychological Variables and Physical Activity: Mediation Analysis
32. Changes in any of the significant psychological variables from baseline to end-point would mediate the effect of the intervention on follow-up PA.
Definitions and Terms

Part A: Terms Related to Physical Activity

Exercise

Exercise is defined as “any planned, structured, repetitive and purposive physical activity in the sense that improvement or maintenance of one or more components of physical fitness is an objective” (Caspersen, et al., 1985, p. 128). Therefore, exercise is a subset of physical activity. The term “exercise” is commonly used interchangeably with the term “physical activity.” However, this should be avoided. “Purposive/purposeful” physical activity (i.e., exercise) to improve aspects of physical fitness is not the same as “general” physical activity, including sleeping, household activities and so on.

Physical Activity

Physical activity is defined as “any bodily movement produced by skeletal muscles that result in energy expenditure” (Caspersen, Powell, & Christenson, 1985). Physical activity can be simply categorized into sleeping, occupational activity and leisure-time activity, such as household activity, sport, conditioning (i.e., exercise) and others.

Moderate physical activity

The CDC/ACSM’s definition was applied: “Moderate-intensity aerobic activity means you are working hard enough to raise your heart rate and break a sweat. One way to tell is that you will be able to talk, but not sing the words to your favorite song.”

Vigorous physical activity

The CDC/ACSM’s definition was applied: “Vigorous-intensity aerobic activity means you are breathing hard and fast, and your heart rate has gone up quite a bit. If you're
working at this level, you won't be able to say more than a few words without pausing for a breath.”

**Purposive/Purposeful physical activity**

Purposive/purposeful physical activity is the main outcome variable in the current study and has the same definition as exercise. The term “physical activity” used in this research is the same as “purposive/purposeful physical activity,” which is any planned, structured or repetitive physical activity used to increase physical fitness and health.

**Operational Definition**

Physical activity was measured using the Modified Paffenbarger Physical Activity Questionnaire (Paffenbarger, Jr. Wing, & Hyde, 1978), which includes questions about stair climbing, brisk walking, and other moderate and vigorous physical activities. Since this study aims to help participants establish exercise habits to improve physical fitness and health, light physical activities, which do not raise heart rate high enough, were not emphasized or investigated.

**Public Health Physical Activity Recommendations**

The CDC/ACSM 2007 PA recommendations state the importance of moderate-intensity PA and specify the appropriate dose for aerobic and muscle-strengthening activities, that is, “to promote and maintain health, all healthy adults aged 18 to 65 years need to engage in moderate-intensity aerobic PA for a minimum of 30 minutes on five days each week or vigorous-intensity aerobic PA for a minimum of 20 minutes on three days each week. Combination of moderate- and vigorous-intensity activity can be performed to meet his recommendation” (Haskell et al., 2007, p. 1431-1432). For muscle-strengthening
activities, “Adults will benefit from performing activities that maintain or increase muscular strength and endurance for a minimum of two days each week” (Haskell et al., 2007, p. 1432). These recommendations are based on accumulating evidence from epidemiologic studies and target the sedentary population to decrease mortality and morbidity from chronic diseases, especially CHD (Haskell, et al., 2007).

**Operational Definition**

The primary PA goal was to accumulate at least 150 minutes of moderate-intensity activity, such as brisk walking, in a week. Performing whole-body strength training twice a week was also suggested.

**Part B: Terms Related to Fitness Variables**

**Aerobic Fitness**

Aerobic fitness, also called cardiorespiratory fitness, is the ability of cardiovascular and pulmonary systems to transport oxygen to the working muscles during exercise. Maximal oxygen consumption (VO$_{2\text{max}}$) is the criterion measure of aerobic fitness. Without a medical physician on site, American College of Sports Medicine guidelines for fitness testing only allow exercise professionals to conduct a VO$_{2\text{max}}$ test with low risk subjects (i.e., asymptomatic and less than two CAD risk factors.). When direct measure of VO$_{2\text{max}}$ is not feasible, using a submaximal exercise test to estimate VO$_{2\text{max}}$ from heart rate and exercise workload is recommended (Thompson, Gordon, & Pescatello, 2009).

**Operational Definition**

Since all participants in the study are considered moderate risk (sedentary and overweight/obese), a submaximal treadmill test using modified Balke’s protocol was
administered. Individuals’ maximal oxygen consumption was predicted by a linear relationship between exercise heart rate and workload/oxygen consumption.

**Hip/Waist Ratio (HWR)**

Hip/Waist ratio has been used as a simple method to estimate body fat distribution. Higher HWR is usually associated with higher risk of chronic diseases.

**Operational Definitions**

Hip/Waist ratio is calculated from the waist circumference divided by the hip circumference. The waist measurement was taken at the narrowest part of the torso that is above the umbilicus and below the xiphoid process. The hip measurement was taken at the maximal circumference of buttocks/hips (Thompson, Gordon, & Pescatello, 2009).

\[
\text{Hip/Waist Ratio (HWR)} = \frac{\text{Waist circumference}}{\text{Hip circumference}}
\]

**Muscular Strength**

Muscular strength is usually referred to the resistance that can be lifted by a group of muscles. The accepted criterion measure is 1-repetition maximum (1RM): “The greatest resistance that can be moved through the full range of motion in a controlled manner with good posture” (Thompson, Gordon, & Pescatello, 2009, p. 90). 1RM bench press is considered a good measure of upper body strength and 1RM leg press is a good measure for lower body strength.

**Operational Definition**

For safety issues, 1RM bench press and leg press results were acquired from participants’ performance using a weight machine. Participants warmed up with 6-8
repetitions at 50% and 25% bodyweight respectively for leg press and chest press.

Resistance was progressively increased until participants reached their 1RM.

**Overweight and obesity**

Body Mass Index (BMI) is commonly used as a screening tool to determine obesity in adults. Although BMI is not a measurement of body fatness, it correlates well with percentage of body fat and is a fairly reliable indicator for most individuals. The World Health Organization (WHO) defines *overweight* as a BMI equal or greater than 25 and *obesity* as a BMI equal or greater than 30. A BMI range from 30 to 34.9 is categorized as obesity (I) and a BMI range from 35 to 39.9 is obesity (II), from 40 and above is obesity (III). The last two categories are also called morbidly obesity. The formula to calculate BMI is presented below:

\[
\text{Body Mass Index (BMI)} = \frac{\text{Body Mass (kg)}}{\text{Height}^2 \ (m^2)}
\]

**Operational Definition**

In the current study, only women with BMI range from 25 to 34.9 were included. Higher BMI is usually associated with more morbidity; with concerns for safety, the study only recruited a rather healthier and homogenous overweight/obese sample.

**Part C: Terms Related to Psychological Variables**

**Depressive symptoms**

The World Health Organization defines depression as a common mental disorder that presents with depressed mood, loss of interest, feeling of guilt or low self-worth, disturbed sleep or appetite, low energy and poor concentration (WHO, 2010). Depressive symptoms can help to classify and diagnosis individuals with depressive disorders.
Operational Definitions

The Center for Epidemiologic Studies Short Depression Scale (CESD-10) was applied to evaluate affective depression symptoms (Andresen, Malmgren, Carter, & Patrick, 1994; Radloff, 1977). Since depression is not a major outcome variable, using the short form lessened the burden on the participants and while also providing a valid measurement.

Motivation

Motivation is one of the critical psychological factors in why individuals initiate and maintain specific behaviors. Motivation for exercise can be to achieve outcomes that result from the behavior, such as weight loss, which would be considered extrinsic motivation. Motivation to engage in exercise can also be to gain outcomes from the behavior itself, such as enjoyment. Deci and Ryan’s (1985) Self-Determination Theory (SDT) distinguished motivations by the level of autonomy: intrinsic motivation, integrated regulation, identified regulation, introjected regulation, and external regulation (Deci & Ryan, 2008).

Operational Definitions

Motivational regulation was measured using the Behavioral Regulation In Exercise Questionnaire (BREQ) (Mullan, Markland, & Inglelew, 1997), which assesses intrinsic motivation, identified regulation, introjected regulation, and external regulation. Integrated regulation was measured with four additional items introduced by Wilson, Rodgers, Loitz, and Scime (2006).
Psychological Needs Satisfaction: Competence, Autonomy, and Relatedness

Basic psychological needs theory provides the central assumption of Self-Determination Theory, which is motivation results from these three fundamental and universal human needs: competence (feel capable to perform the behavior), autonomy (feel able to make own decisions), and relatedness (feel connected with others). The hypothesis is that optimal motivational function is achieved with the satisfaction of all three needs; variables that promote competence, autonomy, and relatedness will increase motivation, especially intrinsic motivation (Ryan & Deci, 2000).

Operational Definitions

Psychological needs satisfaction, competence, autonomy, and relatedness in exercise contexts were measured using The Psychological Needs Satisfaction in Exercise Scale (Wilson, Rogers, Rodgers, & Wild, 2006).

Self-Efficacy

Self-Efficacy (SE) is defined as an individual’s confidence in his or her ability to engage in behaviors that will yield a desired outcome (Bandura, 1986).

Operational Definitions

Task, coping and scheduling SE were measured with the Multidimensional Exercise Self-Efficacy Scale (MSES). Task SE refers to an individual’s belief in the ability to perform the specific task (e.g., confidence in the ability to exercise at moderate-intensity for 30 minutes). Coping SE refers to an individual’s belief in the ability to perform the task under challenging conditions/barriers (e.g., confidence in the ability to exercise when you don’t feel well). Scheduling SE refers to an individual’s belief
in the ability for organizing regular exercise, which is a subtype of coping SE (Maddux, 1995).

**Self-Regulation**

Self-regulation (how people modify their own behavior) is one of the key variables in social cognitive theory, which assumes behavior is goal directed and is guided by forethought. Some cognitive strategies, such as goal setting and planning, are usually emphasized in a behavioral intervention to help enhance the behavior. Goals represent valued and desired objectives and indicate the discrepancy between actual and the target behavior. Goals provide motivation in support of self-regulation (Buckworth & Dishman, 2002).

**Operational Definitions**

Self-regulatory skills, including goal-setting and planning, were measured using the 10-item Exercise Goal-Setting Scale (EGS) and 10-item Exercise Planning and Scheduling Scale (EPS) (Rovniak, Anderson, Winett, & Stephens, 2002).

**Quality of Life**

In clinical research, quality of life, health status, and functional status are the three concepts usually used interchangeably to evaluate the impact of disease, such as obesity, on health and well-being (Fontain & Barofsky, 2001); Guyatt, Feeny, & Patrick, 1993).

**Operational Definitions**

In this current study, quality of life was measured by The Short Form 36 (SF-36) (Ware, 1993). SF-36 is a generic measurement of health-related quality of life and contains 36 questions in eight domains: physical functioning, role limitations due to
physical health problems, social functioning, bodily pain, general mental health, role limitations due to emotional problems, vitality, and general health perceptions.

**Limitations and Assumptions**

The findings of this study only can be generalized to overweight or obese women (BMI 25-34.9) between 18-65 years of age who are employees or students at a mid-west university campus. The study was also limited to volunteers, most of whom were Caucasian, married or partnered, full-time workers, and with education of bachelor’s degree or beyond. The major limitation of the study design is the lack of single- or double-blinding, which is also a common limitation in clinical applied research. Owing to limited resources (money, time, and professional personnel), the same researcher had to lead both the SC group and the SD group and conduct all evaluations. The researcher did her best to not introduce bias and to prevent potential contacts between members of the two different groups. Participants knew there were two different interventions but they were not told which one was the “control” group. The natural and social environments presented additional limitations. The study started in mid-October, 2010 and finished in mid-January, 2011. Winter weather and holidays could have been challenges for the initially sedentary participants who attempted to maintain their new physical activities and therefore attenuated the effects of the interventions. Lastly, we could not control all the confounders, such as personality, social support and access to exercise equipment in a free living condition. The main variables tested have been shown to be strongly related to physical activity based upon the literature. However, it was possible that we failed to select other important mediators of physical activity behavior.
We assumed that randomization could help to achieve equivalence at baseline and outcome confounders were randomly distributed in both groups. Various confounders of physical activity, such as genetics, personality, social support, social-ecological status, and access to exercise equipment were assumed to be equal for both groups. We also assumed there was no cross-contamination. The SC group only received training in exercise/physical strategies and minimal behavioral strategies (only using exercise log sheets.) The SD group received both physical and behavioral interventions. In this way, we could make the hypothesis that greater PA participation of the SD group compared to the SC group was the consequence of greater use of behavioral strategies learned in the intervention. Most importantly, we assumed that all the participants had the same physical and mental health to be able to perform moderate PA, such as brisk walking.
CHAPTER 2

Literature Review

Fitness, Fatness, and Mortality

Spurred on by the overweight and obesity epidemic, researchers and medical professionals have acknowledged that overweight and obesity may be strongly associated with some chronic diseases and health risk factors. Mokdad et al. (2003) examined data from the Behavioral Risk Factor Surveillance System in 2002 and found that overweight and obese individuals had higher risks for diabetes, high blood pressure, high cholesterol, asthma, arthritis, and poor health status. Given that two thirds of adults in the U.S. are overweight or obese, there is a heightened and pervasive focus on shedding weight, with less attention to the benefits of exercise and physical fitness independent of weight loss.

Several researchers have taken into account the effect of fitness on mortality relative to body fatness. Two major cohort studies illustrate this work. In these epidemiological studies, fitness as maximal oxygen consumption was directly measured or predicted and fatness was simply assessed as body mass index (BMI). Two cohort samples of men and women, respectively, were drawn from the Aerobics Center Longitudinal Study (ACLS). It is important to note that the ACLS cohorts are not diverse, in that more than 95% of the participants are White and approximately 80% are college graduates.

Barlow, Kohl, Gibbons and Blair (1995) found a direct association between BMI and mortality in the ACLS cohort of 25,389 men with an average of 8.5 years follow-up.
More importantly, when the relationship between fitness and mortality was examined in different BMI stratum, fitness was inversely correlated with all-cause mortality rates in each BMI stratum. The obese men (BMI>30) with moderate or high fitness had a death rate 71% lower than low fit obese men. Furthermore, since many risk factors are related to low fitness, such as high blood pressure, total cholesterol, fasting blood glucose, smoking and health status, and BMI, these confounding influences were controlled using multivariate regression. After the adjustment, the inverse associations between fitness and mortality in different BMI stratum remained the same. A 9% to 15% lower adjusted risk of mortality was demonstrated for each additional minute of treadmill time (i.e., fitness) across different BMI stratum. These data suggest that a higher level of fitness is associated with lower mortality in normal and overweight men, compared to their low fit peers. Also, fitness is an independent predictor of all-cause mortality.

Consistent results were found in another cohort of 9 925 ACLS woman (Farrell, Braun, Barlow, Cheng, & Blair, 2002). The results showed that moderate and high fit women had death rates of 52% and 43%, respectively, which were significantly lower than death rates for low fit women. However, BMI (normal weight, overweight, obesity) had no significant association with all-cause mortality. Again, they concluded that fitness was a more important predictor than BMI for all-cause mortality in these women.

Another study by Lee, Blair, and Jackson (1999) using the ACLS cohort further assessed the effect of body composition (lean: <16.7% body fat; normal: 16.7-25% body fat; obese: >25% body fat) after taking cardiorespiratory fitness into account among 21 925 men. The results showed that when compared within each fatness group, the unfit
individuals had significantly higher rates of all-cause mortality and CVD mortality than the fit individuals. Their examination of the interaction between fitness and fatness interestingly suggested that fitness still maintained a protective effect for obese individuals even after adjusting for confounding variables, such as smoking habits. The lean but unfit men showed around two-times higher risk ratio for all-cause mortality and CVD mortality than the obese and fit men. Again, when using body composition (i.e., % body fat) as an index of fatness, the effects of fitness and fatness on morality remain similar to those found using BMI.

A more diverse cohort from the Lipid Research Clinics Study (LRCS), including 2 506 women and 2 860 men, was also used to examine the relationship among fitness, fatness and mortality (Stevens, Cai, Evenson, & Thomas, 2002). The researchers categorized subjects into four groups: fat-fit, fat-not fit, not fat-not fit, and not fat-fit groups, and used the not-fat fit group as a reference. They found that the fat-not fit women had 57% higher all-cause mortality rate than the reference but the fat-fit women had only 32% higher rate. Even in the same BMI category, being fit was associated with 25% lower all-cause mortality than being unfit. A similar pattern was also found in men. Fat-not fit men and fat-fit men, respectively, had 49% and 25% higher all-cause mortality rate than not-fat fit men. Again, the important role of fitness, rather than fatness, on mortality was demonstrated in the LRCS cohort.

Two systematic reviews further examined recent research on the effect of fitness and fatness as predictors of mortality. Blair and Brodney (1999) reviewed 24 prospective observational studies published during 1978-1990 and investigated if higher mortality
rates seen in overweight or obese individuals result from decreased fitness/physical inactivity or from elevated weight. They concluded that 1) for overweight or obese individuals, higher level of fitness or physical activity decreases mortality and morbidity; 2) overweight or obese individuals who are fit and active have lower mortality and morbidity than normal weight individuals who are sedentary; and 3) low fitness and inactivity are as important as overweight and obesity as mortality predictors. In the ACLS studies, low fitness was shown as a more important factor on mortality for overweight or obese men. Fogelholm (2009) reviewed 36 articles published during 1990 to 2009 and had a similar conclusion: overweight or obese individuals with good aerobic fitness had lower mortality than normal weight individuals with poor aerobic fitness. But Blair and Brodney’s review suggested both good aerobic fitness and higher physical activity in obese individuals have protection effects on obesity-related risks. Interestingly, Fogelhom’s review indicated that physical activity was not found to be as protective as aerobic fitness, specifically for type 2 diabetes. The author suggested that aerobic fitness might not be enough to counterbalance the very strong effect of obesity on risk of type 2 diabetes.

Overall, these findings highlight the importance of being active and having higher cardiorespiratory fitness, regardless of body fatness. Active and fit individuals who are overweight or obese still have lower death rates than their sedentary, normal weight peers. From a clinical point of view, these studies provide further scientific evidence to emphasize benefits of improving fitness, rather than addressing weight reduction only.
Health at Every Size: New Weight Management Paradigm

More data have suggested that overweight/obese individuals could have similar improvements in fitness as found for normal weight individuals (Blake, Miller, & Brown, 2000). Furthermore, health benefits can be attained without substantial weight reduction. Lamarche et al. (1992) conducted a 6-month exercise program for obese women consisting of four to five 90-minute sessions per week at 55% maximal oxygen consumption. They found that even though participants did not change body composition and body weight significantly, these obese women still significantly improved aerobic capacity and carbohydrate and lipid metabolism (Lamarche, et al., 1992). Another recent intervention for initially sedentary and overweight/obese individuals showed that after 12-weeks of supervised aerobic training at 70% maximal heart rate, even the participants who failed to lose weight or even gained weight (i.e., non-responders) experienced an improvement in aerobic capacity, blood pressure, resting heart rate and waist circumference (King, Hopkins, Caudwell, Stubbs, & Blundell, 2009). These physiological variables are considered risk factors for some chronic diseases, especially coronary vascular diseases and diabetes. When health professionals only consider weight reduction as the main outcome for exercise training, the independent effect of exercise on other health outcomes is neglected. Furthermore, body size and exercise effects on weight loss could be affected by genetic factors (Bouchard, 1996; Bouchard & Rankinen, 2001; Rankinen, et al., 2010). Expecting every overweight or obese individual to have significant weight reduction and reach a predetermined ideal weight through exercise and/or diet interventions is somewhat unrealistic. Therefore, some researchers have
introduced a “healthy at every size” (HAES) paradigm for obesity treatment (Miller & Jacob, 2001; Parham, 1996; Robison, Putnam, & McKibbin, 2007; Robison, Putnam, & McKibbin, 2007).

The treatment goal of the HAES paradigm focuses on improvement of health and quality of life by engaging in self-acceptance, healthy eating, and exercise regardless of weight changes; comparatively, the goal of the traditional paradigm is to reach a predetermined ideal weight through diet restriction and exercise. The HAES paradigm focuses on health improvement, not weight reduction and suggests using behavioral variables and physiologic parameters as the outcomes rather than weight reduction (Liebman, 2005; Miller, 1999a, 1999b; Miller & Jacob, 2001; Robison, et al., 2007; Robison, et al., 2007).

The HAES approach is usually applied in a non-diet lifestyle intervention, and professionals use behavioral-cognitive techniques to enhance self-acceptance, promote regular physical activity and healthy eating habits, and remove dietary restrictions and barriers for the benefit of physical and mental health, but not as a mean of losing weight (Parham, 1996). Although weight loss is not the main focus of the intervention, interventions applying the HAES approach showed a significant trend for weight loss over time at 1 year and 2 year follow-up (Miller & Jacob, 2001). Mellin and Croughan-Minihane (1997) conducted a 15-week non-diet lifestyle intervention with 24-month follow-up and found significant improvements in exercise behavior, blood pressure, and weight loss at 24-month follow-up compared to baseline (Mellin & Croughan-Minihane, 1997). More recently, Carroll, Borkoles, and Polman (2007) used the HAES approach in
a 3-month randomized control study and found that even without weight loss, there was a significantly greater improvement in psychological well-being and maximal oxygen capacity in the intervention compared to the control group. However, there are no long-term follow-up data. Hence, some evidence suggests the HAES paradigm is an effective approach to help overweight and obese individuals to adhere to regular physical activity, practice better eating habits, and enhance physical and mental health.

Conversely, for a traditional approach using diet, exercise or combined methods, weight loss is usually temporary and exercise seems to be a critical factor for long-term weight management (Miller, Koceja, & Hamilton, 1997). Jeffery et al. (2000) reviewed the weight control research from 1974 to 1994 and concluded that short-term treatment efficacy had improved dramatically; however, the long-term effect was less successful. The researchers acknowledged that the beneficial effect of exercise on weight loss is especially evident in the long-term, and has drawn greater attention in recent years (Jeffery, et al., 2000). A more recent 24-month behavioral weight-loss program combining diet and exercise components again indicated consistent findings with Jeffery et al.’s (2000) review. Unick et al. (2010) found that physical activity was the most influential factor for predicting 10% weight loss at the 24-month follow-up. In summary, strategies to enhance exercise adherence, particularly after the intervention is over, are critical for long-term weight loss.

**Self-Determination Theory Applied to Exercise**

Self-Determination Theory (SDT) is a motivational theory proposed by Deci and Ryan in 1985. The SDT is composed of four mini-theories, which are *basic psychological*
needs theory, cognitive evaluation theory, organismic integration theory, and, causality orientation theory. Basic psychological needs theory (1) provides the central assumption that motivation results from three fundamental and universal human needs: competence (feel capable to perform the behavior), autonomy (feel able to make own decisions), and relatedness (feel connected with others). The hypothesis is that optimal motivational function is achieved with the satisfaction of all three needs; variables that promote competence, autonomy, and relatedness will increase motivation, especially intrinsic motivation.

Cognitive evaluation theory (2) describes the environmental contingencies that support or impede intrinsic motivation by fulfilling the three basic physiological needs. In other words, environments, which individuals dynamically interact with daily, could nurture or diminish intrinsic motivation. Environmental conditions that support feelings of competence, autonomy, and relatedness are necessary for the maintenance and enhancement of intrinsic motivation.

Organismic integration theory (3) identifies the quality of motivation on a perceived locus of causality continuum, which ranges from highly autonomous to highly controlling and describes how extrinsically motivated behavior become internalized and integrated. According to SDT, motivation can be distinguished by the level of autonomy: intrinsic motivation, extrinsic motivation, and amotivation. Intrinsic motivation is autonomous or self-determined, and this process is characterized by enjoyment, interest, competency, and choice. Therefore, intrinsic motivation has the highest level of self-determination. Extrinsic motivation is divided into different types based on different
levels of self-determination. *Integrated regulation* is the most autonomous. If a behavior is fully integrated with one’s value system, one demonstrates integrated regulation. For example, when a person exercises regularly to maintain fitness, being fit is part of his/her belief system or identity, and thus behavior is regulated through this integration.

*Identified regulation* is less self-determined. In the case of identified regulation, people recognize the importance of the behavior and accept the value of the behavior. As in the previous example, when a person exercises because of the value, importance, or usefulness of exercise, he/she regulates exercise because of identifying with the underlying values. *Introjected regulation* is more externally controlled. If the person exercises to avoid shame or anxiety, or to enhance pride or ego, the regulation of the behavior is external to the person and is not self-determined. For example, a person exercises to gain pride since this helps him/her to reach someone else’s expectations.

*External regulation* means behavior is totally externally controlled and the only reason for the behavior is to prevent penalty or gain rewards. If a person exercises because of a doctor’s direction, his or her behavior is externally regulated. Lastly, *amotivation* means individuals have no intention to perform the behavior.

*Autonomous motivation* or *self-determined motivation* is composed of intrinsic motivation, integrated regulation and identified regulation; *Controlled motivation* or non-*self-determined motivation*, on the other hand, consists of introjected regulation and external regulation. This model is called a motivational continuum concerning degrees of self-determination or autonomy. Once individuals feel supports for competence,
autonomy, and relatedness in social conditions, people are more likely to accept and internalize a new behavioral regulation (i.e. internalization).

An additional mini-theory, causality orientation theory (4) states how individual differences influence personal orientation to pursue and engage in self-determined behavior. There are three causality orientations (i.e. regulatory styles): autonomy orientation, controlled orientation, and impersonal orientation. These causality orientations are at a global level in terms of motivation and behavior. Autonomy orientation refers the extent to which a person is oriented toward aspects of the environment that stimulate intrinsic motivation. Controlled orientation refers the extent to which a person is oriented toward being controlled extrinsically, such as rewards, ego-involvements, and directions of others. Impersonal orientation is the extent to which a person believes that attaining desired outcomes is beyond ones control and achievement is largely a matter of luck or fate. The causality orientation is at the most global level while motivational regulation (e.g., intrinsic, extrinsic) is more at the domain-specific level. For example, someone with an autonomy orientation who jogs might be motivated for jogging by integrated regulation. Less research has addressed the causality orientations than has addressed motivational regulation.

**SDT Research in Exercise and PA**

Self Determination Theory is a macro-theory that includes three major mini-theories that can be used to explain the influence of different degree of autonomy on exercise behavior, and most studies have adopted some of the important SDT constructs to investigate the relationship between these constructs and PA behavior. These studies are
usually cross-sectional designs and aim primarily to test the theory. These cross-sectional studies only reveal the relationship among variables but fail to examine a causal relationship. On the other hand, prospective observational studies give us some evidence of causality and identify potentially important constructs in behavior change and mediating relationships. There are two common types of SDT research using prospective observational designs. First, researchers attempt to investigate the association between PA behavior and different motivational regulations, based upon different degrees of autonomy and internalization. The other type of research involves investigating the relationship between the three basic psychological needs and motivational regulations. The review of this research is presented in two sections below. In general, these prospective studies attempt to establish some causal evidence that autonomous motivation (i.e., more intrinsic motives) could lead to better exercise adherence.

**Aspects of Motivation and Physical Activity**

Intrinsic motivation, the central component in the SDT, is associated with greater exercise adherence. On the other hand, extrinsic motivation, such as body-related motives, seems to be more related to the decision to adopt exercise. Frederick and Ryan (1993) found that enjoyment motives and competence motives were positively associated with time spent in exercise, and body-related motives were positively associated with weekly frequency of exercise but negatively associated with the actual time spent in exercise in a sample of 376 employees of an eastern university and its associated hospital. (Frederick & Ryan, 1993). Buckworth, Lee, Regan, Schneider, and DiClemente (2007) examined intrinsic and extrinsic motivation for different stages of motivational readiness.
for exercise in 220 healthy college students. They found intrinsic motivation, such as enjoyment, was highly endorsed in the maintenance stage and lowest in contemplation stage. This prospective study also indicated that intrinsic motivation was greater than extrinsic motivation for the continually active group, but decreased over time for the continually inactive group. Hence, exercise maintenance was fostered by greater intrinsic motivation relative to extrinsic motivation and exercise adoption was fostered more by extrinsic motivation (Buckworth, et al. 2007). Intrinsic motivation results from the need for competence, autonomy and relatedness and also fosters engagement and enjoyment.

There have been a few studies using self-determination theory to investigate the relationship between self-determined motivation and physical activity (Daley & Duda, 2006; Edmunds, Ntoumanis, & Duda, 2006; Mullan, Markland, & Ingledew, 1997; Rose, Parfitt, & Williams, 2005). All of these studies are cross-sectional designs and sample sizes have been moderate to large (range: \( N = 105-409 \)). Most of the studies (Landry & Solmon, 2004; Mullan & Markland, 1997; Rose, Parfitt, & Williams, 2005) used the visual-analogue exercise stage of change ladder (Biener & Abrams, 1991) as an outcome measure of physical activity. The three studies using exercise stage all showed consistent evidence to support that level of self-determined motivation increases across the stage of change. Individuals in the latter stages of change (action and maintenance) were more self-determined than those in the earlier stages of change (contemplation and preparation). This consistent result suggests that self-determined motivation is associated with exercise maintenance. However, due to the nature of cross-sectional designs, there is a lack of causal evidence between self-determined motivation and physical activity.
Moreover, these three studies failed to examine the quantity of physical activity (e.g., frequency, volume). Exercise Stage of Change measures the quality of physical activity, indicating a global orientation of exercise adoption, preparation, or maintenance, and the consistency of the behavior over time, usually defined as six months. Physical activity measures, such as self-reports or mechanical devices (accelerometers, step counters, heart rate monitors, etc.) evaluate volume of physical activity in a shorter duration, usually a week. Evaluating the quantity aspect of physical activity could help researchers to explore the relationship between intensity and/or volume of physical activity and motivation.

Edmund et al. (2006) examined several SDT constructs and exercise behavior measured by Godin Leisure Time Exercise Questionnaire (Godin & Shepard, 1985) in a cross sectional study of 369 physically active adults. The subjects were recruited from fitness, community, and retail settings. Their results illustrate the role of self-determined motivation in mild, moderate, strenuous or total exercise behavior. Identified regulation was significantly associated with strenuous exercise while intrinsic motivation was not an independent predictor of exercise when controlling for other motivational regulations in the regression model. This result suggests that intrinsic motivation might not be the most important predictor in the exercise domain; people might not maintain exercise purely because of enjoyment or fun (i.e., intrinsic motivation). Instead, individuals who value exercise or identify themselves as an exerciser might spend more time in exercise, and even participate in more strenuous exercise. It is also possible that the nature of exercise in Edmund and colleagues’ study (i.e., fitness classes) was relatively less fun for most
participants, compared to sports or outdoor activities. Furthermore, a high correlation between intrinsic motivation and integrated motivation might mask the effects of intrinsic motivation on exercise behavior.

Interestingly, introjected motivation significantly predicted both strenuous and total exercise (Edmunds, et al. 2006). However, there is evidence that introjected regulation could be related to poor exercise adherence and less positive emotional functioning and psychological well-being in the long run, which could not be investigated in this current cross-sectional design. Consistent with previous research, external regulation emerged as a negative predictor of strenuous exercise behavior. Generally, Edmund and colleagues’ findings were consistent with the causal pathway proposed in SDT.

Daley and Duda (2006) examined self-determination, stage of change for exercise and frequency of physical activity in 409 university students. They asked a single question regarding frequency of exercise participation in the previous three months. Responses could be never, about once per month, about two or three times per months, about once per week, about twice a week, about three times per week, and about four times or more per week. They used the responses to this question to categorize participants into four activity groups, which were inactive, low active, moderately active and high active. Their results endorsed that more self-determined motivation can distinguished between participants who were at the later stages (maintenance and action) from those who were at the early stages (contemplation and preparation). Also, the results were similar to the amount of activity. More self-determined motivation was evident in
participants who reported higher frequency of physical activity (i.e., at least three times per week).

Based on the SDT, if extrinsic motives are well internalized, they become more autonomous and lead to better exercise adherence and psychological well-being. Moreover, extrinsic motives might not be harmful when individual’s autonomous motives are more dominant for adherence. Providing appropriate environmental support for competence, autonomy and relatedness could enhance internalization and nurture intrinsic motivation, which would result in better exercise maintenance, mental health and well-being.

Aspects of Basic Psychological Needs Satisfaction, Motivation and Physical activity

The other research direction based on SDT involves investigating the relationship between the three basic psychological needs and motivational regulations. Wilson and Rodger (2008) used a prospective design to examine the role of psychological needs satisfaction in regulating exercise motivation. Participants (34 men and 257 women) were staff or students enrolled in aerobic classes at a university. They found that increments of psychological needs satisfaction, especially competence and autonomy, were positively associated with more self-determined motivation. This suggests that perceived competence and autonomy were more important than relatedness to enhance exercise motivation. Edmund et al. (2006) incorporated major SDT constructs, including perceived autonomy support, motivational regulation and psychological needs satisfaction to examine SDT in the exercise domain among 369 adults enrolled in fitness
classes. Their results indicated that fulfillment of the three basic psychological needs is related to more self-determined motivational regulation. Furthermore, perceived autonomy support by the fitness class leader was positively associated with the basic psychological needs and self-determined motivation. Only competence need satisfaction directly predicted strenuous exercise. In addition, identified motivation partially mediated the relationship between competence need satisfaction and strenuous exercise (See Figure 2.1). These direct and indirect effects of competence need satisfaction on prediction of strenuous exercise might imply that the sense of competence plays an important role for sedentary individuals to adopt or maintain exercise behavior, especially strenuous exercise.

Edmunds and colleagues’ findings are consistently with the SDT hypotheses that satisfaction of the three basic psychological needs may predict behavioral outcomes directly and through motivational regulations indirectly. The results from Edmunds and colleagues’ study showed competence need satisfaction predicted strenuous exercise behavior directly and predicted indirectly through identified regulation (Edmunds, et al.,
The indirect effect suggests that feelings of competence could increase vigorous exercise through increasing personal importance and value of the exercise behavior. This is especially important because PA may lack intrinsic appeal for some people. Recognizing the significance of the activity and its value, such as improvements of physical fitness, could help increase exercise adoption and adherence. Overall, helping individuals to recognize personal values of exercise and ensuring that the three psychological needs can be met could help to enhance exercise behavior.

Barbeau, Sweet and Foriter (2009) conducted a prospective study with a sample of 169 undergraduate students that aimed to investigate how psychological needs satisfaction and behavioral motivation predicted leisure-time physical activity after 1 month. They found that satisfying each psychological need positively predicted self-determined motivation and that competence negatively predicted non-self-determined motivation. Also, self-determined motivation was a significant positive predictor of physical activity one month later, while non-determined motivation was not (Barbeau, Sweet, & Fortier, 2009).

**Summary**

These observational studies usually aimed to investigate the complex relationships in the SDT and also attempted to examine the association between SDT constructs and different dimensions of PA, such as intensity, mode, duration, frequency and pattern of PA, such as adoption and maintenance. Evidence from these observational studies can help to identify critical SDT variables in fostering exercise adoption and maintenance and help to further establish the validity of the SDT theory applied in the
exercise domain. However, since SDT is a relatively new behavioral theory, more experimental interventions with exercise that utilize SDT constructs are necessary to establish causal relationships and offer practical approaches for PA promotion.

**Applying SDT in Physical Activity Intervention**

Edmunds et al. (2008) investigated an autonomy supportive, well structured and interpersonally involving teaching style on 56 female exercise class participants’ psychological needs satisfaction, motivational regulations, and exercise behavior. Female exercise class participants (age range: 18-53 yr; average age = 21.26 ± 3.8 yr) enrolled in a 10-week class were exposed to an SDT-based or standard teaching style. In the SDT-based intervention, the class leader focused upon promoting autonomy by providing choices regarding which exercises they wanted to do, taking into account exerciser’s feelings and perspectives, being supportive and praising improvement in techniques and fitness, and providing meaningful rationale, such as why each activity is beneficial, what muscle groups are working and what aspects of fitness will improve. The control group replicated the style of the regular exercise class. The researchers also controlled the amount and mode of physical work-outs to prevent differences in physical workload from confounding the outcome variables. The results showed that attendance rates were significantly higher (effect size $d = 0.54$) in the SDT-based intervention. There were group differences for effects on psychological need satisfaction. The control group showed a significant increase in competence needs satisfaction over time while the SDT-based group demonstrated a significantly greater linear increase in relatedness and competence need satisfaction. The possible explanations for improvement of participant’s
competence over time in control group are from engaging in exercise tasks that were not too complex and being engaged in an exercise class in this short-term 10-week study. For motivational regulations, participants in both conditions increased introjected regulation and decreased amotivation. The decrease in amotivation makes sense since these exercises were not mandatory, and logically individuals who finished the 10-week program voluntarily should not increase amotivation. The researchers commented that the increase in introjected regulation is more difficult to explain. Previous studies had indicated that women tended to be more concerned with appearance-related issues. It might be possible that over the 10-week class period, engaging in the exercise class had initiated social pressures and arousal regarding one’s physical appearance and judgments of their self-worth (Edmunds, Ntoumanis, & Duda, 2008).

In addition to exercise participation in a structured fitness class, there are a few SDT-based interventions aimed to increase leisure-time PA. Fortier, Sweet, O’Sullivan, and Williams (2007) examined the effects of SDT-trained counselors on PA change in primary care. All the 120 participants (69% female) received a 2-4 minute session during which a health provider discussed participant’s current level of PA, introduced the public health PA dosage (i.e., 150 minutes per week), helped set up an attainable 1-month goal, and recommended a PA prescription. Participants randomized to the control group only received this short information session. For the intervention group, SDT-trained counselors provided six additional sessions over the 3 month period and helped participants with behavior changing process, such as setting goals and overcoming barriers, and gave them social support, encouragement, and feedback on their progress.
The SDT-trained counselors also provided information about community sources and discussed relapse prevention. The findings showed that participants in the treatment group had a significantly higher level of PA at week 13, when controlling for the baseline PA. The SDT treatment group also had significantly higher autonomous motivation than the control group at week 6 (mid-point) when controlling for the baseline scores. Perceived competence showed a similar tendency but the difference was not significant.

The researchers also conducted a separate mediation analysis for each condition. For the treatment group, the analysis showed autonomous motivation and perceived competence both influenced PA at week 13. In contrast, no mediation was found via perceived competence on PA at week 13. The researchers suggested that more longitudinal studies are required to investigate the interplay between autonomous motivation and perceived competence since most studies showed that perceived competence was an antecedent of autonomous motivation while still others found it was affected by autonomous motivation (Williams, et al., 2006). Unexpectedly, the analysis showed that the baseline autonomy support index did not predict autonomous motivation at week 6. The authors suggested a possible ceiling effect on these variables or the PA counselors facilitated some other psychological factors that were not measured in the study. For the control group, none of the motivational variables influenced PA at week 13, and therefore, there was no mediating effect of autonomous motivation or perceived competence. Noticeably, the autonomy support index at baseline was positively associated with autonomous motivation at week 6. This result was not surprising since
the 2-4 minutes session for the control group provided some degree of autonomy support (Fortier, Sweet, O'Sullivan, & Williams, 2007).

Another similar SDT school-based intervention, which manipulated the teaching style to facilitate autonomy, aimed to examine physical activity intention and self-reported leisure time physical activity in a sample of 215 pupils (106 boys and 109 girls; average age = 14.84 ± 0.48 yr) (Chatzisarantis & Hagger, 2009). The results indicated that pupils who were taught by autonomy–supportive teachers perceived more autonomy support, had more self-determined motivation and stronger exercise intention at the end of the program, and consistently, were involved more in leisure time physical activity 5 weeks after the program ended. Also, self-determined motivation mediated the effect of the intervention on physical activity.

Another school-based PA intervention, “Active by Choice Today” (ACT), also adopted Self-Determination Theory and Social Cognitive Theory to enhance intrinsic motivation and PA in an underserved adolescent population (Wilson, et al., 2008). The intervention targeted strategy development for PA outside of the program and after school, and was designed to impact essential elements in these two theories: self-efficacy, autonomy/relatedness/competence, supportive environment, social support, and motivational regulation. Lawman et al. (2011) reported preliminary results from ACT baseline data among 1422 adolescents (771 girls and 651 boys) and suggested that motivation and self-efficacy had a significant positive effect on moderate and vigorous PA, especially for girls (Lawman, Wilson, Van Horn, Resnicow, & Kitzman-Ulrich, 2011). The intervention effects of the ACT trial on exercise participation as well as the
psychological variables have not been published at this time. More promising impacts on SDT and SCT variables and exercise behavior would be expected.

Silva et al. (2008) conducted a randomized control trial with 239 pre-menopause overweight and obese women to examine the effects of an 1-year SDT-based comprehensive weight management program conducted by exercise physiologists, nutritionists/dietitians, and psychologists, on structured and lifestyle physical activity, diet, body weight and SDT-related variables. The intervention group completed 30 weekly or bi-monthly meetings over approximately one year with a 2-year follow-up. Main behavioral and cognitive strategies included addressing motivation, overcoming barriers, increasing knowledge related to exercise, diet, and weight, improving body image, behavioral strategies for diet and exercise behaviors, and promoting self-determination. Specifically, the strategies used for enhancing self-determination were: 1) offering a clear rationale, 2) acknowledging internal conflicts, 3) providing participants a menu of options, 4) promoting competence, 5) avoiding the use of external incentives, and 6) giving positive feedback (Silva, et al., 2008). Later, the researchers reported their findings in two separate articles (Silva, et al., 2010a; Silva, et al., 2010b). The participants in the SDT group who received a more autonomous treatment climate reported higher autonomous motivation. After 12 months, the SDT-based intervention group showed greater weight reduction and higher levels of moderate and vigorous exercise. When the researchers further examined the relationships among variables, they suggested that the intervention increased participants’ perceptions of support, which led to a greater sense of autonomy and competence, and linked to greater self-determined
motivation and more PA. Autonomy satisfaction was negatively associated with external regulation, but positively associated with identified and intrinsic motivation. Competence satisfaction was also positively associated with autonomous motivation but had no associations with other regulations. Furthermore, both moderate and vigorous exercise were positively affected by intrinsic motivation while lifestyle PA was not significantly predicted by any motivational regulation.

In summary, the results of the interventional studies were mostly consistent with propositions of SDT and therefore provide support for applying SDT to promote exercise behavior. There are increasing numbers of SDT-based interventions that are applied in different contexts for PA promotion. For example, there is an on-going project in primary care examining differences between a SDT-based exercise referral program and a standard care program on physical activity and other health benefits, and on mediating process among psychological variables (Jolly, et al., 2009). These SDT-based interventions can provide valuable experiences for clinical professionals to develop interventions and to examine the causal relationships among SDT variables. All of these efforts could lead us to a more effective PA intervention.

**Practical Aspects: What we learned from the SDT interventional studies**

There are a few qualitative research studies that examined factors affecting exercise participation within a SDT context. Podlog and Dionigi (2009) summarized several themes and relationship with psychological need satisfaction in their qualitative study of adult workers. “Skill acquisition and regaining physical capabilities” and “trainer’s proficiency and enthusiasm” were sources of competence need fulfillment. “A sense of
“camaraderie” provided a sense of relatedness. The “exercise context,” such as diversity and perceived choice of exercises, and “a flexible program schedule” provided autonomy need fulfillment. The researchers also noticed “a sense of obligation” had potential harm to thwart autonomy needs although it may enhance behavior in the short-term. Identified external pressures in the training group included not wanting to let others down, receiving a hard-time from others for not turning up, and recognizing the effort and time the trainer put in. Interestingly, they found family support could either enhance or hamper relatedness needs. Some participants reported discouragement from spouses for taking on too many commitments or the competing need to spend time with their young children. Lack of family support thwarted relatedness and autonomy needs and therefore decreased exercise participation (Podlog & Dionigi, 2009).

Another qualitative analysis was included in a previously described SDT-based counseling intervention in primary care by Fortier and colleagues (2007) with one follow-up publication in 2010 with O’Sullivan as lead author. Their focus group reported that the tailored approach, the autonomous style of the counseling provided, and the support provided by the counselors who addressed encouragement, information, and strategies to increase PA were the most helpful elements of the intervention (O’Sullivan, et al., 2010).

These qualitative reports consistently showed that if the behavioral and cognitive strategies targeted in the intervention helped participants fulfill the basic psychological needs of competence, relatedness, and autonomy, participants were more likely to adopt and adhere to exercise behavior. Edmunds and colleagues (2009) emphasized the need for exercise/PA interventions to be developed and delivered within the SDT context.
They summarized that satisfaction of basic psychological needs would enhance self-determined motivation and therefore, have a positive impact on behavioral, cognitive and affective outcomes. Therefore, fitness professional’s instructional styles need to promote a sense of competence, relatedness, and autonomy in order to nurture intrinsic motivation and consequently long-term adherence to regular exercise. The current project adopted the SDT framework. The facilitator provided an autonomous style of counseling and used various physical and behavioral strategies aimed to satisfy the basic psychological needs in order to foster intrinsic motivation and enhance exercise behavior.

**Aspects of Self-Regulation for Exercise**

Self-regulation (how people modify their own behavior) is one of the key constructs commonly emphasized in a cognitive-behavioral intervention. Strategies of self-regulation usually include goal-setting, planning, scheduling, monitoring and problem-solving. Lee, Locke, and Lathan defined a goal as that which you want to accomplish, and goals concern a valued, future end state (1989; as cited as Shilts, Horowitz, & Townsend, 2004). Since a goal indicates the discrepancy between actual and target behavior, it can help to provide motivation and support self-regulation (Buckworth & Dishman, 2002). But just setting a goal (i.e., goal intention) does not always lead to the desired behavior (i.e., goal implementation/attainment). There are still gaps between goal intention and goal implementation. If these gaps are identified, effective cognitive strategies, which target the gaps, could be utilized to facilitate goal implementation.

Webb and Sheeran (2005) adopted the “Robicon Model” of action phases (Heckhausen & Gollwitzer, 1987) and categorized four distinct phases in goal striving: 1) predecisional
phase in which people decide which goal to pursue and form an intention; 2) preactional phase in which people decide when, where, and how to act specifically; 3) actional phase in which the behavior is initiated and maintained if necessary; and 4) the actual behavior, which is evaluated in respect to the desired behavior (i.e. goal) (Webb & Sheeran, 2005). When individuals implement their goals successfully, they experience these phases consciously or unconsciously. By adopting effective cognitive strategies in each distinct stage, individuals who form a goal intention could move toward the phase of goal implementation/attainment more successfully. The idea of using cognitive strategies to target each distinct stage sounds logical. However, from a practical point of view, strategies used for the early phases of goal striving could be similar. Actually, in the literature of behavioral intervention including goal setting components, interventionists tend to use “goal setting” as a whole, general concept, instead of just targeting each distinct phase. But understanding these specific phases can help researchers to study process and effects of goal setting in behavior change. It also provides interventionists a framework to consider more effective strategies that can help people accomplish their goals successfully. There have been several goal theories proposing effective components, mediators, moderators and hypotheses for goal achievement. Two goal theories --- Goal-Setting Theory and Implementation Intention --- are discussed below, and Social Cognitive Theory is integrated at the end as a way to remind us of the interactions among behavior, person, and environment. I also linked these theories with the concept of the four phases of goal striving to further understand what can better facilitate each phase of goal striving.
Goal-Setting Theory (GST)

Goal Properties

Goal-Setting Theory (Locke & Latham, 2002) suggested some important goal properties to form an effective goal in the predecisional phase, and mediators/moderators to reach the desired behavior effectively in the preactional and actional phases. The three goal properties are difficulty, specificity, and proximity. GST hypothesized that difficult and specific goals will result in greater performance as compared to easy, “do you best” or no goal comparison groups. Also, short-term goals (i.e., proximal goal) combined with long-term goals will result in greater performance than long-term goal alone. Kyllo and Landers (1995) conducted a meta-analysis with 36 studies to examine these hypotheses in sport and exercise. Their findings indicated that goal setting increased performance in exercise and sport by 0.34 of a standard deviation (ES=0.34), compared to either “no goal” control or “do you best” control. Overall, they suggested goal setting is a motivational tool to enhance performance. For goal difficulty, they found that moderate goals had a significantly greater effect (ES= 0.53) than difficult goals (ES=0.09) or easy goals (ES = 0.07). Also, specifying a goal in an absolute term (i.e., all the treatment members work toward the same goal/performance standard) demonstrated the greatest improvement (ES= 0.93) while relative goals (ES=0.27), which are based on individual performance, and vague, do your best goals (ES=0.38) were not as useful and had similar effects. However, there were only six studies used to examine absolute goals. For goal proximity, the analysis indicated that combined short-term and long-term goals (ES= 0.48) and short-term goals (ES=0.38) had significantly better effects than long-term goals
(ES=0.19) (Kyllo & Landers, 1995). However, the majority of the behaviors investigated in the studies were a single motor event or sport performance, which is rather less complex compared to regular exercise behavior for fitness. A cognitive-behavioral intervention aiming to promote regular exercise usually includes multiple components in addition to goal setting in order to optimize the intervention’s effect on exercise attainment. The unique effect of goal setting is harder to examine in this type of intervention.

Locke & Latham (2002) also described three types of goal sources: 1) self-set, 2) assigned, and 3) anticipatively set. They pointed out self-set goals are more likely to be important and meaningful to individuals. Performance of assigned goals and anticipatively-set goals are comparably similar. However, if given an assigned goal with a clear rationale, the performance is significant better than with an assigned goal only. In Shilt et al.’s review, they found assigned goals were the most common type used in the dietary and PA intervention for adults (Shilts, et al., 2004). These researchers summarized that appropriateness of goal type can be affected by many factors, such as age, education level, and difficulty of the behavior and no sufficient evidence to date could indicate which type is better for dietary and PA interventions. In Kyllo and Lander’s meta-analysis, they found that goal setting seems to be more effective if individuals can participate in setting their goals (effect size = 0.62). The effect size for assigned goal and self-set goal were 0.30 and 0.49, respectively (Kyllo & Landers, 1995).
Goal moderators/mediators

Goal-setting theory (Locke & Latham, 2002) claims that goal commitment and feedback/rewards can influence performance. Goal commitment can be affected by 1) the importance of goal attainment to the individual, which includes the importance of the desired outcome (e.g., control blood pressure by exercise regularly); and 2) self-efficacy: the belief that individuals are capable to accomplish the goal (e.g., belief they can exercise correctly and follow the public health PA recommendations). In other words, individuals are more likely to commit to their goals and achieve them if they consider that the goal is important for them and/or they believe they are capable of achieving their goals.

Goal Commitment: Importance of goal attainment

Two ways to increase importance of goals were identified by Locke and Latham: 1) having individuals makes a public commitment to their goals, and 2) providing monetary incentives to their goals. Kyllo and Lander’s meta-analysis showed positive evidence of public goals in sport and exercise. They found making a public goal (ES = 0.79) seems to have significantly higher performance than a private goal (ES = 0.06) (Kyllo & Landers, 1995). In their analysis, the effect of monetary incentives was not examined; however, Locke and Latham proposed that the amount of incentive is positively associated with commitment: more money gains more commitment. They also proposed that difficulty of the goal and incentive type interacts. However, being regularly physically active is a more a complicated and repetitive behavior, rather than a one shot episode, and some researchers suggest that more external motives, such as monetary incentives, could hinder
long-term behavior attainment and psychological well-being (Ryan & Deci, 2000). On the other hand, since the reason for being active is usually related to fitness and health, incentives for exercise behavior can be perceived benefits of regular exercise, such as fitness improvement and stress management. However, in the line with SDT, extrinsic exercise motives, such as physical appearance, need to be internalized to become more intrinsic motives since extrinsic motives are negatively associated with psychological health (Sebire, Standage, & Vansteenkiste, 2009; Vansteenkiste, et al., 2004). Helping individuals to identify the meaningful benefits/incentives from exercise behavior could emphasize goal importance and thus foster more intrinsic motivation.

*Goal Commitment: Self-efficacy*

Self-efficacy can enhance goal commitment and help to achieve the goal, as well. Poag and McAuley (1992) examined goal setting, self-efficacy and exercise behavior in the context of community conditioning classes and found that participants who perceived higher self-efficacy were more likely to achieve their goals. However, the interaction between goal importance and self-efficacy on goal achievement was not significant. In other words, they failed to demonstrate that efficacious individuals who perceived higher importance of their goals would tend to exercise more frequently. The researchers explained that a more specific goal might be necessary for these regular exercisers, and that goal setting might not have a significant impact on exercise behavior change for regular exercisers (Poag & McAuley, 1992).

To sum up, goal-setting strategies could be important for sedentary individuals who attempt to adopt exercise behavior, and enhancing their self-efficacy could increase goal
commitment, and therefore, help them to achieve their goal. Please see pages 52 to 56 for a review of self-efficacy and exercise, including task, scheduling, and coping self-efficacy.

Feedback

Feedback is information that reveals the quality and results of one’s performance. However, feedback itself is not sufficient for bringing about and maintaining a behavior. According to goal-setting theory, feedback can interact with goals. With respect to feedback, goals are a mediator; goals are one of the critical mechanisms needed to translate feedback into performance improvement. Feedback affects performance if goals are appropriately adjusted. With respect to goals, feedback is a moderator; goals are more likely to be achieved when feedback is given (Locke & Latham, 1990). In the previously discussed model of goal striving, giving feedback could facilitate goal implementation in the actional phase. After gathering the feedback regarding their progress, individuals can use other self-regulatory strategies, such as planning and problem solving, and other environmental resources, such as social support, to work toward the goal effectively. Successful goal implementation/attainment not only needs an effective goal but also other cognitive and behavioral strategies and even environmental supports.

Goal-Setting Theory Applied in a Cognitive-Behavioral Intervention

A recent PA intervention applied the concepts from goal-setting theory in a 12-week randomized control PA intervention in a worksite setting (Dishman, DeJoy, Wilson, & Vandenberg, 2009). The intervention included personal goals and team goals that were self-set, specific regarding performance and time, realistic but attainable, and easily
assessed. Each intervention participant set personal goals and assessed his or her goals bi-weekly. Also, all the 1442 employees (age range: 16-64 yr; average age: 36.2 ± 9.8) at 16 worksites were divided into teams and a point-system was used to encourage participants to reach the team goals. A participant handbook that detailed behavioral strategies, including goal-setting, overcoming obstacles, sedentary temptations, avoiding relapse, staying motivated, and how to keep on moving, was given to facilitate goal attainment.

The results indicated the usefulness of a goal-setting intervention. The intervention participants showed greater improvement in moderate and vigorous PA. During the last 6 weeks of the study, intervention participants exceeded 300 weekly minutes of self-reported moderate-to-vigorous physical activity and 9000 daily pedometer steps.

Furthermore, the researchers identified that participants who set higher goals and sustained higher level of self-efficacy, commitment and intention about attaining their goals had a greater increase in PA (Dishman, et al., 2009; Dishman, Vandenberg, Motl, Wilson, & DeJoy, 2010). Their findings were consistent with goal-setting theory.

Summary

Goal-setting as well as the other self-regulatory strategies are usually targeted in a cognitive-behavioral intervention. Their functions are usually intertwined and also complement each other. Nothwehr and Yang (2007) found that goal setting frequency was positively associated with use of behavioral strategies, and that self-monitoring was strongly associated with goal setting frequency in 385 adults living in a rural area (Nothwehr & Yang, 2007). This again emphasizes the importance of implementing cognitive behavioral strategies together to increase the effectiveness of a behavioral
intervention. Saelens et al. (2000) examined use of cognitive and behavioral strategies, including goal-setting, weighing costs and benefits, self-talk, stress management, enjoyment, social support, activism for PA, time management and relapse prevention in a cognitive-behavioral intervention group compared to an information-only control group in a sample of 256 university seniors (average age: 24.1 ± 1.9). They found that strategy use was more consistently positively related to women’s physical activity than men’s. Strategy use was significantly related to women’s leisure time PA at post-intervention, 1-year, and 2-year follow-up, after controlling for confounders; while men’s strategy use was only associated with PA at 2-year follow-up. Moreover, goal-setting was the only significant strategy that predicted women’s 2-year PA after controlling for their post-intervention PA. Their findings again suggest that goal-setting is an important cognitive strategy to help people initiate and maintain exercise behavior. All other cognitive skills in the intervention can aid in enhancing goal setting (Saelens & Gehrman, 2000).

**Implementation Intention**

The second goal theory, Implementation Intention, approaches behavioral goals from a more practical, process-oriented perspective. After individuals produce an appropriate goal (i.e., goal intention), as we discussed above, in the predecisional phase, they move to the preactional phase. Some researchers suggest helping individuals form an implementation intention in the preactional phase. Implementation intentions have demonstrated a strong association with goal attainment. Gollwitzer and Brandstatter (1997) proposed even with a strong goal commitment, individuals don’t always act on it. They suggested supplementing a goal to which people feel committed with an
implementation intention that specifies where, when and how they will act, which will make goal implementation more possible. The “if-then” format was used in this self-regulatory strategy. “If” indicates the suitable situation in which to act and “then” indicates the goal-directed response. For example, after an exercise participant forms a goal like, “I would like to exercise 30 minutes every day,” a more specific implementation intention, like “If it is not raining in the morning, I will bike to work” is added. The researchers suggested that implementation intentions are powerful self-regulatory tools for overcoming typical barriers associated with the initiation of goal-directed behavior (Gollwitzer & Brandstatter, 1997; Oettingen, Heon-ju, & Schnetter, 2001).

**Implementation Intention Applied in a Cognitive-Behavioral Intervention**

Stadler, Oettingen, and Gollwitzer (2009) examined implementation intentions in a randomized control trial with a 4-month PA intervention with 256 women (average age: 41.28 ± 6.19 yr). The self-regulation group established behavior goals, identified positive outcomes and barriers, and used the “if-then” format to form implementation intention using these three questions: 1) when and where does the obstacle occur, and what can I do to overcome the obstacle? 2) When and where is an opportunity to prevent the obstacle from occurring, and what can I do to prevent it from occurring? 3) When and where is a good opportunity for me to act on my wish (goal), and what would this action be? Participants were given several opportunities to practice these self-regulation techniques with researchers over the course of the intervention. The results showed that
women who learned this self-regulation skill were substantially more active than women in the information only session (Stadler, Oettingen, & Gollwitzer, 2009).

**Summary**

To sum up, in order to initiate the desired behavior and reach the goal, effective goal-setting strategies are critical along with other cognitive and behavioral strategies, such as self-regulation, self-efficacy and feedback, which could mediate or moderate goal-setting. Furthermore, in a border scope, environmental factors could affect personal goal achievement, too, in addition to these cognitive factors. Social Cognitive Theory, which assumes that behavior is goal-directed and is guided by forethought, illustrates the reciprocal relationships among the desired behavior, personal cognitive factors and environmental factors. Social and physical environments could also enhance or hinder goal achievement. Hence, a comprehensive cognitive-behavioral intervention often targets these key elements: self-efficacy (or competence), self-regulation (or autonomy), social support (or relatedness), and accessibility to opportunities for physical activity in order to optimize the effect of the intervention and to help participants reach their goals and maintain the desired behavior.

**Aspects of Self-Efficacy for Exercise**

Among various behavioral correlates of exercise, self-efficacy (SE) has been consistently found to be the strongest predictor of exercise behavior (Sherwood & Jeffery, 2000). Self-Efficacy is generally defined as an individual’s confidence in his or her ability to engage in behaviors that will yield a desired outcome (Bandura, 1986). Since adoption or maintenance of physical activity is a complicated and dynamic process
that could be affected by personal, environmental, and social factors, individuals usually need knowledge, supports, and skills (e.g., coping skills and scheduling skills) to overcome barriers in daily life and reach the desired behavior. This implies that an individual’s belief in managing these self-regulation skills could affect physical activity behavior.

Maddux (1995) proposed two different types of SE: task SE and coping SE. Task SE refers to an individual’s belief in the ability to perform the specific task (e.g., confidence in the ability to exercise at moderate-intensity for 30 minutes). Coping SE refers to an individual’s belief in the ability to perform the task under challenging conditions/barriers (e.g., confidence in the ability to exercise when you don’t feel well). Lack of time is the most common reported barrier in exercise participation, but surprisingly, little research has been conducted to explore the relationship between scheduling efficacy and exercise participation. Woodgate and Lawrence (2008) reviewed 41 SE studies published from 1983 to 2005 that addressed exercise participation in cardiac rehabilitation. They categorized SE into two kinds: task SE and self-regulatory SE (e.g., scheduling efficacy, coping efficacy.) They found that 33 of these studies looked at task SE, while only five studies included both task and self-regulatory SE, and only three used self-regulatory SE as an outcome. This review reveals that there is little empirical evidence about self-regulatory SE and exercise behavior. In order to understand the relative importance of different dimensions of SE on exercise behavior, it is necessary to measure the three critical efficacies, task, coping and scheduling, simultaneously.
Rodgers and Sullivan (2001) developed a Self-Efficacy Questionnaire for Exercisers (SEQE) to examine three different types of SE: task, coping and scheduling efficacy. They investigated which type of self-efficacy could help to distinguish the level of exercise involvement. The results showed that individuals who exercised more often reported higher task, coping and scheduling SE, and task scores were higher than the other two. Discriminate analysis of their data indicated that task SE did not clearly discriminate exercisers and non-exercisers, but coping and scheduling SE could help to distinguish the level of exercise involvement. This finding suggests that self-regulatory skills subsets are necessary to produce the desired exercise behavior, which is complicated and dynamic in nature. Bandura (1997) also noted that it is possible to view SE as multidimensional, which reflects skills needed to reach the desired outcome behavior.

Rodgers, Wilson, Hall, Fraser, & Murray (2008) explored a multidimensional conceptualization of SE for three behavioral domains, task, coping and scheduling SE, by validating the instrument developed in the pilot study described above (Rodgers & Sullivan, 2001). Three studies were conducted in different populations and aimed to validate the latest version of the 9-item Multidimensional Self-Efficacy for Exercise Scale (MSES). In study one, the original 24-item scale was administrated in a sample of 395 undergraduate students and results were examined by an exploratory factor analysis (EFA). The results indicated that only three items were retained in each factor. Cronbach’s alpha equaled .85, .83, and .93, for task, coping and scheduling SE, respectively. Later, the nine items retained from the EFA were examined again in another
undergraduate sample by confirmatory factor analysis (CFA). The findings showed an acceptable model fit (NFI=.99, IFI=.99, CFI=.99, and RMSEA=.08) and Cronbach’s alpha equaled .81, .81, and .91, for task, coping and scheduling SE, respectively. The authors concluded that task, coping, and scheduling SE for exercise could be conceptually and significantly distinguished from each other. In two additional studies, this validated 9-item MSES was administrated in two different populations and studies were designed to examine the relationship among these three self-efficacies. The cross-sectional study (study two) demonstrated a similar finding, that scheduling and coping SE were significantly different in regular exercisers, nonexercising intenders and nonexercising nonintenders, while task SE failed to distinguish exercisers from nonexercising intenders. They used a longitudinal study to examine changes in the three domains of SE over time and found that task SE was not changed, but both coping and scheduling SE increased over a 12-week strengthening program. However, since the researchers only focused on establishing construct validity and criterion validity of MSSE, this longitudinal study failed to include exercise behavior as an outcome measure. If exercise behavior would have been measured in this study, we could have a better understanding of the contribution of multidimensional SE on exercise behavior.

**Summary**

Since regular exercise requires considerable amount of efforts to overcome barriers and regulate exercise related behaviors, fostering self-efficacy is critical for exercise participation. Especially, task SE seems to be more important for exercise adoption, while scheduling and coping SE are much more critical for exercise maintenance.
Bandura (1986) proposed SE could be influenced by four major sources: 1) mastery experiences (i.e., past accomplishments), 2) social modeling, 3) social or verbal persuasion, and 4) physiological arousal. Among them mastery accomplishment seems to be the most influential. Furthermore, a reciprocal relationship between SE and PA is consistently observed (McAuley & Blissmer, 2000). Higher SE could lead to higher exercise participation and also, experiencing success from participating in exercise could result in higher SE. Once exercise participants have learned behavioral strategies, such as self-regulation, to deal with various challenges they encounter when being active, they acquire mastery experiences, and therefore, are more confident to carry out their exercise routine. This “confidence” tightly binds with the idea of “competence need fulfillment” in SDT. These four sources of SE could help to fulfill the competence need satisfaction. Also, self-regulatory strategies could facilitate exercise behavior via better scheduling and planning. In other words, concepts of self-efficacy and self-regulation compliment the SDT framework. Therefore, the current study adopted these elements in our SDT-based cognitive-behavioral intervention.

**Depression: Epidemiological Studies**

Heo et al. (2008) examined data from the Behavioral Risk Factor Surveillance System (BRFSS) in 2006 and found that overall prevalence of doctor-diagnosed depression was 15.7%. Noticeably, prevalence for women (20.1%) was about double that for men (11.0%) (Heo, Murphy, Fontaine, Bruce, & Alexopoulos, 2008). Zhao et al (2009) examined the same 2006 BRFSS data and further suggested that BMI was an independent predictor for depression. After controlling for all the confounding variables,
women who were overweight or obese had significantly more diagnosed depression than
women with normal BMI (Zhao, et al., 2009). Atlantis and Baker (2008) reviewed 24
epidemiological studies on depression and also concluded that gender moderated the
relationship between obesity and depression. Most studies showed the positive
association for women and more inconsistent findings for men (Atlantis & Baker, 2008).

The consistent association of overweight/obesity and depression for women was
demonstrated in Ma and Xiao’s recent report in 2010. They examined the relationship
between BMI and depression in US women from the 2005-2006 National Health and
Nutritional Examination Survey. They consistently found that BMI was positively
associated with the probability of moderate/major depressive symptoms and major
depression in US women. Especially, at BMI of 30, the probability of depression
increased progressively. Furthermore, there was a strong association between severe
obesity and moderate/major depressive symptoms, which suggested that the dose-
response relationship even existed within the general obese classification for women.

A large-scale epidemiologic study (Aerobic Center of Longitudinal Survey; 5 454
men, 1 277 women, age range = 20 - 88 yr) reveled an inverse relationship between
depressive symptoms and physical activity for both men and women (Galper, Trivedi,
Barlow, Dunn, & Kampert, 2006). Also, the data showed that a modest volume of
physical activity (around 30-minute aerobic activity, most days of a week) can help to
reduce the likelihood of depressive symptoms. Since this cross-sectional study only could
indicate an association between inactivity and depressive symptoms, antecedents of this
relationship are unknown, and there may be a reciprocal relationship between activity and
depression. But it is a reasonable deduction that individuals with depressive symptoms might have lower physical activity due to the nature of the disease. Therefore, in order to control for confounding variables that could impact the main outcome --- physical activity, I only included subjects without depressive symptoms in the current study. However, studies have shown that increasing physical activity could help to alleviate depressive symptoms. Considering that higher prevalence of overweight/obesity, depression, and inactivity are common in our society for women, effective interventions are needed to address these critical health problems.

**Aspects of Quality of Life for Overweight and Obese Individuals**

Several large-scale observational studies have aimed to investigate the association between quality of life (QoL) and BMI, and have found an inverted U-shaped relationship. Soltoft et al. (2009) found a significant association between QoL and BMI, after controlling for confounding factors in a sample \( N = 14,416 \) from a Health Survey conducted in England in 2003. The researchers reported that the maximum QoL was reached at a BMI of 26.0 in men and 24.5 in women, meaning that QoL is negatively associated with BMI for underweight and obese people (Soltoft, Hammer, & Kragh, 2009). Renzaho et al. (2010) reported similar findings in a sample of 9,771 Australians. People with healthy BMI had higher QoL scores than people who were underweight or obese. As obesity increased, QoL scores decreased. The degree of obesity significantly influenced physical and mental well-being, but the impact on the physical dimension was more significant than on the mental and social dimensions (Renzaho, Wooden, & Houng, 2010). Fontaine et al. (1996) observed that obesity had a greater effect on vitality and
bodily pain in the Short Form-36 quality of life domains, when compared to US norms (Fontaine, Cheskin, & Barofsky, 1996). Furthermore, obese persons seeking treatments reported greater impairment on bodily pain, general health and vitality (Fontaine, Bartlett, & Barofsky, 2000). In summary, studies have demonstrated a dose-response relationship between QoL and BMI, and the degree of obesity impacted more on physical domains of SF-36 (Fontaine & Barofsky, 2001; Mannucci, et al., 2010).

Fontaine and Barofsky (2001) also reviewed effects of weight reduction on QoL for morbidly obese and mild-to-moderate obese individuals. Bariatric surgeries for morbidly obese individuals produced and maintained significant improvements in majority domains of QoL. For mild-to-moderate obese individuals, modest weight reduction from lifestyle modification also improved their QoL, at least in the short term (Fontaine & Barofsky, 2001). A weight management intervention focusing on lifestyle modifications, such as physical activity and healthy diet, could help to improve QoL for overweight/obese individuals.

Furthermore, PA participation was shown to be associated with better QoL, regardless of BMI status. Likewise, obese individuals reported poorer QoL than normal weight individuals, regardless of PA level (Kruger, Bowles, Jones, Ainsworth, & Kohl, 2007). This implies that although obese individuals usually experience lower QoL, regular PA participation could help enhance QoL. Given the obesity epidemic and low population rates of physical activity, emphasizing positive effects of PA participation on health and quality of life, rather than just weight reduction, could be more encouraging.
for the generally sedentary and overweight/obese public to maintain exercise as a lifestyle.
CHAPTER 3

Methods

Study Design and Statistical Analysis

Project CHANGE was a randomized control trial integrating an 8-week SDT-based exercise training and behavioral intervention with 4-week follow-up for overweight/obese women in the Ohio State University Community and approved by the OSU Office of Responsible Research Practices. The measurement points included baseline, mid-point, post-intervention and 4-week follow-up. The participants were randomized into either SDT-based exercise training plus behavioral intervention group (SD group) or standard care group (SC group) with traditional supervised exercise training. The required total sample size to provide sufficient power to examine the treatment effect on physical activity and other psychological variables was calculated as 22. This sample size was estimated using G*Power Software (Faul, Erdfelder, Buchner, & Lang, 2009) with ANOVA repeated measure design (within-between interaction) using effect size $f = .20$, which is the small to medium effect size recommend by Cohen (1992), power $(1-\beta) = .80$, number of measurements = 4, correlation among repeated measures $= .70$, non-sphericity correction $= 1.0$. The correlation among repeated measures was estimated base on data from a previous prospective pilot study including some of the
same SDT variables. After considering an estimated 30% attrition rate, the sample size of 30 participants was established (i.e., N_{SDT-based} = 15; N_{Standard Care} = 15).

Participants were asked to complete demographic data, physical tests, and psychological and behavioral questionnaires at baseline (T1), mid-point (T2) and post-intervention (T3) and 4-week follow-up (T4). Also, a process evaluation was administrated at the end of the intervention (T3) in order to get feedback from the participants. The data were analyzed using the Statistical Packet for the Social Sciences version 19.0. Descriptive statistics, including means, standard deviations, ranges, and correlations were reported for all the outcome variables and demographic data. Cronbach’s alpha was calculated to assess the internal consistency of the questionnaires.

The Primary Aim

The main aim of Project CHANGE was to examine the effects of an 8-week SDT-based exercise and behavioral intervention (SD) compared to a standard care group (SC) on psychosocial and fitness variables. A two-factor mixed design analysis of variance (ANOVA) procedure with one between-group factor (2 intervention: SD group, SC group) and one within-group factor (4 time: pre, mid, post, and follow-up) was applied to examine the outcome variables, including physical activity, quality of life, SDT-based constructs and other physical and psychological variables. Baseline values were used as a covariate to control for baseline differences. The significance level was set at $p = .05$ and effect size using $\eta^2$ was reported. Cohen indicated criteria for evaluating Eta-Square ($\eta^2$) such that .01 is a “small effect” (i.e., $d = 0.02$), .06 is a “medium effect” (i.e., $d = 0.5$), and .14 is a “large effect” (i.e., $d = 0.8$). Effect sizes were used to provide information
about the effects of intervention (i.e., clinical significance) in addition to $p$ values (i.e., statistical significance).

**The Secondary Aim**

The secondary aim was to investigate the relationship among participation in physical activity and the psychological variables targeted in the intervention. Specifically, we were interested in discovering which psychological variables best predicted physical activity after the intervention was over and in examining the mediating effects among the psychological variables. After finding the significant psychological variables from the ANOVA procedure described above, a multiple regression technique, which included the significant psychological variables, was employed to identify important predictors for physical activity at follow-up. Furthermore, the mediating effects for significant variables was tested with a three-step regression analysis recommended by Baron and Kenny (1986). There are three paths in this model: a) the direct effect of independent variable (X) on dependent variable (Y); b) the direct effect of mediators (M) on dependent variable (Y); and c) a path from independent variable (X) to mediators (M). The criterion for mediation is satisfied when all of the following conditions are met:

- **Variation of M is significantly explained by variation of X (path c).** That is, mediators are strongly correlated with independent variables.
- **Variation of Y is significantly explained by variation of M (path b).** That is, dependent variables are strongly correlated with mediators.
- **When path b and c are controlled, the relationship between X and Y (path a) is no longer significant.**
A single and dominant mediation effect is indicated when path a decreases to zero after controlling for paths b and c. When path a decreases, but not to zero, there might be other mediators that were not examined in the model. In behavioral sciences, because the outcome variables are behaviors and are usually affected by multiple factors, the realistic goal is to find a mediator that significantly reduces path a, but does not totally eliminate the effect of X on Y. A substantial reduction suggests a potent mediator, but does not guarantee or provide a sufficient condition for the outcome to occur (Baron & Kenny, 1986).

The independent variable treatment (SC group, SD group) is a categorical variable, and thus dummy codes were used for analysis (SC group = 0, SD group = 1). The dependent variable is physical activity at the 4-week follow-up. The potential mediators were the significant psychological variables found from the mixed design ANOVA. The mediating effects on physical activity would be further examined by the three-step regression analysis. Furthermore, possible mediation among psychological variables was explored by the same procedure. The appropriateness of these proposed procedures was decided after data collection.

**Subject Selection and Recruitment**

Project CHANGE was an 8-week exercise intervention for sedentary overweight/obese women that targeted constructs from Self-Determination Theory (SDT) and addressed both behavioral strategies and physical skills. Sedentary overweight/obese women were recruited from The Ohio State University (OSU) community through word of mouth, emails, flyers, health-related newsletters from the College of Education and
Human Ecology, from academic classes upon instructor’s approval and from health services such as student health, employee health and staff wellness. Flyers were posted in various locations on the OSU Campus (Appendix A). Potential participants were instructed to e-mail or call the co-investigator (Ya-Ting Hsu) for more information about the project and to determine if they were eligible. All information and communication with potential participants are confidential.

When potential participants contacted the research team, research staff went through an eligibility verification checklist (Appendix B) with them. The participants needed to be sedentary and overweight/obese (BMI: 25-34.9) women with no medical complications that might affect their ability to carry out physical activity. Also, participants needed to understand and speak English, and were willing to attend an exercise program and/or group meeting 1-2 times per week for 2 months and be evaluated four times, one of which would be 4 weeks after the intervention. Exclusion criteria included: smoking, pregnancy or planning to get pregnant, depression, involvement in any exercise intervention within the past three months, inability to participate in physical activity or contraindications to exercise, and failure to pass the revised Physical Activity Readiness Questionnaire (rPAR-Q) (Thomas, Reading, & Shephard, 1992). For depressive symptoms, potential subjects were screened with two yes/no questions: 1) During the past month, have you often been bothered by feeling “down,” depressed, or hopeless? 2) During the past month, have you often been bothered by having little interest or pleasure in doing things? These two screening questions have a high false-positive rate (33-43%) (Price, 2004). Hence, if one or both answers were “yes”, the
interviewer needed to use an instrument with higher sensitivity and specificity (e.g., Center for Epidemiologic Studies Short Depression Scale: CESD 10) to decide the degree of depressive symptoms. The details of the CESD 10 questionnaire are described in the Measures section on page 73.

The recruitment window was from July through early October 2010. Once eligible participants were identified, baseline evaluations were scheduled when the participants were available. All the baseline evaluations were scheduled during September 22 to October 8, 2010, which was from two to three weeks before the project started. The average time from the baseline assessment to the first group session was 10 days (range 17 to 5) for the SD group and 11 days (range 18 to 5) for the SC group. After the evaluation session, the participants were randomly assigned to the SD group or the SC group. There were two groups of 7 to 8 participants (Monday group vs. Wednesday group) for the SD group depending on number of eligible volunteers and their available time. The participants in the SC group also chose an additional convenient time to come in for an exercise session on Tuesday and Thursdays. A group-based intervention was essential because group cohesion and social support can enhance one of the targeted psychological constructs (i.e., relatedness). Participants could decide not to participate in the project anytime.

**Intervention**

Eligible participants were randomly assigned to a standard care group (SC) or a SDT-based intervention group (SD). Social contact was designed to be approximately equal for the two groups since both groups spent 90 minutes per week in the intervention
session(s) during the 2-month training period. The SC group received a supervised and individualized progressive exercise training program for 45 minutes, 2 times per week. The program consisted of moderate-intensity aerobic walking exercise on treadmill and resistance training. The exercise intensity progressively increased from 40% to 75% of reserved oxygen consumption (VO$_2$R), which follows the American College of Sports Medicine (ACSM) guidelines (Thompson, Gordon, & Pescatello, 2009) (Appendix C). The SD group participated in a weekly 1-hour behavioral meeting designed to change psychological mediators of exercise behavior (Appendices D and E), and 30-min of supervised and individualized exercise training that also included elements designed to target SDT variables. The participants in the SD group were assigned to either a Monday or Wednesday meeting session in small groups of two to six women or individually if participants could not attend their assigned group session in that week. The participants in both groups were asked to engage in home-based exercise outside of the program in order to meet the recommended public health dosage of physical activity – accumulating moderate intensity physical activity for 150 minutes per week. A log exercise sheet was provided to all participants to record exercise participation each week. No specific dietary advice was provided since the outcome variables were physical activity and quality of life.

Measures

At the beginning (T1), mid-point (T2), end of the intervention (T3) and at 1-month follow-up (T4), participants provided demographic data and completed eight questionnaires to measure physical activity, depressive symptoms, quality of life, SDT
constructs and other established psychological mediators of exercise, such as self-efficacy, goal setting, and self-regulation. They also completed physical assessments, including stair-climbing ability for functional performance, a sub-maximal treadmill-walking test for aerobic fitness, and 1-repetition maximal (1RM) strength tests using bench press and leg press machines. A table of all the assessments with four measurement points can be found in Appendix F. All the physical tests followed the ACSM exercise testing guidelines (Thompson, et al., 2009). The descriptions of the physical tests and questionnaires can be found in Appendices G and H.

**The Modified Paffenbarger Physical Activity Questionnaire**

The total volume of purposeful physical activity in a week, including stair-climbing, brisk walking for exercise or transportation, and any sport, fitness or recreational activity was assessed using a modified version of the Paffenbarger Physical Activity Questionnaire (Jessica Unick, personal communication, June 30, 2010; Unick, Jakicic, & Marcus, 2010). Assessing only purposeful physical activity for exercise, but not including occupational activities and household activities, was more appropriate for this exercise intervention study. The aim of our study was that participants would increase purposeful physical activity by applying the behavioral and physical strategies they learned in the training period. The adapted questionnaire contains five questions. The first question asks if participants had any illness, injury or vacation in the past week that made exercise especially different. If they did, they were asked to answer the questionnaire about the previous typical week that occurred within the past 30 days; if they did not, they would complete the questionnaire about this past week. The following three questions included:
a) stair-climbing: how many flight of stairs do they usually climb up, b) brisk walking: how many minutes per day and how many days a week do they usually walk briskly for exercise or transportation, at least 10 continuous minutes in duration, and c) sports, fitness and recreational activities: the time spent in vigorous and moderate-intensity sport, fitness, and recreational activity in a week. The questionnaire only measures moderate and vigorous physical activity. The fifth question asked if the activity level during the past week was different or the same comparing to a usual week, and this item was used to help us to determine if the responses were reliable and reasonable.

The scoring method is consistent with the original Paffenbarger instrument. The estimate of kilocalories for a 10-minute walk is 48 kcal, assuming a 20 min · mile⁻¹ pace (i.e., 3.0 mph). Walking one flight of stairs counted for 4 kcal. For sport, fitness, and recreational activities, 5 kcal· min⁻¹, 7.5 kcal· min⁻¹, and 10 kcal· min⁻¹ are used for light, moderate, and vigorous intensity in general, although the modified questionnaire does not include any item for light physical activity. Finally, the total energy expenditure spent in physical activity (kcal · wk⁻¹) for a week was computed by adding values for the three categories. Again, physical activity here only includes moderate to vigorous physical activity. A scoring method for the Modified Paffenbarger Physical Activity Questionnaire and examples can be found in Appendix I.

**Self-Determined Motivation: Behavioral Regulation in Exercise Questionnaire (BREQ)**

Motivational regulation was measured using the Behavioral Regulation In Exercise Questionnaire (BREQ) (Mullan, et al., 1997), which assesses intrinsic motivation,
identified regulation, introjected regulation, and external regulation. Four additional items for integrated regulation were introduced by Wilson, Rodgers, Loitz, and Scime (2006). All 19 items are scored on a Likert-type 5-point scale from “0” (not true for me) to “4” (very true for me). External regulation, identified regulation, integrated regulation, and intrinsic motivation are measured through four items and introjected regulation through three items. An average score was calculated for each subscale. Three additional variables, autonomous motivation (AM), controlling motivation (CM) and the relative autonomy index (RAI) were created for further analysis using the BREQ items. The AM was the mean from identified regulation, integrated regulation, and intrinsic motivation subscales. The CM was the mean from introjected regulation and external regulation. The relative autonomy index (RAI) was obtained by applying a weight to each of the four subscales and summing these weighted scores. RAI = –2*(external regulation) – 1*(introjected regulation) + 1*(identified regulation) + 2*(intrinsic motivation).

This index indicates the degree to which respondents feel self-determined. These aggregated variables have been commonly applied in SDT and exercise literature (e.g., Barbeau, et al., 2009; Russell & Bray, 2009).

The Psychological Needs Satisfaction in Exercise Scale (PNSE)

Psychological needs satisfaction, competence, autonomy, and relatedness in exercise contexts was measured using The Psychological Needs Satisfaction in Exercise Scale (Wilson, Rogers, Rodgers, & Wild, 2006). Each of the three subscales includes six items and all 18 items are scored on a Likert-type 6-point scale from “1” (false) to “6” (true). Sample items are as follows: I feel that I am able to complete exercises that are
personally challenging (perceived competence); I feel free to exercise in my own way (perceived autonomy); I feel attached to my exercise companions because they accept me for who I am (perceived relatedness). An average score was calculated for each subscale and the higher scores indicated higher levels of perceived competence, autonomy or relatedness. The psychometric characteristics were established and a high internal consistency was observed for all subscales scores in the exercise domain (Barbeau, et al., 2009; Russell & Bray, 2009; Sebire, et al., 2009; Wilson, Rogers, et al., 2006).

The Perceived Autonomy Support Scale for Exercise Setting (PASSES)

Perceived autonomy support was measured using The Perceived Autonomy Support Scale for Exercise Setting (PASSES) (Hagger, et al., 2007). The PASSES has a valid psychometric structure with good internal consistency, and discriminant and convergent validity with measurements of motivational regulation from Self Determination Theory (Hagger, et al., 2007). The participants indicated their level of agreement with statements regarding their instructor during the past training period on a Likert-type 7-point scale from “1” (strongly disagree) to “7” (strongly agree). The PASSES includes 12 items (e.g., My instructor displays confidence in my ability to do active sports and/or exercise in my free time) and the ratings for each item were summed and calculated to get a mean score.

Multidimensional Self-Efficacy for Exercise (MSES)

Rodger et al.’s (2008) 9-item Multidimensional Exercise Self-Efficacy Scale (MSES) was used to evaluate three critical self-efficacies for exercise (i.e., task, coping, and scheduling efficacy) simultaneously. Whether participants exercised or not, they
rated their confidence to perform behaviors described in nine statements consistently for at least six months. They rated their confidence on 10-point scales ranging from “0” (not at all confident) to “10” (completely confident). There are three items for each subscale, specifically, task (e.g., complete exercise using proper technique), coping (e.g., exercise when you feel discomfort), and scheduling (e.g., include exercise in your daily routine) efficacy. The ratings for each of the three items were summed and calculated to get a mean score for each of the three subscales.

**Exercise Goal-Setting Scale (EGS) and Exercise Planning and Scheduling Scale (EPS)**

Self-regulatory skills, including goal-setting and planning/scheduling, which would enhance essential SDT constructs (e.g., completeness and autonomy), were measured using 10-item Exercise Goal-Setting Scale (EGS) and 10-item Exercise Planning and Scheduling Scale (EPS) (Rovniak, Anderson, Winett, & Stephens, 2002). The participants rated exercise goal setting and planning/scheduling on a Likert-type 5-point scale ranging from “1” (does not describe) to “5” (describes completely). Sample items for EGS are: I often set exercise goals; I usually keep track of my progress in meeting my goals; If I do not reach an exercise goal, I analyze what went wrong. The sample items for EPS are: I never seem to have enough time to exercise; I plan my weekly exercise schedule; Everything is scheduled around my exercise routine — both classes and work. The scales have demonstrated good internal consistency and test-retest reliability, and goal-setting and scheduling have been shown to have strong correlations with physical activity (Ayotte, Margrett, & Hicks-Patrick, 2010; Rovniak, et al., 2002; Rovniak,
Scores were averaged across the 10-items for EGS and for EPS. Higher scores mean higher perceived ability to set goals or to schedule/plan exercise.

**Center for Epidemiologic Studies Short Depression Scale (CES-D 10)**

The Center for Epidemiologic Studies Short Depression Scale was applied to evaluate affective depression symptoms. This short form has shown good predictive accuracy compared to the 20-item version (i.e., CES-D) (Andresen, Malmgren, Carter, & Patrick, 1994; Radloff, 1977). Since depression is not a major outcome variable, using the short form lessened the burden on the participants and also provided a valid measurement. The CES-D 10 consists of 10 statements that participants rank according to how often they felt what was described during the past week from “0” (*rarely or none of the time*) to “3” (*all of the time*). Sample statements are as follows: I had trouble keeping my mind on what I was doing; My sleep was restless; I felt depressed. A sum score of 10 or greater is considered to indicate depression. This scale was included in the verification checklist for eligibility. We excluded individuals with depressive symptoms, that is, having a sum score of 10 or greater. In addition, the scale was administered during the intervention and at the follow-up as a secondary outcome variable.

**Quality of Life: Short Form 36 (SF-36)**

The Short Form 36 (SF-36) (Ware, 1993) is a generic measurement of health-related quality of life and contains 36 questions in eight domains: physical functioning, role limitations due to physical health problems, social functioning, bodily pain, general mental health, role limitations due to emotional problems, vitality, and general health
perceptions. Each item is scored from 0 to 100. A higher score stands for a more favorable status. After scoring each item, an average score is calculated for each subscale. A physical component summary score was calculated as an average of the four subscales: physical functioning, role limitations due to physical health problems, bodily pain, and general health perceptions. A mental component summary score was calculated using social functioning, general mental health, role limitations due to emotional problems, and vitality. Finally, a total summary score was the average of the eight subscale scores. The scale is designed such that it has a mean of 50 and a standard deviation of 10. Hence, a summary score higher or lower than 50 indicates health related quality of life is better or worse than the average of the normal US population. Each 1-point difference stands for one-tenth of a standard deviation from the norm. SF-36 is commonly used in overweight or obese population (Fontaine, et al., 1999; Kushner & Foster, 2000).

**Process Evaluations: Feedback and Satisfaction**

Two different version of process evaluations were administered at the end of the intervention for the SD and SC group. The questionnaire was anonymous and included questions related to class time, satisfaction, and open-questions asking for feedback and comments. The SD group had five extra questions related to the behavioral intervention they received. The participants rated their satisfaction on a Likert-type 5-point scale ranging from “1” (does not describe) to “5” (describes completely). The complete questionnaires and their responses can be found in the Appendix J.
CHAPTER 4

RESULTS

Part I: Results Based Upon the Proposed Purposes and Analysis

A total of 25 eligible participants entered Project CHANGE and were randomized to two treatment conditions: SDT-based exercise training plus behavioral intervention group (SD group) or standard care group (SC group) with traditional supervised exercise training. There were 2 dropouts during the first half of the 8-week training for each group. The reasons for dropouts were illness (n=1; SC group), time (n=2; 1 in SC group, 1 in SD group) and one did not state reasons (n=1; SD group). The final sample size was 21 (N_{SD} = 11; N_{SC} = 10). These 21 participants completed the 8-week intervention as well as end-point and follow-up evaluations. The consort diagraph is presented in figure 4.1. Participants who were not able to attend their group session met with the researcher individually that week. For the SD group, 7 out of 10 participants attended 100% (i.e., 8 sessions) of the 8-week training sessions. However, only one of these 10 participants successfully attended all the group sessions. The majority had to meet individually, for at least one session, due to time conflicts or illness. The average of individual meeting among these 9 participants was 1.7 sessions and ranged from 1 to 5 sessions. If participants failed to meet in a group or individually, they were counted as non-attendance for that session. The class materials were emailed to them and the researcher usually had a short discussion with them after that week.
Figure 4.1
Consort Diagram

$N = 147$
Potential participants received screening questionnaire

$n = 48$
Non-respondents

$n = 99$
Respondents

$n = 71$
Non-eligible participants
- BMI $<$ 25 = 1
- BMI $\geq$ 35 = 21
- High PA = 11
- High BMI + high PA = 1
- CESD scores $> 10$ = 12
- Lack of time = 9
- Location = 1
- Orthopedic problems = 4
- Willing to start ex earlier = 6
- Personal reasons = 2
- Not stated = 3

$n = 28$
Eligible participants completed baseline evaluations

$n = 25$
Eligible participants enrolled in Project CHANGE

$n = 13$
Standard Care (SC group)
$n = 12$
SDT-based intervention (SD group)

$n = 2$ dropouts
1 time, 1 illness

$n = 11$
(SC group)
Completed intervention and evaluations

$n = 10$
(SD group)
Completed intervention and evaluations

$n = 3$
Decided not to attend (lack of time)

$n = 13$
Standard Care (SC group)

$n = 12$
SDT-based intervention (SD group)

$n = 2$ dropouts
1 time, 1 not stated

*Note.* BMI = Body Mass Index; PA = Physical Activity; CESD = Center for Epidemiologic Studies Depression Scores
Overall, the lowest attendance was 75% (i.e., 6 out of 8 sessions) and the average of individual attendance rate for the SD group was 95%.

For the SC group, 6 out of 11 participants attended 100% (i.e., 16 exercise sessions) of the 8-week training sessions. The lowest attendance was 68.75% (i.e., 11 out of 16 sessions) and the average individual attendance rate for the SC group was 91.47%.

**Baseline Characteristics**

**Demographics**

The majority of the participants were Caucasian (76.2%), married or partnered (66.7%), full-time workers (81.0%) and with education equal to or beyond bachelor’s degree (76.2%). Participants in both groups were relatively healthy and able to safely exercise, although there were a few health issues. Of the total sample, 19% were diagnosed with hypertension ($n_{SC} = 3; n_{SD} = 1$), 4.8% with diabetes ($n_{SC} = 1; n_{SD} = 0$), 9.5% with cancer ($n_{SC} = 0; n_{SD} = 2$), 14.3% with heart problems ($n_{SC} = 3; n_{SD} = 0$), 14.3% with musculoskeletal problems in past 6 months ($n_{SC} = 1; n_{SD} = 2$), 14.3% mental problems ($n_{SC} = 2; n_{SD} = 1$). There was no significant difference statistically.

Overall, the average age was 42.67 years (range: 23-60 years), the average BMI was 30.66 (range: 25.29-34.97), and the average waist-hip ratio (WHR) was 0.78 (range 0.68-0.88). There were no significant differences for age ($p = .13$), BMI ($p = .23$), and WHR ($p = .86$) between groups. Demographics of the participants are shown in Table 4.1 separately by groups.
Table 4.1
Baseline Characteristics for the SD Group and the SC Group

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>SC group M ± SD</th>
<th>SD group M ± SD</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>46.27 ± 11.18</td>
<td>38.70 ± 10.56</td>
<td>.128</td>
</tr>
<tr>
<td>Body Mass, kg</td>
<td>78.65 ± 8.91</td>
<td>84.08 ± 11.26</td>
<td>.233</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>30.51 ± 3.08</td>
<td>30.81 ± 3.41</td>
<td>.831</td>
</tr>
<tr>
<td>Waist-Hip Ratio</td>
<td>0.79 ± 0.05</td>
<td>0.77 ± 0.06</td>
<td>.863</td>
</tr>
<tr>
<td>1 RM Machine Chest Press, kg</td>
<td>89.25 ± 28.15</td>
<td>105.10 ± 26.68</td>
<td>.202</td>
</tr>
<tr>
<td>1 RM Machine Leg Press, kg</td>
<td>33.26 ± 7.82</td>
<td>40.00 ± 11.94</td>
<td>.139</td>
</tr>
<tr>
<td>Predicted VO₂max, ml/km/min</td>
<td>27.32 ± 5.68</td>
<td>30.57 ± 5.30</td>
<td>.192</td>
</tr>
<tr>
<td>EE, kcal/week</td>
<td>252.86 ± 226.81</td>
<td>501.55 ± 260.11</td>
<td>.030*</td>
</tr>
</tbody>
</table>

Note. BMI = Body Mass Index; RM= Repetition Maximal; VO₂max = Maximal Oxygen Consumption; EE = Energy Expenditure computed from the Modified Paffenbarger Physical Activity Questionnaire
* p < .05

Physical Activity and Fitness Variables

At the baseline, physical activity converted to total energy expenditure (EE) was significantly higher for the SD group than the SC group (p = .03). The average EE was 252.86 ± 226.81 Kcal/week for the SC group and 501.55 ± 260.11 Kcal/week for the SD group. This suggested that participants in the SD group spent more time climbing stairs, brisk walking or engaging in moderate and vigorous exercises in general. Other fitness variables measured, including predicted VO₂max, 1RM machine leg press, 1RM machine chest press, and time in stair-climbing were not different between groups (Table 4.1).

SDT Psychological Variables and Other Psychological Variables

The psychological variables at baseline were not significantly different between groups, although the group difference in intrinsic motivation was close to the level of
significance \((p = .051; \ SD = 2.25 \pm 1.05 \ and \ SC = 1.41 \pm 0.80)\). In order to adjust for baseline differences, we used baseline as a covariate in all the ANOVA procedures. The baseline values of the psychological variables are presented in Table 4.2.

Table 4.2

*Baseline Values of the Psychological Variables for the SD Group and the SC Group*

<table>
<thead>
<tr>
<th>Variable</th>
<th>SC group (M \pm SD)</th>
<th>SD group (M \pm SD)</th>
<th>(p)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motivational Regulation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>External Regulation</td>
<td>0.80 ± 0.86</td>
<td>1.43 ± 1.10</td>
<td>.158</td>
</tr>
<tr>
<td>Introjected Regulation</td>
<td>1.58 ± 1.26</td>
<td>1.97 ± 1.00</td>
<td>.443</td>
</tr>
<tr>
<td>Identified Regulation</td>
<td>2.30 ± 0.77</td>
<td>2.75 ± 0.84</td>
<td>.210</td>
</tr>
<tr>
<td>Integrated Regulation</td>
<td>1.36 ± 0.76</td>
<td>1.83 ± 1.32</td>
<td>.334</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>1.41 ± 0.80</td>
<td>2.25 ± 1.05</td>
<td>.051</td>
</tr>
<tr>
<td>Relative Autonomy Index</td>
<td>1.94 ± 2.26</td>
<td>2.43 ± 3.20</td>
<td>.690</td>
</tr>
<tr>
<td><strong>Psychological Needs Satisfaction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competence</td>
<td>4.30 ± 1.13</td>
<td>4.15 ± 1.04</td>
<td>.751</td>
</tr>
<tr>
<td>Autonomy</td>
<td>4.68 ± 1.11</td>
<td>4.65 ± 0.97</td>
<td>.945</td>
</tr>
<tr>
<td>Relatedness</td>
<td>3.29 ± 1.56</td>
<td>3.53 ± 1.46</td>
<td>.714</td>
</tr>
<tr>
<td><strong>Self-Efficacy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task Self-Efficacy</td>
<td>8.76 ± 1.08</td>
<td>8.27 ± 0.78</td>
<td>.251</td>
</tr>
<tr>
<td>Coping Self-Efficacy</td>
<td>6.91 ± 1.69</td>
<td>5.50 ± 2.25</td>
<td>.119</td>
</tr>
<tr>
<td>Scheduling Self-Efficacy</td>
<td>7.67 ± 2.27</td>
<td>8.57 ± 1.10</td>
<td>.270</td>
</tr>
<tr>
<td><strong>Self-Regulation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal-Setting</td>
<td>1.88 ± 0.69</td>
<td>1.94 ± 0.69</td>
<td>.849</td>
</tr>
<tr>
<td>Planning</td>
<td>2.04 ± 0.63</td>
<td>2.15 ± 0.62</td>
<td>.893</td>
</tr>
<tr>
<td><strong>Depressive Symptoms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CESD</td>
<td>3.55 ± 2.95</td>
<td>5.00 ± 5.01</td>
<td>.422</td>
</tr>
<tr>
<td><strong>Quality of Life: SF-36</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PF: Physical Function</td>
<td>90.45 ± 7.23</td>
<td>89.50 ± 10.40</td>
<td>.808</td>
</tr>
<tr>
<td>RP: Role Playing-Physical Health</td>
<td>100.00 ± 0.00</td>
<td>95.00 ± 10.54</td>
<td>.168</td>
</tr>
<tr>
<td>BP: Bodily Pain</td>
<td>93.09 ± 8.55</td>
<td>85.45 ± 12.34</td>
<td>.113</td>
</tr>
<tr>
<td>GH: General Health</td>
<td>69.55 ± 23.82</td>
<td>65.50 ± 18.02</td>
<td>.668</td>
</tr>
<tr>
<td>VT: Vitality</td>
<td>59.09 ± 19.21</td>
<td>59.00 ± 11.26</td>
<td>.990</td>
</tr>
<tr>
<td>SF: Social Function</td>
<td>93.18 ± 11.68</td>
<td>90.00 ± 21.89</td>
<td>.678</td>
</tr>
<tr>
<td>RE: Role Playing-Emotional Health</td>
<td>96.97 ± 10.05</td>
<td>83.33 ± 28.33</td>
<td>.177</td>
</tr>
<tr>
<td>MH: Mental Health</td>
<td>82.91 ± 11.33</td>
<td>80.00 ± 13.20</td>
<td>.593</td>
</tr>
<tr>
<td>Physical Components Scores</td>
<td>82.44 ± 9.36</td>
<td>78.89 ± 8.373</td>
<td>.374</td>
</tr>
<tr>
<td>Mental Components Scores</td>
<td>80.34 ± 12.34</td>
<td>75.57 ± 15.30</td>
<td>.439</td>
</tr>
<tr>
<td>Total Scores</td>
<td>85.66 ± 8.58</td>
<td>80.97 ± 10.86</td>
<td>.284</td>
</tr>
</tbody>
</table>

*Note.* CESD = Center for Epidemiologic Studies Depression Scale; SF-36 = 36-Item Short Form Health Survey
Effects of the Intervention

A two-factor mixed design analysis of variance (ANOVA) procedure was applied and the sphericity assumption was examined for all the outcome variables. If the assumption was not satisfied, Greenhouse-Geisser correction was used to adjust F values. The ANOVA tables for the non-significant were reported in Appendix K.

Physical Activity

After 8-weeks of the intervention and 4-weeks of follow-up, the weekly EE (i.e., PA) did not differ significantly between the groups, $F(2, 36) = .055, p = .947, \eta_p^2 = .003$. The estimated mean was $904.302 \pm 134.140$ Kcal/week for the SC group and $1135.588 \pm 141.534$ Kcal/week for the SD group after controlling for EE at the baseline. Also, the time and group effects were not significant (Table 4.3). The effect of the intervention on level of physical activity was the same for both groups.

Table 4.3

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>\eta_p^2</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between-Subjects</td>
<td>Group</td>
<td>652457.961</td>
<td>1</td>
<td>652457.961</td>
<td>1.250</td>
<td>.278</td>
<td>.065</td>
</tr>
<tr>
<td>Subjects</td>
<td>Error (Group)</td>
<td>9397647.543</td>
<td>18</td>
<td>522091.530</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>117147.311</td>
<td>2</td>
<td>58573.656</td>
<td>0.315</td>
<td>.732</td>
<td>.017</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>20347.222</td>
<td>2</td>
<td>10173.611</td>
<td>0.055</td>
<td>.947</td>
<td>.003</td>
</tr>
<tr>
<td></td>
<td>Error (Time)</td>
<td>6688897.803</td>
<td>36</td>
<td>185802.717</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

80
Fitness Variable

The repeated measure ANOVA showed no significant interaction, group, or time effect for all the fitness variables, including BMI, WHR, predicted VO2 max, 1RM machine chest press, 1RM machine leg press, and stair-climbing test. The results indicated that there were no significant differences between the SD group and the SC groups on the fitness variables.

SDT Psychological Variables

Motivational Regulation

The repeated measure ANOVA was conducted separately on external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic motivation, as well as relative autonomy index (i.e., the summary score). There were no significant interaction, time, or group effects for all but one of these variables. There was a significant effect for time on integrated regulation, $F(2, 36) = 6.206, p = .005, \eta_p^2 = .256$ (Table 4.4). The post hoc procedure (Bonferroni comparison) indicated that when controlling for baseline, integrated regulation at post-intervention (T3) was significantly higher than at mid-point (T2) ($p = .038$). The mean differences between mid-point (T2) and follow-up (T4) or between end-point (T3) and follow-up (T4) were not significant. The results demonstrated that integrated regulation significantly peaked (2.133 ± .193) right at the end of the intervention for both groups and remained at relatively the same level (2.097 ± .181) at the 4-week follow-up.
Tests of Time, Interaction and Group Effects for Integrated Regulation

The repeated measure ANOVA was conducted separately on competence, autonomy, and relatedness needs satisfaction. However, the findings showed the interaction, time and group effects on the three variables were not significant.

Perceived Autonomy Support

The results of the repeated measure ANOVA showed there was a significant time effect for perceived autonomy support, $F(2, 38) = 4.680, p = .015$, $\eta^2_p = .198$ (Table 4.5) but the interaction and group effects were not significant. The *post hoc* procedure (Bonferroni comparison) indicated that when controlling for baseline, the scores at follow-up (T4) was significantly higher than those at mid-point (T2) ($p = .01$) but the mean difference between mid-point (T2) and post-intervention (T3) or between post-intervention (T3) and 4-week follow-up (T4) were not significant. The findings suggests that perceived autonomy support for both groups gradually increased over time (T2 = 6.201 ± .175; T3 = 6.299 ± .152; T4 = 6.524 ± .134) but the increment, compared to mid-point (T2), was not significant until at 4-week follow-up.

Table 4.4
Tests of Time, Interaction and Group Effects for Integrated Regulation

<table>
<thead>
<tr>
<th>Source</th>
<th>$SS$</th>
<th>$df$</th>
<th>$MS$</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta^2_p$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>2.000</td>
<td>2</td>
<td>1.000</td>
<td>6.206</td>
<td>.005</td>
<td>.256</td>
<td>.886</td>
</tr>
<tr>
<td>Time*Group</td>
<td>.010</td>
<td>2</td>
<td>0.005</td>
<td>.030</td>
<td>.970</td>
<td>.002</td>
<td>.054</td>
</tr>
<tr>
<td>Error (Time)</td>
<td>5.801</td>
<td>36</td>
<td>0.161</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>0.116</td>
<td>1</td>
<td>0.116</td>
<td>0.077</td>
<td>.784</td>
<td>.004</td>
<td>.058</td>
</tr>
<tr>
<td>Error (Group)</td>
<td>27.016</td>
<td>18</td>
<td>1.501</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Psychological Needs Satisfaction

The repeated measure ANOVA was conducted separately on competence, autonomy, and relatedness needs satisfaction. However, the findings showed the interaction, time and group effects on the three variables were not significant.
Table 4.5  
*Tests of Time, Interaction and Group Effects for Perceived Autonomy Support*

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>η_p²</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>1.150</td>
<td>2</td>
<td>0.575</td>
<td>4.680</td>
<td>.015</td>
<td>.198</td>
<td>.753</td>
</tr>
<tr>
<td>Time*Group</td>
<td>0.036</td>
<td>2</td>
<td>0.018</td>
<td>0.147</td>
<td>.864</td>
<td>.008</td>
<td>.071</td>
</tr>
<tr>
<td>Error (Time)</td>
<td>4.669</td>
<td>38</td>
<td>0.123</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>0.057</td>
<td>1</td>
<td>0.057</td>
<td>0.045</td>
<td>.833</td>
<td>.002</td>
<td>.055</td>
</tr>
<tr>
<td>Error (Group)</td>
<td>23.727</td>
<td>19</td>
<td>1.249</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other Psychological Variables

**Self-Efficacy (SE)**

The repeated measure ANOVA showed non-significant effects on task and coping SE. There was a significant group effect on scheduling SE, $F(1, 18) = 6.196, p = .023$, $\eta_p^2 = .256$, (Table 4.6). The SD group showed significantly higher scheduling SE ($8.595 \pm .383$) than the SC group ($7.257 \pm .365$), controlling for baseline. The interaction and time effects for scheduling SE were not significant.

Table 4.6  
*Tests of Time, Interaction and Group Effects for Scheduling Self-Efficacy*

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>η_p²</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>1.223</td>
<td>2</td>
<td>0.611</td>
<td>0.787</td>
<td>.463</td>
<td>.042</td>
<td>.174</td>
</tr>
<tr>
<td>Time*Group</td>
<td>1.170</td>
<td>2</td>
<td>0.585</td>
<td>0.753</td>
<td>.478</td>
<td>.040</td>
<td>.168</td>
</tr>
<tr>
<td>Error (Time)</td>
<td>27.976</td>
<td>36</td>
<td>0.777</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>26.324</td>
<td>1</td>
<td>26.324</td>
<td>6.196</td>
<td>.023</td>
<td>.256</td>
<td>.654</td>
</tr>
<tr>
<td>Error (Group)</td>
<td>76.473</td>
<td>18</td>
<td>4.248</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Self-Regulation

For goal setting, the repeated measure ANOVA indicated a significant time effect, 
\( F(2, 36) = 9.022, p = .001, \eta_p^2 = .334 \), but no interaction and group effects after controlling for baseline (Table 4.7). The *post hoc* procedure (Bonferroni comparison) indicated that when controlling for baseline, the scores at end-point (T3) were significantly higher than those at mid-point (T2) \( (p = .029) \), but the mean differences between mid-point (T2) and follow-up (T4) or between post-intervention (T3) and 4-week follow-up (T4) were not significant. The results demonstrated that goal setting progressively increased during the intervention, peaked at the post-intervention, \( (T2 = 2.897 \pm .163; T3 = 3.287 \pm .185) \), and remained at the same level at the follow-up \( (T4 = 3.135 \pm .208) \).

<table>
<thead>
<tr>
<th>Table 4.7</th>
<th>Tests of Time, Interaction and Group Effects for Goal-Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>SS</td>
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<td>Within-Subjects</td>
<td>Time</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
</tr>
<tr>
<td></td>
<td>Error (Time)</td>
</tr>
<tr>
<td>Between-Subjects</td>
<td>Group</td>
</tr>
<tr>
<td></td>
<td>Error (Group)</td>
</tr>
</tbody>
</table>
For exercise planning, the repeated measure ANOVA interaction, time, and group effects were not significant, while time effect was close to the level of significance, $F(2, 36) = 3.466, p = .058, \eta_p^2 = .161$ (Table 4.8). The pattern of exercise planning during the study period was similar to goal-setting. However, the mean changes over time did not differ significantly.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta_p^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>0.543</td>
<td>1.499</td>
<td>0.362</td>
<td>3.466</td>
<td>.058</td>
<td>.161</td>
<td>.524</td>
</tr>
<tr>
<td>Time*Group</td>
<td>0.041</td>
<td>1.499</td>
<td>0.028</td>
<td>0.264</td>
<td>.706</td>
<td>.014</td>
<td>.083</td>
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<td>Error (Time)</td>
<td>2.821</td>
<td>26.974</td>
<td>0.105</td>
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<td>Between-Subjects</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>2.487</td>
<td>1</td>
<td>2.487</td>
<td>2.648</td>
<td>.121</td>
<td>.128</td>
<td>.338</td>
</tr>
<tr>
<td>Error (Group)</td>
<td>16.908</td>
<td>18</td>
<td>0.939</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Depressive Symptoms**

The repeated measure ANOVA indicated there were no significant interaction, group and time effects. The results suggested that the interventions had no effect on depressive symptoms.

**Quality of Life**

For all summary scores of quality of life using SF-36, the repeated measure ANOVA showed that interaction, group and time effects were not significant, when controlling for baseline. This suggested that the intervention did not significantly change the total scores of SF-36, or physical/mental components of SF-36, regardless of time and group.
After examination of the 6 domains of SF-36, there were 3 variables with significant effects: bodily pain (BP) with interaction effect, social functioning (SF) with time effect, and role playing due to emotional health (RE) with interaction and group effects. The other non-reported variables/effects were not significant.

For bodily pain (BP), the group x time interaction was significant, $F(2, 36) = 3.377, p = .045$, $\eta^2_p = .158$ (Table 4.9) and I further tested the simple effects of the interaction by dividing the interaction effect into component parts and then testing the separate parts for significance.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta^2_p$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects Time</td>
<td>522.673</td>
<td>2</td>
<td>261.336</td>
<td>2.015</td>
<td>.148</td>
<td>.101</td>
<td>.388</td>
</tr>
<tr>
<td>Time*Group Error (Time)</td>
<td>876.126</td>
<td>2</td>
<td>438.063</td>
<td>3.377</td>
<td>.045</td>
<td>.158</td>
<td>.600</td>
</tr>
<tr>
<td>Between-Subjects Group</td>
<td>12.616</td>
<td>1</td>
<td>12.616</td>
<td>0.041</td>
<td>.842</td>
<td>.002</td>
<td>.054</td>
</tr>
<tr>
<td>Error (Group)</td>
<td>5579.366</td>
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<td>309.965</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The differences in time were examined for the SD group and the SC group, respectively, and the differences in group were examined at T1, T2, T3, and T4, respectively (i.e., six simple effects). The results showed that the simple effects of time at each level of group (Table 4.10) were not significant. This could be due to insufficient power and sample size because the effect size was rather large (SC: $\eta^2_p = .106$; SD: $\eta^2_p = .104$). Also, the simple effects of group at each level of time (Table 4.11) were not
significant and the effect sizes were mostly medium (T1: $\eta^2 = .127$; T2: $\eta^2 = .056$; T3: $\eta^2 = .003$; T4: $\eta^2 = .076$).

Table 4.10
*Simple Effect of Time: Changes of Bodily Pain (BP) by Group*

<table>
<thead>
<tr>
<th>SF36: Bodily Pain</th>
<th>Mid-Point (T2)</th>
<th>Post-Intervention (T3)</th>
<th>Follow-Up (T4)</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta^2_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>SC group</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>80.27</td>
<td>11.026</td>
<td>86.23</td>
<td>13.31</td>
<td>87.36</td>
<td>13.44</td>
<td>1.066</td>
</tr>
<tr>
<td>SD group</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>85.95</td>
<td>13.417</td>
<td>87.35</td>
<td>9.31</td>
<td>77.90</td>
<td>20.87</td>
<td>0.932</td>
</tr>
</tbody>
</table>

*Note.* Baseline values were used as a covariate: 93.09 for the SC group and 85.45 for the SD group.

Table 4.11
*Simple Effect of Group: Changes of Bodily Pain (BP) by Time*

<table>
<thead>
<tr>
<th>SF36: Bodily Pain</th>
<th>SC group</th>
<th>SD group</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Intervention(T1)</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>2.766</td>
</tr>
<tr>
<td>93.09</td>
<td>8.549</td>
<td>85.45</td>
<td>12.337</td>
<td>.131</td>
<td>.301</td>
</tr>
<tr>
<td>Mid-Point(T2)</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>1.131</td>
</tr>
<tr>
<td>80.27</td>
<td>11.026</td>
<td>85.95</td>
<td>13.417</td>
<td>9.310</td>
<td>20.867</td>
</tr>
<tr>
<td>Post-Intervention(T3)</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>0.049</td>
</tr>
<tr>
<td>86.23</td>
<td>13.307</td>
<td>87.35</td>
<td>9.310</td>
<td>77.90</td>
<td>20.867</td>
</tr>
<tr>
<td>Follow-Up(T4)</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>1.557</td>
</tr>
</tbody>
</table>

For social functioning (SF), the time effect was significant, $F(1.514, 27.252) = 8.660, p = .003, \eta^2_p = .325$ (Table 4.12). The *post hoc* procedure (Bonferroni comparison) indicated that when controlling for baseline, SF changes between each time-point did not differ significantly (T2 = 95.14± 1.47; T3 = 92.22 ± 1.57; T4 = 90.98 ± 2.21). This suggested that overall SF pattern overtime was significant, regardless of group; however, the power was insufficient to detect changes between each time-point.
Table 4.12
Tests of Time, Interaction and Group Effects for Social Function (SF)

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>η_p²</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>947.969</td>
<td>1.514</td>
<td>626.132</td>
<td>8.660</td>
<td>.003</td>
<td>.325 .905</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>29.012</td>
<td>1.514</td>
<td>19.162</td>
<td>.265</td>
<td>.707</td>
<td>.015 .084</td>
</tr>
<tr>
<td></td>
<td>Error (Time)</td>
<td>1970.463</td>
<td>27.252</td>
<td>72.305</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td>Group</td>
<td>199.043</td>
<td>1</td>
<td>199.043</td>
<td>0.919</td>
<td>.350</td>
<td>.049 .149</td>
</tr>
<tr>
<td></td>
<td>Error (Group)</td>
<td>3898.210</td>
<td>18</td>
<td>216.567</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For role playing due to emotional health (RE), the analysis revealed a significant group x time interaction effect, $F(2, 36) = 4.8, p = .014, \eta_p^2 = .211$ (Table 4.13), six simple effects were investigated separately.

Table 4.13
Tests of Time, Interaction and Group Effects for Role Playing due to Emotional Health (RE)

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>η_p²</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>1783.878</td>
<td>2</td>
<td>891.939</td>
<td>2.349</td>
<td>.110</td>
<td>.115 .445</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>3645.039</td>
<td>2</td>
<td>1822.519</td>
<td>4.800</td>
<td>.014</td>
<td>.211 .762</td>
</tr>
<tr>
<td></td>
<td>Error (Time)</td>
<td>13668.712</td>
<td>36</td>
<td>379.686</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td>Group</td>
<td>3206.335</td>
<td>1</td>
<td>3206.335</td>
<td>5.550</td>
<td>.030</td>
<td>.236 .606</td>
</tr>
<tr>
<td></td>
<td>Error (Group)</td>
<td>10399.455</td>
<td>18</td>
<td>577.747</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First, the two simple effects of time at each level of group (SD vs. SC group) were examined. For the SD group, the RE scores over time was significant, $F(2, 16) = 0.884, p = .432, \eta_p^2 = .100$ (Table 4.14). The RE scores for the SD group decreased from $90.00 \pm 22.498$ at the mid-point (T2) to $63.33 \pm 39.91$ at the post-intervention (T3), while the SC
group increased from 96.97 ± 10.05(T2) to 100.00 ± 0 (T3). For the SC group, the pattern was not significant, $F(2, 18) = 6.199, p = .009, \eta_p^2 = .408$ (Table 4.14).

Table 4.14
Simple Effect of Time: Changes of Role Playing due to Emotional Health (RE) by Group

<table>
<thead>
<tr>
<th>SF36: Role Playing due to Emotional Health</th>
<th>M</th>
<th>SD</th>
<th>M</th>
<th>SD</th>
<th>F</th>
<th>p</th>
<th>$\eta_p^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mid-Point (T2)</td>
<td>Post-Intervention (T3)</td>
<td>Follow-Up (T4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC group</td>
<td>96.97 &lt;.001</td>
<td>100.00 &lt;.001</td>
<td>93.94 4.24</td>
<td>6.199</td>
<td>.009</td>
<td>.408</td>
<td></td>
</tr>
<tr>
<td>SD group</td>
<td>90.00 20.877</td>
<td>63.33 42.26</td>
<td>90.00 22.84</td>
<td>0.884</td>
<td>.432</td>
<td>.176</td>
<td></td>
</tr>
</tbody>
</table>

Lastly, the other four simple effects of group at each level of time (T1, T2, T3 and T4) were examined separately and the results showed that they were non-significant for any time point (Table 4.15). This could be due to insufficient power and sample size given that there was a significant group main effect, $F(1, 18) = 5.55, p = .03, \eta_p^2 = .236$ (Table 4.15). The average of the SD group (81.51 ± 14.30) was significant lower than the SC group (96.61 ± 14.26) after controlling for baseline differences. Taken together, these findings suggest that group membership might help to explain the significant group x time interaction.

Table 4.15
Simple Effect of Group: Changes of Role Playing due to Emotional Health (RE) by Time

<table>
<thead>
<tr>
<th>SF36: Role Playing due to Emotional Health</th>
<th>SC group</th>
<th>M</th>
<th>SD</th>
<th>SD</th>
<th>SD</th>
<th>F</th>
<th>p</th>
<th>$\eta_p^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Intervention(T1)</td>
<td>M</td>
<td>96.97</td>
<td>10.05</td>
<td>83.33</td>
<td>28.33</td>
<td>2.248</td>
<td>.150</td>
<td>.106</td>
</tr>
<tr>
<td>Mid-Point(T2)</td>
<td>M</td>
<td>96.97</td>
<td>10.05</td>
<td>90.00</td>
<td>22.50</td>
<td>0.869</td>
<td>.363</td>
<td>.044</td>
</tr>
<tr>
<td>Post-Intervention(T3)</td>
<td>M</td>
<td>100.00</td>
<td>0</td>
<td>63.33</td>
<td>39.91</td>
<td>9.335</td>
<td>.007</td>
<td>.329</td>
</tr>
<tr>
<td>Follow-Up (T4)</td>
<td>M</td>
<td>93.94</td>
<td>13.44</td>
<td>90.00</td>
<td>22.50</td>
<td>0.242</td>
<td>.628</td>
<td>.013</td>
</tr>
</tbody>
</table>
Relationships among Physical Activity and Psychological Variables: Pearson’s Correlation

Pearson’s correlation was performed to test the relationship between physical activity at follow-up (T4 PA) and psychosocial variable scores at end-point (T3) and follow-up (T4), as well as the relationship between physical activity at follow-up (T4 PA) and changes scores from baseline to end-point (T1-T3) and from baseline to follow-up (T1-T4). Since the purpose was to learn which psychological variables were critical for exercise adherence (i.e., T4 PA), not to examine the effect of intervention, the analysis did not include midpoint data (T2) and the overall sample size (N = 21) was used in the Pearson’s correlation analysis to increase power. The psychological variables that were significantly associated with T4 PA are identified below.

Physical Activity and SDT Variables

Motivational Regulation: Autonomous Regulation

Intrinsic motion, integrated regulation and identified regulation at T3 showed significant, positive relationships with T4 PA. A similar pattern was observed between autonomous regulation at T4 and T4 PA, except for integrated regulation, which was non-significant at T4. Of the significant relationships with PA, intrinsic motivation had the strongest correlations ($r = .558, p = .009$ at T3; $r = .553, p = .009$ at T4), following by identified regulation ($r = .536, p = .012$ at T3; $r = .503, p = .020$ at T4) and integrated regulation ($r = .370, p = .020$ at T3; $r = .370, p = .098$ at T4) (Table 4.16). For change scores, the correlations were even smaller and none of the correlations between change scores and T4 PA was significant. The findings showed that the actual autonomous SDT
variable scores at T3 and T4, not the change scores, were positively associated with T4 PA.

Table 4.16
Pearson Correlations for Physical Activity at Follow-Up and Scores/Change Scores of the SDT Variables: Motivational Regulations

<table>
<thead>
<tr>
<th></th>
<th>All (N=21)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scores at T3</td>
<td>Scores at T4</td>
<td>Change Scores T1-T3</td>
<td>Change Scores T1-T4</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>p</td>
<td>r</td>
<td>p</td>
</tr>
<tr>
<td>Autonomous regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrinsic motivation</td>
<td>.558</td>
<td>.009</td>
<td>.553</td>
<td>.009</td>
</tr>
<tr>
<td>Integrated regulation</td>
<td>.370</td>
<td>.020</td>
<td>.370</td>
<td>.098</td>
</tr>
<tr>
<td>Identified regulation</td>
<td>.536</td>
<td>.012</td>
<td>.503</td>
<td>.020</td>
</tr>
<tr>
<td>Controlling regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Introjected regulation</td>
<td>.145</td>
<td>.530</td>
<td>.275</td>
<td>.228</td>
</tr>
<tr>
<td>External regulation</td>
<td>.180</td>
<td>.434</td>
<td>.257</td>
<td>.262</td>
</tr>
<tr>
<td>Relative autonomy index</td>
<td>.397</td>
<td>.075</td>
<td>.296</td>
<td>.192</td>
</tr>
</tbody>
</table>

Note. SDT= Self-Determination Theory; T1= pre-intervention; T2= mid-point; T3= post-intervention; T4= 4-week follow-up

Motivational Regulation: Controlling regulation

There was a small positive correlation between introjected regulation/external regulation and T4 PA (r range: .145 - .275) (Table 4.16). However, none of the correlations were significant. For change scores, none of the correlations were significant, either. The results did not indicate any significant controlling regulation association with PA.

Motivational Regulation: Relative Autonomy Index (RAI)

Relative Autonomy Index is a summary score for the level of autonomy. The results showed there was a positive, but not significant, correlation between RAI and T4
PA. However, none of the correlations for absolute scores or change scores was significant (Table 4.16).

**Psychological Needs Satisfaction**

Autonomy at T3 was the only significant psychological needs satisfaction variable associated with PA \( (r = .442; p = .045) \). Although the other correlations failed to be significant, these correlations suggested that Autonomy and Competence had a higher association with T4 PA than Relatedness. The change scores of Autonomy and Relatedness had a negative, but trivial, relationship with T4 PA (Table 4.17).

**Perceived Autonomy Support (PAS)**

The results showed there was a positive, but not significant, correlation between PAS and T4 PA. Also, the change scores of PAS had a negative, but trivial, relationship with T4 PA (Table 4.17).

<table>
<thead>
<tr>
<th>Psychological needs satisfaction</th>
<th>Scores at T3</th>
<th>Scores at T4</th>
<th>Change Scores T1-T3</th>
<th>Change Scores T1-T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence</td>
<td>.303</td>
<td>.182</td>
<td>.360</td>
<td>.109</td>
</tr>
<tr>
<td>Autonomy</td>
<td>.442</td>
<td><strong>.045</strong></td>
<td>.389</td>
<td>.081</td>
</tr>
<tr>
<td>Relatedness</td>
<td>&lt;.001</td>
<td>.999</td>
<td>-.076</td>
<td>.744</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perceived autonomy support</th>
<th>Change Scores T1-T3</th>
<th>Change Scores T1-T4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.186</td>
<td>.419</td>
</tr>
</tbody>
</table>

|                          | .284                | .212               |
|                          | -.126               | .586               |
|                          | -.053               | .821               |

*Note.* SDT = Self-Determination Theory; T1 = pre-intervention; T2 = mid-point; T3 = post-intervention; T4 = 4-week follow-up;
Physical Activity and other Psychological Variables

Self-Efficacy (SE)

Task SE at post-intervention or at follow-up did not show any significant correlation with T4 PA and this was the same for the change scores. Coping SE at T4 ($r = .466; p = .033$) and the T1-T4 change score ($r = .588; p = .005$) were positively associated with T4 PA. Scheduling SE at T3 ($r = .497; p = .022$) and T4 ($r = .585; p = .005$) showed a strong and positive correlation with T4 PA. However, neither of the change scores had a significant correlation. The results suggested that scheduling SE and coping SE had a stronger association with PA than task SE (Table 4.18).

Table 4.18
Pearson Correlations for Physical Activity at Follow-Up and Scores/Change Scores of the Other Psychological Variables: Self-Efficacy, Self-Regulation and Depressive Symptoms

<table>
<thead>
<tr>
<th></th>
<th>All (N=21)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Scores at T3</td>
<td>Scores at T4</td>
<td>Change Scores</td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>p</td>
<td>r</td>
</tr>
<tr>
<td>Self-Efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task SE</td>
<td>-.111</td>
<td>.633</td>
<td>.072</td>
</tr>
<tr>
<td>Coping SE</td>
<td>.291</td>
<td>.200</td>
<td>.466</td>
</tr>
<tr>
<td>Scheduling SE</td>
<td>.497</td>
<td><strong>.022</strong></td>
<td>.585</td>
</tr>
<tr>
<td>Self-Regulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal-setting</td>
<td>.631</td>
<td><strong>.002</strong></td>
<td>.584</td>
</tr>
<tr>
<td>Planning</td>
<td>.756</td>
<td>&lt;.001</td>
<td>.673</td>
</tr>
<tr>
<td>Depressive symptoms:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CESD</td>
<td>-.026</td>
<td>.911</td>
<td>-.262</td>
</tr>
</tbody>
</table>

Note. T1= pre-intervention; T2= mid-point; T3= post-intervention; T4= 4-week follow-up;
Self-Regulation

Both goal-setting and planning at post-intervention and follow-up, as well as the change scores, were significantly and positively associated with T4 PA ($r$ range = .522 to .756, $p$ range = .015 to <.001). The higher scores of goal-setting or planning were associated with more physical activity at follow-up and these significant correlations were consistently evident when examining all four conditions, including at post-intervention, follow-up, change from baseline to post-intervention, or change from baseline to follow-up. (Table 4.18). The results indicated that goal-setting and planning were the most consistently significant predictors among all the psychological variables.

Depressive Symptoms: CESD

Center of Epidemiology Survey on Depression (CESD) scores was negatively, but not significantly, associated with T4 PA (Table 4.18).
Intervention, Psychological Variables and Physical Activity: Mediation Analysis

According to the results of repeated measure ANOVA presented previously, several psychological variables had significant interaction, time, or group effects. This suggested that these variables might be affected by the intervention and also might influence physical activity at the follow up (i.e., T4 PA). Therefore, I further investigated if the significant psychological variables, including integrated regulation, perceived autonomy support, scheduling self-efficacy, goal setting, and planning, mediated the intervention and physical activity at follow-up. Since intervention assignment is a categorical variable, it was dummy coded for regression analysis (SC group = 0; SD group = 1). The change scores from baseline to post-intervention (i.e., direct changes from intervention) were used in the mediation analysis. The mediating effects for significant variables were tested with a three-step regression analysis recommended by (Baron & Kenny, 1986). Step 1: regressed potential mediators on intervention assignment. Step 2: regressed T4 PA on intervention assignment. Step 3: regressed T4 PA on potential mediators and intervention assignment. If the relationship in step one or two was not significant, step 3 was not necessary since the first two steps need to be significant to test for mediation.

The regression equations of mediation analysis for the five variables, integrated regulation, perceived autonomy support, scheduling self-efficacy, goal setting, and planning, are presented in Table 4.19. Since the regression of T1-T3 change scores for each variables on intervention assignment was not significant (i.e., step 1), even if the regression of T4 PA on intervention assignment was significant (i.e., step 2), the
mediating effects of each variable could not exist. In other words, there was no mediation of the intervention on physical activity at follow-up.

Table 4.19
*Regression Equations of Mediation Analysis for Integrated Regulation, Perceived Autonomy Support, Scheduling Self-Efficacy, Goal-Setting, and Planning*

<table>
<thead>
<tr>
<th>Step 1: Regressed mediators on intervention assignment</th>
<th>Predictor</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV= Integrated regulation</td>
<td>Intervention</td>
<td>-0.0139</td>
<td>0.444</td>
<td>-0.071</td>
<td>0.758</td>
</tr>
<tr>
<td>DV= Perceived autonomy support</td>
<td>Intervention</td>
<td>-0.046</td>
<td>0.232</td>
<td>-0.046</td>
<td>0.844</td>
</tr>
<tr>
<td>DV= Scheduling self-efficacy</td>
<td>Intervention</td>
<td>0.558</td>
<td>0.958</td>
<td>0.132</td>
<td>0.568</td>
</tr>
<tr>
<td>DV= Goal setting</td>
<td>Intervention</td>
<td>0.388</td>
<td>0.435</td>
<td>0.200</td>
<td>0.384</td>
</tr>
<tr>
<td>DV= Planning</td>
<td>Intervention</td>
<td>0.335</td>
<td>0.273</td>
<td>0.271</td>
<td>0.236</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 2: Regressed T4 PA on intervention assignment</th>
<th>Predictor</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV = T4 PA</td>
<td>Intervention</td>
<td>709.745</td>
<td>254.214</td>
<td>0.539</td>
<td>0.012</td>
</tr>
</tbody>
</table>

| Step 3: Regressed T4 PA on mediator and intervention assignment | Not necessary since the results of step 1 were not significant |

*Note.* Step 1: Regressed mediators on intervention assignment; DV = mediators (change scores from baseline to post-intervention) and IV = intervention assignment; Step 2: Regressed *Physical activity at follow-up* (T4 PA) on intervention assignment; DV = T4 PA and IV = intervention assignment; Step 3: not necessary since the results of step 1 were not significant.
Part II: Results Based Upon the Follow-Up Analysis

Purpose and Rationale

The effect of intervention was not significantly different for the main outcome behavioral variables (i.e., physical activity) and the majority of the psychological variables in the repeated measure ANOVA. The purpose of this follow-up analysis was to investigate which psychological variables were important for predicting exercise adherence, defined by membership in exercise adherent and non-adherent outcome groups.

The CDC/ACSM PA recommendation (discussed in Chapter 1) claimed a PA dosage of at least 1 000 Kcal EE per week helps to decrease mortality and morbidity of many chronic diseases, especially cardiovascular disease. Also, being regularly active at this public health dosage can help sedentary individuals to gain various health benefits, such as weight control, stress management, and so on. Therefore, the follow-up analysis was conducted to examine which variables were related to individuals who exercised regularly and reached the 1 000 Kcal goal at follow-up (i.e., adherents).

Adherents/Non-Adherents Assignment

I re-categorized the participants into a new “group” assignment (i.e., adherent/non-adherent). This new “adherent/non-adherent” assignment, instead of the “SD group/SC group” assignment was used in all the following analyses. Adherents ($n = 10$) were the participants who expended $\geq 1 000$ Kcal/week at the follow-up (1530.43±576.57 Kcal/week), while non-adherents ($n = 11$) expended $< 1 000$ Kcal/week (502.57±233.33 Kcal/week). The comparison between PA at post-intervention (T3) and 4-week
follow-up (T4) showed that the majority (70%) of the adherents reached 1 000 Kcal/week at T3 and maintained or increased PA at T4. A few (18.2%) non-adherents reached 1 000 Kcal/week at T3, but fell under the threshold at T4, and therefore, were categorized as non-adherents. A list of weekly energy expenditure of all participants and adherent/non-adherent assignment can be found in Appendix L.

The results of Crosstab of SC/SD group assignment vs. non-adherent/adherent assignment showed that among adherents, 70% (7/10) was from the SD group; among non-adherent, 72.7% (8/11) was from the SC group (Table 4.20). The findings suggested that the participants in the SD group were more likely to become exercise adherents while the participants in the SC group were more likely to be non-adherents in this study ($\chi^2(1) = 3.834, p = .05$).

Table 4.20
*Crosstab of SC/SD Group Assignment vs. Non-adherent/Adherent Assignment*

<table>
<thead>
<tr>
<th>SC group</th>
<th>SD group</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-adherent (EE &lt; 1000Kcal/week)</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>72.7% (8/11)</td>
<td>27.3% (3/11)</td>
<td>100%</td>
</tr>
<tr>
<td>Adherent (EE &gt; 1000Kcal/week)</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>30% (3/10)</td>
<td>70% (7/10)</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>

*Note.* EE= energy expenditure (Kcal/week)

Statistical Analysis

A two-factor mixed design analysis of variance (ANOVA) procedure with one between-group factor (2 group: adherents, non-adherents) and one within-group factor (4 time: pre, mid, post, and follow-up) was applied to examine the outcome variables,
including physical activity, quality of life, SDT-based constructs and other physical and psychological variables. Baseline values were used as a covariate to control for baseline differences. The significance level was set at .05 and effect size using $\eta^2$ was reported.

After significant variables were identified in the ANOVA procedure, logistic regression analysis that included the identified variables was applied. The primary objective was to investigate which variables could predict exercise adherence at the 4-week follow-up.

**Results: Difference in Baseline Characteristics**

There were no significant differences for age, BMI, and WHR between adherent/non-adherent groups. The averages of all the fitness and psychological variables at baseline were not significantly different between adherent/non-adherent groups, either (Table 4.21 and 4.22).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Non-Adherents $M \pm SD$</th>
<th>Adherents $M \pm SD$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>41.36 ± 9.16</td>
<td>44.10 ± 13.65</td>
<td>.593</td>
</tr>
<tr>
<td>Body Mass, kg</td>
<td>81.67 ± 10.23</td>
<td>80.76 ± 10.75</td>
<td>.846</td>
</tr>
<tr>
<td>Body Mass Index</td>
<td>30.55 ± 3.13</td>
<td>30.78 ± 3.37</td>
<td>.869</td>
</tr>
<tr>
<td>Waist-Hip Ratio</td>
<td>.78 ± .06</td>
<td>.77 ± .05</td>
<td>.893</td>
</tr>
<tr>
<td>1 RM Machine Chest Press, kg</td>
<td>36.57 ± 8.03</td>
<td>36.36 ± 12.86</td>
<td>.965</td>
</tr>
<tr>
<td>1 RM Machine Leg Press, kg</td>
<td>92.97 ± 8.03</td>
<td>101.01 ± 23.07</td>
<td>.524</td>
</tr>
<tr>
<td>Predicted VO$_2$max, ml/km/min</td>
<td>29.66 ± 5.88</td>
<td>27.99 ± 5.48</td>
<td>.509</td>
</tr>
<tr>
<td>Energy Expenditure, kcal/week</td>
<td>215.94 ±189.83</td>
<td>542.20 ± 242.50</td>
<td>.003*</td>
</tr>
</tbody>
</table>

*Note. RM= Repetition Maximal; VO$_2$max = Maximal Oxygen Consumption; $* p < .05$


Table 4.22

*Baseline Values of the Psychological Variables for Non-Adherents and Adherents*

<table>
<thead>
<tr>
<th>Motivational Regulation</th>
<th>Non-Adherents</th>
<th>Adherents</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M ± SD</td>
<td>M ± SD</td>
<td></td>
</tr>
<tr>
<td>External Regulation</td>
<td>0.93 ± 0.881</td>
<td>1.27 ± 1.151</td>
<td>.450</td>
</tr>
<tr>
<td>Introjected Regulation</td>
<td>1.67 ± 1.87</td>
<td>1.183 ± 1.124</td>
<td>.696</td>
</tr>
<tr>
<td>Identified Regulation</td>
<td>2.48 ± 0.905</td>
<td>2.55 ± 0.753</td>
<td>.844</td>
</tr>
<tr>
<td>Integrated Regulation</td>
<td>1.55 ± 1.060</td>
<td>1.63 ± 1.126</td>
<td>.869</td>
</tr>
<tr>
<td>Intrinsic Motivation</td>
<td>1.43 ± 0.888</td>
<td>2.23 ± 0.989</td>
<td>.068</td>
</tr>
<tr>
<td>Relative Autonomy Index</td>
<td>1.181 ± 2.595</td>
<td>2.583 ± 2.860</td>
<td>.524</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Psychological Needs Satisfaction</th>
<th>Non-Adherents</th>
<th>Adherents</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competence</td>
<td>3.97 ± 1.256</td>
<td>4.45 ± 0.764</td>
<td>.249</td>
</tr>
<tr>
<td>Autonomy</td>
<td>4.45 ± 1.204</td>
<td>4.90 ± 0.775</td>
<td>.332</td>
</tr>
<tr>
<td>Relatedness</td>
<td>3.38 ± 1.310</td>
<td>3.43 ± 1.713</td>
<td>.935</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Self-Efficacy</th>
<th>Non-Adherents</th>
<th>Adherents</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task Self-Efficacy</td>
<td>8.546 ± 0.981</td>
<td>8.500 ± 0.984</td>
<td>.917</td>
</tr>
<tr>
<td>Coping Self-Efficacy</td>
<td>5.879 ± 2.553</td>
<td>6.663 ± 1.356</td>
<td>.405</td>
</tr>
<tr>
<td>Scheduling Self-Efficacy</td>
<td>7.879 ± 1.656</td>
<td>8.333 ± 2.061</td>
<td>.582</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Self-Regulation</th>
<th>Non-Adherents</th>
<th>Adherents</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal-Setting</td>
<td>1.936 ± 0.726</td>
<td>1.880 ± 0.648</td>
<td>.854</td>
</tr>
<tr>
<td>Planning</td>
<td>1.936 ± 0.548</td>
<td>2.260 ± 0.660</td>
<td>.235</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depressive Symptoms</th>
<th>Non-Adherents</th>
<th>Adherents</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CESD</td>
<td>3.270 ± 2.494</td>
<td>5.300 ± 5.165</td>
<td>.259</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quality of Life: SF-36</th>
<th>Non-Adherents</th>
<th>Adherents</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF: Physical Function</td>
<td>88.180 ± 10.787</td>
<td>92.000 ± 5.375</td>
<td>.325</td>
</tr>
<tr>
<td>RP: Role Playing-Physical Health</td>
<td>95.450 ± 10.113</td>
<td>100.000 ± 0</td>
<td>.167</td>
</tr>
<tr>
<td>BP: Bodily Pain</td>
<td>91.410 ± 10.278</td>
<td>87.300 ± 11.840</td>
<td>.405</td>
</tr>
<tr>
<td>VT: Vitality</td>
<td>55.910 ± 12.413</td>
<td>62.500 ± 18.447</td>
<td>.345</td>
</tr>
<tr>
<td>SF: Social Function</td>
<td>90.910 ± 16.855</td>
<td>92.500 ± 17.873</td>
<td>.836</td>
</tr>
<tr>
<td>RE: Role Playing-Emotional Health</td>
<td>96.970 ± 10.050</td>
<td>83.330 ± 28.328</td>
<td>.177</td>
</tr>
<tr>
<td>MH: Mental Health</td>
<td>81.090 ± 11.327</td>
<td>82.000 ± 13.367</td>
<td>.868</td>
</tr>
<tr>
<td>Physical Components Scores</td>
<td>79.550 ± 8.923</td>
<td>82.060 ± 9.092</td>
<td>.532</td>
</tr>
<tr>
<td>Mental Components Scores</td>
<td>78.340 ± 11.392</td>
<td>77.770 ± 16.501</td>
<td>.927</td>
</tr>
<tr>
<td>Total Scores</td>
<td>83.340 ± 9.050</td>
<td>83.520 ± 11.023</td>
<td>.969</td>
</tr>
</tbody>
</table>

*Note.* CESD = Center for Epidemiologic Studies Depression Scale; SF-36 = 36-Item Short Form Health Survey
Noticeably, adherents’ baseline PA (542.20 ± 242.50 Kcal/week) was significantly higher than non-adherents’ (215.94 ± 189.83 Kcal/week) ($p = .003$). This finding was not surprising since 70% of the adherents were in the SD group, which also had a higher baseline PA. In order to control for baseline differences better, although there was no significant difference, all the following ANOVA procedures used the values at the baselines as a covariate.

**Results: Adherents/Non-Adherents Differences Examined by ANOVA**

The purpose of the following repeated-measure ANOVA was to examine which variables were significantly different between adherent/non-adherent groups (i.e., significant group effects). The significant variables would be included in the logistic regression and further determined which best predicted exercise adherence.

**Physical Activity**

The repeated-measures ANOVA indicated that there was a significant group effect, $F(1, 19) = 20.497, p = < .001$, $\eta^2_p = .519$, time effect, $F(3, 57) = 15.535, p = < .001$, $\eta^2_p = .450$, and interaction effect, $F(3, 57) = 3.757, p = .016$, $\eta^2_p = .165$ (Table 4.23). The adherents (1240.600 ± 118.091 kcal/week) had a significant higher activity level than non-adherents (501.877 ± 112.596 kcal/week) overall.

I further examined simple effects of physical activity due to the significant interaction. First, the simple effect of *time* at each level of group (adherent group vs. non-adherent group) was examined separately. For the adherent group, after controlling for baseline, the ANOVA analysis indicated physical activity was not significantly changed...
Table 4.23  
*Tests of Time, Interaction and Group Effects for Physical Activity by Adherent/Non-Adherent Group*

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta^2_p$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects Time</td>
<td>6823731.82</td>
<td>3</td>
<td>2274577.27</td>
<td>15.535</td>
<td>&lt;.001</td>
<td>.450</td>
<td>1.000</td>
</tr>
<tr>
<td>Time*Group Error (Time)</td>
<td>1650095.72</td>
<td>3</td>
<td>550031.905</td>
<td>3.757</td>
<td>.016</td>
<td>.165</td>
<td>0.784</td>
</tr>
<tr>
<td>Between-Subjects Group</td>
<td>11433950.37</td>
<td>1</td>
<td>11433950.37</td>
<td>20.497</td>
<td>&lt;.001</td>
<td>.519</td>
<td>0.990</td>
</tr>
<tr>
<td>Error (Group)</td>
<td>8345689.61</td>
<td>57</td>
<td>146415.607</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>10598639.48</td>
<td>19</td>
<td>557823.13</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

over time, but, the effect size was large, $F(1.169, 9.355) = 1.063, p = .159, \eta^2_p = .117$. This showed that PA had a tendency to increase over time for the exercise adherents (T2 = 1330.12 ± 72.907; T3 = 1559.65 ± 894.134; T4 = 1530.43 ± 576.574 Kcal/wk). The result of the non-adherent group was not significant, with a small effect size, $F(1.112) = 0.171, p = .067, \eta^2_p = .019$ (Table 4.24), which suggests that the non-adherents’ PA participation tended to decrease over time (T2 = 693.64 ± 407.773; T3 = 595.39 ± 307.233; T4 = 502.57 ± 233.326 Kcal/wk).

Table 4.24  
*Simple Effect of Time: Changes in Physical Activity by Adherents/Non-Adherents*

<table>
<thead>
<tr>
<th>Physical Activity</th>
<th>Mid-Point (T2)</th>
<th>Post-Intervention (T3)</th>
<th>Follow-Up (T4)</th>
<th>$F$</th>
<th>p</th>
<th>$\eta^2_p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherents</td>
<td>1330.12</td>
<td>723.91</td>
<td>1559.65</td>
<td>894.13</td>
<td>1530.43</td>
<td>576.57</td>
</tr>
<tr>
<td>Non-Adherents</td>
<td>693.64</td>
<td>407.77</td>
<td>595.39</td>
<td>307.23</td>
<td>502.57</td>
<td>233.33</td>
</tr>
</tbody>
</table>

Note. Baseline values were used as a covariate: 215.91 for the non-adherents and 542.20 for the adherents. Physical activity was converted into weekly energy expenditure (kcal/week).
Similarly, the simple effects of group at each level of time (T1, T2, T3, T4) were examined in four ANOVA analyses. Physical activity at T1, T2, T3 and T4 were all significantly different. In other words, PA participation for the adherent group was significantly higher than the non-adherent group consistently at these time points (Table 4.24=5). The pattern of physical activity for adherents/non-adherents was not surprising since I categorized the participants based upon their activity level, and therefore, expected significant difference between groups. The results provided some evidence that the assignment of adherents/non-adherents was reasonable.

Table 4.25
Simple Effect of Adherents/Non-Adherents: Physical Activity by Time

<table>
<thead>
<tr>
<th></th>
<th>Physical Activity</th>
<th></th>
<th></th>
<th>F</th>
<th>p</th>
<th>η²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adherents</td>
<td>Non-Adherents</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-Intervention(T1)</td>
<td>215.91</td>
<td>242.50</td>
<td>215.91</td>
<td>189.83</td>
<td>11.91</td>
<td>.003</td>
</tr>
<tr>
<td>Mid-Point(T2)</td>
<td>1330.12</td>
<td>723.91</td>
<td>693.64</td>
<td>407.77</td>
<td>6.32</td>
<td>.021</td>
</tr>
<tr>
<td>Post-Intervention(T3)</td>
<td>1559.65</td>
<td>894.13</td>
<td>595.39</td>
<td>307.23</td>
<td>11.37</td>
<td>.003</td>
</tr>
<tr>
<td>Follow-Up (T4)</td>
<td>1530.57</td>
<td>576.57</td>
<td>502.57</td>
<td>233.33</td>
<td>29.73</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Note. T1= Pre-Intervention; T2=Mid-Point; T3 = Post-Intervention; T4 = Follow-Up

**Fitness Variables**

The repeated measure ANOVA showed no significant interaction, group and time effects for all the fitness variables, including BMI, WHR, predicted VO2 max, 1RM machine chest press, 1RM machine leg press, and stair-climbing test. The results indicated that there were no significant differences between adherent/non-adherent groups on the fitness variables. In other words, these variables would not be included in logistic regression analysis.

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SDT Psychological Variables.

Motivational Regulation.

The results of the repeated measure ANOVA showed there was a significant effect for adherent/non-adherent group for identified regulation, $F(1, 18) = 9.012, p = .008, \eta_p^2 = .334$, integrated regulation, $F(1, 18) = 11.512, p = .00, \eta_p^2 = .390$, and intrinsic motivation, $F(1, 18) = 4.870, p = .041, \eta_p^2 = .213$ (Table 4.26, 4.27, and 4.28).

The adherent group had significantly higher scores than the non-adherent group for these three autonomous regulations. The other controlling regulations did not differ significantly. This finding suggested that identified regulation, integrated regulation, and intrinsic motivation were significantly different between adherents and non-adherents, and therefore, were good candidates for logistic regression analysis.

Table 4.26
Tests of Time, Interaction and Group Effects for Identified Regulation

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta_p^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>0.043</td>
<td>1.355</td>
<td>0.032</td>
<td>0.192</td>
<td>.740</td>
<td>.011</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>0.064</td>
<td>1.355</td>
<td>0.048</td>
<td>0.286</td>
<td>.668</td>
<td>.016</td>
</tr>
<tr>
<td></td>
<td>Error (Time)</td>
<td>4.064</td>
<td>24.388</td>
<td>0.167</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td>Group</td>
<td>4.716</td>
<td>1</td>
<td>4.716</td>
<td>9.012</td>
<td>.008</td>
<td>.334</td>
</tr>
<tr>
<td></td>
<td>Error (Group)</td>
<td>9.419</td>
<td>18</td>
<td>0.523</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance. Group = adherents/non-adherents group.
Table 4.27
Tests of Time, Interaction and Group Effects for Integrated Regulation

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta_p^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>2.226</td>
<td>2</td>
<td>1.113</td>
<td>7.713</td>
<td>.002</td>
<td>.300</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>0.616</td>
<td>2</td>
<td>0.308</td>
<td>2.133</td>
<td>.133</td>
<td>.106</td>
</tr>
<tr>
<td></td>
<td>Error (Time)</td>
<td>8.196</td>
<td>36</td>
<td>.144</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td>Group</td>
<td>10.584</td>
<td>1</td>
<td>10.584</td>
<td>11.512</td>
<td>.003</td>
<td>.390</td>
</tr>
<tr>
<td></td>
<td>Error (Group)</td>
<td>16.548</td>
<td>18</td>
<td>0.919</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Group = adherents/non-adherents group.

Table 4.28
Tests of Time, Interaction and Group Effects for Intrinsic Motivation

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta_p^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>0.050</td>
<td>1.325</td>
<td>0.038</td>
<td>0.170</td>
<td>.753</td>
<td>.009</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>0.319</td>
<td>1.325</td>
<td>0.241</td>
<td>1.076</td>
<td>.331</td>
<td>.056</td>
</tr>
<tr>
<td></td>
<td>Error (Time)</td>
<td>5.342</td>
<td>23.845</td>
<td>0.224</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td>Group</td>
<td>6.174</td>
<td>1</td>
<td>6.174</td>
<td>4.870</td>
<td>.041</td>
<td>.213</td>
</tr>
<tr>
<td></td>
<td>Error (Group)</td>
<td>22.818</td>
<td>18</td>
<td>1.268</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance. Group = adherents/non-adherents group.

Psychological Needs Satisfaction.

The repeated measure ANOVA was conducted separately on competence, autonomy, and relatedness needs satisfaction. The results showed that adherents had significantly higher scores than non-adherents in autonomy, $F(1,18) = 6.214, p = .023$ $\eta_p^2 = .257$ (Table 4.29), but not relatedness or competence. Autonomy need satisfaction was included in logistic regression.
Table 4.29
Tests of Time, Interaction and Group Effects for Autonomy Need Satisfaction

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta_p^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>0.070</td>
<td>1.530</td>
<td>0.046</td>
<td>0.217</td>
<td>.747</td>
<td>.012</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>0.322</td>
<td>1.530</td>
<td>0.211</td>
<td>1.002</td>
<td>.360</td>
<td>.053</td>
</tr>
<tr>
<td></td>
<td>Error (Time)</td>
<td>5.792</td>
<td>27.535</td>
<td>.210</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td>Group</td>
<td>3.036</td>
<td>1</td>
<td>3.036</td>
<td>6.214</td>
<td>.023</td>
<td>.257</td>
</tr>
<tr>
<td></td>
<td>Error (Group)</td>
<td>8.795</td>
<td>18</td>
<td>0.489</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance. Group = adherents/non-adherents group.

**Perceived Autonomy Support.**

The repeated measure ANOVA also showed that adherents had significantly higher scores in perceived autonomy support, $F(1, 19) = 7.209, p = .015, \eta_p^2 = .275$ (Table 4.30). Perceived autonomy support was included in logistic regression.

Table 4.30
Tests of Time, Interaction and Group Effects for Perceived Autonomy Support

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta_p^2$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>1.086</td>
<td>2</td>
<td>.543</td>
<td>4.740</td>
<td>.015</td>
<td>.200</td>
</tr>
<tr>
<td></td>
<td>Time*Group</td>
<td>0.353</td>
<td>2</td>
<td>0.177</td>
<td>1.542</td>
<td>.227</td>
<td>.075</td>
</tr>
<tr>
<td></td>
<td>Error (Time)</td>
<td>4.352</td>
<td>38</td>
<td>0.115</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td>Group</td>
<td>6.542</td>
<td>1</td>
<td>6.542</td>
<td>7.209</td>
<td>.015</td>
<td>.275</td>
</tr>
<tr>
<td></td>
<td>Error (Group)</td>
<td>17.242</td>
<td>19</td>
<td>0.907</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Group = adherents/non-adherents group.
Other Psychological Variables.

**Self-Efficacy (SE).**

The repeated measure ANOVA showed there was no significant effect on task SE. There was a significant effect for adherent/non-adherent groups on coping SE, $F(1, 18) = 5.074, p = .037, \eta^2_p = .220$, (Table 4.31) and scheduling SE, $F(1, 18) = 22.593, p < .001, \eta^2_p = .557$, (Table 4.32). Adherents had significantly higher scores for both coping and scheduling SE, which were good candidates for the following logistic regression.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta^2_p$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects Time</td>
<td>1.186</td>
<td>2</td>
<td>0.593</td>
<td>0.271</td>
<td>.764</td>
<td>.015</td>
<td>.090</td>
</tr>
<tr>
<td>Time*Group</td>
<td>10.403</td>
<td>2</td>
<td>5.202</td>
<td>2.380</td>
<td>.107</td>
<td>.117</td>
<td>.450</td>
</tr>
<tr>
<td>Error (Time)</td>
<td>78.689</td>
<td>36</td>
<td>2.186</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects Group</td>
<td>18.258</td>
<td>1</td>
<td>18.258</td>
<td>5.074</td>
<td><strong>.037</strong></td>
<td>.220</td>
<td>.568</td>
</tr>
<tr>
<td>Error (Group)</td>
<td>64.768</td>
<td>18</td>
<td>3.598</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Group = adherents/non-adherents group.*

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>$F$</th>
<th>$p$</th>
<th>$\eta^2_p$</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects Time</td>
<td>0.928</td>
<td>2</td>
<td>0.464</td>
<td>0.579</td>
<td>.565</td>
<td>.031</td>
<td>.139</td>
</tr>
<tr>
<td>Time*Group</td>
<td>0.316</td>
<td>2</td>
<td>0.158</td>
<td>0.197</td>
<td>.822</td>
<td>.011</td>
<td>.078</td>
</tr>
<tr>
<td>Error (Time)</td>
<td>28.829</td>
<td>36</td>
<td>0.801</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects Group</td>
<td>57.214</td>
<td>1</td>
<td>57.214</td>
<td>22.593</td>
<td><strong>.001</strong></td>
<td>.557</td>
<td>.994</td>
</tr>
<tr>
<td>Error (Group)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Group = adherents/non-adherents group.*
**Self-Regulation.**

The repeated measure ANOVA showed both goal-setting and planning were significantly different between adherents and non-adherents. Adherents consistently had a higher scores on goal-setting, $F(1, 18) = 18.470, p < .001, \eta^2_p = .506$, (Table 4.33) and planning, $F(1, 18) = 23.226, p < .001, \eta^2_p = .563$, (Table 4.34). Also, the effect sizes were both large and this suggested that these two variables could be critical factors to influence exercise adherence. These two variables were included in logistic regression and further examined for their relative importance, when considering other significant predictors in the model.

**Table 4.33**

*Tests of Time, Interaction and Group Effects for Goal-Setting*

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>\eta^2_p</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>3.469</td>
<td>2</td>
<td>1.734</td>
<td>10.452</td>
<td>&lt;.001</td>
<td>.367</td>
<td>.982</td>
</tr>
<tr>
<td>Time*Group</td>
<td>1.048</td>
<td>2</td>
<td>0.524</td>
<td>3.159</td>
<td>.054</td>
<td>.149</td>
<td>.569</td>
</tr>
<tr>
<td>Error (Time)</td>
<td>5.974</td>
<td>36</td>
<td>0.166</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Between-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>17.979</td>
<td>1</td>
<td>17.979</td>
<td>18.470</td>
<td>&lt;.001</td>
<td>.506</td>
<td>.982</td>
</tr>
<tr>
<td>Error (Group)</td>
<td>17.522</td>
<td>18</td>
<td>0.973</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Group = adherents/non-adherents group.*

**Table 4.34**

*Tests of Time, Interaction and Group Effects for Planning*

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>\eta^2_p</th>
<th>Observed Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>0.443</td>
<td>2</td>
<td>0.222</td>
<td>2.806</td>
<td>.074</td>
<td>.135</td>
<td>.517</td>
</tr>
<tr>
<td>Time*Group</td>
<td>0.017</td>
<td>2</td>
<td>0.009</td>
<td>0.109</td>
<td>.897</td>
<td>.006</td>
<td>.065</td>
</tr>
<tr>
<td>Error (Time)</td>
<td>2.845</td>
<td>36</td>
<td>0.079</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between-Subjects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>10.927</td>
<td>1</td>
<td>10.927</td>
<td>23.226</td>
<td>&lt;.001</td>
<td>.563</td>
<td>.995</td>
</tr>
<tr>
<td>Error (Group)</td>
<td>8.468</td>
<td>18</td>
<td>0.470</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. Group = adherents/non-adherents group.*
**Other Variables: Depressive Symptoms and Quality of Life.**

The repeated measure ANOVA indicated there were no main effects on group for both depressive symptoms and any domain of quality of life. In other words, adherents and non-adherents did not differ statistically in either depressive symptoms or quality of life. Therefore, none of the variables was included in logistic regression.

**Results: Logistic Regression**

According to the results of repeated measure ANOVA, adherents and non-adherents significantly differed (i.e., significant main effect on adherent/non-adherent group) in identified regulation, integrated regulation, intrinsic motivation, autonomy need satisfaction, perceived autonomy support, coping self-efficacy, scheduling self-efficacy, exercise goal-setting and exercise planning. These nine psychological variables were included in logistic regression with forward stepwise entry using likelihood ratio. The change scores from baseline and post-intervention (T1-T3) and from baseline to follow-up (T1-T4) for each variable were used to predict the membership in adherent/non-adherent groups in two separate logistic regression models.

**Model 1: Using Change Scores from T1-T3 (Δ T1-T3)**

Nine variables were included in the forward stepwise procedure using likelihood ratio. The final model with only one predictor, goal setting ($p = .037$) was significant, initial deviance = 29.065, final deviance = 19.009, $\chi^2 (1) = 10.055, p = .002$. Furthermore, the final model decreased rather moderate amounts of initial deviance in the null model ($R^2_L = .346, R^2_{Cox-and-Snell} = .380, R^2_{Nagelkerke} = .508$). The Hosmer and Lemeshow test indicated
a good model fit, $\chi^2(8) = 5.512, p = .702$. The overall classification was 76.2% (Table 4.35). Sensitivity for correct classification into adherents was 70% (7/10). Specificity (percent of participants correctly predicted as non-adherents) was 81.82% (9/11). For prediction efficiency (Menard, 2000), proportion reduction in error from using the full model is 50% ($\lambda_p = .50$) and after adjusting for base rate, classification error is reduced by 52.27% ($\tau_p = .5227$) when using the model.

<table>
<thead>
<tr>
<th>Table 4.35</th>
<th>Classification Table when Using Change Scores from Baseline to Post-Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed</td>
<td>Predicted</td>
</tr>
<tr>
<td>Non-Adherent</td>
<td>Non-adherent 2</td>
</tr>
<tr>
<td>Adherent</td>
<td>3 7</td>
</tr>
<tr>
<td>Overall Percentage</td>
<td>76.2</td>
</tr>
</tbody>
</table>

Goal-setting turned out to be the only significant predictor ($b = 2.353, p = .037$) to distinguish adherents vs. non-adherents, when controlling for the other eight variables in the model. For one unit increase of the scores, the odds of being in the adherent group increased by a factor of 10.519, $\text{Exp}(b) = 10.519$. When calculating the probability for being an exercise adherent, the final prediction model showed that when goal setting equals to one point, the probability was 29.71%. The probability was 81.63% and 97.91% with scores of two and three, respectively. When the score increased, the probability greatly increased. This result indicated that goal setting was the most significant predictor when controlling all the nine variables in the model to predict exercise adherent group membership.
Model 2: Using Change Scores from T1-T4 (Δ T1-T4)

The same nine variables were included in the forward stepwise procedure using likelihood ratio. Goal-setting, perceived autonomy support and scheduling SE were entered into the stepwise procedure in sequence. Although the final model was significant and the model fit was good, initial deviance = 29.065, final deviance = 5.65E-7, $\chi^2 (3) = 29.065, p < .001$, the three predictors were not significant in the model (i.e. $p = .955 \sim .999$). Similarly, the second model was significant, initial deviance = 29.065, final deviance = 9.251, $\chi^2 (2) = 19.814, p < .001$, but neither of the predictors was significant, either (i.e. $p = .114$ and $p = .162$). Therefore, the most meaningful and parsimonious model was the first model with only one significant predictor – goal setting ($p = .013$), initial deviance = 29.065, final deviance = 15.724, $\chi^2 (1) = 13.341, p < .001$.

Furthermore, the final model decreased rather moderate amounts of initial deviance in the null model ($R^2_L = .481$, $R^2_{Cox-and-Snell} = .470$, $R^2_{Nagelkerke} = .627$). The Hosmer and Lemeshow test indicated a good model fit, $\chi^2 (8) = 4.111, p = .847$. The overall classification was 85.7% (Table 4.36). Sensitivity for correct classification into adherents was 90% (9/10). Specificity (percent of participants correctly predicted as non-adherents) was 81.8% (9/11). For prediction efficiency (Menard, 2000), proportion reduction in error from using the full model is 70% ($\lambda_p = .70$) and after adjusting for base rate, classification error is reduced by 71.36% ($\tau_p = .7136$) when using the model. Using change scores from T1 to T4 helped reduce more errors and increase prediction.
Goal-setting was consistently shown to be a significant predictor ($b = 2.556$, $p = .013$) to distinguish adherents vs. non-adherents, when controlling for the other eight variables in the model. For one unit increase in goal-setting change scores, the odds of being in the adherents group increased by a factor of 12.890, $\text{Exp}(b) = 12.890$. When calculating the probability for being an exercise adherent, the final prediction model showed that when goal setting change equals to one point, the probability was 33.69%. The probabilities were 86.75% and 98.83% with scores of two and three, respectively. These findings were consistent with the results using changes scores from T1 to T3. This emphasized that goal-setting was a very strong predictor for exercise adherence at follow-up. Also, the T1-T4 change score had a better prediction than the T1-T3 score. This might suggest that the goal-setting ability, even after the intervention was concluded, was important for exercise adherence.

<table>
<thead>
<tr>
<th>Observed</th>
<th>Predicted</th>
<th>Percentage correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-adherent</td>
<td>Adherent</td>
</tr>
<tr>
<td>Non-Adherent</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Adherent</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Overall Percentage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Results: Mediation Analysis --- Goal-Setting and Planning

A Person Correlation analysis for the T1-T3 or T1-T4 change scores of all the nine significant variables (identified regulation, integrated regulation, intrinsic motivation, autonomy need satisfaction, perceived autonomy support, scheduling self-efficacy, coping self-efficacy, goal setting, and planning) indicated that there were significant inter-correlations among them (See Appendix M). Therefore, I conducted a series of mediation analysis to investigate the potential mediators (M) between the predictor (X) and the outcome (Y) --- adherent/non-adherent group. The mediation analysis was tested with a three-step regression procedure recommended by Baron and Kenny (1986). The group assignment is a categorical variable and dummy coded for regression analysis (non-adherent = 0; adherent = 1). The scores at post-intervention (T3) and follow-up (T4), as well as change scores from baseline to post-intervention (T1-T3) and from baseline to follow-up (T1-T4) were used in the mediation analysis.

The results of mediation analysis for the nine variables showed that most of the variables failed to satisfy the three-step regression analysis, except for goal-setting and planning. The relationship between scheduling SE at follow-up and adherent/non-adherent group was mediated by goal-setting and by planning at follow-up. When controlling for goal-setting, the direct effect of T4 Scheduling SE ($\beta = .773, p < .001$) on adherent/non-adherent group reduced ($\beta = .477, p = .034$) (see table 4.37 & figure 4.1).
Table 4.37  
Regression Equations of Mediation Analysis: Scheduling Self-Efficacy at Follow-up --- Goal-Setting at Follow-up --- Adherents/Non-Adherents Group

<table>
<thead>
<tr>
<th>Step 1: DV= T4 Goal Setting</th>
<th>Predictor</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4 Scheduling SE</td>
<td></td>
<td>0.438</td>
<td>0.102</td>
<td>.702</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 2: DV = adherent/non-adherent</th>
<th>Predictor</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4 Scheduling SE</td>
<td></td>
<td>0.241</td>
<td>0.051</td>
<td>.733</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 3: DV = adherent/non-adherent</th>
<th>Predictor</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4 Scheduling SE</td>
<td></td>
<td>0.157</td>
<td>0.068</td>
<td>.477</td>
<td>.034</td>
</tr>
<tr>
<td>T4 Goal-Setting</td>
<td></td>
<td>0.192</td>
<td>0.109</td>
<td>.365</td>
<td>.096</td>
</tr>
</tbody>
</table>

Note. Step 1: Regressed the mediator (goal-setting) on T4 scheduling self-efficacy; Step 2: Regressed adherent/non-adherent group on T4 scheduling self-efficacy; Step 3: adherent/non-adherent group on T4 scheduling self-efficacy and the mediator (goal-setting). T1= baseline; T2= mid-point; T3= post-intervention; T4= follow-up.

Figure 4.1  
Mediating Effects of Goal-Setting

![Mediating Effects Diagram]

Similarity, when controlling for planning, the direct effect of T4 scheduling SE (β = .773, p < .001) on adherent/non-adherent group membership decreased (β = .458, p = .022) (see table 4.38 & figure 4.2). The results suggested that there was a positive association between scheduling self-efficacy and exercise adherents (i.e., direct effect)
Table 4.38

Regression Equations of Mediation Analysis: Scheduling Self-Efficacy at Follow-up --- Goal-Setting at Follow-up --- Adherents/Non-Adherents Group

<table>
<thead>
<tr>
<th>Step 1:</th>
<th>Predictor</th>
<th>$B$</th>
<th>$SE$</th>
<th>$B$</th>
<th>$\beta$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV= T4 Planning</td>
<td>T4 Scheduling SE</td>
<td>0.319</td>
<td>0.087</td>
<td>.643</td>
<td>.002</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 2:</th>
<th>Predictor</th>
<th>$B$</th>
<th>$SE$</th>
<th>$B$</th>
<th>$\beta$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV = adherent/non-adherent</td>
<td>T4 Scheduling SE</td>
<td>0.241</td>
<td>0.051</td>
<td>.733</td>
<td>&lt;.001</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Step 3:</th>
<th>Predictor</th>
<th>$B$</th>
<th>$SE$</th>
<th>$B$</th>
<th>$\beta$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>DV = adherent/non-adherent</td>
<td>T4 Scheduling SE</td>
<td>0.150</td>
<td>0.060</td>
<td>.458</td>
<td>.022</td>
<td></td>
</tr>
<tr>
<td>T4 Planning</td>
<td>0.284</td>
<td>0.121</td>
<td>.429</td>
<td>.031</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Step 1: Regressed the mediator (goal-setting) on T4 scheduling self-efficacy; Step 2: Regressed adherent/non-adherent group on T4 scheduling self-efficacy; Step 3: adherent/non-adherent group on T4 scheduling self-efficacy and the mediator (goal-setting). T1= baseline; T2= mid-point; T3= post-intervention; T4= follow-up.

Figure 4.2
Mediating Effects of Planning

and goal-setting or planning could mediate the relationship. In other words, scheduling self-efficacy increases exercise adherence by enhancing the ability to set exercise goals and to plan for exercise (i.e. indirect effect).
Part III: Process Evaluations --- Feedback and Satisfaction

The results showed that the average scores for each question were more than 3.0, which suggested that the participants had good satisfaction overall. Noticeably, the lowest scores were for the SD group. The SD group, which had a weekly 90-minute session, scored low on the question of the class time (3.00 ± 1.247). They noted that a biweekly session or a shorter session would have been better. The SC group, which had a biweekly 45-minute sessions, comparatively had a higher scores on the class time (4.36 ± 1.027) ($p = .013$). Some other comments included adding nutrition information, follow-up exercise regimen, more social support and more time in practicing/discussing behavioral strategies (See Appendix J).
CHAPTER 5
DISCUSSION

Project CHANGE was a SDT-based exercise intervention in the theme of “Healthy at Every Size” (HAES) concept that aims to increase exercise participation for a healthy lifestyle change, instead of focusing on weight loss. The primary purpose of the study was to examine the effects of the intervention on physical activity (PA), fitness variables, and psychosocial variables in initially sedentary and overweight/obese women. The secondary purpose was to investigate the relationship among physical activity and psychological variables targeted in the intervention. In the follow-up analysis, we investigated which psychological variables were critical for exercise adherence and their relative importance.

Long-term PA participation has consistently shown to be important for the overweight/obese population. Silva et al. (2011) reported the results of a 1-year SDT-based intervention and a 2-year follow-up with 221 initially overweight/obese women and noted that 2-year moderate or vigorous exercise mediated 3-year weight loss and maintenance. Unick et al. (2010) also reported that exercise participation explained the most variance in >10% weight loss at 2-year in 170 overweight/obese women participating in a weight management program that included diet, exercise, and behavior modification. Therefore, an exercise intervention that is able to facilitate long-term PA participation for this population is necessary. A weight management program adopting
the concepts of SDT and HAES would be one of the approaches to help motivate overweight and obese women to start and maintain exercise behavior as a lifestyle change.

**Effect of Intervention vs. Exercise Adherence**

**Physical Activity and Exercise Adherence**

The first and second research hypotheses proposed that PA would increase over time for both groups and the increase in PA would be greater for participants in the SD group. Our data failed to support these two hypotheses. At the baseline, physical activity converted to total energy expenditure was significantly higher for the SDT group than the SC group, which implied randomization did not help to control the baseline PA differences. After using baseline PA as a covariate in the ANOVA procedure, none of the main effects on group, time, or interaction was significant. Noticeably, the effect size for the main effect on group was medium ($\eta_p^2 = .065$) and the effects size for time and the interaction were small ($\eta_p^2 = .017$ for time; $\eta_p^2 = .003$ for interaction), which suggest that the intervention failed to impact level of PA and the SD group maintained a higher level of PA than the SC group, regardless time.

Participants who continued to exercise and expended $\geq 1000$ Kcal/week at the follow-up were furthered categorized as exercise adherents. This PA threshold was determined by the CDC/ACSM’s recommendation (i.e., $\geq 150$ minute moderate activity or $\geq 1000$ Kcal/week), which has been associated with various health benefits. The follow-up analysis showed that 70% (7/10) of the exercise adherents were from the SD group while only 27% (3/11) were from the SC group. Although there were no statistical
differences over time between treatment groups on PA, the average time spent in
moderate and vigorous PA by the SD group was over the 150-minutes public health
dosage at mid-point and stayed over 150 minutes/week (baseline: 76.50 ± 46.55
min/week; mid-point: 202.70 ± 108.93 min/week; post-intervention: 196.80 ± 146.60
min/week; 4-week follow-up: 212.00 ± 122.25 min/week). On the other hand, the average
PA time for the SC group was below the public health recommendation during the whole
course of the study (baseline: 29.55 ± 39.40 min/week; mid-point: 112.45 ± 53.87
min/week; post-intervention: 121.00 ± 62.96 min/week; 4-week follow-up: 93.36 ± 53.47
min/week). Therefore, although the results failed to indicate significant differences in PA
change for the SD group and the SC group over time, there was still a significant, higher
percentage of exercise adherents in the SD group, compared to the SC group. The results
from the current study might imply that the SDT-based exercise intervention helped the
participants to reach the public health dosage by adopting more lifestyle physical activity
outside of the training sessions, but also prepared the participants with some behavioral
strategies, which were not provided in the traditional exercise group (i.e., SC group) to
stay active during the 8-week of the intervention period as well as 4 weeks after the
training was concluded. In order to further examine the effects of the intervention on PA,
a larger simple size matched on initial level of physical activity with longer follow-up is
needed.

**Fitness Variables**

The third research hypothesis proposed that body measurements, including BMI and
waist/hip ratio, would be the same or lower for the SD group. The fourth to sixth
hypotheses proposed that muscular strength, aerobic fitness and stair climbing PA would be better for the SD group. Our data indicated that there were no significant changes on these fitness variables, and therefore, did not support these hypotheses. However, the effect sizes of the interaction for BMI, VO2max, and stair-climbing were medium ($\eta_p^2 = .055 - .076$). Since the study was only 12-week long, it is possible that a longer duration was needed to see the significant changes on these fitness variables.

**SDT Variables**

**Motivational Regulation**

The seventh hypothesis proposed that autonomous regulation, including intrinsic motivation, integrated regulation and identified regulation, would be higher in the SD group and the eighth hypothesis proposed that controlling regulation, including introjected regulation and external regulation, would be lower in the SD group. Hence, the overall relative autonomy index would be higher for the SD group (i.e., the ninth hypothesis). However, these hypotheses were not supported since there were no significant main effects on group, time, or interaction for these regulatory variables, except for integrated regulation. Both groups significantly increased integrated regulation during the intervention and maintained around the same level during follow-up. Noticeably, when comparing the effect sizes for controlling regulation and autonomous regulation, the interaction effect on controlling regulation showed a medium effect size ($\eta_p^2 = .048 - .092$), while the effect size for autonomous regulation was small ($\eta_p^2 = .002-.018$). This could suggest that our SDT-based intervention (SD group) might have been more effective at reducing external motives for exercise, compared to the traditional
exercise intervention (SC group). When comparing our results to other exercise interventions, we found that Wilson et al. (2003) reported a higher group effect size in autonomous regulation than controlling regulation after their 12-week exercise intervention in a relatively healthy population. Silva et al (2010a) had a similar increase in more autonomous regulation in a 1-year SDT-based weight management program for overweight/obese women. These previous findings suggest that our intervention needed to provide more supports for fostering autonomous motivation and/or extend beyond our 8-week duration to see significant changes on these regulatory variables.

The SD group received an autonomous style of exercise training, and also had a weekly group meeting that focused on teaching various behavioral strategies and incorporated the “Healthy at Every Size” (HAES) concept. The HAES paradigm encourages overweight/obese individuals to value regular exercise and healthy eating and to feel confident about their ability to practice these behaviors by removing the external controls in a traditional weight loss approach, such as using weight loss as the only desired outcome and the life-long food restriction and obligation to exercise for weight management. Therefore, interventions using the HAES paradigm help their participants to see exercise and diet as ways to live a healthier life, instead of only as a means to lose weight; thus, the participants may be more likely to choose to sustain the healthy habits even after the intervention.

The medium effect sizes for the interaction effect in external regulation and introjected regulation are illustrated in profile plots (see Figure 5.1 and 5.2), which show a tendency for the SD group to decrease and the SC group to increase controlling
regulation during the intervention. The effect size of the interaction was medium, but not statistically significant. Therefore, the behavioral meetings in the SD group might have helped to decrease more controlling regulation, since the SC group, the traditional exercise group, showed a tendency to increase introjected and external regulation.

**Figure 5.1**
*Profile Plots for External Regulation*

![Profile Plot for External Regulation](image1)

*Note. Baseline values were used as a covariate. 0.80 for the SC group; 1.43 for the SD group.*

**Figure 5.2**
*Profile Plots for Introjected Regulation*

![Profile Plot for Introjected Regulation](image2)

*Note. Baseline values were used as a covariate. 1.58 for the SC group; 1.97 for the SD group.*
Edmunds et al. (2008) examined the effects of a SDT-based teaching style compared to typical teaching style on exercise class participation with 56 university students for 10 weeks. There was no behavioral meeting in this study. The researchers found both the SDT and control exercise groups increased introjected regulation, decreased amotivation, and had no change on any autonomous regulation. The researchers explained that perhaps being around social pressure regarding physical appearance became more prominent over the 10-week exercise sessions. This was consistent with the tendency to increase introjected regulation we found in the traditional exercise group (SC group). The issues regarding social pressure and physical appearance might be more critical for overweight/obese women in whom the poor body image and body size satisfaction was usually observed. Schwartz and Brownell (2004) reported that obesity is associated with poor body image. However, not all the overweight or obese individuals are vulnerable to body image problems. The risks are associated with degree of overweight/obesity, being female, binge eating and additional factors. Hence, modifications in an exercise intervention for overweight/obese individuals, especially women, could be necessary, such as providing a secure and friendly exercise environment or adopting home-exercise plans. This might further suggest that a typical gym-based exercise intervention, without any cognitive-behavior change element, might increase introjected regulation, at least in the short-term, through social pressure and attention to physical appearance. Hence, a weight management program incorporating a cognitive-behavioral intervention and the HAES paradigm could help to decrease controlling regulation and gradually increase autonomous regulation to enhance exercise adherence in the long run.
However, our 8-week intervention failed to show any significant effect on autonomous regulations, except for integrated regulation. Being in an exercise intervention helped both groups developed integrated regulation over time. It might be possible that just having a novel experience in an exercise intervention as well as having social attention with exercise professionals helped these sedentary overweight/obese women develop their sense of exercise identity/ego in the short-term, regardless of their group assignment. For intrinsic motivation, the effect sizes for group, time and interaction were small. This is consistent with previous literature. Edmunds et al. (2006) found that intrinsic motivation was not a significant predictor of exercise after controlling for other regulations in their regression analysis. They suggested that intrinsic motivation may not be the most important predictor in the exercise domain. People might not exercise purely for intrinsic motivation when considering all the commitments it entails.

Furthermore, some research indicated that overweight/obese individuals reported a significant higher decline in pleasure when exercising with an imposed intensity that was 10% higher than self-selected intensity (Ekkekakis & Lind, 2006). It was possible that the SC group, which followed a progressive prescribed traditional exercise plan, could have experienced negative affect and therefore, impeded development of intrinsic motivation. Self-selected exercise intensity using ratings of perceived exertion that was implemented in the SD group might be more appropriate to provide a pleasurable exercise experience and foster exercise adherence for overweight/obese women.

Overall, the effect of this SDT-based intervention on motivational regulation was not statistically significant. However, results of the effect size might indicate that the
SDT-based intervention, combined with exercise training and behavioral meetings, might have had some effect on controlling regulation. It might take longer than 8-weeks to facilitate internalization and foster autonomous regulation, especially since new exercisers need time to experience positive feedback, such as gaining confidence in overcoming exercise barriers, increasing stamina, or controlling blood pressure, from their exercise experience, which could help to internalize external motivation. For example, facilitating internalization to increase autonomous regulation might take longer while decreasing external regulation could be easier to achieve in a shorter time frame. Rodgers et al (2010) reported that after 8-weeks of exercise training, initiate exercisers increased identified and intrinsic motivation, which may be necessary for exercise adherence. However, compared to regular exercisers, initiate exercisers showed more variability and less stability in their autonomous motivation. Furthermore, after up to six months, the initiate exercisers were still not similar to regular exercisers in levels of identified and intrinsic motivation. The researchers summarized that initiate exercisers might not develop stable autonomous motivation to enhance adherence after beginning an exercise program for 6 months. Further research is needed to examine the time it takes to change SDT variables.

**Psychological Needs Satisfaction**

The 10th hypothesis proposed that psychological needs satisfaction (i.e., autonomy, competence, and relatedness) would be higher for the SD group. Similarly, our data failed to support this hypothesis since none of the effects on group, time, and interaction was statistically significant. Noticeably, the group effect of autonomy showed a medium –
large effect size ($\eta_{p}^{2} = .111$), which indicates that the SDT-based intervention might have had a greater impact on autonomy need satisfaction than the exercise only intervention. The effect size for the group effect on relatedness was medium ($\eta_{p}^{2} = .051$), but the SC group had a tendency to have a higher sense of relatedness than the SD group. Since the SC group received a bi-weekly 45-minutes exercise session and the SD group met once a week for 90 minutes, the frequency of group contact might have had a stronger impact on relatedness, rather than the total duration of social contact. Controlling for frequency of contacts might be necessary in future investigations.

For competence need satisfaction, the effect size of the intervention was small ($\eta_{p}^{2} = .007$ for group effect; $\eta_{p}^{2} = .011$ for time effect; $\eta_{p}^{2} = .009$ for interaction effect) and not significant. This indicates that the SDT-based exercise intervention failed to strongly influence competence need satisfaction. Since both groups received exercise training in this study and mastery experience is a strong source of self-efficacy or competence, the intervention effects on competence need satisfaction for both groups might be similar. This finding was consistent with the results for self-efficacies (SE), especially that group effect for task SE was not significant. In Edmunds et al.’s (2008) interventional study of 56 participants enrolled in exercise classes, competence was the only psychological need that significantly increased over the 10 weeks of exercise training for the typical exercise group (i.e., control group). The authors explained that if the exercise task were not too complex, being in an exercise program would increase a sense of competence. For the SDT group with an autonomous style instructor, relatedness and competence need satisfaction increased at a significantly faster rate over time compared to the control.
group. Our study did not have sufficient power to show a significant intervention effect on psychological needs satisfaction. But when considering the medium to large effect size on autonomy, the SDT-based intervention might have influenced the participants’ autonomy need satisfaction more than the exercise-only group.

**Perceived Autonomy Support**

The 11th hypothesis proposed perceived autonomy support would be higher in the SD group. Our data failed to support this hypothesis since there was no significant group or interaction effect. But the analysis indicated that perceived autonomy support significantly increased over time for both groups, but the increment, comparing to mid-point, was not significant until 4-week follow-up. The increase in perceived autonomy support could be influenced by just attending the exercise intervention, regardless of group assignment. It was possible that the researchers provided an autonomy supportive climate that was similar for both groups, although during exercise training, the SC group had to follow their prescribed exercise program (i.e., less autonomous), while the SD group used self-selected exercise intensity using RPE at the range of moderate effort (i.e., more autonomous). Even though a facilitator using an autonomous instructional style led the group meetings to help the SD group learn and practice behavior strategies and increase exercise participation, the results still suggested that the manipulation of low vs. high fidelity of autonomy support for the SC group vs. the SD group was not successful. Another reason for the lack of group difference may be a function of the ceiling effect. Scores could range from 0 to 7, and the mean scores for both groups at the three time-
points were all close to the maximum score (mid-point = 6.2 ± 0.779; post-intervention = 6.3 ± 0.680; follow-up = 6.52 ± 0.596).

Silva et al.’s (2010) study indicated the SDT treatment group received a more autonomy supportive treatment climate. Also, Edmunds et al.’s (2009) study demonstrated that an autonomous teaching style instructor was able to manipulate social-contextual variables, including autonomy support, structure, and interpersonal involvement, to foster exercise participants’ perceived autonomy support and then facilitate adaptive motivational processes and outcomes. Our study also showed that an autonomy style facilitator could help participants to enhance autonomy support regardless of group assignment. These findings suggest that perceived autonomy support could be influenced by the instructional style. However, in order to further investigate the intervention effects on participants’ perceived autonomy support, the degree of autonomy climate provided in the intervention needs to be more strictly defined and manipulated. Independent observers to evaluate the facilitators’ instructional style with participants might be necessary.

Other Psychological Variables

Self-Efficacy

The 12th hypothesis proposed that task, coping and scheduling self-efficacy would be higher in the SD group. Our data only partially supported this hypothesis since there was only a significant group effect for scheduling self-efficacy, but not task and coping self-efficacy. The SDT-based exercise intervention significantly enhanced the participants’ confidence in scheduling exercise into their life and might have some
positive influences on overcoming barriers and completing exercise tasks correctly.

When considering the effect size, task \( \eta_p^2 = .056 \) and coping \( \eta_p^2 = .077 \) self-efficacy both showed a medium group effect, though, without statistical significance. The observed low effect size for group for task self-efficacy was reasonable; especially, there was no “true” control group, which has no intervention (e.g., waiting list control group) in this study design. The SC group received a traditional exercise program, including an individualized exercise plan and exercise supervision. Participants in the SC group could have enhanced their task self-efficacy by mastery experiences and oral feedback during the exercise sessions.

**Self-Regulation**

The 13th hypothesis proposed that goal-setting and planning would be higher in the SD group. Our data failed to support this hypothesis since there was not a significant group effect on either of them. We did observe that goal-setting significantly increased for both groups over time and exercise planning also had a tendency to increase, but not significantly. For the SC group, even if they only received exercise training, without any group meetings focusing on behavioral strategies, the participants were still given exercise log sheets and public health PA guidelines, which recommended 150 minutes moderate-activity each week. It was possible that these tools facilitated the goal-setting and planning for some participants, and therefore, decreased the statistical power to detect the group difference on these two variables. The effect sizes for group effect on goal-setting \( \eta_p^2 = .095 \) and planning \( \eta_p^2 = .128 \) were medium to larger. A larger
sample size or a control group that did not receive any behavioral tools (i.e., increasing treatment effect size) could help to increase statistical power.

On the other hand, the findings may suggest that simply giving participants some self-regulatory tools, such as log-sheets and exercise prescription/guideline, (i.e., the SC group) could increase the participants’ ability to set goals and plan for exercise, at least in the short-term. Behavioral meetings that focus on providing more details of the goal-setting and planning process, complimented with training in other behavioral skills, like problem-solving and relapse prevention, might enhance participants’ ability and competence (i.e., regulatory self-efficacy) in goal-setting and planning for the long term and therefore increase exercise participation and adherence.

**Depressive symptoms**

The 14th hypothesis proposed that depressive symptoms measuring by CESD-10 would be the same or lower for the SD group. Our data failed to support this hypothesis since the SD group had a higher score of CESD-10, but the difference was not significant. However the effects size was large ($\eta^2_p = .175$). Because the exercise intervention was not designed for alleviating depressive symptoms, we did not expect to see significant changes on the CESD-10 scores. However, greater depressive symptoms in the SD group and a corresponding large group effect were interesting. This suggests that the participants randomized in the SD group might have had more stress, which was reflected in a higher score on depressive symptoms. The theory of physical activity maintenance (PAM) (Nigg, Borrelli, Maddock, & Dishman, 2008) proposes that life stress could decrease personal resources used for PA participation and increase negative
affect, such as depression and anxiety, which hamper motivation to engage in an active lifestyle. Stress also has physiological impact on our immune and endocrine systems, which could lead to fatigue and lack of energy and cause physical weakness and lower ability to be active. Also, the PAM suggests that life stress could have a negative influence on goal-setting and achievement. Therefore, it was possible that the intervention effect was attenuated for participants with a more challenging, stressful life and/or with more depressive symptoms.

Quality of Life: SF-36

The 15th hypothesis proposed that quality of life (i.e., physical functioning, role limitations due to physical health problems, social functioning, bodily pain, general mental health, role limitations due to emotional problems, vitality, and general health perceptions) would be the same or higher for the SD group. Our data barely supported this hypothesis since there was no significant interaction, group, or time effects for the total SF-36 scores, mental components and physical components. However, when examining each dimension of SF-36 scale, bodily pain (BP) showed a significant interaction effect, social functioning (SF) showed a significant time effect, and role playing due to emotional health (RE) showed significant interaction and group effects. The effect size for the group effect was large for the total score ($\eta_p^2 = .086$) and mental components ($\eta_p^2 = .185$) and was small for physical components ($\eta_p^2 = .029$).

Interestingly, the SC group had higher SF-36 summary scores than the SD group, although the group difference was not significant. The results suggest that the SD group might have had a lower quality of life, especially psychological well-being, during the
intervention course for reasons outside of the study that were not non-investigated. This finding was consistent with the results of more depressive symptoms in the SD group.

We further examined the four dimensions of mental components, including general mental health (GH), role limitations due to emotional problems (RE), vitality (VT), and social functioning (SF). Noticeably, effect size for the group difference was medium ($\eta_p^2 = .049$ for SF) to large ($\eta_p^2 = .109$ for VT; $\eta_p^2 = .168$ for MH; $\eta_p^2 = .236$ for RE), even thought the majority of difference failed to reach statistical significance. This again suggests that the SD group tended to have poorer quality of life scores than the SC group.

For the significant interaction and group effects of role playing due to emotional health (RE), overall, the SC group had a higher function of role playing (i.e., RE scores) than the SD group which again demonstrated that a better mental health in the SC group. Also, the significant simple effects of time for the SD group showed that the RE scores significantly decreased from mid-point to post-intervention, while the SC group increased the RE scores, but not significantly.

On the other hand, the four dimensions of physical components, which are physical functioning (PF), role limitations due to physical health problems (RP), bodily pain (BP), general perceived health (GH), did not have significant group effects, and the effect size was small or large ($\eta_p^2 = .176$ for general health). It was possible that the exercise interventions did not have influential impacts on these physical components in the short-term.
For the significant interaction of BP, the simple effect analysis of changes over time for each group indicated large effect sizes with a decrease for SD and an increase for SC (SC: $\eta_p^2 = .106$; SD: $\eta_p^2 = .104$), but no statistically significant differences were found. The large effects may imply that the SD group gradually reported decreasing body pain compared to reports of the SC group, which might be a positive outcome from the intervention.

In the follow-up analysis with adherent/non-adherent groups, we hoped to see if any dimension of SF-36 was critical to exercise adherence. Unfortunately, none of the 8 dimensions or 3 summary scores showed a significant group effect and the majority of the effect sizes was small. It is worth mentioning that the effect sizes for group effects on general health ($\eta_p^2 = .039$), vitality ($\eta_p^2 = .098$) and social functioning ($\eta_p^2 = .102$) were medium to large. This might infer that exercise adherents tend to have better general health, vitality and social functioning.

**Summary: Effects of Intervention**

After 8-weeks of the intervention and 4-weeks of follow-up, the weekly energy expenditure did not differ significantly between the groups. The effect of the intervention on level of physical activity was the same for both groups. Noticeably, the majority of the participants in the SDT-based intervention remained active and met the public health recommendation for PA at the 4-week follow-up, although the group difference on PA participation failed to be significant. We did find some changes in the psychological variables. For both groups, integrated regulation, perceived autonomy support, and
exercise goal-setting significantly increased over time. Exercise planning had a tendency to increase, but not significantly ($p = .058$). Scheduling self-efficacy was significantly higher in the SD group than the SC group, regardless of time. Our findings suggested that the SDT-based intervention could have impacts on some psychological variables important to exercise participation. A higher fidelity of SDT intervention plus a larger sample size could increase power to examine the treatment effects.
Psychological Variables and Exercise Adherence

The total sample (N = 21) was used in the Pearson’s correlation analysis to investigate which psychological variables were important for PA participation at the 4-week follow-up (defined as exercise adherence in previous discussion). In the follow-up analysis, participants who continued to exercise and expended ≥ 1 000 Kcal/week at the follow-up were categorized as exercise adherents regardless of their intervention group. An ANOVA procedure was conducted to determine which psychological variables were different for exercise adherents. These statistical procedures evaluated each psychological variable to explain exercise adherence at a univariate level, without considering any shared variance and inter-correlation among the predictors. In order to further investigate the relative importance among the significant predictors, a multivariate analysis (i.e., logistic stepwise regression) was conducted. The following sections summarize each proposed hypothesis according to the potential predictive psychological variables. Additional follow-up analysis using adherent/non-adherent group in the ANOVA are combined in each section. Finally, the results of logistic stepwise regression are discussed.

SDT Variables

Motivational Regulation

The 16th and 21th hypotheses proposed that there would be a positive relationship between scores and change scores of autonomous regulation and follow-up PA. Our data support these hypotheses since intrinsic motivation, integrated regulation and identified
regulation at post-intervention and/or 4-week follow-up, were significantly positively associated with follow-up PA. The 17\textsuperscript{th} and 22\textsuperscript{th} hypotheses proposed that there would be a negative relationship between scores and change scores of controlling regulation and follow-up PA. Our data failed to support these hypotheses since the associations found were positive and none of them was significant. The 18\textsuperscript{th} and 23\textsuperscript{th} hypotheses proposed that there would be a positive relationship between scores and change scores of relative autonomy index and T4 PA. Our data did not indicate a significant positive correlation and therefore, failed to support these hypotheses. In the follow-up analysis with adherent/non-adherent groups, the results indicated that the exercise adherents had significantly higher intrinsic motivation, integrated regulation, and identified regulation.

The positive association between autonomous regulation and exercise adherence was noticed in our relatively short 12-week study. Silva et al. (2010) conducted a 1-year SDT-based behavior change intervention for overweight/obese women. The control group only received 1-year of thematic course meetings, which covered topics not directly related to exercise, such as nutrition, stress management and so on. The researchers reported that the SDT group had higher PA participation and also had significantly higher autonomous regulation at 12 months. Furthermore, the group differences in autonomous regulation at 4 months were accentuated at 12 months. These findings again emphasized that longer duration SDT-based interventions that facilitate autonomous motivation could benefit overweight/obese women and promote better exercise adherence. In summary, in our study, intrinsic motivation, integrated regulation and identified regulation were all strongly correlated with exercise adherence at a
univariate level, and intrinsic motivation seems to be most influential for exercise adherence.

**Psychological Needs Satisfaction**

The 19\textsuperscript{th} and 24\textsuperscript{th} hypotheses proposed that there would be a positive relationship between scores and change scores of psychological needs satisfaction (i.e., competence, autonomy, and relatedness) and follow-up PA. Our data partially support the hypotheses since only autonomy at post-intervention, but not any change scores, was significantly positively associated with follow-up PA. The results suggested that autonomy had a greater association with follow-up PA, followed by competence and relatedness.

In the follow-up analysis using exercise adherent/non-adherent groups, the results indicated that exercise adherents had a significantly higher autonomy need satisfaction, but no different competence and relatedness. Although without statistical significance, exercise adherents still tended to have a higher level of competence ($\eta_p^2 = .085$ for medium effect size). This finding was consistent with our correlation analysis and SDT literature, which suggest that competence and autonomy are important to exercise adherence. In Barbeau et al.’s (2009) longitudinal observational study in 118 undergraduate students (37 men, 55 women, and 2 unspecified), they found that competence, autonomy, and relatedness were all significantly correlated with PA participation 1 month later. Wilson and Rodger (2008) used a prospective design to examine the role of psychological needs satisfaction in regulating exercise motivation. Participants (34 men and 257 women) were staff or students enrolled in aerobic classes at a university. They found that increments of psychological needs satisfaction, especially
competence and autonomy, were positively associated with more self-determined motivation. This suggests that perceived competence and autonomy were more important than relatedness to enhance exercise motivation.

Our results indicate that autonomy, and perhaps competence, was an important predictor of exercise adherence. Since the majority of our female participants were full-time workers living with spouse/children, and thus had multiple demands on their time, a sense of choicefulness (i.e., autonomy) for their exercise routine could be especially critical for exercise adherence. Interestingly, the influence of relatedness on exercise adherence was not evident in our study, although previous literature suggested that social support is an important factor for exercise adherence, especially for women. A longer study might be necessary to examine its effect, or it might be possible that relatedness need satisfaction is not that critical for adherence, at least in the short-term.

**Perceived Autonomy Support**

The 20th and 25th hypotheses proposed that there would be a positive relationship between scores and change scores of perceived autonomy support and follow-up PA. Our data failed to support these hypotheses since none of the correlations was significant. In the follow-up analysis with adherent/non-adherent groups, adherents perceived significantly more autonomy support than non-adherents. The insignificant correlations might be caused by less variance among the participants due to the ceiling effect that I discussed previously. The result from ANOVA analysis was consistent with the previous conclusion that autonomy needs satisfaction could be important for overweight/obese women with full-time jobs and family obligations. In the line with SDT, Silva et al.’s
(2010a & 2010b) findings of a SDT-based exercise and weight management program for 239 overweight women supported the SDT propositions: perceived autonomy support helped to enhance the psychological needs satisfaction, which facilitated autonomous motivation and exercise adherence.

**Other Psychological Variables**

**Self-Efficacy**

The 26th and 29th hypotheses proposed that there would be a positive relationship between scores and change scores of self-efficacy (i.e., task, coping, and scheduling self-efficacy) and follow-up PA. Our data partially support these hypotheses. Scheduling SE at post-intervention and follow-up showed a strong and positive correlation with follow-up PA. Coping SE at follow-up and its change score from baseline to follow-up had a significant positive correlation with follow-up PA. The results suggest that scheduling SE and coping SE had a stronger association with PA than task SE. In the follow-up analysis with adherent/non-adherent groups, exercise adherents had a significant higher scheduling self-efficacy ($p < .001; \eta_p^2 = .557$) and coping self-efficacy ($p = .037; \eta_p^2 = .220$) than non-adherents.

These findings again emphasized the importance of self-regulatory self-efficacies for exercise adherence, which is consistent with the literature. Rodgers et al. (2008) found scheduling and coping SE were significantly different in regular exercisers, nonexercising intenders and nonexercising nonintenders, while task SE failed to distinguish exercisers from nonexercising intenders in their cross-sectional study of college students. In another longitudinal study, they also reported both coping and
scheduling SE increased over a 12-week period, while task self-efficacy did not change. However, they failed to evaluate exercise participation in this longitudinal design. Therefore, our study provides more evidence that scheduling and coping self-efficacy help to increase exercise adherence.

**Self-Regulation**

The 27th and 30th hypotheses proposed that there would be a positive relationship between scores and change scores of self-regulation (i.e., goal-setting and planning) and follow-up PA. Our data supported these two hypotheses. Both goal-setting and planning showed a strong, significant association with follow-up PA. These findings indicated that goal-setting and planning were the most consistently significant predictors among all the psychological variables and were critical for exercise adherence at an univariate level. Also, in the follow-up analysis with adherent/non-adherent groups, exercise adherents had significant higher scores for goal-setting and planning. Along with the results for scheduling and coping self-efficacy, these findings demonstrated that learning and practicing self-regulatory strategies and gaining confidence in these strategies were critical for exercise adherence. More discussion about goal-setting and planning will be presented.

**Depressive Symptoms: CESD**

The 28th and 31st hypotheses proposed that there would be a negative relationship between scores and change scores of CESD and follow-up PA. Our data failed to support these hypotheses since these negative correlations were not significant. In the follow-up analysis with adherent/non-adherent groups, we did not find significant effects for group,
time, and interaction. However, the effect sizes for interaction ($\eta^2_p = .087$) and group ($\eta^2_p = .046$) were medium to large. The exercise adherents tended to have less depressive symptoms, when compared to non-adherents. Also, depressive symptoms of exercise adherents had a tendency to decrease over the 12-week period and were lowest at the 4-week follow-up. Conversely, the non-adherents tended to increase depressive symptoms and reached their maximum measured depression scores at the follow-up. This interesting finding provides some direction to further examine the role of stress/depression in exercise adherence, as proposed in the theory of physical activity maintenance (Nigg et al., 2008)

**Conclusions**

In summary, we found some significant psychological predictors of exercise adherence in the univariate procedures, including intrinsic motivation, integrated regulation, identified regulation, autonomy need satisfaction, perceived autonomy support, coping self-efficacy, scheduling self-efficacy, goal-setting and planning. For these sedentary overweight/obese women working or studying in a mid-western university community, the confidence and ability to schedule and plan their exercise, as well as a sense of choicefulness (i.e., autonomy) could increase their chance of adhering to regular exercise. Also, a more autonomous motivation might also be associated with exercise adherence. This current study provided some promising suggestions that exercise professionals using a more autonomous style to facilitate the psychological needs satisfaction may be able to foster exercise adherence in sedentary, overweight/obese women. Also, some self-regulatory behavioral strategies like goal-setting and planning
need to be addressed in the intervention. Future research needs to address the time courses for changes in specific components of the SDT. For example, if changes of controlling regulation comes first and then autonomous regulation or vice versa or how long until changes in autonomous regulation can be detected. The philosophy of the “Healthy at Every Size” paradigm as a non-traditional weight management approach is in line with SDT and could help to facilitate autonomous regulation.

**Exercise Goal-Setting vs. Exercise Adherence**

The results of the two logistic regression models, including the nine psychological variables discussed above, indicated that goal-setting was consistently shown to be a significant predictor to distinguish adherents vs. non-adherents. If participants had increased their scores by two points from baseline to post-intervention or to follow-up, their probability of being in the exercise adherent group was 81.63% or 86.75%, respectively. This indicates that if participants learned and practiced goal-setting skills to a level that could increase two points in the goal-setting scale at the post-intervention or follow-up evaluations, they would have a higher chance, at least 80%, to become exercise adherents compared to not increasing goal-setting skills. In another words, goal-setting would be an important predictor for exercise adherence. Furthermore, using change scores from baseline to follow-up helped reduce more errors and improved prediction compared to change scores from baseline to post-intervention. This might suggest that goal-setting ability after the intervention was concluded was important for exercise adherence. Furthermore, the self-management skill of goal-setting seems to be
more critical than other psychological variables for predicting exercise adherence in this current 12-week study.

Saelens et al. (2000) conducted a cognitive-behavioral PA intervention with a 2-year follow-up in a sample of 256 college-age participants (55.5% women). The results demonstrated that the use of self-management strategies, such as self-monitoring, goal-setting, self-talk, and relapse prevention, was higher for women compared to men. Also, use of self-management strategies was positively correlated to women’s overall PA participation at post-intervention, 1-year and 2-year follow-up, but these relationships were not found for men. Saelens et al. (2000) suggested that goal-setting may be a potent strategy to help women maintain exercise behavior since they found frequency of goal-setting accounted for 5.1% of women’s PA at the 2-year follow-up. Dishman et al. (2009 & 2010) examined the effects of 12-week worksite interventions based upon goal-setting theory. They reported that participants who set higher goals and had higher self-efficacy, commitment and intention about attaining their goals had a greater increase in PA. Also, the increase in self-set goal mediated the relationship between the change in participants’ satisfaction with current PA and the improvement in PA. The findings of goal-setting in this current study were consistent with previous research. The cumulative evidence suggests that goal-setting may be one of the most influential predictors of exercise adherence. Therefore, a physical activity intervention based on theories of goal-setting that emphasizes self-regulation techniques might help participants to adopt and maintain PA.
However, it must be noted that there were some multi-collinearity issues among these psychological variables, which shared the same variance to a certain degree since some psychological variables measured similar constructs (e.g., identified regulation and integrated regulation or goal-setting and planning) or some were related to each other (scheduling self-efficacy and goal-setting). The severity of multicollinearity was assessed with the Variance Inflation Factor (VIF), and we found that identified regulation (VIF = 4.367), integrated regulation (VIF=7.217), scheduling self-efficacy (VIF=5.358) and goal-setting (VIF=9.834) had multi-collinearity concerns. It was possible a higher collinearity problem with goal-setting masked the influence of the other variables, especially planning.

**Mediation Analysis: Intervention, Psychological Variables, and PA**

The 32th hypothesis proposed that changes in any of the significant psychological variables from baseline to end-point would mediate the effect of the intervention on follow-up PA. Unfortunately, there was no significant intervention effect on PA or on the majority of the psychological variables. Hence, our data failed to indicate any mediating effects of psychological variables.

In the follow-up analysis, a series of mediation analyses was conducted to investigate potential mediating effects among the nine significant psychological variables on adherence defined by membership in adherent/non-adherent group. We found that only goal-setting and planning had mediating effects. The results suggested that there was a positive association between scheduling self-efficacy and exercise adherence (i.e., direct effect) and goal-setting or planning partially mediated this relationship. This might
infer that having a sense of confidence about putting exercise into a daily routine would help individuals adhere to exercise, but goal-setting and planning ability would further enhance these regulatory self-efficacies and foster better exercise adherence. This finding again emphasized the importance of goal-setting and planning ability.

Rhodes and Pfaeffli (2010) reviewed 22 theory-based PA interventions, published during 1998 to 2008, in adult non-clinical populations. They found half of the interventions failed to show an intervention effect on PA. The remaining studies reported that interventions had impacts on proposed mediators, but only six of them examined the mediating effects. The researchers summarized the mediators from the six studies into four groups: (1) self-efficacy/perceived control, (2) outcome expectation, (3) self-regulation constructs, and (4) social constructs, and concluded that self-regulation constructs may have the most effect on changes in PA. The mediating effects of self-efficacy and outcome expectation constructs were shown to be trivial in limited studies. Therefore, self-regulation techniques seem to be critical to include in an exercise intervention. Also, the researchers recommended increasing fidelity of interventions to enhance intervention efficacy. More interventional studies including mediation analysis are necessary to help us understand the mechanism of PA behavior change.

In this current study, although there were some associations among SDT variables or between SDT variables and self-regulation constructs, we did not find any other mediation. It would be interesting to examine if there was any SDT variables, especially autonomous regulation, that could mediate the effects of self-regulation or self-efficacy on exercise adherence. If we had found such relationships, we might have been able to
infer that having self-regulation techniques were associated with exercise adherence, but having more autonomous regulation could further enhance the relationship. More research is necessary to investigate this interesting point. Since the intervention effect in this current study might be too small to change the psychological variables significantly, and the small sample size was small (N = 21), it was not easy to investigate mediation among the variables. In the future, an intervention with higher fidelity and/or a larger sample size would be more appropriate to investigate mediation among variables using path analysis or structural equation modeling.

**Limitations**

Some limitations of the current study need to be addressed. First, internal consistency of exercise planning scale was low (Cronbach’s α = .346 ~.622). We might need to be more conservative about the conclusions drawn from exercise planning scale since the scale was not quite reliable. Second, frequency and duration of the intervention sessions were not controlled in this study (SD group: 90-minute weekly meeting; SC group: 45-minute biweekly meeting). Instead, we controlled the total training time for both groups in order to make social contacts equal. However, in the process evaluation, the SD group had a significantly lower satisfaction with the class time compared to the SC group, and this might have affected some psychological variables. Third, there was no “true” control group, such as waiting-list control group, in the current study design. The SC group received traditional exercise training and was supplied with a prescribed exercise plan and log sheets. The SD group received a traditional exercise program plus a cognitive-behavioral intervention. Therefore, since the SC group (i.e., control group) still
received some self-regulatory tools and autonomy support, it was more difficult to conclude that any group differences were mainly from the behavioral intervention. Perhaps, an exercise intervention without supplying any log sheets or facilitating any behavioral strategies, or even a “true” control group who do not receive any active intervention, could help to examine the “true” effectiveness of a behavioral intervention. However, in reality, having a “true” control group would be more challenging in a behavioral study. Fourth, due to limited resources and time, the class facilitator had to conduct interventions and evaluations for both groups. A double-blinding design could be less biased. Fifth, we used self-report questionnaires to measure physical activity. A more objective measurement, such as pedometers or accelerometers, could help to establish more valid PA data. Sixth, the intervention occurred during autumn and winter, which might increase mental and physical challenges (e.g., get sick more easily in cold weather) for the initially sedentary participants. Seventh, it was possible that we failed to include some important variables such as social support from friends and family, and personality, that affected participants’ exercise behavior and their attitudes, beliefs, and behavioral skills. For example, personality traits, like extraversion, might play a role in responds to different exercise intervention strategies. Finally, the sample was relatively small compared to many exercise intervention studies. This could be the main reason that most of the variables failed to show significant changes while the effects size was rather medium to large and the observed power was low for the non-significant variables.
Summary and Recommendations

Project CHANGE was an 8-week SDT-based exercise intervention, including exercise training and behavioral sessions using the HAES paradigm, for sedentary, overweight or obese women. The majority of the participants in the SDT-based intervention was more active than the comparison group at baseline and remained active and met public health PA recommendations at the 4-week follow-up, although later group differences on PA participation failed to be significant. For a follow-up analysis, participants were grouped according to meeting public health recommendations 4-weeks after the intervention was over. The exercise adherents, regardless of the initial group assignment, had higher autonomous motivation (i.e., intrinsic motivation, integrated regulation, and identified regulation), scheduling and coping self-efficacies, and self-regulatory techniques (i.e., goal-setting and planning) compared to women who did not meet the PA criteria. Confidence and ability to self-regulate were important for exercise adherence, and goal-setting seemed to be the most influential predictor among these variables in this short-term study. The results showed promising evidence to test Project CHANGE in a larger and longer study to help overweight or obese women start and further maintain exercise behavior. A higher fidelity SDT intervention with larger sample size would be necessary to examine the treatment effect and the proposed SDT causal pathways.
REFERENCES


APPENDIX A

Recruitment Flyer
**PROJECT CHANGE**

To being a Confident, Healthy And Goal-directed Exerciser!

Exercise Research Program for Overweight Women

Do you want to start exercise and feel healthy?

Is your exercise plan on and off?

This is your chance to **CHANGE** now!!

**Volunteers needed for Exercise Behavior Change Program!**

<table>
<thead>
<tr>
<th>Volunteers should be...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
</tr>
<tr>
<td>Age 18-65</td>
</tr>
<tr>
<td>Body Mass Index 25-34.9</td>
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<tr>
<td>Non smokers</td>
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<tr>
<td>Not pregnant and not planning to get pregnant in the next 4 months</td>
</tr>
<tr>
<td>Free of any medical condition that could prevent exercising safely</td>
</tr>
<tr>
<td>Not exercising or in any exercise intervention within the past 3 months</td>
</tr>
</tbody>
</table>

If you meet these criteria, you could be eligible for the Project CHANGE.
For further information, please contact:

**Ya-Ting Hsu**
(352) 871-3260 or hsu.224@osu.edu

**Janet Buckworth, PhI**
(614) 292-0757 or buckworth.1@osu.edu

**PAES Building, Health and Exercise Science**
School of Physical Activity and Educational Services
305 West 17th Avenue, Columbus, OH 43210

The Project CHANGE will take place on the campus of
THE OHIO STATE UNIVERSITY
IRB Protocol 2010H0197
APPENDIX B

Eligibility Verification Checklist and Screening Telephone Script
Thank You for Your Interest in the Project CHANGE!

We are glad that you are interested in possibly participating in the project “to being a Confident, Healthy And Goal-directed Exercise” (CHANGE). My name is Dr. Janet Buckworth and I am the principal investigator for this study. We need to get some important information from all volunteers who are interested in participating in the study.

The questions on this and the following pages help us determine if you will be eligible to participate in the study so please complete each question as accurately as possible. Members of the project staff may need to contact you to verify information on these questionnaires or to schedule an assessment if you are eligible for participation. So, please list your name, email, preferred phone number to contact you at, and best time to reach you below.

Name: __________________________ ID number: __________ (assigned by staff)

Email: __________________________ Phone #: __________________________

Date: __________

Please check the best time of day to reach you by phone:

Mornings: □ 8:00-10:00am □ 10:00-noon
Afternoons: □ Noon-3:00pm □ 3:00pm-6:00pm
Evenings: □ 6:00-9:00pm

We believe the project CHANGE will help you feel healthy and more confident with your exercise plan. We hope you that you will participate in our important study!
Inclusion Verification: asking on the phone or via emails/fax/mails

The questions that follow will ask for some information about your personal information and health which will help to decide if you are eligible to this study. Please answer them as completely as possible. Thank you very much.

I. Demographic and Medical information:
   - Height: __________feet__________inches
   - Weight: __________ lbs

<table>
<thead>
<tr>
<th>Please check the items best describe you:</th>
<th>YES</th>
<th>NO</th>
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</thead>
<tbody>
<tr>
<td>1. Are you a female?</td>
<td></td>
<td></td>
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<td>2. Are your age between 18 and 55 years?</td>
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<td>3. Are you currently a smoker or quitting smoke for less than 3 months?</td>
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<td>4. Are you currently pregnant?</td>
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<td>5. Are you planning to get pregnant during the next 4 months?</td>
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<tr>
<td>6. To your knowledge, do you have any medical conditions that would prevent you from exercising safely?</td>
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<tr>
<td>7. Have you had any orthopedic surgeries or operations for injuries during the past six months? (fractures, torn tendons/ligaments, disc herniation, sciatica pain, etc)</td>
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<tr>
<td>8. Have you participated in a formal exercise program during the past 3 months?</td>
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<td>9. Will you be able to attend the intervention one or two days per week for 10 weeks if you are eligible to this study?</td>
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</tbody>
</table>
II. Physical Activity status:

**INSTRUCTIONS:**

Considering a 7-day period (a week), how many times on the average do you do the following kinds of exercise for more than 15 minutes during your free time.

Write the appropriate number on each line.

1. Write down on how many times per week (frequency) you engage in strenuous or moderate exercise.
2. Write down how long do you usually do averagely (duration) for the strenuous and moderate exercise separately.

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Duration</th>
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<tbody>
<tr>
<td>a) STRENuous EXERCISE (HEART BEATS RAPIDLY)</td>
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<td>(for example, running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, roller skating or blading, vigorous swimming, vigorous long-distance biking)</td>
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<tr>
<td>b) MODERATE EXERCISE (NOT EXHAUSTING)</td>
<td>Frequency</td>
<td>Duration</td>
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<td>(for example, fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, down-hill skiing, popular and folk dancing)</td>
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</table>

Considering a 7-day period (a week), during your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

<table>
<thead>
<tr>
<th>OFTEN</th>
<th>SOMETIMES</th>
<th>NEVER / RARELY</th>
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III. Center for Epidemiologic Studies Short Depression Scale (CES-D-10)

**INSTRUCTIONS:**
For each of the following statements, please check the box that best describes how often you felt or behaved this way during the past week.

<table>
<thead>
<tr>
<th></th>
<th>Rarely or none of the time (less than 1 day)</th>
<th>Some or a little of the time (1-2 days)</th>
<th>Occasionally or a moderate amount of time (3-4 days)</th>
<th>All of the time (5-7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I was bothered by things that usually don’t bother me</td>
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<tr>
<td>2. I had trouble keeping my mind on what I was doing</td>
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<td>3. I felt depressed</td>
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<td>4. I felt that everything I did was an effort</td>
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<td>5. I felt hopeful about the future</td>
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<td>6. I felt fearful</td>
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<td>7. My sleep was restless</td>
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<td>8. I was happy</td>
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<td>9. I felt lonely</td>
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<td>10. I could not “get going”</td>
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PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

<table>
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<tr>
<th>YES</th>
<th>NO</th>
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<td>1.</td>
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YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:
- start becoming much more physically active — begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal — this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over /44/94, talk with your doctor before you start becoming much more physically active.

DELAY BECOMING MUCH MORE ACTIVE:
- if you are not feeling well because of a temporary illness such as a cold or a fever — wait until you feel better; or
- if you are or may be pregnant — talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informal Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

“I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction.”

NAME

SIGNATURE

SIGNATURE OF PARENT or GUARDIAN (to participants under the age of majority)

DATE

WITNESS

Note: This physical activity clearance is valid for a minimum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.
Physical activity improves health.

Get active your way—build physical activity into your daily life...

- at home
- at school
- at work
- on the go...
- or however feels right.
- that's active living!

The following companies forms are available for doctors’ use by contacting the Canadian Society for Exercise Physiology (address below):

- The Physical Activity Readiness Medical Examination (PARmed-X) — to be used by doctors with people who answer YES to one or more questions on the PAR-Q.
- The Physical Activity Readiness Medical Examination for Pregnancy (PARmed-X for Pregnancy) — to be used by doctors with pregnant patients who wish to become more active.

References:

For more information, please contact the:
Canadian Society for Exercise Physiology
202-185 Somerset Street West
Ottawa, ON K2P 0Z
Tel: 1-877-651-3755 • FAX (613) 234-3565
Online: www.cscep.ca

© Canadian Society for Exercise Physiology
Supported by: Health Canada Santé Canada
Eligibility Screening Telephone Script

Pre-Screening Form / Telephone Script (Comments and instructions are in bold.)

Hello, this is Ya-Ting Hsu, and I'm a PhD student from the Health and Exercise Science program at The Ohio State University. We are glad that you are interested in participating in project CHANGE. I was wondering if this is a good time to talk about the study.

If NO:

Is there a good time I may call you back? (If YES, arrange time to call again. If she is not interested in the study, thank her for her time.)

If YES:

Thank you. I would like to tell you about Project CHANGE and get some information from you so that we can find out if you can take part in the study. These questions will take about 15-20 minutes. I won't be able to determine your eligibility until we've gone through all of the questions. One or more of your answers may mean that you may not be able to be in the study. Your answers will be kept confidential and will be used for research purposes only. You can refuse to answer any question or you may stop me at any time. Is this all right with you?

If YES, the interview will continue. If during the interview the individual refuses to answer a particular question, "REFUSED" will be written beside the question.

If NO, the interviewer will ask the reason(s) and thank her for her time.

(Reason for refusal: CTORCA)
month training period. The standard exercise group will meet for 45 minutes, 2 sessions per week. The combination group will attend weekly educational sessions for 60 minutes followed by 30-minutes practicing the physical skills they just learned. Also, all the participants will need to engage in home-based exercise outside of the program. During this study, you will be asked to record your physical activity every day. One month after the 2-month training period is over, you will need to come back for follow-up evaluations.

There will be approximately 30 women participating in this research study.

Do you have any questions? (Any questions or concerns will be answered.)

Now, I would like to ask you a few questions to help me contact you about this research study.

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Please spell your full legal name</td>
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<tr>
<td></td>
<td>First Middle Last</td>
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<tr>
<td>2.</td>
<td>Is there a name you would prefer to be called? ___Yes ___No</td>
</tr>
<tr>
<td><strong>If No, go to Number 3</strong></td>
<td></td>
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<tr>
<td></td>
<td>What do you like to be called?</td>
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<tr>
<td>3.</td>
<td>Do you have an email address?</td>
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<tr>
<td><strong>If No, go to Number 4</strong></td>
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<tr>
<td>4.</td>
<td>When is the best time to contact you during a weekday?</td>
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<tr>
<td></td>
<td>Mornings:   ☐ 8:00-10:00am   ☐ 10:00-noon</td>
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<tr>
<td></td>
<td>Afternoons: ☐ Noon-3:00pm   ☐ 3:00pm-6:00pm</td>
</tr>
<tr>
<td></td>
<td>Evenings:   ☐ 6:00-9:00pm</td>
</tr>
</tbody>
</table>
Now, the questions that follow will help us to decide if you are eligible for this study. Please answer these questions as completely as possible. Thank you very much.

- How tall are you? ________feet _________inches
- How much do you weigh? _________Ibs
- Calculate BMI = ________, if not 25 - 34.9 kg/m², the person is not eligible
- How old are you? ________, if not 18-65, the person is not eligible

<table>
<thead>
<tr>
<th>If answer any is NO, the person is not eligible.</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Are you a woman?</td>
<td></td>
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<tr>
<td>2. Are you currently a smoker or have quit smoking for less than 3 months?</td>
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<tr>
<td>3. Are you currently pregnant?</td>
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<tr>
<td>4. Are you planning to get pregnant during the next 4 months?</td>
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<tr>
<td>5. To your knowledge, do you have any medical conditions that would prevent you from exercising safely?</td>
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<tr>
<td>6. Have you had any orthopedic surgeries or operations for injuries during the past six months? (fractures, torn tendons/ligaments, disc herniation, sciatica pain, etc.)</td>
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<tr>
<td>7. Have you participated in a formal exercise program during the past 3 months?</td>
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<tr>
<td>8. Will you be able to attend the intervention one or two days per week for 8 weeks if you are eligible for this study?</td>
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<tr>
<td>9. Will you be able to come back for follow-up assessments 4 weeks after the intervention is over?</td>
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</tbody>
</table>
Now, the following questions will decide your activity level. You need to spend some time to recall your physical activity last week. You could grab a pen and paper, even a calendar, to help you.

1. Was there anything about the past week that made exercising especially different for you in terms of extended illness, injury, or vacation?

☐ YES. If “YES,” please answer the following activity questions about the previous “typical” week that occurred within the past 30 days.

☐ NO. If “NO,” please complete this following activity questions about this past week.

The first two questions are about the amount of moderate activity in the past week.
Here, moderate activity means you are working hard enough to raise your heart rate and break a sweat, for example, fast walking, tennis, and easy bicycling.

2. Considering a 7-day period (a week), how many times per week on average do you do moderate activity for more than 15 minutes during your free time? ______

3. How long on average do you usually do moderate activities? __________

The next two questions are about the amount of strenuous activity in the past week.
Here, strenuous activity means you are breathing hard and fast, and your heart rate has gone up quite a bit, for example, fast walking, tennis, and easy bicycling.

4. Considering a 7-day period (a week), how many times per week on average do you do strenuous activity for more than 15 minutes during your free time? ______

5. How long on average do you usually do strenuous activities? __________

The last question is about your general activity in a week.

6. Considering a 7-day period (a week), during your leisure-time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?
   ☐ OFTEN    ☐ SOMETIMES    ☐ NEVER / RARELY

The algorithm for active/sedentary status will be used to decide eligibility. The person categorized as active will be ineligible. (The algorithm is attached as appendix 1 in this document.)
Thank you for staying with me. The last part of the screening is about depressive symptoms. Please answer YES or NO for the following two questions.

1. During the past month, have you often been bothered by feeling “down,” depressed, or hopeless?  □ YES  □ NO
2. During the past month, have you often been bothered by having little interest or pleasure in doing things?  □ YES  □ NO

If both answers are NO, the person may be eligible.

That was my last question. I want to thank you for your time and interest in the study.

If one or both answers are YES, the interviewer needs to use an instrument with higher sensitivity and specificity (e.g., CESD-10 questionnaire) to decide the degree of depressive symptoms. These two screening questions have a high false-positive rate (33-43%)(Price, 2004).

Since you answer at least one “Yes”, I need your help to further decide your eligibility. I will now read 10 more statements and for each statement, please pick the answer that best describes how often you felt or behaved this way during the past week.

<table>
<thead>
<tr>
<th>CESD-10 questionnaire</th>
<th>Rarely or none of the time (less than 1 day)</th>
<th>Some or a little of the time (1-2 days)</th>
<th>Occasionally or a moderate amount of time (3-4 days)</th>
<th>All of the time (5-7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I was bothered by things that usually don’t bother me</td>
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<td>5. I felt hopeful about the future</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>6. I felt fearful</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. My sleep was restless</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. I was happy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I felt lonely</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I could not “get going”</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sum all the scores for each item; a score of 10 or greater is considered depressed and the volunteer is ineligible. The scoring method is attached as appendix 2.

That was my last question. I want to thank you for your time and interest in the study. Do you have any additional questions for me? (Answer any questions or concerns)

The woman's responses will be reviewed and her eligibility to participate in the study will be determined.

IF ELIGIBLE: Based upon your responses you may be eligible to participate in the study. I would like to invite you to a baseline evaluation and to confirm your eligibility.

Schedule appointment time and provide information about location and preparation for fitness evaluations (e.g., comfortable clothing and footwear).

Once again, thank you for your interest in this study.

IF INELIGIBLE: I am sorry Ms. _______, but based upon some of your answers you don't meet the study criteria and you are not eligible to be in the study. However, I would recommend that if you would like to begin an exercise program to talk with your doctor about exercise. * Once again, thank you for your interest in this study.

* If INELIGIBLE because of the CESD-10 scores is 10 or greater:
  One of the exclusion criteria for our study is depression, and your responses may mean that you have some symptoms of depression. Exercise is a great way to ease symptoms of anxiety or depression, but it isn't a substitute for psychotherapy, medications or other treatment.

IF OSU STUDENT:
  Counseling and Consultation Service (CCS) services are free to all currently enrolled students. Counselors at OSU CCS are able to see students on an urgent basis during most hours of the business day from 9-5pm. You can reach CCS at 614-292-5766.

IF OSU EMPLOYEE:
  The University Faculty and Staff Assistance Program (UFSAP) is a free service for OSU employees and dependents offered to help address personal, social, or work related issues. Please contact UFSAP at (614) 292-4472.

ALL OTHERS:
  You can get help or referrals by calling OSU Harding Hospital (614-293-9600).
Appendix 1

Algorithm for Active/Sedentary Status

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Duration (minute)</th>
<th>Total time (minute)</th>
<th>Target (minute)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) VIGOROUS PHYSICAL ACTIVITY</td>
<td>F_V</td>
<td>D_V</td>
<td>VPA</td>
<td>60</td>
<td>VPA/60</td>
</tr>
<tr>
<td>b) MODERATE PHYSICAL ACTIVITY</td>
<td>F_M</td>
<td>D_M</td>
<td>MPA</td>
<td>150</td>
<td>MPA/150</td>
</tr>
<tr>
<td>Total percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Procedure:

1. Fill in Frequency and Duration for vigorous and moderate PA based on the responses.

2. Calculate total time for VPA = F_V x D_V
   Calculate total time for VPA = F_M x D_M

3. Calculate how many percentage of targeted exercise duration is achieved for both conditions:
   Percentage achieved for vigorous PA= VPA/60
   Percentage achieved for moderate PA= MPA/150

4. Calculate total percentage = VPA/60 + MPA/150

5. If total percent equals or is greater than 100% ACTIVE \(\rightarrow\) EXCLUDE
   If total percent is less than 100% NOT ACTIVE \(\rightarrow\) INCLUDE

SWEAT QUESTION

Use to augment information from table:

- If “Often” = ACTIVE (compare to table for logic)
- If “Sometimes” = consult table
- If “Never/rarely” = NOT ACTIVE (compare to chart for logic)

### SAMPLE

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Duration (minute)</th>
<th>Total time (minute)</th>
<th>Target (minute)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) VIGOROUS PHYSICAL ACTIVITY</td>
<td>2</td>
<td>20</td>
<td>40</td>
<td>60</td>
<td>67%</td>
</tr>
<tr>
<td>b) MODERATE PHYSICAL ACTIVITY</td>
<td>3</td>
<td>30</td>
<td>90</td>
<td>150</td>
<td>60%</td>
</tr>
<tr>
<td>Total percentage</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>67%+60%=127%</td>
</tr>
</tbody>
</table>

127% > 100% = ACTIVE → EXCLUDE

**Appendix 2**

**Scoring for CES-D10 Questionnaire**

<table>
<thead>
<tr>
<th>Item Weights</th>
<th>Rarely or none of the time (less than 1 day)</th>
<th>Some of a little of the time (1-2 days)</th>
<th>Occasionally or a moderate amount of the time (3-4 days)</th>
<th>All of the time (5-7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Items 5 &amp; 8</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>All other items:</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
APPENDIX C

Exercise Plan and Information for the SC Group
Welcome to your first exercise session
in Project CHANGE!

Today is an exciting day! By increasing your daily activity levels (i.e., how much you are purposefully moving around) and choosing to add exercise to your lifestyle, you are taking the first steps toward enhancing your physical function and quality of life!

- In Project CHANGE, we focus on moderate-intensity aerobic activity (e.g. brisk walking) and whole-body strengthening based on current exercise recommendations for health improvement.

- Public Health Recommendation:
  Moderate-intensity aerobic activity for a total of 150 minutes per week
  AND
  8 to 10 weight training exercises, 8 to 12 repetitions of each exercise twice a week.

- Moderate-intensity activity means you are working hard enough to raise your heart rate and break a sweat. One way to tell is that you will be able to talk, but not sing the words to your favorite song. Here are some examples of activities that require moderate effort:
  - Walking fast
  - Doing water aerobics
  - Riding a bike on level ground or with few hills
  - Playing doubles tennis

- Our CHANGE goal is to participate in moderate-intensity activity for 150 minutes per week. We will gradually build up the activity minutes in the program.
- You will use the provided exercise log sheet to record your exercise every day and submit them in Tuesday’s sessions. Research shows us that monitoring your progress can help you to succeed.

We understand that things come up. So, please contact Ya-Ting if you are unable to attend a session. We will be happy to schedule a make-up session with you.

Ya-Ting Hsu: hsu.224@osu.edu or (352) 871-3260, Lab number: 292-0098
Step 1: Start with aerobic exercise, then progress to weight training to maximize calorie ‘burning’.

- Aerobic or “cardiovascular” exercise has many benefits. For those trying to lose weight the two biggest benefits are:
  1. Burning or using calories (about 2 times the amount from weight training)
  2. Increasing your overall fitness, which even without losing weight, helps lower your risk of many diseases

- These improvements allow individuals to not only feel better, but it lets them be more active throughout the day, and this helps to ‘burn’ even more calories to help in losing more weight.

Step 2: Determine the appropriate frequency, intensity, and duration.

- **Type:**
  
  Recommended aerobic exercises (in order):
  
  - Walking
  - Chair aerobics
  - Swimming
  - Rowing
  - Golfing
  - Hiking
  - Biking
  - Video aerobics
  - Dancing

  Recommended aerobic machines:
  
  - Treadmill
  - Airdyne Bike
  - Recumbent Bike
  - Recumbent Stepper (Nustep)
  - Rower
  - Stationary Bike
  - Cross Country Skier
  - Elliptical
  - Stair Stepper

- **Frequency:** Individuals whose focus is to lose or maintain weight loss should try to maximize their amount of physical activity each day. Current guidelines suggest these individuals engage in exercise on 5-7 days throughout the week. The more days that you are active during the week the more calories you will burn.

- **Intensity:** Intensity refers to how difficult the exercise is that you perform. Exercise intensity for health and weight loss is much different than that required to train and perform in competitive sports. Many believe that exercise should be “hard” (“no pain, no gain”) and they often have unrealistic expectations. Use the Rate of Perceived Exertion (RPE) to help you determine the appropriate moderate intensity level. Your intensity should feel in the fairly light to somewhat hard range (11-14) for the entire exercise time. We will discuss more how to use RPE to decide your exercise intensity next week.

- **Time:** Duration refers to how long an exercise bout should take. It takes calories, calories, and more calories burned to lose or maintain body weight. An average 30-minute workout burns about 150 - 200 calories, while it takes 3,500 calories to burn 1 pound of fat! Recent guidelines suggest up to 60 minutes or more of aerobic exercise (>300 calories per workout) to lose or maintain weight loss. However, it is important to understand that someone who is completely inactive should start much lower and slowly progress to these guidelines. Always remember to include at least a 5-minute warm-up and cool-down with each of your workouts.

Step 3: Monitor your progress and expect positive changes.

- Individuals that monitor their progress increase their odds of success by 50%. Keeping an exercise log will provide you with more awareness of how often you exercise, what times work best, what exercises you enjoy, and how much progress you are making. You will use the provided exercise log sheet to record your physical activity.

(Adapted from 1-2-3: Guide to Exercise and Weight Loss, Henry Ford Weight Management Program)
### Example: Weekly Aerobic Exercise Prescription

<table>
<thead>
<tr>
<th>Week</th>
<th>Weekly minute goal</th>
<th>VO2 max</th>
<th>Intensity (RPE)</th>
<th>Speed (mph) Incline (%)</th>
<th>Speed (mph) Incline (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80</td>
<td>40%</td>
<td>11-14</td>
<td>2.8 mph 1.5%</td>
<td>3.0 mph 1.0%</td>
</tr>
<tr>
<td>2</td>
<td>100</td>
<td>45%</td>
<td>11-14</td>
<td>2.8 mph 2.5%</td>
<td>3.0 mph 2.0%</td>
</tr>
<tr>
<td>3</td>
<td>120</td>
<td>45%</td>
<td>11-14</td>
<td>2.8 mph 3.5%</td>
<td>3.0 mph 3.0%</td>
</tr>
<tr>
<td>4</td>
<td>135</td>
<td>50%</td>
<td>11-14</td>
<td>2.8 mph 3.5%</td>
<td>3.0 mph 3.0%</td>
</tr>
<tr>
<td>5</td>
<td>150</td>
<td>50%</td>
<td>11-14</td>
<td>2.8 mph 4.5%</td>
<td>3.0 mph 4.0%</td>
</tr>
<tr>
<td>6</td>
<td>150</td>
<td>55%</td>
<td>11-14</td>
<td>2.8 mph 4.5%</td>
<td>3.0 mph 4.0%</td>
</tr>
<tr>
<td>7</td>
<td>150</td>
<td>55%</td>
<td>11-14</td>
<td>2.8 mph 4.5%</td>
<td>3.0 mph 4.0%</td>
</tr>
<tr>
<td>8</td>
<td>150+</td>
<td>60%</td>
<td>11-14</td>
<td>2.8 mph 5.5%</td>
<td>3.0 mph 5.0%</td>
</tr>
<tr>
<td>Maintenance stage</td>
<td>150+</td>
<td>11-14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
- In Project CHANGE, we emphasize trying to incorporate “purposeful” structured exercise into each day. Whether it is multiple 10 minute sessions or single sessions of 30+ minutes, we try to encourage this increased activity.

- Public Health Recommendation:
  
  **Moderate-intensity aerobic activity 150 minutes per week**

  AND

  8 to 10 weight training exercises, 8 to 12 repetitions of each exercise twice a week

- Moderate-intensity physical activity means *working hard enough to raise your heart rate and break a sweat, yet still being able to carry on a conversation.* The 30-minute recommendation is for the average healthy adult to maintain health and reduce the risk for chronic disease.
Example: Project CHANGE Workout session for SC group

- Week 1: Aerobic exercise: 15 minutes

<table>
<thead>
<tr>
<th>Treadmill</th>
<th>Intensity (RPE)</th>
<th>Time (min)</th>
<th>Speed (mph)</th>
<th>Incline (%)</th>
<th>Speed (mph)</th>
<th>Incline (%)</th>
<th>RPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm-up</td>
<td>11</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12-14</td>
<td>15</td>
<td>2.8</td>
<td>1.5</td>
<td>3.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Cool-down</td>
<td>7</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Week 1: Mini weight training exercise: 10-15 minutes

<table>
<thead>
<tr>
<th>Upper limbs/trunk</th>
<th>Push-up with knees on the mat</th>
<th>2 sets of 10-12 reps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core strength</td>
<td>Plank prone on elbows</td>
<td>Holding 10 sec, 1 set of 8-10 reps</td>
</tr>
<tr>
<td>Lower limbs/trunk</td>
<td>Bridge lying on back</td>
<td>Holding 10 sec, 1 set of 8-10 reps</td>
</tr>
<tr>
<td>Progression</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Your aerobic goal this week: ___
Minutes: _______
Frequency: _______
Your strength goal this week: ___
Frequency: _______

My Weekly Activity

<table>
<thead>
<tr>
<th>Day</th>
<th>What I will do</th>
<th>Minutes</th>
<th>When</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>☐ Aerobic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Strengthening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td>☐ Aerobic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Strengthening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>☐ Aerobic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Strengthening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td>☐ Aerobic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Strengthening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td>☐ Aerobic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Strengthening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td>☐ Aerobic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Strengthening</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunday</td>
<td>☐ Aerobic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Strengthening</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PLEASE RECORD ALL STRUCTURED PHYSICAL ACTIVITY ON THIS TRACKER EVERY DAY!
APPENDIX D

SDT Constructs Targeted in the Intervention
The psychological need fulfilments and how they are targeted in the intervention

<table>
<thead>
<tr>
<th>Theoretical construct</th>
<th>Theme</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compassion</strong></td>
<td>Trainer's knowledge and enthusiasm</td>
<td>Provide individualized guidance for healthy and overweight/obese population. Provide instructions on better techniques to prevent injury. Provide timely, specific, and personalized feedback. Teach physical skills to and practice using them to regain physical capabilities.</td>
</tr>
<tr>
<td><strong>Autonomy</strong></td>
<td>Provision of meaningful rationale</td>
<td>Discuss and link the exercise regimen with meaningful concerns for this population. Emphasize the specific evidence regarding to volume of PA for this population.</td>
</tr>
<tr>
<td><strong>Choice</strong></td>
<td>Implement self-selected intensity exercise regimens. Foster opportunities for participants to provide meaningful inputs and have influence on their training program. Encourage exploration of options and choices in home-based PA. Set participants’ goals and exercise progress. Participants will behavioral skills and have assignments to help them start exercise program, set goal, self-monitor, solve problems and make their personal choices that fit their life best.</td>
<td></td>
</tr>
<tr>
<td><strong>Instructional style</strong></td>
<td>Spend time chatting before the session, learn participants’ names, and show enthusiasm. Prevent blame or judgment. Mix within class and ensure availability during exercise training.</td>
<td></td>
</tr>
<tr>
<td><strong>Relational support</strong></td>
<td>Offer suggestions for developing friendships, such as buddy systems, for social support. Encourage sharing of behavioral strategies through group discussions among participants with similar challenges. Provide strategies for ways to seek social support from family and friends.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E

SDT-Based Exercise Intervention For the SD group: Weekly Lesson Plan
Session 1: Start to CHANGE your lifestyle!

- Understand what to expect in Project CHANGE.
- Learn how to be supportive of your group members.
- Understand benefits of physical activity and how being active can improve your health.
- Learn the FITT principle and how to safely participate in regular physical activity.
- Worksheet: start your aerobic exercise in the gym and discover what activities you can do to CHANGE!
Welcome to your first group session in Project CHANGE!

Today is an exciting day! By increasing your daily activity levels (i.e., how much you are purposefully moving around) and choosing to add exercise to your lifestyle, you are taking the first steps toward enhancing your physical function and quality of life!

What do we mean by this? We mean that, by the end of our work together, you will be: 1) more active, 2) able to do the things you want to do better, 3) more comfortable doing these things, and 4) more ready to achieve your life goals. You will understand how being active improves your mental and physical health. You will also learn how to overcome your personal barriers to physical activity and develop a more active lifestyle.

Being a member of the CHANGE Group is an important part of your journey. Everyone in the group is similar in a very important way: You are facing similar challenges as a larger size woman and most importantly, you want to CHANGE, be active, and become healthier! Your fellow group members will be your supporters when you need help problem-solving, your cheerleaders when you’ve achieved a goal, and your fellow travelers throughout. So, the group is important! By agreeing to be a part of this group, you have agreed to participate in all scheduled activities, group and individual sessions.

We understand that things come up. So, please contact Ya-Ting if you are unable to attend a session. We will be happy to schedule a review session with you. This review session will allow you to stay on track, as you will receive instruction and any materials that you may have missed as a result of your
absence.

Ya-Ting Hsu: hsu.224@osu.edu or (352) 871-3260, Lab number: 292-0098

What are the goals of Project CHANGE?

There are 2 main components in Project CHANGE:

1. Group sessions
2. Exercise practices following a group session

The purpose of Project CHANGE is to provide you with the tools, practice, information, and reinforcement you need to feel empowered to be more physically active in your daily life.

The group sessions will help develop your Behavioral Skills necessary to live a more active lifestyle. These skills will help you:

1. Continue exercising regularly even when faced with challenging barriers

2. Apply the endurance, strength, and fitness you are developing through exercise to improve your daily lives

The exercise practices will help to develop your Physical Skills necessary to live a more active lifestyle. By increasing your activity and fitness levels you will improve your physical function, and quality of life. You will learn how to:

1. Find an appropriate and efficient exercise plan that can fit in your daily life and improve your health. There are three types of physical activity we will talk about and practice.
   - Aerobic exercises
   - Weight training
   - Lifestyle activities
How to be Supportive of your Group

The group meeting is a great way to learn more about YOU.
To get the most benefit from your group,
it will be important for you to practice these key strategies:

Confidentiality

Please keep sensitive group information within this group.
This helps to create a safe environment where everyone feels
comfortable voicing concerns and thoughts. If you do share
information with family and friends, try to only talk about
yourself and your own perspectives. Try to avoid using
names or any descriptors that might help others identify your
fellow group members.

Time Management

Please arrive on time for the group sessions. If possible, please
schedule other appointments with the class dates and time in
mind. 100% attendance keeps the group successful. If you must
arrive later or leave early, please try to avoid disrupting the
group.

Communication

Call Ya-Ting at 352-871-3260 (cell) 614-292-0098 (lab) or
email: hsu.224@osu.edu if you cannot attend a group session.
Every member is important to the group. Sharing your
unique views and personal experiences helps to contribute to
the success of the group every week. Remember that we
want everyone to have a chance to add to group discussion!
Active Participation

Often group discussion will focus around brainstorming and planning for coming weeks. Participating in these activities will help you find your best personal approach to successfully reaching your exercise goals. It’s important to try to allow time for everyone to share, so actively participate not only by talking but also by inviting your fellow group members to share, too!

Sharing the Floor and Giving Back

If someone has something to share, please be respectful and listen; allow each group member equal time to share. After listening carefully to a group member’s thoughts and ideas, be willing to help that person by offering solutions that have worked for you.

Respecting Other Group Members’ Ideas and Avoiding Criticism

Please resist being judgmental and try not to criticize a group member for not meeting her goals. This can be done by showing respect to fellow group members and resisting any urge to tell people what they should do. Instead, try to understand where fellow group members are coming from and then make suggestions of what they could do.

Remember, group members are present to help each other. Always try to create a positive, supportive setting for everyone.
The benefits of exercise keep coming!

Staying active helps you to....

- Prevent cancers of breast, uterus, and colon.
- Reduces risks of chronic disease: heart diseases, diabetes, hypertension and certain cancer.
- Increase strength of heart and cardiovascular system.
- Regulate blood sugar and help improve insulin resistance.
- Regulate blood pressure.
- Control HDL “bad cholesterol” and boost LDL “good cholesterol.”
- Build your bone density and slow bone loss.

Regular physical activity also boosts the way you feel and....

- Gives you more energy.
- Helps you to relax and cope better with stress.
- Allows you to fall asleep more quickly and sleep more soundly.
- Builds confidence.
- Helps you to beat the blues.
- Provides an enjoyable way to share time with friends or family.

Adapted from “your guide to physical activity and your heart”, US department of health and human services.

Specific Health Benefits for YOU!!

- Provides protection from osteoporosis.
- Decreases risk of breast and cervical cancer.
- Improves premenstrual syndrome and irregular menstrual cycle.
- Reduces risks of gestational diabetes.
- Improves pregnancy-related pelvic and back pain
- Facilitates labor and postnatal recovery.

************
How much exercise is enough?

Today's session will help you to start your aerobic exercise plan. You'll learn how to find the appropriate intensity while exercising here or out on your own.

The FITT principle is a guide for setting achievable goals and then making sure that you are exercising properly and reaching your goals. FITT stands for:

- **Frequency** — How often you exercise
- **Intensity** — How hard you are working while being active, or how fast our heart is beating.
- **Time** — How long you exercise
- **Type** — The type of activity you do

* In Project CHANGE, we focus on moderate-intensity aerobic activity (e.g. brisk walking) and whole-body strengthening based on current exercise recommendations for health improvement.

* Moderate-intensity activity means you are working hard enough to raise your heart rate and break a sweat. One way to tell is that you will be able to talk, but not sing the words to your favorite song. Here are some examples of activities that require moderate effort:
  - Walking fast
  - Doing water aerobics
  - Riding a bike on level ground or with few hills
  - Playing doubles tennis
Step 1: Start with aerobic exercise, then progress to weight training to maximize calorie ‘burning’.

- **Aerobic or “cardiovascular” exercise** has many benefits. For those trying to lose weight the two biggest benefits are:
  1. Burning or using calories (about 2 times the amount from weight training)
  2. Increasing your overall fitness, which even without losing weight, helps lower your risk of many diseases

- These improvements allow individuals to not only feel better, but it lets them be more active throughout the day, and this helps to ‘burn’ even more calories to help in losing more weight.

Step 2: Determine the appropriate frequency, intensity, and duration.

- **Type:**
  - **Recommended aerobic exercises (in order):**
    - Walking
    - Chair aerobics
    - Swimming
    - Rowing
    - Golfing
    - Hiking
    - Biking
    - Video Aerobics
    - Dancing
  - **Recommended aerobic machines:**
    - Treadmill
    - Airdyne Bike
    - Recumbent Bike
    - Recumbent Stepper (Nustep)
    - Rower
    - Stationary Bike
    - Cross Country Skier
    - Elliptical
    - Stair Stepper

- **Frequency:** Individuals whose focus is to lose or maintain weight loss should try to maximize their amount of physical activity each day. Current guidelines suggest these individuals engage in exercise on 5-7 days throughout the week. The more days that you are active during the week the more calories you will burn.

- **Intensity:** Intensity refers to how difficult the exercise is that you perform. Exercise intensity for health and weight loss is much different than that required to train and perform in competitive sports. Many believe that exercise should be “hard” (“no pain, no gain”) and they often have unrealistic expectations. Use the Rating of Perceived Exertion (RPE) to help you determine the appropriate moderate intensity level. Your intensity should feel in the fairly light to somewhat hard range (11-14) for the entire exercise time. We will discuss more how to use RPE to decide your exercise intensity next week.

- **Time:** Duration refers to how long an exercise bout should take. It takes calories, calories, and more calories burned to lose or maintain body weight. An average 30-minute workout burns about 150 - 200 calories, while it takes 3,500 calories to burn 1 pound of fat! Recent guidelines suggest up to 60 minutes or more of aerobic exercise (>300 calories per workout) to lose or maintain weight loss. However, it is important to understand that someone who is completely inactive should start much lower and slowly progress to these guidelines. Always remember to include at least a 5-minute warm-up and cool-down with each of your workouts.

Step 3: Monitor your progress and expect positive changes.

Individuals that monitor their progress increase their odds of success by 50%. Keeping an exercise log will provide you with more awareness of how often you exercise, what times work best, what exercises you enjoy, and how much progress you are making. You will use the provided exercise log sheet to record your physical activity.

(Adopted from 1-2-3: Guide to Exercise and Weight Loss, Henry Ford Weight Management Program)
To Being a Confident, Healthy and Goal-directed Exerciser

Overall, we hope for you to achieve the following outcomes from your participation in Project CHANGE:

- Be a **Confident, Healthy and Goal-directed Exerciser**
- Improve your physical function and quality of life
- Build stamina and tones your muscles; be able to use exercise to manage your stress
- Gradually increase to exercising for 150 minutes a week

Our CHANGE goal is to participate in moderate-intensity activity for 150 minutes per week. Each of us may need to use a different way to get there. Each of us may have our own limitations and could need different approaches to reach this same ultimate goal. Some of you may even be able to go beyond 150 minutes per week.
CHANGE! Worksheet

I. Use the FITT principle to start your individualized aerobic exercise plan:
   a. Frequency: start with 2-3 times a week
   b. Intensity: moderate-intensity: working hard enough to raise your heart rate and break a sweat
      • Treadmill: speed: _____ mph  grade: _________%
   c. Time:
      • Warm-up: ______________ minutes
      • Conditioning: ______________ minutes
      • Cool-down: ______________ minutes
   d. Type:
      I am trying: brisk-walking on Treadmill

II. Plan your activity to CHANGE your lifestyle!! ~WHERE and WHEN~
   • Brisk walking in the neighborhood
   • Biking with family and friends
   • Doing aerobic with DVDs Joining a gym
   • More and more….

Question:
What activities you would like to try to start CHANGEing your lifestyle?

Activity Tips
• Find activities that are fun, that suit your needs, and that you can do year-round.
• Get your workout buddy and find support!!
III. In Project CHANGE, you will use the **FITT principle** to help you start your individualized exercise plans.

<table>
<thead>
<tr>
<th>F.I.T.T.</th>
<th>What to do:</th>
<th>My plans for this week:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FREQUENCY</strong></td>
<td>Build the frequency of exercise gradually. Try to exercise on most days of the week (about 5 days per week).</td>
<td></td>
</tr>
<tr>
<td><strong>INTENSITY</strong></td>
<td>Moderate-intensity activity • You are working hard enough to raise your heart rate and break a sweat. • You will be able to talk, but not sing the words to your favorite song.</td>
<td></td>
</tr>
<tr>
<td><strong>TIME</strong></td>
<td>Start <strong>slowly</strong> and gradually increase your time up to <strong>30 ± minutes per session</strong> and <strong>150 minutes per week</strong>. To do this, you will increase the amount of time you spend exercising every week early on in the program. 10-minutes at a time is fine. Try to accumulate your minutes with shorter bouts of exercise. The total minutes you walk/exercise each week could be at least as much as your exercise goal for the week.</td>
<td></td>
</tr>
<tr>
<td><strong>TYPE OF ACTIVITY</strong></td>
<td>We focus on moderate-intensity aerobic activity (e.g. brisk walking) and whole-body strengthening.</td>
<td></td>
</tr>
</tbody>
</table>

*Remember, it is important to start slowly and gradually increase your exercise!*
Session 2: Setting your SMART goals

- Learn using the FITT principles, the RPE scale, the feeling scale, and exercise logs to monitor your exercise routines and reach your goals.
- Learn how to set SMART goals.
- Set individual short-term, long-term and lifelong goals.
- Worksheets: learn warm-up exercises and how to gauge your exercise intensity.
Learning to Gauge Your Exercise Intensity

Let's look at these three tools we can use to help you develop and monitor your exercise routine: the FITT principle, the RPE scale, and the feeling scale.

<table>
<thead>
<tr>
<th>FITT principle</th>
<th>What to do:</th>
<th>My plans for this week:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FREQUENCY</strong></td>
<td>Build the frequency of exercise gradually. Try to exercise on <strong>most days of the week</strong> (about 5 days per week).</td>
<td></td>
</tr>
<tr>
<td><strong>INTENSITY</strong></td>
<td>Do moderate-intensity activity. Aim for a Rate of Perceived Exertion (RPE) of 13, with a range of 11-14. When you are exercising, stay at an intensity which give you a good feeling, (i.e., &quot;1-5&quot; on the Feeling Scale).</td>
<td></td>
</tr>
<tr>
<td><strong>TIME</strong></td>
<td>Start slowly and gradually increase your time up to <strong>30+ minutes per session</strong> and <strong>150 minutes per week</strong>. 10-minutes at a time is fine. Try to accumulate your minutes with shorter bouts of exercise.</td>
<td></td>
</tr>
<tr>
<td><strong>TYPE OF ACTIVITY</strong></td>
<td>We focus on moderate-intensity aerobic activity (e.g. brisk walking) and whole-body strengthening.</td>
<td></td>
</tr>
</tbody>
</table>
The RPE Scale:

A Measure of How Hard You Are Working

While being active, it is also important to keep track of how hard you are working. Therefore, while exercising here, we will also ask you to look at the RPE scale described below and rate your overall perception of exertion (i.e., how hard you feel that you are working). We want you to pick a number that describes how hard you feel you are working. When doing this, think about the total feeling of work in your entire body (i.e., leg muscles, heart, and lungs). The RPE scale contains numbers ranging from 6 (no effort) to 20 (working so hard you need to stop) that correspond to verbal descriptors for various levels of exertion.

When you are walking for exercise, your intensity goal is to stay between ratings 11 and 14.

<table>
<thead>
<tr>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-10</td>
<td>The exercise intensity is not challenging at all.</td>
</tr>
<tr>
<td>11-14</td>
<td>The exercise intensity feels brisk and challenging, but you can continue at this level for some time.</td>
</tr>
<tr>
<td>15-20</td>
<td>The exercise intensity is so hard that you cannot continue at this level.</td>
</tr>
</tbody>
</table>

6  NO EXERTION
7  EXTREMELY LIGHT
8  VERY LIGHT
9  LIGHT
10 SOMewhat HARD
11 HARD (HEAVY)
12
13
14
15
16
17
18
19 EXTREMELY HARD
20 MAXIMAL EXERTION
The Feeling Scale:

A Measure of How You Feel While Exercising

While being active, it is not only important to track what you are feeling (for example, Pain, Discomfort, and Exertion), it is also important to keep track of how you feel. Therefore, while walking in the CHANGE Program, we will also ask you to look at the Feeling Scale described below and rate how you are feeling. We want you to pick a number that describes how, overall, you feel while you are exercising.

When you are exercising,
your intensity goal is to stay between ratings 0 and 5. If you drop into negative ratings, take a short break until you feel better.

1-5
You feel good when you are exercising at this intensity.

<table>
<thead>
<tr>
<th></th>
<th>VERY GOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>GOOD</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>NEUTRAL</td>
</tr>
<tr>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>-2</td>
<td></td>
</tr>
<tr>
<td>-3</td>
<td>BAD</td>
</tr>
<tr>
<td>-4</td>
<td></td>
</tr>
<tr>
<td>-5</td>
<td>VERY BAD</td>
</tr>
</tbody>
</table>
Setting Goals Is Important

Setting goals helps you plan how to carry out what you want to accomplish. When you set an exercise goal, you need to define when, where, and how you will do it. You can use the FITT principle to help you. You can also use the RPE scale and the feeling scale to help you think about how hard you need to work during each bout of exercise. Then, you can use all these standards to evaluate your progress.

Goal setting is an ongoing process that will require patience and interaction with your peers and the CHANGE staff. Please ask for assistance as needed!

A goal is a desired result from individual or group efforts. Goals provide direction and focus to the process of changing behaviors.

It is easier to start with a big picture here—your lifelong goal. Take a minute to ask yourself what is meaningful for you and what you want to become in the life. Based upon different stage of your life, you might have different lifelong goal: such as in the phase of school-age, mid-age, and elderly-age. Connect being physically active and with your lifelong goal. For example, in your 30’s, your life goal could be to have energy and stamina to take care of your children and do fun outdoor activities together with family.

A long-term goal is a broad goal you hope to achieve over time. For example, with CHANGE, your long-term goal could be to increase your walking exercise and maintain it for 3 months.

A short-term goal is a more specific goal you want to achieve over a shorter period of time. An example of a short-term goal you might use is: “I will walk 5 times this week for 20 minutes each time.”
How to set SMART goals

Set **Specific** Goals – Goals need to be stated with details. Oftentimes, people make goals that are so large and vague that it’s hard to know whether they’ve reached them or not. Use “When, Where, and How” principle. Example: I will walk 30 minutes in my neighborhood on Tuesdays and Thursdays after work. (instead of vague: I will walk more)

Set **Measurable** Goals – You need to be able to know whether you’ve accomplished your walking exercise goals by making them measurable. Use “FITT” principle and focus on the frequency and/or duration of your walking exercise in order to measure your weekly progress. Example: I will climb stairs with RPE=12 for 10 minutes, in the morning, lunch hours and afternoon during weekdays.

Set **Achievable** Goals – Goals should be challenging yet realistic and attainable. Find a goal that you know is one you can ultimately achieve. A good idea is to have at least one short term goal that leads to one long term goal.

Set **Realistic/Relevant** Goals – Think about these things: do you have the resources necessary to complete the goal? Is the goal health-related? Does this goal help you move towards the life you want? Will you have support in this goal? Why is this goal important to me?

Set a **Timeline** – Have realistic dates set for you to measure your success as you try to reach your goals. Remember, timelines can be adjusted as needed. You may need to modify a goal if you are presented with a barrier you cannot control (e.g., illness). Example: I will walk 150 minutes this week. (instead of open ended: I plan to walk 150 minutes)
Helpful Hints for Setting SMART Goals

Make your goals...

Flexible: your SMART goals need to be adaptable. Set up an exercise goal with a minimal and ideal range and think about your back-up plans ahead. For examples, my goal is brisk walking at least 15 minutes and ideally 30 minutes during weekday. I will have a nice long walk with my dog on Saturday as my back-up plan.

Motivated: I am not motivated to go to gym today. BUT, I am motivated to walk my dog.

Positive: I will walk in place while I watch TV since any activity is better than no activity at all. (instead of negative: I will stop watching TV).

Something under your control: I will walk 15 minutes after breakfast and 15 minutes after lunch and ask my spouse to join me. (instead of what you can’t control: I will get my spouse to walk with me).

Realistic enough so you can reach the goal: I will walk 15 more minutes this Wednesday night. (instead of: I will walk 60 more minutes this week).

Broken into small steps: I will walk a total of 30 minutes today: 10 minutes walking the dog in the morning, 10 minutes after lunch, and 10 minutes after dinner. (instead of: I will walk 30 minutes total today).

Related to a reward: I will buy a copy of my favorite magazine or I will treat myself to a movie or show if I walk 30 minutes 5 times this week. (instead of: I hope to walk 5 times this week).
CHANGE: Goal-Setting Sheet

Writing down your goals will encourage you to stay committed. You can then refer back to your notes if you need clarification or encouragement to stick to your goals. Also consider recording short term goals, evaluating your progress, and rewarding mini-victories.

- **Lifelong goal:** The big picture!!
  What do you see yourself 5 years from now?

- **Long-term activity goal:** over the 3 month period
  My SMART Long-term activity goal is:

  

  I can measure it by Frequency, Intensity, Time, Type:

  

  I plan to meet my long-term activity goal by:

- **Short-term activity goal:** weekly and daily goal
  In order to reach my long-term activity goal, I will set the following SMART short-term activity goals:

  

  I can measure it by Frequency, Intensity, Time, Type:

  

  I plan to meet my short-term activity goal by:

- **Seek your support**
  Who will support me in my goals: ____________________________

This signature represents my support of my friend/spouse/family member’s goal.

X_________________________ Date:________________________

This signature represents my commitment to this goal.

X_________________________ Date:________________________
CHANGE! Worksheet

1. Target heart rate: another method to get you into the zone

   In Project CHANGE we recommend you to use the RPE scale to gauge your exercise intensity. Research has shown aerobic exercise using RPE scores of 11-14 is at the range of moderate-intensity activity which can improve your physical/mental fitness and general health. However, if you are interested at your exercise heart rate zone, the method is shown below.

   1. Decide resting heart rate by taking pulse for 1-min in a resting state.
   2. Find your maximum heart rate = 220-age
   3. Calculate your heart rate reserve (HRR) = maximum HR – resting HR
   4. Suggestions: workout at 40%-65% HRR
   5. Find your target HR zone = adding 40%-65% of your HRR to your resting HR

   Example:
   Age = 30 years old;
   1. Find resting heart rate = 60 bpm
   2. Maximum heart rate = 220 - 30 = 190 bpm
   3. Heart rate reserve (HRR): 190 - 60 = 130
   4. 40% of HRR: 130 x .4 = 52
       65% of HRR: 130 x .65 = 85
   5. 40% of HRR + resting HR = 52 + 60 = 112
       65% of HRR + resting HR = 85 + 60 = 145

   Target heart rate zone is 112-145 bpm.

   Find your target heart rate zone:
   Your age = ________ years old;
   1. Find resting heart rate = ________ bpm
   2. Maximum heart rate = 220 - ________ = ________ bpm
   3. Heart rate reserve (HRR): ________ - ________ = ________
   4. 40% of HRR: ________ x .4 = ________
       65% of HRR: ________ x .65 = ________
   5. 40% of HRR + resting HR = ________ + ________ = ________
       65% of HRR + resting HR = ________ + ________ = ________

   Target heart rate zone is ________ - ________ bpm.

Activity Tips

- Heart rate could be changed by various reasons: hydration, caffeine intake, medication, stress and so on.
- Heart rate is sometimes not easy to take during exercise unless there is a HR monitor.
- Mainly, use the RPE scale to gauge your intensity and HR as a supplemental tool.
II. How to start your warm-up exercise:

Warming-up is important since it prepare your mind, heart, muscles and joints for the work they are about to do and decrease the risk of injuries. Although previously though, we now know that static stretching is not a proper warm-up, but better for/after cool-down. Cool-downs are also important that allows your body to recover and back to normal heart rate and blood pressure. You could perform static stretch for cool-downs.

<table>
<thead>
<tr>
<th>Warm-up: 5-10 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choose warm-up exercises that use the same muscles you will use during your activities. You could combine dynamic stretches and lower intensity aerobics for warm-up.</td>
</tr>
<tr>
<td>• Dynamic movements or dynamic stretches: see examples below</td>
</tr>
<tr>
<td>• Aerobic warm-up: around 50% of the intended intensity for your work-out.</td>
</tr>
</tbody>
</table>

1. Front-to-back leg swings: each leg 1 x 10-12 reps

2. Side-to-side leg swings: each leg 1 x 10-12 reps

3. Arm circle: with tall posture and knee slightly bend, rotate your arms in a circle forward and then reverse. Each direction 1 x 10-12 reps

4. Trunk rotation: Feet positioned wider than your shoulders, extend your shoulder out to your sides and gently rotate your trunk to face the opposite wall. Each side 1 x 10-12 reps

5. Straight-leg march: Kick one leg straight out in front of you, with your toes flexed toward the sky. Reach your opposite arm to the upturned toe. Drop the leg and repeat with the opposite limbs. Each leg 1 x 10-12 reps

6. Twist and jog: jog while rotating your trunk and letting one side of the elbow touch the opposite side of the knee.
III. Weekly Aerobic Exercise Plan

<table>
<thead>
<tr>
<th>Week</th>
<th>Weekly minute goal</th>
<th>Intensity (RPE)</th>
<th>Speed (mph) Incline (%)</th>
<th>Speed (mph) Incline (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11-14</td>
<td>____ mph</td>
<td>____ %</td>
<td>____ %</td>
</tr>
<tr>
<td>2</td>
<td>11-14</td>
<td>____ mph</td>
<td>____ %</td>
<td>____ %</td>
</tr>
<tr>
<td>3</td>
<td>11-14</td>
<td>____ mph</td>
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<tr>
<td>4</td>
<td>11-14</td>
<td>____ mph</td>
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<td>____ %</td>
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<tr>
<td>5</td>
<td>11-14</td>
<td>____ mph</td>
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<td>____ %</td>
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<tr>
<td>6</td>
<td>11-14</td>
<td>____ mph</td>
<td>____ %</td>
<td>____ %</td>
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<tr>
<td>7</td>
<td>11-14</td>
<td>____ mph</td>
<td>____ %</td>
<td>____ %</td>
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<tr>
<td>8</td>
<td>11-14</td>
<td>____ mph</td>
<td>____ %</td>
<td>____ %</td>
</tr>
<tr>
<td>Maintenance stage</td>
<td>11-14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
- In Project CHANGE, we emphasize trying to incorporate “purposeful” structured exercise into each day. Whether it is multiple 10 minute sessions or single sessions of 30+ minutes, we try to encourage this increased activity.

- Public Health Recommendation:
  **Moderate-intensity aerobic activity** 150 minutes per week
  AND
  8 to 10 weight training exercises, 8 to 12 repetitions of each exercise twice a week

- **Moderate-intensity physical activity** means working hard enough to raise your heart rate and break a sweat, yet still being able to carry on a conversation. The 30-minute recommendation is for the average healthy adult to maintain health and reduce the risk for chronic disease.
### My Weekly Activity Plan

<table>
<thead>
<tr>
<th>Day</th>
<th>What I will do</th>
<th>Minutes</th>
<th>When</th>
<th>Where</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>□ Aerobic:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>□ Strengthening:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Tuesday</td>
<td>□ Aerobic:</td>
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<tr>
<td></td>
<td>□ Strengthening:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>□ Aerobic:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>□ Strengthening:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td>□ Aerobic:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>□ Strengthening:</td>
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<tr>
<td>Friday</td>
<td>□ Aerobic:</td>
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<tr>
<td></td>
<td>□ Strengthening:</td>
<td></td>
<td></td>
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<tr>
<td>Saturday</td>
<td>□ Aerobic:</td>
<td></td>
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<tr>
<td></td>
<td>□ Strengthening:</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Sunday</td>
<td>□ Aerobic:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>□ Strengthening:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PLEASE RECORD ALL STRUCTURED PHYSICAL ACTIVITY ON THIS TRACKER EVERY DAY!
### Weekly Exercise Log Sheet

<table>
<thead>
<tr>
<th>Day/Date</th>
<th>Type of Activity:</th>
<th>Total daily minutes</th>
<th>RPE /HR</th>
<th>Feeling (+5 ~ -5)</th>
<th>Accomplished your daily goals? (0% to 100%)</th>
<th>Comments/Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday <em><strong>/</strong>/</em>__</td>
<td>□Acrobic □Strengthening</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuesday <em><strong>/</strong>/</em>__</td>
<td>□Acrobic □Strengthening</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday <em><strong>/</strong>/</em>__</td>
<td>□Acrobic □Strengthening</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Thursday <em><strong>/</strong>/</em>__</td>
<td>□Acrobic □Strengthening</td>
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<tr>
<td>Friday <em><strong>/</strong>/</em>__</td>
<td>□Acrobic □Strengthening</td>
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<td>□Acrobic □Strengthening</td>
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</tr>
<tr>
<td>Sunday <em><strong>/</strong>/</em>__</td>
<td>□Acrobic □Strengthening</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Total aerobic minutes = _______ Total aerobic days=_______ Total strength days=_______

**PLEASE RECORD ALL STRUCTURED PHYSICAL ACTIVITY ON THIS TRACKER EVERY DAY!**
Project

CHANGE

Session 3:
Healthy at Every Size

- Review and discuss goal setting and self-monitoring
- Myths and Misconceptions
- The responses to a 12-week exercise program
- Healthy at Every Size
- Worksheets: benefits and barriers of physical activity; weight training guideline
Healthy at Every Size

You probably have had some ideas and perceptions about body size, weight, beauty, and happiness based upon your life experiences. Today, we will step forward and consider more than what we traditionally perceived.

Sherry is always struggling with her weight, cycling up and down 5, 10, and even 30 pounds. She would severely restrict her caloric intake and have a hard time sticking to limited diet. She also tried exercise but felt disappointed if she didn't make her weight goal and would think, “Why bother?” Sherry feels uneasy when she has to walk around with friends since she feels tired so easily. She feels like if she was in a smaller size, like her friends, she would be happier and fitter.

• Do you think what can help Sherry feel better about herself?
• Can you be happy and fit at your body size?

Lucy has a busy life as an administrative associate. She has been exercising on a regular basis during her lunch hour every day since her doctor put her on blood pressure pills. When she started, she could only briskly walk for 10 minutes each time and now she can even jog for 30 minutes. After 6 months of regular activities, her doctor decided to cut her blood pressure dosage into half and she was very happy about it. Being active also gave her more energy and stamina for her work and family. If she had a crazy, busy schedule but still took a 20 minute break for a workout, she felt empowered and proud of herself. People might see Lucy as a larger size woman, but Lucy is fit and healthy compared to most of us. Lucy now is willing to spend more time for her own well-being and wants to be able to stay active, happy, and confident at her body size. She feels sexy when she dresses up!

• Do you think what help Lucy start to CHANGE? What help her to stay active?
• What can help YOU change and help YOU to stay active?
• Healthy at EVERY size!!
Myths and Misconceptions

- Weight loss and being thin is the only solution for health and a happy life??
  - Unhealthy diet behaviors
  - Mental health
  - Self-value
  - Self-acceptance
  - Self-esteem

- Thin = healthy and happy??
  - Thin is not intrinsically healthy and beautiful, nor is fat intrinsically unhealthy and unappealing
  - Removing an average of 22 lb body fat by liposuction from 15 women
    + no physical activity and diet modifications:
    → no improvements in any health markers over the next 10-12 weeks

- Body mass is strongly associated with mortality (i.e., death rate) ??
  - This statistical linkage does not control for other factors:
    - Fitness, Diet, Exercise, Weight cycling and so on.
  - These lifestyle factors are more readily to modify than body mass. When one or two factors are controlled, the
    relationship between body mass and mortality tends to be greatly attenuated or disappear altogether.
  - Fitness has powerful impact on health and mortality.

![Bar chart showing age-standardized death rates across BMI categories](image-url)
What we can expect after joining a 12-week exercise program....

After participating in a 12-week supervised aerobic exercise intervention, there are some respondents and some non-respondents who have lower-than-expected weight loss.


Considerations:

1. Despite the lower-than-expected weight loss, the non-respondents did improve some health markers
   a. Decrease waist circumference
   b. Improve aerobic capacity (i.e. increase fitness level)
   c. Improve systolic blood pressure
   d. Improve diastolic blood pressure
2. Weight loss is not the only benefit of exercise.
3. Weight loss is not the most appropriate indicator of health.
4. Even the reduction of 5% in body weight improve some health markers

A fat but fit person has fewer health risks than a lean but unfit person.

Aerobic fitness is a more powerful predictor of mortality than body weight.

Physical activity and healthy diet not just a mean for weight management, being active and fit is actually the key to improve your health. Not just check out the numbers on the scale!!!
Healthy at Every Size: What can we do?

- **Self-acceptance**
  - Positive changes come from self-acceptance and self-love, not from self-hating.
  - Respect for diversity

- **Pleasurable physical activity**
  - No need to always link your activity to “calorie burnings.”
  - More enjoyable physical activities, not just a “workout.”
  - See physical activities as “caretaking.”

- **Healthy diet**
  - Listening to appetite, hunger, and satiety cues → portion control.
  - Take pleasure in eating a variety of foods.
  - Meet energy and nutrient needs through a lifetime of healthful, enjoyable eating.
  - Enjoy lower-fat, higher-fiber food more often.

- **Health-centered outcomes**
  - Focus on more benefits of exercise, other than a single result: weight loss.
    - Stress, energy, stamina, blood pressure, blood sugar, psychological health, quality of life.

- **Realistic weight loss expectations**
  - It takes time: look at other short-term benefits.
  - Being regularly active helps people manage weight.
    - A 2-year weight management research showed that exercise was the only influential predictor of 10% weight loss in the 24-month follow up.

Project CHANGE provides you behavioral and physical skills to help you being active, confident, and active!!
CHANGE! Worksheet

Congratulations! You have started to change and being active for two weeks. Now, it’s time to share your success and challenges you meet.

I. Healthy at Every Size:

How do you define success in Project CHANGE? In addition to weight loss, what other indicators can define your success?

______________________________________________________________

______________________________________________________________

• Healthy Behavior change

• Cardiovascular fitness, strength.....

• Energy/Stamina....

• Stress, anxiety, mood, sleep...

• Blood pressure, blood sugar, insulin resistance...

II. Benefits and barriers of being physical active:

You have been active for two weeks; please recall any benefits and barriers you received.

Benefits:

______________________________________________________________

______________________________________________________________

______________________________________________________________

Barriers:

______________________________________________________________

______________________________________________________________

______________________________________________________________
Guidelines for Strength Training

1. Overload principle: Continue adding loads on muscles to stimulate muscular growth.
2. Use a weight or resistance setting that causes the muscle group to fatigue after 8-12 repetitions of a given exercise. In other words, perform sets of 8-12 repetitions for each exercise. Increase the weight when you can perform more than 12 repetitions.
3. Each repetition should last 3-5 seconds: 1-2 seconds for lifting, pressing or pulling the weight; 2-3 seconds for returning the weight to the starting position.
4. When performing multiple sets of a given exercise, be sure to rest at least 60 seconds between successive sets.
5. Breathing: Exhale (breathe out) with you lift, press or pull the weight. Inhale (breathe in) while you control the weight as it returns to the starting position. Never hold your breath.
6. Posture: When standing or sitting during an exercise, be sure to keep your torso upright. Do not arch your back.
7. Frequency: Perform strength training 2 or 3 days per week with at least one day of rest between training days.
8. Major muscles: Perform strength training exercises for all major muscles, including legs, chest, shoulder, arms, and trunk.

<table>
<thead>
<tr>
<th>Major muscle group</th>
<th>Exercise</th>
<th>Sets</th>
<th>Reps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper limbs/upper trunk</td>
<td>Push-up on wall/mat</td>
<td>2</td>
<td>10-12</td>
</tr>
<tr>
<td></td>
<td>Bent Row with weight</td>
<td>2</td>
<td>10-12</td>
</tr>
<tr>
<td>Core strength</td>
<td>Plank</td>
<td>2</td>
<td>10-12</td>
</tr>
<tr>
<td></td>
<td>prone on elbows/heads</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Leg raises (w/ knee bend)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>lying on back</td>
<td>2</td>
<td>10-12</td>
</tr>
<tr>
<td></td>
<td>Bicycle crunch</td>
<td>2</td>
<td>10-12</td>
</tr>
<tr>
<td></td>
<td>lying on back</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower limbs/lower trunk</td>
<td>Bridge lying on back</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Holding 10 sec</td>
<td>1</td>
<td>8-10</td>
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<tr>
<td></td>
<td>1 set of 8-10 reps</td>
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<tr>
<td></td>
<td>Squats with arm raises</td>
<td>2</td>
<td>8-10</td>
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<tr>
<td></td>
<td>from/Back Lounges</td>
<td>1</td>
<td>4-6</td>
</tr>
<tr>
<td></td>
<td>One-leg Bridge</td>
<td>2</td>
<td>10-12</td>
</tr>
<tr>
<td></td>
<td>lying on back</td>
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Session 4:
Overcoming Your Barriers(I)

- Review and discuss goal setting and self-monitoring
- What is a barrier
- Learn a simple tool to overcome barriers
- Worksheets: apply the problem solving model for your real life barriers
Overcoming Barriers:
How to continue your success with the GOALS!

One way to continue successful behavior change is to be prepared for any barriers you may encounter. As you may have seen with your first goal setting experience, setting up a plan and sticking to it is more of an art than a science.

Goal setting is dynamic. This means that you may need to modify your goals based on situations or barriers that pop up when you are trying to live an active lifestyle. If you learn how to clearly define the problems that arise, then you and the group will be better able to brainstorm for possible solutions.

A barrier is something that seems to limit or stop you from participating in your planned physical activity. Barriers may include things such as the environment (cold or hot weather), our thoughts or feelings, travel/vacation and changes in your health.

If barriers to your planned physical activity are left unchecked, you are at a greater risk of not meeting your goals and losing motivation to continue.

A barrier can be something that is positive (care giving) or negative (rainy weather). So barriers may not be something that you need, want, or are able to completely delete from your daily lives, but rather things that you should be aware of, and plan for and work around as needed, in order to remain active.
Tools for Overcoming Barriers

When you find yourself facing a barrier for your planned physical activity, use the following four tools to help you overcome the barrier.

1. **Stopping in the moment**
   Stop the moment you encounter the barrier. Tell yourself to stop all thoughts and behaviors that are negative (e.g., I cannot get my walk in today because it's raining. I'll just sit here and not worry about reaching my walking goal today. I have no other options). Examine what is happening right now.

2. **Breathing**
   Take one or two deep breaths to allow your body to calm down and refocus. Slowly breathe in and out, filling your abdomen up with air. Feel yourself relaxing and becoming more focused with each breath.

3. **Reflection**
   Think back on the situation. Recall the facts. Try to avoid allowing the emotions that you might have felt during the situation to fall away. Try to reflect without judgment.

4. **Objectivity**
   It often helps to look at a barrier as if it were a friend's problem. If he or she presented this problem to you and asked you for advice, what might you tell him or her?
Now that we have learned some important tools that will guide us in the problem solving process, let’s begin to examine the strategy we can use to help us overcome any barriers that might come our way—in the group and in life in general!

Problems caused by barriers can be solved by following specific steps. Here are the first two:

1. **Stop and recognize the problem:**

   The first step is to become aware of and state how you first noticed the problem. Stop in the moment and breathe. What came to your mind?

   Oftentimes, we start by viewing a problem as something that we cannot control or solve. This can bring about an emotional reaction, which may cloud our ability to clearly see the problem for what it is. So, the goal here is to look at the problem objectively. Remember, you might not be able to control a situation, but you can always control your reaction!

2. **Clearly define the barrier/problem:**

   The way in which you define your problems will ultimately determine your success with solving them. Use breathing to help you focus in on the problem and reflect thoughtfully.

   In order to clearly define your barriers to participating in regular exercise, follow these suggestions:

   1. Seek out all facts and describe them clearly without making assumptions or judgments (i.e., with objectivity!).

   2. Identify what barrier makes the situation a problem.
Let's take some time now to do an activity that will allow us to practice these first two steps of problem solving.

Debbie has decided to use her treadmill five times a week for 20 minutes right after work or before she goes to bed in order to work toward meeting the Project CHANGE goal of 150 minutes of activity each week. She knows she cannot exercise in the morning. She enjoys listening to music while she is briskly walking. Breaking a sweat on a treadmill makes her feel good since she feels she is doing something good for her own sake. Exercising after work also gives her a chance to relieve stress. However, there was a new project this quarter and she became very busy at work since last week. More and more often, she has to work afterhours. After getting home and fixing her dinner, she is exhausted. She can only fit in 20 minutes of exercise on two days of this week. She is frustrated and upset. She is starting to feel that maybe she will just never reach her goal since she has no time or energy left at the end of the day.

What can Debbie do in order to prevent quitting her exercise plan?

Complete the first two steps:

1. **Stop and recognize the problem** - What is your first thought or reaction to Debbie's problem?

   

2. **Clearly Define the Problem** - Clearly state the facts and define the barrier. What about this situation makes this a problem?

   


In step 3, we look at possible solutions!

3. Brainstorm for solutions:

The best way to brainstorm for solutions to problems is to **start off with an open mind**. Brainstorming should take place when you are relaxed and have had some time to reflect (check back with our helpful tools to learn more about reflecting). Use breathing as a tool!

The basic purpose of brainstorming is to come up with as many possible solutions as you can. This will increase your chances of finding a solution.

**Judgment of the solution should be done at a later time, once all possible ideas/solutions have been written down.** So keep in mind that there is no right or wrong answer when brainstorming!

1. __________________________________________

2. __________________________________________

3. __________________________________________

4. __________________________________________

5. __________________________________________

6. __________________________________________

7. __________________________________________
Problem Solving Steps 4 and 5:

4. Evaluate & decide on the best solution that is in line with your values

Begin by reflecting on what values might be affected by your decision. Take some time to evaluate the list of solutions that you came up with.

Look at each solution and ask yourself “What are the benefits and costs of using this solution?” That is, what good things might come from this solution? Why might this solution be a difficult one? The solution with the greatest benefit and the least cost should be the solution that you put into action! So, be sure that the solution does not compromise something you value! Is it in line with your likes/dislikes?

5. Executing & evaluating the plan:

Your plan for execution may look a lot like a SMART goal. You will want to be specific in describing your plan and provide self-encouragement by posting reminders of your plan in visible locations. You can use your plan of execution as a guide for evaluation. Evaluate how well you did with this plan at the end of each week for two weeks. If the solution worked, then great! If not, go back to the drawing board and create another plan—perhaps you have another one of your brainstormed solutions ready as a backup plan. Gather support!
Group Activity: Putting Yourself in Debbie’s Shoes

Let’s take some time now to do an activity that will allow us to practice these last two steps of problem solving. Let’s put ourselves in Debbie’s shoes. You and your partner will now be given one of the solutions we came up with to evaluate for yourselves; think about this solution as if you had a similar barrier and were trying to implement the solution yourself. What would the costs and benefits of using this solution be for you? Write down any costs and benefits that you and your partner discuss. We will then share our thoughts in the group... is this solution one that would work for you? Why or why not?

**Determine the Best Solution to the Problem**
- Write the costs and benefits for the solution that was provided to you and your partner. Remember to think about what you value and how this solution may or may not be in line with what you value.

**Possible Solution:**

**Values Related to this Solution:**

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<tr>
<th>Benefits</th>
<th>Costs</th>
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Great brainstorming! Please review Project CHANGE problem solving model. Remember to go through each of these 5 steps when you encounter a Barrier/ Problem in CHANGE and throughout the rest of your lifetime. This will help you to maintain all of the positive changes that you continue to make.

**Project CHANGE Problem Solving Model**

1. Stop and recognize the problem
2. Clearly define the barrier/problem
3. Brainstorm for solutions
4. Evaluate & decide on the best solution
5. Execute & evaluate the plan
CHANGE! Worksheet

Now, recall your difficult situations. Did you make your goal last week? If not, how did you feel and what is the problem to stop you reaching your goal? Apply the problem solving model to your real-life barriers. Complete the five-step problem solving process:

1. Stop and recognize the problem - What is your first thought or reaction for your situation?

2. Clearly Define the Problem - Clearly state the facts and define the barrier. What about this situation makes this a problem?

3. Brainstorming for solutions - Start off with an open mind and not judge or evaluate the solutions during the process.
   1. 
   2. 
   3. 
   4. 
   5. 
   6. 

4. Evaluate and decide on the best solution that is in line with your values - Write the costs and benefits for the solution that was provided to you and your partner. Remember to think about what you value and how this solution may or may not be in line with what you value.

   Possible Solution:

   Values Related to this Solution:

<table>
<thead>
<tr>
<th>Benefits:</th>
<th>Costs:</th>
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5. Executing & evaluating the plan - execute it and tell us what you feel next week.
Project

Mid-point Evaluations

• Next week, we will conduct mid-point evaluations which take 15-20 minutes at the beginning of the meeting. The evaluations include two parts:
  o Functional test: stair-climbing
  o Psychological questionnaires

• It is important to know how your psychological variables changes in this study. So, please let Ya-Ting know if you cannot come to our meeting next week.

• Please arrive on time. Thank you so much!!

• Contact information:
  Ya-Ting Hsu
  Email: hsu.224@osu.edu
  Fax: 614-688-3432
  Cell: 352-871-3260 (no signals at the lab)
  Exercise Behavior Lab--Project CHANGE: 614-292-0098
  Mail address:
  A12 PAES Building, 305 W 17th Ave. Columbus OH, 43210
Session 5:
Overcoming Your Barriers (II)

- Mid-point evaluations: stair-climbing and psychological variables
- Review and discuss problem solving model
- Worksheets: working around your barriers and seeking supports
Session 5: Review of problem solving

Reviewing Debbie’s Response to Her Problem/Barrier

You are now equipped with the five-step model in problem solving as well as some tools to help you in the process. During the last session, you learned to take a step back and think about how you are looking at the problem and to clearly define the problem by gathering the facts. You also brainstormed about possible solutions to Debbie’s problem and decided on the best solutions in line with your values. All of this occurred because you decided that this was a problem that could be solved!

It is important to note that Debbie initially looked at the problem in a negative way. Feeling frustrated, she decided that this situation was out of her control. She began to think that she should just ignore the problem and drop out of the program. This way of looking at a problem is exactly what you want to prevent from happening!

In fact, having negative emotional responses to barriers stops the problem-solving process and leaves you at risk for falling behind with your exercise plan and for being unable to tackle barriers in every aspect of your life!

Common barriers:
- Time
- Work/school
- Family responsibility/care taking
- Lack of enjoyment
- Lack of energy
- Weather
- Illness/injuries

---

**Project CHANGE**

**Problem Solving Model**

1. Stop and recognize the problem
2. Clearly define the barrier/problem
3. Brainstorm for solutions
4. Evaluate & decide on the best solution
5. Execute & evaluate the plan

---

230
Now, recall your difficult situations. Did you achieve your goal last week? If not, how did you feel and what stopped you from reaching your goal? Apply the problem solving model to yourself: Complete the five-steps problem solving process:

1. **Stop and recognize the problem** - What is your first thought or reaction to your situation?

2. **Clearly Define the Problem** - Clearly state the facts and define the barrier(s). What about this situation makes this a problem?

3. **Brainstorm solutions** - Start off with an open mind and don’t judge or evaluate the solutions during the process.
   1. 
   2. 
   3. 
   4. 
   5. 
   6. 

4. **Evaluate and decide on the best solution that is in line with your values** - Write the costs and benefits for the solution that was provided to you and your partner. Remember to think about what you value and how this solution may or may not be in line with what you value.
   
   **Possible Solution:**
   
   **Values Related to this Solution:**
   
   **Benefits:**
   
   **Costs:**

5. **Execute & evaluate the plan** - put your solution into action and tell us what happened next week.
CHANGE! Worksheet

Working around your barriers and seeking supports!

Barriers may not be something you are able to completely remove from your daily lives, but rather things you should be aware of, plan for, and work around as needed, in order to remain active.

Negotiating your barriers: Seeking supports to negotiate these barriers and reframe these responsibilities to become your facilitators.

- Work/School
- Family responsibility

You want to gather as many as supports and resources to help to execute your plan and overcome your barriers successfully.

- Positive re-enforcements:
  - What are the **benefits** you have received after being active for 4 weeks?
    Physical:
    
    __________________________________________________________
    __________________________________________________________
    __________________________________________________________
    Psychological:
    __________________________________________________________
    __________________________________________________________
    Others:
    __________________________________________________________
    __________________________________________________________
    __________________________________________________________
• Social supports: friends/co-workers/family/health professionals
  ▪ How have you gathered social support to help you execute your plan and overcome barriers?
    __________________________________________________________
    __________________________________________________________
    __________________________________________________________

  ▪ What else can you do to get the social support you might need to execute your plan and overcome barriers?
    __________________________________________________________
    __________________________________________________________
    __________________________________________________________

• Resources: resources in the workplace and community.
  Share resources you have discovered with us!
    __________________________________________________________
    __________________________________________________________
    __________________________________________________________

• Cues to action: What strategies could you use to remind you being active?
  ▪ Notes/signs, step-counter, running shoes in the car, etc…
    Others:
    __________________________________________________________
    __________________________________________________________
    __________________________________________________________
Session 6: 
Smart CHANGE: 
Finding supports & resources and decreasing your inactive time

- Discuss some strategies that can support your active lifestyle.
- Learn how to find social support.
- Learn about community and workplace resources to help you maintain your exercise.
- Learn how to identify additional community resources to help you.
- Develop and practice strategies for decreasing sedentary time.
- Worksheets:
Find your supports and resources

You are now equipped with some useful strategies, such as goal setting, self-monitoring and problem solving to help you be a Confident, Healthy, and Goal-directed exerciser. This section will help you to consider what supports and resources will help you maintain your active lifestyle.

- **Social supports: friends/co-workers/family/health professionals**
  - How have you gathered social support to help you execute your plan and overcome barriers?
    - 
    - 
    - 

  - What else can you do to get the social support you might need to execute your plan and overcome barriers?
    - 
    - 
    - 

- **Cues to action: What strategies could you use to remind you to be active?**
  - Notes/signs, step-counter, running shoes in the car, etc…
  - Others: 
    - 
    - 
    - 

You want to gather many supports and resources to help to overcome your barriers and maintain your active lifestyle.
How can community and workplace resources help you?

Exercise and physical activity resources available in your community and workplace can help you stick to your exercise schedule more easily by providing an indoor place to exercise, social contact, and possibly new exercise equipment.

Community centers, fitness centers, parks, walking/biking trails, home exercise equipment, and local walking clubs are all examples of existing community resources that can help you maintain your active lifestyle as we transition towards independent exercise participation in Project CHANGE.

How can you find community and workplace resources?

- Talk to your friends
- Check with your place of worship
- Ask your doctor
- Check workplace newsletters/announcements
- Search the internet
OSU and Community Resources

- **OSU Faculty and Fitness Program:** [http://ehe.osu.edu/paes/fsfp/](http://ehe.osu.edu/paes/fsfp/)
  The FSFP Program includes:
  - Aerobic Fitness Evaluation with ECGs
  - Flexibility, Body Composition (skinfolds), and Strength Evaluations
  - Exercise Prescriptions and Individual Counseling and Training
  - Quarterly Newsletter
  Exercise options include:
  - General Conditioning (the workout time in our facility)
  - Water Aerobics
  - Lap Swimming
  FSFP payment options
  - Yearly: $140
    All services for a full calendar year, paid in full on day of fitness assessment
  - Quarterly: $65 for first 3 months, $45 for each subsequent 3 month period
    All services for each quarter paid in full

- **The OSU Center for Wellness and Prevention (CWP):**
  [http://medicalcenter.osu.edu/patientcare/healthcare_services/healthy_living/center/Pages/index.aspx](http://medicalcenter.osu.edu/patientcare/healthcare_services/healthy_living/center/Pages/index.aspx)
  Aerobic and strengthening exercise equipment and specialty classes that are included in the membership cost are: yoga, aerobics, strength training, Body Recall, warm water aquatic fitness and balance ball and body sculpting. Other services offered are: fitness evaluations, wellness assessments, VO2 cardiovascular fitness testing, personal training, weight management and nutrition counseling. If you are interested in joining the CWP and want to learn more, attend an information session. CWP fitness information sessions are held every Tuesday at 5:30 p.m. For more information, call 256-2800.

- **YMCA of central Ohio:** [http://www.ymcacityofcolumbus.org/](http://www.ymcacityofcolumbus.org/)

- **Westerville Community Center**
  350 N. Cleveland Ave, Westerville, OH 43081 Phone: (614) 901-6500
  The community center has an indoor walking track, swimming pool and fitness center. Discounted rates for Westerville residents and those > 60 years of age. Memberships can be purchased for access to select services (walking track, fitness center, pool).

- **Speedy sneakers:** [http://www.speedysneakers.com/](http://www.speedysneakers.com/)
  Walking and running training for women, need membership ($55 yearly)
• **Map my walk**: [http://www.mapmywalk.com/](http://www.mapmywalk.com/)
  Provides walking maps and training tools.

• **Get Active Columbus**: [http://getactivecolumbus.com/](http://getactivecolumbus.com/)
  Biking paths, walking routines, organized activities, park info.

• **Healthy Places**: [http://publichealth.columbus.gov/healthy-places.aspx](http://publichealth.columbus.gov/healthy-places.aspx)
  The Healthy Places program works to create a built environment that encourages walkability, bikeability and physical activity.
  The built environment includes the physical elements added to the natural environment to create the environment in which humans live. Examples include buildings, road systems, parks, neighborhoods, civic buildings, and schools.
  - Columbus Neighborhood Walking Maps
  - Columbus Art Walks
    - [http://publichealth.columbus.gov/artwalk.aspx](http://publichealth.columbus.gov/artwalk.aspx)

• **Polaris Mall walking**
  Polar Mall walkers are welcome everyday! You can enter the Food Hall doors (entrance 4, to the left of The Great Indoors) at 8:00 a.m. Monday thru Saturday and 10:00 a.m. on Sundays.

• **Just walk: Walk with a doc**: [http://www.walkwithadoc.org](http://www.walkwithadoc.org)
  *Just Walk is a free, non-profit program for anyone interested in taking steps for their health. Bring friends and loved ones or come alone, and enjoy a refreshing, rejuvenating walk in the park. Physicians, specialists and healthcare professionals from your community will provide support and answer questions. Check their calendar!*
  - **Walk With A Doc Franklin Park Conservatory - Columbus, OH**
    - Saturday Morning 8:30am to 9:30am
    - Rain, Shine, Sleet or Snow ... We are inside for the winter!
    - We have moved the FPC walk inside. We will resume at FPC in the Spring
  - **Walk With A Doc Westerville Sports Complex**
    - Saturday Morning 9:00 AM Rain or shine!
    - Westerville Community Center
    - 350 N. Cleveland Avenue Westerville, Ohio 43081
    - Meet at the Westerville Community Center south patio
  - **Walk With A Doc Glacier Ridge - Dublin, OH**
    - Saturday Morning 8:00am to 9:00am Rain or shine!
    - Glacier Ridge Metro Park
    - 9801 Hyland Cray Road
    - Plain City, Ohio 43064
• **Driving Park Walking Club** [http://drivingparkwalkingclub.org/](http://drivingparkwalkingclub.org/)
The club members meet every Saturday at 8:00 am at the Driving Park Recreation Center, 1100 Rhoads Avenue. After walking, members participate in educational sessions conducted by a Certified Personal Trainer, Licensed Nutritionist and other health professionals.

• **Leukemia & Lymphoma Society’s Team In Training** [http://www.teamint raining.org/381/eb/](http://www.teamint raining.org/381/eb/)
TNT is the world’s largest endurance sports training program, preparing people of all athletic abilities to run or walk a 26.2-mile marathon or a 13.1-mile half marathon, or to complete a 100-mile (century) bike ride or a triathlon. In return for professional training and travel to one of many national event sites, participants raise valuable funds to support the Leukemia & Lymphoma Society’s (LLS’s) mission.

• **Meet-up**
  - **Central Ohio Hikers & Backpackers**
    Central Ohio Hikers & Backpackers is a group of active outdoors enthusiasts with a serious interest in 3+ mile day hikes as well as multi-day backpacking adventures in and around Ohio. There are a number of other “walk-in-the-park” groups out there, but the focus of this group is on longer hikes and backpacking events. Feel free to sign up and share your ideas and interests with us. We invite you to join us on our many upcoming hikes & backpacking events!
  - **Hike OHIO!**
    922 members. Active group. Provides some walking meet-ups
    This group is for anyone who likes to hike and walk on nature trails, backpacking trails and just about anywhere in the great outdoors. All those who are dedicated to hiking excursions in Ohio, with a focus on leaving no trace of litter on our lands can join us! We will get together for evening hikes on metro parks trails, gather for day hikes in the Ohio State park and forest system and maybe even do overnight trips if anyone is interested. We are trying to get some dog friendly hikes in for you and your canine companions.
• Events in the community:
  • **The Flying Feather** [http://www.theflyingfeather.com/info.html](http://www.theflyingfeather.com/info.html)
    November 25, Dublin, OH, Walking training program online provided.

    Thanksgiving is all about family, fun and food. Now you can add fun and activity! Bring all your relatives, house guests, cooking buddies and little turkeys out for the Flying Feather Four Miller, Thanksgiving Day, Thursday, November 25, 2010.

    All adult participants will receive a bottle of wine for the Thanksgiving Table! Kids should get a piece of the pie, or COOKIE too! Every young gobbler participating in the Four Miller or Gobbler Chase will receive specially made, packaged Thanksgiving Day cookies. Kids 10 and under can participate in the Kids' Gobbler Chase, which takes place before the four miler so parents and family can cheer the kids on.

  • **Columbus Turkey Trot**
    November 25, Upper Arlington, OH

    2000 PUMPKIN PIES will be awarded to the top finishers in the 5 miler and the top 100 walkers in the 2 mile Columbus Parent Magazine Walk and Talk. Swag Bags include a great looking multi-colored technical dry release shirt, EAS energy bar. Bring the kids to the 100 yard McDonalds Tot Trot (IT'S FREE) and don't forget the camera. All kids who register before November 20th receive a free entry, free t-shirt, finisher award and finish line goody!
Exercise v.s. Physical Activity: 
Importance of Sitting Less and Moving More

Let's use a little story to introduce this topic. Michelle and Alice are both committed to exercising. They jog together every day over lunch and, being similar in fitness, they jog the same pace and distance. In fact, their pedometers had the same number of steps after their jog = 6,000.

However, something strange happened the rest of the day. At night, when Michelle checked her pedometer before going to bed, she had 7,000 steps but Alice had 10,000. What happened? Had Michelle's pedometer broken? No, the problem was what Michelle did the rest of the day.

After her walk, Michelle sat at her desk to work and then sat on the couch to watch TV. Meanwhile, Alice walked 10 minutes to an after lunch meeting, went to the mall to do some quick shopping, and walked her dog after dinner. These small, moderate activities made a big difference in the total amount of activity the two friends accumulated. If you add that up over a week that is a lot of physical activity!

In CHANGE, we emphasize trying to incorporate structured exercise into each day. Whether it is multiple 10 minute sessions or single sessions of 30+ minutes we try to encourage this increased activity.

However, minimizing your sedentary (inactive) time can have a meaningful CHANGE on your overall activity. In fact research shows that doing more of this “purposeful” physical activity results in significant benefits for health, physical function, and quality of life!

With a little planning and effort,
You can get these benefits too!
How Do We Reduce Sedentary Time?

- Park your car a little farther away from the store, mall, or restaurant.

- During a commercial, get up and move...walk around the house or do small chores, such as taking out the trash.

- Take the stairs instead of the elevator...

- Do some chores around the house or work in the yard. You will be doubly productive!

- Others:

  __________________________________________
  __________________________________________
  __________________________________________
  __________________________________________

These are just a few suggestions to help try and increase your physical activity throughout the day. Doing this and your planned exercise will help you reach your health goals!
CHANGE worksheet: Goal-Setting Sheet (I)

Next week, we will re-visit goal settings, barriers, problem and finding supports!!

- Review your lifelong goal: The big picture!!
  What do you see yourself like 5 years from now?

- Review your long-term activity goal: the end of Project CHANGE in January 2011.
  My SMART long-term activity goal is:

  ______________________________
  I can measure it by Frequency, Intensity, Time, Type:

  ______________________________

- Review your short-term activity goal: weekly and daily goal
  In order to reach my long-term activity goal, I will set the following SMART short-
  term activity goals:

  ______________________________
  I can measure it by Frequency, Intensity, Time, Type:

  ______________________________

- **Consider**: How my exercise plan will adapt to the coming cold weathers?

  ______________________________

- **Seek your support and resources**
  Who will support me in my goals:
  What resources you will support you reaching my goals:

  ______________________________

This signature represents my support of my friend/spouse/family member’s goal.

X______________________________ Date:____________________

This signature represents my commitment to this goal.

X______________________________ Date:____________________
### CHANGE worksheet: (I)

#### Weekly Aerobic Exercise Plan

<table>
<thead>
<tr>
<th>Week</th>
<th>Weekly minute goal</th>
<th>Intensity (RPE)</th>
<th>Speed (mph)</th>
<th>Speed (mph)</th>
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<tbody>
<tr>
<td>1</td>
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Note:
- In Project CHANGE, we emphasize trying to incorporate "purposeful" structured exercise into each day. Whether it is multiple 10 minute sessions or single sessions of 30+ minutes, we try to encourage this increased activity.

- Public Health Recommendation:
  Moderate-intensity aerobic activity 150 minutes per week
  AND
  8 to 10 weight training exercises, 8 to 12 repetitions of each exercise twice a week

- Moderate-intensity physical activity means working hard enough to raise your heart rate and break a sweat, yet still being able to carry on a conversation. The 30-minute recommendation is for the average healthy adult to maintain health and reduce the risk for chronic disease.
CHANGE worksheet: Problem solving models (II)

1. **Stop and recognize the problem** - What is your first thought or reaction to your situation?

2. **Clearly Define the Problem** - Clearly state the facts and define the barriers. What about this situation makes this a problem?

3. **Brainstorming for solutions** - Start off with an open mind and not judge or evaluate the solutions during the process.
   1. 
   2. 
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   6. 

4. **Evaluate and decide on the best solution that is in line with your values** - Write the costs and benefits for the solution that was provided to you and your partner. Remember to think about what you value and how this solution may or may not be in line with what you value.

   **Possible Solution:**

   **Values Related to this Solution:**

   **Benefits:**
   
   **Costs:**

5. **Executing & evaluating the plan** - Execute it and tell us what happened next week.
**CHANGE worksheet:** Finding your motivation!! (III)

- In order to keep us being active, there are some strategies to keep us committed to our exercise goals. **What strategies work for you or would you consider trying?** Let’s us share our ideas about how we will continue to stay motivated to be active on a regular basis throughout CHANGE and the rest of our life!

---

- **Tips:** consider some positive reinforcements
  - Reward yourself for your accomplishments
  - Think about improvements in your physical health
  - Notice how your psychological health has improved (better mood, more energy, etc.)
  - Sense of accomplishment and competence
    - Setting small goals and reaching them
    - Successfully work around your barriers
    - Noticing how daily activities are easier
    - Realize that you are getting stronger
  - Change your physical activities: using PITT principles
    - Try different type of activity
    - Progressively increase Frequency, Intensity, and Time
    - Adjust your activity based upon your daily schedules (i.e. working around your barriers.)
Session 7:
Re-visit goal setting & problem solving and develop your motivational plan

- Review how to set SMART goals and modify your goals.
- Discuss how to find your supports and resources to reach your goals.
- Discuss your exercise plan for cold weather and some tips for exercising in cold weather.
- What is motivation?
- How to stay motivated and develop your motivational strategies.
- Work sheets: find your high-risk situations
Re-visit SMART goals

Set **Specific Goals** – Goals need to be stated with details. Oftentimes, people make goals that are so large and vague that it’s hard to know whether they’ve reached them or not. Use the “**When, Where, and How**” principle. Example: I will walk 30 minutes in my neighborhood on Tuesdays and Thursdays after work. (instead of vague goal: I will walk more)

Set **Measurable Goals** – You need to be able to know whether you’ve accomplished your walking exercise goals by making them measurable. Use the “**FITT**” principle and focus on the frequency and/or duration of your walking exercise in order to measure your weekly progress. Example: I will climb stairs with RPE-12 for 10 minutes, in the morning, during lunch hour and in the afternoon during weekdays.

Set **Achievable Goals** – Goals should be challenging yet realistic and attainable. Find a goal that you know is one you can ultimately achieve. A good idea is to have at least one short term goal that leads to one long term goal.

Set **Realistic/Relevant Goals** – Think about these things: do you have the resources necessary to complete the goal? Is the goal health-related? Does this goal help you move towards the life you want? Will you have support for this goal? Why is this goal important to you?

Set a **Timeline** – Have realistic dates set for you to measure your success as you work to reach your goals. Remember, timelines can be adjusted as needed. You may need to modify a goal if you are presented with a barrier you cannot control (e.g., illness). Example: I will walk 150 minutes this week. (instead of open ended: I plan to walk 150 minutes)
CHANGE worksheet: Goal-Setting Sheet (I)

- **Review your lifelong goal:** The big picture!!
  How do you see yourself 5 years from now?

- **Review your long-term activity goal:** for the end of Project CHANGE in January 2011.
  My SMART Long-term activity goal is:

  I can measure it by *Frequency, Intensity, Time, Type*:

- **Review your short-term activity goal:** weekly and daily goal
  In order to reach my long-term activity goal, I will set the following SMART short-term activity goals:

  I can measure them by *Frequency, Intensity, Time, Type*:

- **Seek your support and resources**
  Who will **support** me in my goals: ______________________
  What **resources** will support me in reaching my goals: ______________________

---

Our CHANGE goal is to participate in moderate-intensity activity for **150 minutes per week**, but each of us may need to use a different way to get there. Each of us has our own limitations and we need different approaches to reach this same ultimate goal. Some of you may even be able to go beyond 150 minutes per week.
**CHANGE worksheet: (I)**

**Weekly Aerobic Exercise Plan**

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1. **Stop and recognize the problem** - What is your first thought or reaction to your situation?

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   **Possible Solution:**
   **Values Related to this Solution:**
   **Benefits:**
   **Costs:**

5. **Executing & evaluating the plan** - Execute it and tell us how you feel.

- **Consider:** How will I adapt my exercise plan to the coming cold weather?
Exercise and cold weather: Tips to stay safe outdoors

http://www.preventbully.com/teaching/lesson1018760.html

So you don’t like jogging out miles on the treadmill or power walking the mall, but you dread exercising during cold weather. Unfortunately, cold weather can discourage even the most motivated exercisers. And if you’re not so motivated, it’s all too easy to pack away your workout gear along with your warm-weather clothing. You don’t have to let cold weather spoil the end of your exercise. With these tips for exercising during cold weather, you can stay fit, motivated and warm when the weather turns chilly.

Stay safe during cold-weather exercise

Almost everyone can exercise safely during cold weather. But if you have certain conditions, such as asthma, heart problems or Raynaud’s disease, check with your doctor before you work out in cold weather. Your doctor can review any special precautions you need based on your condition or medications you might take. The following tips can also help you stay safe — and warm — while working out in the cold.

• Dress in layers

One of the biggest mistakes you can make while exercising in cold weather is to dress too warmly. Exercise generates a considerable amount of heat — enough to make you feel like it’s much warmer than it really is. Yet, once your sweat starts to dry, you can get chilled. The solution?

Dress in layers that you can remove as soon as you start to sweat and then put back on as needed. First, put on a thin layer of synthetic material, such as polypropylene, which draws sweat away from your body. Avoid cotton, which stays wet next to your skin. Next, add a layer of fleece or wool for insulation. Top this with a waterproof, breathable outer layer. A heavy down jacket or vest may cause you to overheat if you’re exercising hard. If you’re lean, you may need more insulation than someone who is heavier. If it’s very cold, consider wearing a face mask or scarf to warm the air before it enters your lungs.

You may need to experiment before you find a combination of clothing that works well for you based on your exercise intensity. Keep in mind, too, that stop-and-go activities, such as mixing walking with running, can make you more vulnerable to the cold if you repeatedly work up a sweat and then get chilly.

• Protect your hands, feet, head and ears

When it’s cold, blood flow is concentrated on your body’s core, leaving your hands and feet vulnerable to frostbite. Try wearing a thin pair of gloves under a pair of heavier gloves or mittens lined with wool or fleece. Don the mittens or gloves before your hands become cold and then remove them if your hands begin to sweat.

Considering buying exercise shoes a half-size or one size larger than usual to allow for thick thermal socks or an extra pair of regular socks. Also, your head should be covered because heat loss from the head and neck may be as much as 40 percent of the total heat being lost by your body. And don’t forget a hat or headband to protect your ears, which also are vulnerable to frostbite.

• Pay attention to weather conditions and wind chill and STAY DRY!

Exercising when it’s cold and raining can make you more vulnerable to the cold. If you get soaked, you may not be able to keep your core body temperature high enough, and layering won’t help if your clothes are wet. If it’s extremely cold, you may need to take your exercise indoors or skip it for a day or two.

Wind chill extremes can make exercising outdoors unsafe even if you dress warmly. The wind can penetrate your clothes and remove the insulating layer of warm air that surrounds your body, and any exposed skin is vulnerable to frostbite.

If the temperature dips well below 0 °F (-17.5 °C) or the wind chill is extreme, consider taking a break or choosing an indoor activity instead, or take extra precautions if you choose to exercise outdoors anyway.
• Choose appropriate gear
  If it's dark when you exercise outside, wear reflective clothing. To stay steady on your feet, choose
  footwear with enough traction to prevent falls, especially if it's icy or snowy. Wear a helmet while skiing,
  snowboarding and snowmobiling. Consider using chemical heat packs to warm up your hands or feet.

• Remember sunscreen
  It's as easy to get sunburned in winter as in summer — even more so if you're exercising in the snow or at
  high altitudes. Wear a sunscreen that blocks both UVA and UVB rays and has an SPF of at least 30. Use
  a lip balm that contains sunscreen. And protect your eyes from snow and ice glare with dark glasses or
  goggles.

• Head into the wind
  If possible, do the second half of your workout with the wind at your back. This way, you're less likely to
  get chilled, especially if you've worked up a sweat. This may take some planning of your exercise route
  before you head out the door.

• Drink plenty of fluids
  You need to stay well hydrated when exercising in cold weather just as you do when exercising in warm
  weather. Drink water or sports drinks before, during and after your workout, even if you're not really thirsty.
  You can become just as dehydrated in the cold as in the heat from sweating, breathing and increased
  urine production, but it may be harder to notice during cold weather.

• Know the signs of frostbite and hypothermia
  Frostbite is most common on exposed skin, such as your cheeks, nose and ears, but it also can occur on
  hands and feet. Early warning signs include numbness, loss of feeling or a stinging sensation. If you
  suspect frostbite, get out of the cold immediately and slowly warm the affected area — but don't rub it
  since that can damage your skin. If numbness continues, seek emergency care.

  Exercising in cold, rainy weather increases the risk of hypothermia, as does being an older adult.
  Hypothermia signs and symptoms include intense shivering, slurred speech, loss of coordination and
  fatigue. Seek emergency help right away for possible hypothermia.

• Putting it all together for cold-weather safety
  These tips can help you safely — and enjoyably — exercise when the weather turns chilly. But as you
  exercise during cold weather, continually monitor how your body feels to help prevent cold-weather
  injuries, such as frostbite. Consider shortening your outdoor workout or skipping it altogether during
  weather extremes, and know when to head home and warm up. Also, be sure to let someone know your
  exercise route and your expected return time, in case something does go wrong.
Your Motivational Strategies

Motivation can help people to initiate, direct and regulate our behavior. Motivation works like gas or power of a vehicle and drives us to the destination/goal we intend to arrive.

Often times, people are moved by totally external factors, such as punishment, reward, orders and rules. However, frequently, people engage in certain activities because they value, enjoy or are curious about it! People have different kinds of motivation for different activities due to their life experiences, capabilities, values, personality, and even physical conditions and social environments.

In order to continue through our journey of being physically active, we need to motive ourselves, like adding gas to the vehicles. We may begin to ask ourselves “bigger” questions such as, “What do I value most in my life?” “What do I see myself in 10 years?” If we do not take time to think about these “bigger” questions, then there is a good chance that we may get distracted in our day-to-day behavior and eventually be disappointed with ourselves. The good news is that it is never too late to begin clarifying our life goals and getting on track!

My Current Motivational Plans: The Best Laid Plans....

We can have various kinds and sources of motivation. The cornerstone of a motivational plan involves clarifying why exercise and your physical function are so important in your own life and then developing the tools that will help you to be mindful of this on a daily basis.

• In what ways is your exercise and physical function important to the “big picture” of your life?
• In addition to keeping the big picture in mind, we have used a number of strategies to keep us committed to our goals. What strategies work for you or would you consider trying?

• Tips: consider some positive reinforcements
  ○ Reward yourself for your accomplishments
  ○ Think about improvements in your physical health
  ○ Notice how your psychological health has improved (better mood, more energy, etc.)
  ○ Experience a sense of accomplishment and competence
    ▪ Set small goals and reach them
    ▪ Successfully work around your barriers
    ▪ Notice how daily activities are easier
    ▪ Realize that you are getting stronger
  ○ Change your physical activities: using FITT principles
    ▪ Try a different type of activity
    ▪ Progressively increase Frequency, Intensity, and Time
    ▪ Adjust your activity based upon your daily schedules (i.e., working around your barriers)
CHANGE worksheet: reality check!

Life is challenging and meeting our exercise goals is not always easy.

- Do you know what high-risk situations might cause you to slip from your exercise plan?
  ____________________________________________________________
  ____________________________________________________________
  ____________________________________________________________

- What strategies you have used to help yourself get back on track?
  ____________________________________________________________
  ____________________________________________________________
  ____________________________________________________________
  ____________________________________________________________

- What strategies will you try to help yourself get back on track again?
  ____________________________________________________________
  ____________________________________________________________
  ____________________________________________________________
Session 8:
Relapse Prevention: The Danger of Zero Tolerance to Slips

- Discuss risk of relapse.
- Identify your high risk situations and apply the problem solving model to prevent relapse.
- Review physical and behavioral skills to help you become active independently.
- Decide the date for evaluations.
Zero Tolerance
It's time for reality check!

Today, we want to focus on a common “pot hole” on the road to regular exercise — zero tolerance!

Zero Tolerance is the practice of not accepting slips or glitches in adhering to your exercise program. It can lead to “all or none” thinking when you are working on your exercise goals.

Keeping an “all or none” attitude towards exercise behavior can turn activity into a chore, something that you may even dread! Also, setting such high expectations for yourself and not allowing for necessary “wiggle room” may make you feel anxious, angry, or momentarily depressed, thus making exercise yet another task of daily life that you experience in the “doing” mode rather than the “being” mode.

Remember: ups and downs in exercise participation are normal...don’t let “all or none” thinking turn lapses (short periods of inactivity) into a return to sedentary behavior (relapse).

Relapse occurs when we stop being physically active and return to sedentary behaviors.

High-risk situation ➔ Slip ➔ Lapse ➔ Relapse

Zero tolerance with high-risk situations increases the risks of relapse.
Three steps toward better tolerance of slips-ups and stress-free maintenance of your exercise routine:

1. Identify your high risk situations.

After you establish your exercise routine, you usually find there are always some life situations, such as illness, injury, and vacation that make maintaining an active lifestyle very challenging. Be aware and deal with your high risk situations, instead of neglecting them, to help you get back on track afterwards.

Do you know what your high-risk situations are to slip from your exercise plan?

2. Plan for barriers. Take a positive problem solving approach!

Nobody likes to be caught off guard! We can become very set in our ways and routines as we go through life. Although a set and well planned out routine helps us to meet our exercise goals, having no wiggle room in our schedules can have the opposite effect!

We must always keep a back-up plan in mind in order to meet our daily exercise goals. This way, if something else comes up that takes precedence, we can switch gears and focus on completing that task, without feeling stressed and guilty.

Always have a plan B in mind! Most likely, the next day will be less hectic and you will be able to get back on track. Remember the 5 problem solving steps and start off approaching the barrier with a “can do” attitude!

<table>
<thead>
<tr>
<th>Project CHANGE</th>
<th>Problem Solving Model</th>
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<tbody>
<tr>
<td>1. Notice how you look at the problem</td>
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<tr>
<td>2. Clearly define the barrier/problem</td>
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<tr>
<td>3. Brainstorm for solutions</td>
<td></td>
</tr>
<tr>
<td>4. Evaluate &amp; decide on the best solution</td>
<td></td>
</tr>
<tr>
<td>5. Execute &amp; evaluate the plan</td>
<td></td>
</tr>
</tbody>
</table>
Let's hear our old friend, Debbie's, story and help her out again....

Debbie has a pretty regular exercise program now. She uses her treadmill five times a week for 20 minutes right after work or before she goes to bed in order to work toward meeting the Project CHANGE goal of 150 minutes of activity each week. She also uses weekends as her back-up days and does some fun activities with friends, like hiking in the park. She is very happy with setting up an exercise routine. However, with holidays coming, she starts getting a little unconfident about being active. Vacation, family reunion, and party with friends...She feel likes it is impossible to stick with her original exercise routine.

• What strategies/modifications can Debbie use to help her be more active during holidays (her high risk situations)?

• What strategies you will suggest to help Debbie go back on track again after the holidays?

Barriers to being active always occur. However, you now have a toolbox of behavioral skills to cope with these challenges more effectively.

• Identify your high risk situations.
• Make a plan to deal with your high risk situations.
• Find support and use behavioral strategies to help you go back to your exercise routine!
3. **Taking control of what we can...**

   **Coping effectively with challenges we cannot control**

   There are many things that we can encounter in our lives that are out of our control. We could develop a challenging illness or a loved one could require care giving. Whatever the case, there will be times when it will be a real challenge to maintain an active lifestyle. You may even question whether it is worth it to continue to make exercise a priority.

   **This is the time when you actually need exercise the most!**

   With that said, exercise will need to happen on your own time and within your own abilities. You may need to modify the amount of time that you exercise to prevent the onset of pain. You may need to walk in the early morning so that you can be a caregiver to a relative in the afternoons. **Whatever the case, this is a time when you will need to do the best with what life deals you!**

   **In summary**, remember that we can be our own worst enemies! Life is challenging and meeting our exercise goals is not always easy. Once we learn to have compassion for ourselves, then we will be able to take a positive approach to working through roadblocks and enjoying the process along the journey of life!
Congratulations! You are now a regular exerciser. Throughout the past two months, you have learned how to modify your behavior through attending your CHANGE group, and you are now in control of your own exercise program.

You are armed with the key skills that will allow you to maintain a lifelong commitment to remaining active and healthy. Let’s review some of the skills that you have acquired.

**Skills to help me maintain exercise:**

- Use FITT principles and RPE scale to establish my individualized exercise program
- Track my daily and weekly exercise habits
- Put into action effective goal setting strategies
- Recognize and problem-solve around exercise barriers
- Utilize social support and community/workplace resources to continue being physically active
- Identify my “big picture” of life and use personal motivational strategies to keep me on track
How to continue being active after 8-week of training?

- Use the physical and behavioral strategies you have learned to keep you on track.
- Set goals and record your daily activity minutes for four weeks and even longer.
- Please bring all the four goal setting and exercise log sheets with you when you come back for the follow-up evaluations.

Ya-Ting will email you the date for your evaluations:

End-Point Evaluations: during 12/13-12/17
Follow-up Evaluations: during 1/10-1/14

The assessments will take approximately 2 hours, including questionnaires and physical tests, such as strength evaluations and aerobic tests. Please wear comfortable clothing and shoes for your evaluation.

The location of our lab is:
Room A38, PAES Building, 305 W 17th Ave. Columbus OH, 43210
Lab phone number: (614) 292-0098
Ya-Ting cell number: (352) 871-3260; email: hsu.224@osu.edu

Since the lab is located on the ground floor, my cell phone does not have stable signals. Please call the lab phone number, email me or leave a phone message if you have an emergency and need to reschedule your appointment.
APPENDIX F

Measurement Points
<table>
<thead>
<tr>
<th>TASKS</th>
<th>pre</th>
<th>Intervention</th>
<th>Post</th>
<th>4 wk follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>week</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1. Inclusion verification</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Consent form</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Questionnaires</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Patterson PA</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Motivation :BREQ</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5. 3 Psychological needs :PNSE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6. Perceived autonomy support</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7. Quality of life: SF-36</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>8. Depression: CES-D10</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>9. Self efficacy: MESE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>10. Goal setting and self-regulation</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Physical ability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Stair climbing test</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>12. Submax treadmill walking test</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. 1RM strength test</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX G

Physical Tests
Physical Test A
Stair Climbing Test

Procedure
1) Accompany the participant to the starting line at bottom of the stairs.
2) Describe the stair climbing test protocol and then demonstrate the test for the participant.
   
   Script: “This is a stair climbing test and it is important that you give a good effort. You will be timed as you walk up and down this flight of stairs one time. You may use the handrail for support. Try to complete the task as quickly as you can but be cautious as you climb the stairs. Be particularly careful when you turn at the top of the stairs.
   “Stand there and watch me demonstrate how to walk the flight of stairs.
   “When I say: ‘Go’ climb the stairs as quickly as you can while still being safe. Do you have any questions? Okay. Are you ready to begin? Ready, Go.”

3) Start the stop watch when the participant takes the 1st step.

4) Offer appropriate encouragement during the test. Consistent feedback will be given during each test.
   
   “Keep up the good work.” “You are doing well.” “Good job.”
   
   If a participant is having difficulty, encourage him/her to complete the test.

5) Stop the stop watch to end the test when the participant’s foot crosses the starting line at the bottom of the stairs.
Physical Test B
Submaximal Treadmill Walking Test

Procedure
1) Accompany the participant to the exercise testing lab (A24 in the PAES building).
2) Prepare and attach the heart rate monitor.
3) Measure and record the participant's basic data: age, height, weight, resting blood pressure and heart rate.
4) Describe the testing protocol and then let participants get a chance to practice walking on the treadmill if they have never used a treadmill before.

Script: "This is a treadmill test that helps us know about your aerobic fitness. You will walk on the treadmill at a brisk walking pace at 3.0 mile per hour. Every three minutes, we will increase the incline 2.5%. You will keep walking until your heart rate reaches 85% of your age-predicted maximal heart rate, which is 220-your age. It is important that you give a good effort. We will check your heart rate and blood pressure during the test to ensure your safety. Also, we will check how hard you are exercising by asking you to rate your exertion based on a scale from 6-20. A score of 6 means 'no exertion at all,' and it feels like you are sitting there and doing nothing. A score of 20 means that this feels 'very very hard' and you are reaching exhaustion. After you start exercising, you will give a score that best describes what you feel for each stage.

"You can practice walking on the treadmill and test what 3.0 mile per hour feels like.

"When you are ready, let me know and we will start the test.

Do you have any questions? Okay, Are you ready to begin? Ready. Go."
5) Start the treadmill when the participant is ready. Follow the protocol attached below. Also, heart rate and blood pressure will be monitored and recorded for each stage.
6) Offer appropriate encouragement during the test. Consistent feedback will be given during each test.
"Keep up the good work." "You are doing well." "Good job."

If a participant is having difficulty, encourage him/her to complete the test.

7) When reaching 85% age-predicted heart rate, slow down the treadmill and let the participant walk at a slower pace (e.g., 1.7 mph) for cool-down.

"You did a great job. May I give you a glass of water?"

8) Check recovery heart rate and blood pressure. Once the participant feels comfortable and is ready to stop, let the participant sit and finish the test.
Physical Test C
1 Repetition Maximal Strength Test

Procedure
1) Accompany the participant to the fitness lab (A22) in the PAES building.
2) Describe the testing procedure and then let participants get a chance to practice using weight machines if they never used them before.
   a. Scripts for leg press machine:

   "This is the 1 repetition maximal leg press test that allows us to know the strength of your lower body. First, I want to teach you how to perform the exercise correctly. Now, position yourself on the leg press machine so you are comfortable. Put your feet on the foot plate about shoulder width apart with 90 degrees at the knee. The knees should be in line with the feet and neither bowed inward nor outward. Also, put your hands on the grips at the side."

   "Now, try to extend your knees and push the foot plate forward until your legs are extended but the knees do not lock. Also, match your breathing with the movement: Exhale (breathing out) while you extend the knees and inhale as you return to the initial position.

   b. Scripts for chest press machine:

   "This is the 1 repetition maximal chest press test that allows us to know the strength of your upper body. First, I want to show you how to perform the exercise correctly. Now, sit on the machine with your feet flat on the ground and shoulder-width apart. Hold the handles with your elbow joints at around 90 degrees."

   "Now, try to push the handles forward until your arms are extended but the elbows do not lock. Again, match your breathing with the movement:
3) The subject should warm up by completing several submaximal repetitions.
   a. Warm-up 1: Complete a warm-up set of 8-10 reps at the prescribed weight:
      i. Log press: 50% of body weight
      ii. Chest press: 25% of body weight
   b. Warm-up 2: Complete another warm-up set of 8-10 reps at the prescribed weight:
      i. Log press: add another 30 lbs
      ii. Chest press: add another 20 lb

4) Determine the 1-RM within 4 trials with rest periods of 3-5 minutes between trials.

5) Resistance is progressively increased by 5 to 45 lb each time until the subject cannot complete the selected repetition; all repetitions should be performed at the same speed of movement and range of motion to instill consistency between trials.
   a. Trial 1: the technician adds an additional weight to estimate the 1RM. The participant attempts one single rep at this weight.
   b. Trial 2-4: If subject successfully completes trial 1, let the subject rest 1-2 min and then attempt another single rep with higher loads.

6) Offer appropriate encouragement during the test. Consistent feedback will be given during each test.

"Keep up the good work." "You are doing well." "Good job."

If a participant is having difficulty, encourage him/her to complete the test.

7) The final weight lifted successfully is recorded as the absolute 1-RM.
Anthropometric Measurements:

Procedures:
- All measurement should be made with a flexible yet inelastic tape measure.
- The tape should be placed on the skin surface without compressing the subcutaneous adipose tissue.
- Take duplicate measures at each site, and retest if duplicate measurements are not within 5 mm.
- Rotate through measurement sites or allow time for skin to regain normal texture.

Locations:
- Waist: with the subject standing, arms at the sides, feet together, and abdomen relaxed, a horizontal measure is taken at the narrowest part of the torso (above the umbilicus and below the xiphoid process).
- Hips/Buttocks: with the subject standing erect and feet together, a horizontal measure is taken at the maximal circumference of buttocks.
- Waist-Hip Ratio (WHR): the circumference of the waist divided by the circumference of the hips/buttocks measure.
Physical Tests Recording Form

Date: ___________________  Staff: ___________________

- **Anthropometric Measurements:**

<table>
<thead>
<tr>
<th>Weight (lb)</th>
<th>Age</th>
<th>Height (m)</th>
<th>BMI</th>
<th>Waist circumference (cm)</th>
<th>Hip Circumference (cm)</th>
<th>Waist-Hip Ratio (WHR)</th>
</tr>
</thead>
</table>

- **Physical Test A --- Stair Climbing Test:**
Performance (record performance time in seconds): ___________________

- **Physical Test C --- 1 Repetition Maximal Strength Test**

<table>
<thead>
<tr>
<th>Leg Press</th>
<th>Weight (lb)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm-up 1</td>
<td>50% of body weight 8-10 reps</td>
<td></td>
</tr>
<tr>
<td>Warm-up 2</td>
<td>Add more 20 lbs 8-10 reps</td>
<td></td>
</tr>
<tr>
<td>1RM trial 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1RM trial 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1RM trial 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1RM trial 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chest Press</th>
<th>Weight (lb)</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm-up 1</td>
<td>25% of body weight 8-10 reps</td>
<td></td>
</tr>
<tr>
<td>Warm-up 2</td>
<td>Add more 20 lbs 8-10 reps</td>
<td></td>
</tr>
<tr>
<td>1RM trial 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1RM trial 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1RM trial 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1RM trial 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
• Physical Test B — Submax Treadmill Test: Modified Balke Protocol

<table>
<thead>
<tr>
<th>Stage</th>
<th>Time (min)</th>
<th>Speed (mph)</th>
<th>Incline (%)</th>
<th>BP (mmHg)</th>
<th>HR (bpm)</th>
<th>RPE</th>
<th>VO2</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rest</td>
<td></td>
<td>3.0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>3-6</td>
<td>3.0</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>6-9</td>
<td>3.0</td>
<td>7.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>9-12</td>
<td>3.0</td>
<td>10</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>12-15</td>
<td>3.0</td>
<td>12.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3.0</td>
<td>15</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>3.0</td>
<td>17.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>3.0</td>
<td>20</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>3.0</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R1*</td>
<td>1 min</td>
<td>1.7</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>4 min</td>
<td>1.7</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Target: 85% Age-predicted max HR:

Total Time: Predicted VO2max

Comments:

Page 8 of 8
APPENDIX H

Psychological Questionnaires
Physical Activity Questionnaire

The following questions ask you about your current physical activity. Please answer as accurately as possible. Provide a specific number or check your answers in the spaces provided.

1. How many city blocks or their equivalent do you normally walk each day?
   ________ blocks/day (Let 12 blocks = 1 mile)

2. How many flights of stairs do you climb up each day?
   ________ flights/day (Let 1 flight = 10 steps)

3. At least once a week, do you engage in regular activity akin to brisk walking, jogging, bicycling, swimming, etc. long enough to work up a sweat, get your heart thumping, or get out of breath?
   ________ Yes  ________ No  Why not?
   ________ How many times per week? ________  Activity(ies): __________________________

4. On a usual weekday and a weekend day, how much time do you spend on the following activities? Total for each day should add to 24 hours.

<table>
<thead>
<tr>
<th>Activity Description</th>
<th>Usual Weekday Hours/Day</th>
<th>Usual Weekday Hours/Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Vigorous activity (digging in the garden, strenuous sports, jogging, aerobic dance, sustained swimming, brisk walking, heavy carpentry, bicycling on hills, etc.)</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>b. Moderate activity (housework, light sports, regular walking, golf, yard work, lawn mowing, painting, repairing, light carpentry, ballroom dancing, bicycling on level ground, etc.)</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>c. Light activity (office work, driving car, strolling, personal care, standing with little motion, etc.)</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>d. Sitting activity (eating, reading, desk work, watching TV, listening to radio, etc.)</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>e. Sleeping or reclining</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>
**WHY DO YOU ENGAGE IN EXERCISE?**

We are interested in the reasons underlying peoples' decisions to engage, or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Not true for me</th>
<th>Sometimes true for me</th>
<th>Very true for me</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I exercise because other people say I should</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. I feel guilty when I don't exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3. I value the benefits of exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>4. I exercise because it's fun</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>5. I exercise because it is consistent with life goals.</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>6. I take part in exercise because my friends/family/partner say I should</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>7. I feel ashamed when I miss an exercise session</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>8. It's important to me to exercise regularly</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Not true for me</td>
<td>Sometimes true for me</td>
<td>Very true for me</td>
</tr>
<tr>
<td>---</td>
<td>----------------</td>
<td>-----------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>9. I consider exercise to be part of my identity</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10. I enjoy my exercise sessions</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>11. I exercise because others will not be pleased with me if I don't</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>12. I consider exercise a fundamental part of who I am.</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>13. I feel like a failure when I haven't exercised in a while</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>14. I think it is important to make the effort to exercise regularly</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>15. I find exercise a pleasurable activity</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>16. I feel under pressure from my friends/family to exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>17. I get restless if I don't exercise regularly</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>18. I get pleasure and satisfaction from participating in exercise</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>19. I consider exercise consistent with my values</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
The Psychological Need Satisfaction in Exercise Scale

The following statements represent different feelings people have when they exercise. Please answer the following questions by considering how you typically feel while you are exercising.

<table>
<thead>
<tr>
<th></th>
<th>False</th>
<th>Mostly False</th>
<th>More False than True</th>
<th>More True than False</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel that I am able to complete exercises that are personally challenging</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>2. I feel free to exercise in my own way</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>3. I feel attached to my exercise companions because they accept me for who I am</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>4. I feel confident I can do even the most challenging exercises</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>5. I feel free to make my own exercise program decisions</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>6. I feel like I share a common bond with people who are important to me when we exercise together</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7. I feel like I am in charge of my exercise program decisions</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>8. I feel confident in my ability to perform exercises that personally challenge me</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>9. I feel a sense of camaraderie with my exercise companions because we exercise for the same reasons</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>10. I feel capable of completing exercises that are challenging to me</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>False</td>
<td>Mostly False</td>
<td>More False than True</td>
<td>More True than False</td>
<td>Mostly True</td>
<td>True</td>
</tr>
<tr>
<td>---</td>
<td>-------</td>
<td>--------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td>-------------</td>
<td>------</td>
</tr>
<tr>
<td>11. I feel close to my exercise companions who appreciate how difficult exercise can be</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>12. I feel like I have a say in choosing the exercises that I do</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>13. I feel like I am capable of doing even the most challenging exercises</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>14. I feel connected to the people who I interact with while we exercise together</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>15. I feel free to choose which exercises I participate in</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>16. I feel good about the way I am able to complete challenging exercises</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>17. I feel like I am the one who decides what exercises I do</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>18. I feel like I get along well with other people who I interact with while we exercise together</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>
Perceived Autonomy support

Directions: Please circle the one answer that best indicates your level of agreement about your instructor during the past training period.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Neutral</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel that my instructor provides me with choices, options, and opportunities about whether to do active sports and/or exercise in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. I think that my instructor understands why I choose to do active sports and/or exercise in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. My instructor displays confidence in my ability to do active sports and/or exercise in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. My instructor encourages me to do active sports and/or exercise in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. My instructor listens to me about my active sports and/or exercise in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. My instructor provides me with positive feedback when I do active sports and/or exercise in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. I am able to talk to my instructor about the active sports and/or exercise I do in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. My instructor makes sure I understand why I need to do active sports and/or exercise in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. My instructor answers my questions about doing active sports and/or exercise in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. My instructor cares about the active sports and/or exercise I do in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. I feel I am able to share my experiences of active sports and/or exercise with my instructor</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. I trust my instructor’s advice about the active sports and/or exercise I do in my free time</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Health related Quality of Life Questionnaire

Instructions

Please answer every question. Some questions may look like others, but each one is different. Please take the time to read and answer each question carefully by placing a check mark or "X" in the box that best represents your response.

EXAMPLE

This is for your review. Do not answer this question. The questionnaire begins with the section Your Health in General below.

1. How strongly do you agree or disagree with each of the following statements?

<table>
<thead>
<tr>
<th>Strongly agree</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
</table>
   a) I enjoy listening to music
   b) I enjoy reading magazines

Please begin answering the questions now.

Your Health in General

1. In general, would you say your health is: [health]
   - Excellent
   - Very good
   - Good
   - Fair
   - Poor

2. Compared to one year ago, how would you rate your health in general now?
   - Much better now than one year ago
   - Somewhat better now than one year ago
   - About the same as one year ago
   - Somewhat worse now than one year ago
   - Much worse now than one year ago

Please turn the page to continue.
3. The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

<table>
<thead>
<tr>
<th>Activity</th>
<th>Yes, limited a lot</th>
<th>Yes, limited a little</th>
<th>No, not limited at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b) Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c) Lifting or carrying groceries</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d) Climbing several flights of stairs</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>e) Climbing one flight of stairs</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>f) Bending, kneeling, or stooping</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>g) Walking more than a mile</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>h) Walking several blocks</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>i) Walking one block</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>j) Bathing or dressing yourself</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

4. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

<table>
<thead>
<tr>
<th>Problem</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Cut down on the amount of time you spent on work or other activities</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>b) Accomplished less than you would like</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>c) Were limited in the kinds of work or other activities</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>d) Had difficulty performing the work or other activities (for example, it took extra time)</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

Please turn the page to continue.
5. During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

   Yes  No

   a) Cut down on the amount of time you spent on work or other activities ................................................... □ □
   b) Accomplished less than you would like ................................ □ □
   c) Didn't do work or other activities as carefully as usual ................................................................. □ □

6. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

   Not at all  Slightly  Moderately  Quite a bit  Extremely
   □ □ □ □ □

7. How much bodily pain have you had during the past 4 weeks?

   None  Very mild  Mild  Moderate  Severe  Very severe
   □ □ □ □ □ □

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

   Not at all  A little bit  Moderately  Quite a bit  Extremely
   □ □ □ □ □

*Please turn the page to continue.*

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9. These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks...

<table>
<thead>
<tr>
<th>All of the time</th>
<th>Most of the time</th>
<th>Some of the time</th>
<th>A little of the time</th>
<th>None of the time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) did you feel full of pep? ........................................ | ........ | ........ | ........ | ........ | ........ |
b) have you been a nervous person? ................................ | ........ | ........ | ........ | ........ | ........ |
c) have you felt so down in the dumps nothing could cheer you up? .......... | ........ | ........ | ........ | ........ | ........ |
d) have you felt calm and peaceful? .................................. | ........ | ........ | ........ | ........ | ........ |
e) did you have a lot of energy? ....................................... | ........ | ........ | ........ | ........ | ........ |
f) have you felt downhearted and blue? ................................ | ........ | ........ | ........ | ........ | ........ |
g) did you feel worn out? .................................................. | ........ | ........ | ........ | ........ | ........ |
h) have you been a happy person? ....................................... | ........ | ........ | ........ | ........ | ........ |
i) did you feel tired? ...................................................... | ........ | ........ | ........ | ........ | ........ |

10. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

<table>
<thead>
<tr>
<th>All of the time</th>
<th>Most of the time</th>
<th>Some of the time</th>
<th>A little of the time</th>
<th>None of the time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. How TRUE or FALSE is each of the following statements for you?

<table>
<thead>
<tr>
<th>Definitely true</th>
<th>Mostly true</th>
<th>Don’t know</th>
<th>Mostly false</th>
<th>Definitely false</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) I seem to get sick a little easier than other people ........................................ | ........ | ........ | ........ | ........ | ........ |
b) I am as healthy as anybody I know ................................................................. | ........ | ........ | ........ | ........ | ........ |
c) I expect my health to get worse ........................................................................ | ........ | ........ | ........ | ........ | ........ |
d) My health is excellent ...................................................................................... | ........ | ........ | ........ | ........ | ........ |

Thank you for completing this Questionnaire!

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Center for Epidemiologic Studies Short Depression Scale (CES-D-10)

**INSTRUCTIONS:**
For each of the following statements, please circle the number that best describes how often you felt or behaved this way during the past week.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rarely or none of the time (less than 1 day)</th>
<th>Some or a little of the time (1-2 days)</th>
<th>Occasionally or a moderate amount of time</th>
<th>All of the time (5-7 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I was bothered by things that usually don't bother me</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2. I had trouble keeping my mind on what I was doing</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>3. I felt depressed</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4. I felt that everything I did was an effort</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>5. I felt hopeful about the future</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>6. I felt fearful</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>7. My sleep was restless</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>8. I was happy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>9. I felt lonely</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>10. I could not &quot;get going&quot;</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Multidimensional Exercise Self-Efficacy Scale

The following are statements people might do while trying to increase or continue regular exercise. We are interested in exercises like running, swimming, brisk walking, bicycling riding, aerobics classes, or weight training.

**Whether you exercise or not**, please rate how confident you are that you could do things like these consistently, for at least six months, by circling the corresponding number. "0" is not at all confident and "10" is completely confident.

<table>
<thead>
<tr>
<th>How confident are you that you can ...</th>
<th>Not at all Confident</th>
<th>Completely Confident</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. complete exercise using proper technique</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>2. follow directions to complete exercise</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>3. perform all of the requirement movements</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>4. exercise when you feel discomfort</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>5. exercise when you lack energy</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>6. exercise when you don't feel well</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>7. include exercise in your daily routine</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>8. consistently exercise three times a week</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>9. arrange schedule to include regular exercise</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
</tbody>
</table>
**Exercise Planning and Scheduling**

The following questions refer to how you fit exercise into your lifestyle. Please indicate the extent to which each of the statements below describes you.

<table>
<thead>
<tr>
<th></th>
<th>Does not Describe</th>
<th>Describes Moderately</th>
<th>Describes Completely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I never have enough time for exercise.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Exercise is generally not a high priority when I plan my schedule.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Finding time for exercise is difficult for me.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. I schedule all events in my life around my exercise routine.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. I schedule my exercise at specific times each week.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. I plan my weekly exercise schedule.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. When I am very busy, I don't do much exercise.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Everything is scheduled around my exercise -- both classes and work.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. I try to exercise at the same time and same day each week to keep a routine going.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. I write my planned activity sessions in an appointment book or calendar.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exercise Goal Setting

The following questions refer to how you set exercise goals and plan activities. Please indicate the extent to which each of the statements below describes you.

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
<th>Does not Describe</th>
<th>Describes Moderately</th>
<th>Describes Completely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I often set exercise goals.</td>
<td>1</td>
<td>2</td>
<td>3 4 5</td>
</tr>
<tr>
<td>2</td>
<td>I usually have more than one major exercise goal.</td>
<td>1 2</td>
<td>3        4 5</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I usually set dates for achieving my exercise goals.</td>
<td>1 2</td>
<td>3        4 5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>My exercise goals help to increase my motivation for doing exercise.</td>
<td>1 2</td>
<td>3        4 5</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I tend to break more difficult exercise goals down into a series of smaller goals.</td>
<td>1 2</td>
<td>3 4 5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I usually keep track of my progress in meeting my goals.</td>
<td>1 2</td>
<td>3        4 5</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I have developed a series of steps for reaching my exercise goals.</td>
<td>1 2</td>
<td>3        4 5</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I usually achieve the exercise goals I set for myself.</td>
<td>1 2</td>
<td>3        4 5</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>If I do not reach an exercise goal, I analyze what went wrong.</td>
<td>1 2</td>
<td>3 4        5</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I make my exercise goals public by telling other people about them.</td>
<td>1 2</td>
<td>3        4 5</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I

Scoring Method for the Modified Paffenbarger Physical Activity Questionnaire
Scoring for the Modified Paffenbarger Physical Activity Questionnaire

- Estimate of kilocalories per week of physical activity
  - Climbing stairs (only count up)
    - 1 flight of stairs = 10 steps = 4 kcal
  - Walking
    - 1 city block = 8 kcal
    - 12 city blocks = 1 mile = 96 kcal
    - Assuming walking as a 20 min/mile pace (i.e. 3.0 mph)
      - 12 city blocks = 1 mile = 20 minute = 3.3 MET= 96 kcal
      - 10 minute walk = 48 kcal
      - 1 minute walk = 4.8 kcal
  - Sports, fitness and recreational activities
    - Light intensity (< 3MET) = 5 kcal/min
    - Moderate intensity (3-6MET)= 7.5 kcal/min
    - Vigorous intensity (>6 MET)= 10 kcal/min

Example:

Question #2: Stairs: 10 flights/day (4 kcal/flight)
Question #3. Walking: 3 days/wk, 20 minutes/day (48 kcal per 10 minute walk)
Question #4: Running 3 times per week for 45 minutes (vigorous intensity, 10 kcal/min)
   Weight lifting 2 times per week for 30 minutes (moderate intensity, 7.5 kcal/min)

Example to get kcal/wk in physical activity and exercise:

\[(4 \times 10 \times 7) + (48 \times 2 \times 3) + (10 \times 45 \times 3) + (7.5 \times 30 \times 2)\]
\[= 280 + 288 + 1350 + 450 = 2368 \text{ kcal/wk}\]
APPENDIX J

Process Evaluation
<table>
<thead>
<tr>
<th></th>
<th>SC group</th>
<th>SD group</th>
<th>t</th>
<th>Sig.</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Mean±SD</td>
<td>Mean±SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>My time as a participant has been enjoyable.</td>
<td>4.82±.405</td>
<td>4.20±.532</td>
<td>2.695</td>
</tr>
<tr>
<td>2.</td>
<td>The group sessions I attended were helpful.</td>
<td>4.09±1.300</td>
<td>3.80±.919</td>
<td>.586</td>
</tr>
<tr>
<td>3.</td>
<td>Since becoming a participant, I know more about how to keep physically active.</td>
<td>4.27±.647</td>
<td>4.00±1.247</td>
<td>.638</td>
</tr>
<tr>
<td>4.</td>
<td>The self-monitoring techniques (e.g. exercise log, RPE scale) helped me to reach my exercise goals.</td>
<td>3.64±1.120</td>
<td>3.80±1.135</td>
<td>-.332</td>
</tr>
<tr>
<td>5.</td>
<td>I learned some useful strategies that will keep me motivated to be physically active.</td>
<td>3.82±1.079</td>
<td>4.30±.675</td>
<td>-1.212</td>
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<tr>
<td>6.</td>
<td>I am able to perform the physical skills and exercises I learned in the program independently.</td>
<td>4.73±.467</td>
<td>4.70±.675</td>
<td>.109</td>
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<tr>
<td>7.</td>
<td>The class time (SD: weekly 90-min. SC: biweekly 45-min. session) format was the right length of time.</td>
<td>4.36±1.027</td>
<td>3.00±1.247</td>
<td>2.746</td>
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<td>8.</td>
<td>The 8-week format was a good length.</td>
<td>4.45±.820</td>
<td>3.50±1.269</td>
<td>2.067</td>
</tr>
<tr>
<td>9.</td>
<td>The program met my expectations.</td>
<td>4.45±.820</td>
<td>3.80±.632</td>
<td>2.032</td>
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<tr>
<td>10.</td>
<td>I would tell a friend to become a participant in a program like this.</td>
<td>4.82±.405</td>
<td>4.10±.738</td>
<td>2.002</td>
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<tr>
<td>11.</td>
<td>I was able to achieve my physical activity goals during the program.</td>
<td>3.91±1.136</td>
<td>3.4±1.265</td>
<td>.972</td>
</tr>
<tr>
<td>12.</td>
<td>I am able to do more things I want to do since starting the program.</td>
<td>3.82±.874</td>
<td>3.70±.949</td>
<td>.297</td>
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<tr>
<td>13.</td>
<td>My group members were supportive.</td>
<td>4.27±1.348</td>
<td>4.00±1.054</td>
<td>.513</td>
</tr>
<tr>
<td>14.</td>
<td>The goal setting session helped me to reach my goals.</td>
<td>3.90±.876</td>
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<tr>
<td>15.</td>
<td>The problem solving model was helpful for overcoming my barriers and my reaching goals.</td>
<td>3.70±.949</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>The social support and resources session was helpful.</td>
<td>3.20±1.033</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>The relapse prevention session prepared me to be more confident when facing life challenges.</td>
<td>3.90±.876</td>
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<td>18.</td>
<td>The “Health at Every Size” concept helped me to focus more on being healthy and not just the number on a scale.</td>
<td>3.89±.782</td>
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<td></td>
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</tbody>
</table>

**d.f.=19**
Process Evaluation: SC group

1. What do you think should be added to the program?
   * This is a study. It was what it is within the criteria set forth.
   * A follow up exercise regime so we can continue to make the lifestyle changes on our own outside the program. (Give us handouts for the next 5-8wks with increases in treadmill/speed/incline because I don't know where I should go on my own, how much is good increase, what interval etc...)
   * I think the class component would have been helpful. I believe I would have made better connections and developed exercise partners.
   * The program may seem more interesting if more weight/machine training was added.
   * A group if possible, for camaraderie.
   * Maybe suggestions of what kind of exercises and when you can fit them in your day.
   * More instructions for what is expected outside of the bi-weekly sessions — and how to better achieve the exercise goals.
   * From a research standpoint two things: 1) weather factors as most of us walked outside, 2) Myers-Briggs type indicators could show interesting insights.

2. What do you think should be removed from the program?
   * Lower the step height.
   * Maybe increase to 3x/week instead of 2x/week.
   * None — I thought it was all well-connected.

3. You may add other comments below or on the back.
   * Ya-Ting is great. Very supportive.
   * I am thrilled to be a participant in this program. I feel that I was a model subject and the program and I both benefited.
   * Thursdays undergrad assistants were great. Helpful, talkative, knowledgeable. Esp. Andrew and Ann.
   * I really enjoyed working with Ya-Ting. Her welcoming personality made me want to come each session.
   * Wish the program was longer, or, we could sign up for a program voluntarily.
   * Having a sample picture of the exercises would be helpful for
remembering proper technique.

*I truly enjoyed Project Change, it gave me a whole new outlook on maintaining an exercise program.

*1) The log sheets should start on Tues and end Monday. 2) Ya-Ting was an absolute "Joy" to work with – she accommodated schedule change requests graciously and was very professional in her interfaces.
Process Evaluation: SD group

1. What do you think should be added to the program?
   * 1. Test body fat.
   * 2. Health diet solutions to help lose weight.
   * 3. Meet twice a week.

   * I would say if you could give the participants a place to work out at for that time frame.

   * I think the exercise time should be longer than 30 minutes.

   * I think tips on healthy eating habits may be useful. It would also be helpful to have access to a gym while participating in the study – but I know resources are limited.

   * You should encourage participants to bring planners with them; give them time to plan their activities for the upcoming week; require them to share when they plant to exercise; upon reconvening, have them share whether they met their goals.

   * Add more time between meetings for last 4 sessions to practice strategies.

   * Have the participants reading the information out loud in the sessions. A session on the various types of exercises and their primary benefits.

   * Nutritional information – how can changing my diet help my exercise program? Would like to learn more workout strategies – the gym can be an intimidating place – show me where to being and how to use the equipment – by increasing my confidence I am more likely to use the resource available to me. Email format – I am into technology and would prefer being able to email my log sheets – I would also have like to keep a food diary or an assignment to write how I feel before/after exercise – only for encouragement.

   * More exercise time.

   * Include contact information for the other group members – if they will allow it – the group was supportive the 2 hours each week and never more than that. We should be calling/emailing to encourage exercise. Make a sheet of preferred exercise for all participants – why am I limited to only exercising/encouraging people within my time slot? The resources day was extremely helpful – can you do more of this? Can we have the lessons a few days early to read them over before class? This way I have time to formulate questions and think. Maybe talk about the benefits of owning a planner? Talk about procrastination? I would have like to know more motivators- how do you motivate yourself to exercise? A list similar to the resources list would be nice. The biggest negative for me is lack of social support – I can't get it at home and only get it 2 hours/week in this class. Can this be changed? (see comments above) Overall, I do now exercise regularly and really appreciate the opportunity to participate.
2. What do you think should be removed from the program?
   * The sessions before the workout were a bit repetitive.
   * It was very helpful to me.
   * I think the support sessions could be shorter or to have the handouts to read at home then come in and discuss. I think the sessions were sometimes focused on reading and could be more discussions based.
   * Information during group session – would be helpful to review in advance and then discuss in group – more time to exercise.
   * It's rather tedious to have someone read through the handouts aloud. The hour or so provided for that is about 30 min to long.
   * Too much repetition on focusing on long-term life goals. Only need to set/write down once.
   * Avoid repetition of information in order to have more information.
   * The class typically lasted 2 hours – would have preferred to meet for 2 days – ½ hr discussion ½ hour workout as more time together means more support.
   * Less class time – more activity time. The info was helpful, but I would have rather been in the group who exercised twice a week.

3. You may add other comments below or on the back.
   * When Ya-Ting talked to us as we were on the treadmill – it made time go faster and it was “easier” to go the 15 minutes.
   * Overall I think the study was well done. I hope to stay on the route of a healthier person.
   * Ya-Ting never really indicated whether she wanted us to fill out the planning side or not. Given the goal-setting emphasis, I think that should have been required. Once I left the weekly meeting, I never looked at it again except to record.
   * I think most people know what they need to do to be physically active – just need someone to push them to do it. Ya-Ting = Good motivator.
APPENDIX K

ANOVA Tables for Non-Significant Variables
Table K.1
Tests of Time, Interaction and Group Effects for Body Mass Index

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
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<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta^2$</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within Subjects</td>
<td>Time</td>
<td>0.217</td>
<td>2</td>
<td>0.109</td>
<td>0.822</td>
<td>.447</td>
<td>.044</td>
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<tr>
<td></td>
<td>Group</td>
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<tr>
<td>Between Subjects</td>
<td>Group</td>
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<td>3.741</td>
<td>1.138</td>
<td>.300</td>
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<td>Error (Group)</td>
<td>18</td>
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Table K.2
Tests of Time, Interaction and Group Effects for Waist:Hip Ratio

<table>
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<th>Source</th>
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<td>Within Subjects</td>
<td>Time</td>
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<td>.158</td>
<td>.447</td>
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<td>Group</td>
<td>5.80E-5</td>
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<td>2.90E-5</td>
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<td>.858</td>
<td>.008</td>
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<td>Error (Time)</td>
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<td>36</td>
<td>&lt;0.0001</td>
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<td>Between Subjects</td>
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<td>-0.0001</td>
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<td>.605</td>
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Table K.3
Tests of Time, Interaction and Group Effects for Predicted Maximal Oxygen Consumption

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<tbody>
<tr>
<td>Within Subjects</td>
<td>Time</td>
<td>1.759</td>
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<td>3.480</td>
<td>0.931</td>
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<td>.055</td>
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<td>Error (Time)</td>
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<td>1</td>
<td>0.048</td>
<td>0.003</td>
<td>.999</td>
<td>&lt;.0001</td>
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<td>Between Subjects</td>
<td>Group</td>
<td>0.048</td>
<td>1</td>
<td>0.048</td>
<td>0.003</td>
<td>.999</td>
<td>&lt;.0001</td>
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<td>Error (Group)</td>
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Table K.4

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<tr>
<td>Within- Time</td>
<td>2.230</td>
<td>1</td>
<td>2.230</td>
<td>0.390</td>
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<td>Subjects Time*Group</td>
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<td>3.155</td>
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<td>.032</td>
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<tr>
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<td>.993</td>
<td>&lt;.0001</td>
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Table K.5
Tests of Time, Interaction and Group Effects for 1 Repetition-Maximum Machine Leg Press

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<tr>
<td>Within- Time</td>
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<td>68.194</td>
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<td>Error (Time)</td>
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<td>36.569</td>
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<td>Subjects Error (Group)</td>
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<td>489.007</td>
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Table K.6
Tests of Time, Interaction and Group Effects for Stair Climbing Test

<table>
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<tbody>
<tr>
<td>Within- Time</td>
<td>0.159</td>
<td>1.417</td>
<td>.106</td>
<td>0.283</td>
<td>.680</td>
<td>.017</td>
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<td>.005</td>
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<tr>
<td>Between- Group</td>
<td>3.419</td>
<td>1</td>
<td>3.419</td>
<td>0.828</td>
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<td>.049</td>
<td>.137</td>
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<td>Subjects Error (Group)</td>
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<td>16</td>
<td>1.715</td>
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Note: The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance.
Table K.7
Tests of Time, Interaction and Group Effects for External Regulation

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<tr>
<th>Source</th>
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<th>η²</th>
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<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
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<td>Error (Time)</td>
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<td>Group</td>
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<td>1</td>
<td>1.492</td>
<td>1.652</td>
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<td>.084</td>
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<td>Subjects</td>
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Table K.8
Tests of Time, Interaction and Group Effects for Intrinsic Regulation

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<th>η²</th>
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<td>2</td>
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<td>0.650</td>
<td>1.828</td>
<td>.175</td>
<td>.092</td>
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<td>Error (Time)</td>
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<td>0.356</td>
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<td>Group</td>
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Table K.9
Tests of Time, Interaction and Group Effects for Identified Regulation

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<td>24.871</td>
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<td>Error (Group)</td>
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Note. The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance.

Table K.10
Tests of Time, Interaction and Group Effects for Intrinsic Motivation

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<th>η²</th>
<th>Observed Power</th>
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<td>Time</td>
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<td>1.295</td>
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Note. The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance.
Table K.11
Tests of Time, Interaction and Group Effects for Relative Autonomy Index

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<th>( \eta^2 )</th>
<th>Observed ( \Phi )</th>
</tr>
</thead>
<tbody>
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<td>Within-Subjects</td>
<td>Time</td>
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<td>1.680</td>
<td>0.711</td>
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<td>Time*Group</td>
<td>7.116</td>
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<td>3.558</td>
<td>1.506</td>
<td>.235</td>
<td>.077</td>
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<td>Error (Time)</td>
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<td>Between-Group</td>
<td>Group</td>
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Table K.12
Tests of Time, Interaction and Group Effects for Competence

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<th>( \eta^2 )</th>
<th>Observed ( \Phi )</th>
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<td>Within-Subjects</td>
<td>Time</td>
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<td>2</td>
<td>0.039</td>
<td>0.135</td>
<td>.825</td>
<td>.013</td>
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<td>Subjects</td>
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<td>1</td>
<td>0.127</td>
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Table K.13
Tests of Time, Interaction and Group Effects for Autonomy

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<th>p</th>
<th>( \eta^2 )</th>
<th>Observed ( \Phi )</th>
</tr>
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<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>0.054</td>
<td>1.531</td>
<td>0.032</td>
<td>0.101</td>
<td>.854</td>
<td>.006</td>
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<td>1.531</td>
<td>0.002</td>
<td>0.010</td>
<td>.974</td>
<td>.001</td>
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<td>6.111</td>
<td>27.334</td>
<td>0.222</td>
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<tr>
<td>Between-Group</td>
<td>Group</td>
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<td>1</td>
<td>1.319</td>
<td>2.235</td>
<td>.130</td>
<td>.111</td>
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<td>Error (Group)</td>
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Note: The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geiser correction. Both original and adjusted results both showed non-significance.

Table K.14
Tests of Time, Interaction and Group Effects for Relatedness

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<th>Observed ( \Phi )</th>
</tr>
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<td>Within-Subjects</td>
<td>Time</td>
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<td>.051</td>
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### Table K.15
Tests of Time, Interaction and Group Effects for Task Self-Efficacy

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<th>p</th>
<th>$\eta^2$</th>
<th>Observed Power</th>
</tr>
</thead>
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<td>Within-Subjects</td>
<td>Time</td>
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<td>2</td>
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### Table K.16
Tests of Time, Interaction and Group Effects for Coping Self-Efficacy

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</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
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<td>2</td>
<td>1.609</td>
<td>0.662</td>
<td>0.335</td>
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Note: The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance.

### Table K.17
Tests of Time, Interaction and Group Effects for Center of Epidemiology Survey in Depression

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<th>$\eta^2$</th>
<th>Observed Power</th>
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</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
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<td>2</td>
<td>1.382</td>
<td>0.199</td>
<td>0.800</td>
<td>0.011</td>
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<td>14.597</td>
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<td>7.299</td>
<td>1.064</td>
<td>0.356</td>
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<td>246.971</td>
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<td>68.529</td>
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### Table K.18
Tests of Time, Interaction and Group Effects for SF-36: Total Scores

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<th>Observed Power</th>
</tr>
</thead>
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<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>25.059</td>
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### Table K.19
Tests of Time, Interaction and Group Effects for SF-36: Physical Components

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<td>73,442</td>
<td>2,116</td>
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### Table K.20
Tests of Time, Interaction and Group Effects for SF-36: Mental Components

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### Table K.21
Tests of Time, Interaction and Group Effects for SF-36: Physical Function (PF)

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<th>p</th>
<th>η²</th>
<th>Observed Power</th>
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<td>1.458</td>
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<td>.066</td>
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Note. The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance.
Table K.22
Tests of Time, Interaction, and Group Effects for SF-36: Role Playing due to Physical Health (RP)

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<th>p</th>
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<td>Within-Subjects</td>
<td>Time</td>
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<td>714.362</td>
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<td>.126</td>
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<td>1</td>
<td>316.922</td>
<td>0.338</td>
<td>.557</td>
<td>.019</td>
</tr>
<tr>
<td></td>
<td>Error (Group)</td>
<td>16960.227</td>
<td>18</td>
<td>942.225</td>
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</tr>
</tbody>
</table>

Note. The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance.

Table K.23
Tests of Time, Interaction, and Group Effects for SF-36: General Health (GH)

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta^2$</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>137.836</td>
<td>2</td>
<td>78.918</td>
<td>2.645</td>
<td>.144</td>
<td>.102</td>
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<tr>
<td></td>
<td>Group</td>
<td>1352</td>
<td>4</td>
<td>338.025</td>
<td>0.081</td>
<td>.929</td>
<td>.001</td>
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<tr>
<td></td>
<td>Error (Time)</td>
<td>1589.969</td>
<td>36</td>
<td>43.562</td>
<td></td>
<td></td>
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<td>757.856</td>
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<tr>
<td></td>
<td>Error (Group)</td>
<td>3514.483</td>
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<td>197.471</td>
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</table>

Note. The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance.

Table K.24
Tests of Time, Interaction, and Group Effects for SF-36: Vitality (VT)

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
<th>$\eta^2$</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within-Subjects</td>
<td>Time</td>
<td>276.140</td>
<td>2</td>
<td>138.070</td>
<td>1.557</td>
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<td>.080</td>
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<td></td>
<td>Group</td>
<td>524.275</td>
<td>5</td>
<td>112.855</td>
<td>1.284</td>
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<td>.066</td>
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<td>Error (Time)</td>
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<td>26</td>
<td>89.704</td>
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<tr>
<td>Between-Group</td>
<td>Time</td>
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<td>703.838</td>
<td>2.211</td>
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<td></td>
<td>Error (Group)</td>
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<td>318.338</td>
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</table>

Note. The sphericity assumption was not satisfied. The results were adjusted with Greenhouse-Geisser correction. Both original and adjusted results both showed non-significance.
APPENDIX L

Adherent/Non-Adherent Assignment
Table

Adherent and Non-Adherent Assignment

<table>
<thead>
<tr>
<th>EE at T3 (Kcal/wk)</th>
<th>EE at T4 (Kcal/wk)</th>
<th>EE at T4 &lt; 1000 kcal/wk</th>
<th>Change of PA</th>
<th>Group assignment</th>
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<tbody>
<tr>
<td>246</td>
<td>352</td>
<td>*</td>
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<td>339</td>
<td>302</td>
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<td>632</td>
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<td>660</td>
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<td>856</td>
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<tr>
<td>1120</td>
<td>966</td>
<td>*</td>
<td>↓</td>
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<td>1120</td>
<td>1736</td>
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<td>1195</td>
<td>870</td>
<td>*</td>
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<td>1253</td>
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<td>↓</td>
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<td>1488</td>
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<td>1592</td>
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<td>3736</td>
<td>1036</td>
<td>↓</td>
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</tbody>
</table>

*Note.* EE = energy expenditure (Kcal/week); ↑ = increase; ↓ = decrease; For group assignment: 0 = non-adherents (n=11); 1 = adherents (n=10)
APPENDIX M

Correlation Between the Nine Significant Predictors
Table 1: Pearson’s Correlation Among the Change Scores of the Nine Predictors From Baseline (T1) to Post-intervention (T3)

<table>
<thead>
<tr>
<th></th>
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<th>Intrinsic</th>
<th>Autonomy</th>
<th>PAS</th>
<th>Coping SE</th>
<th>Scheduling SE</th>
<th>Planning</th>
<th>Goal setting</th>
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<td>.091</td>
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<tr>
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<td>.207</td>
<td>.512*</td>
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<td>.183</td>
<td>.581**</td>
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Table 2: Pearson’s Correlation Among the Change Scores of the Nine Predictors From Baseline (T1) to 4-week Follow-Up (T4)

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<th>Intrinsic</th>
<th>Autonomy</th>
<th>PAS</th>
<th>Coping SE</th>
<th>Scheduling SE</th>
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<th>Goal setting</th>
</tr>
</thead>
<tbody>
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<td>Integrated</td>
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<tr>
<td>Intrinsic</td>
<td>.358</td>
<td>.678**</td>
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<tr>
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<tr>
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<td>.188</td>
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<td>.4466</td>
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<tr>
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<td>.555*</td>
<td>.525*</td>
<td>.395</td>
<td>.061</td>
<td>-.242</td>
<td>.519*</td>
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<tr>
<td>Goal setting</td>
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<td>-.146</td>
<td>.632*</td>
<td>.757**</td>
<td>.790**</td>
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</table>
APPENDIX N

Application for Initial Review of Human Subjects Research
# Initial Review of Human Subjects Research

The Ohio State University Institutional Review Board

Office of Responsible Research Practices (ORRP)
300 Research Foundation Building, 1960 Kenny Road, Columbus, OH 43210
Phone: (614) 688-8457 / Fax: (614) 688-0366  www.orrp.osu.edu

<table>
<thead>
<tr>
<th>#</th>
<th>DATE RECEIVED</th>
<th>DATE VERIFIED COMPLETE</th>
<th>OSU PROTOCOL NUMBER</th>
</tr>
</thead>
</table>

## 1. Project Title

The effects of a Self-Determination Theory based exercise intervention on physical activity and psychological variables in sedentary overweight or obese women

## 2. Institutional Review Board

Select the Board to review this research:
- [ ] Behavioral and Social Sciences
- [ ] Biomedical Sciences
- [ ] Cancer

Final Board assignment is determined by ORRP.

## 3. Principal Investigator (or Adviser) - see Qualifications for service as a PI

<table>
<thead>
<tr>
<th>Name (Last, First, MD):</th>
<th>Buckworth, Janel</th>
</tr>
</thead>
<tbody>
<tr>
<td>University Academic Title:</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Department Name (TIU):</td>
<td>PAES</td>
</tr>
<tr>
<td>Department # (TIU):</td>
<td>EHE</td>
</tr>
<tr>
<td>Campus Mailing Address:</td>
<td>PAES building, Exercise Science A44 305 West 17th Avenue</td>
</tr>
<tr>
<td>E-mail:</td>
<td><a href="mailto:Buckworth.j@osu.edu">Buckworth.j@osu.edu</a></td>
</tr>
<tr>
<td>Phone:</td>
<td>614-292-0757</td>
</tr>
<tr>
<td>Degree(s):</td>
<td>MSW, MA, PhD</td>
</tr>
<tr>
<td>OSU ID Number:</td>
<td>96075524</td>
</tr>
</tbody>
</table>

## 4. Co-Investigator(s)

Are there any OSU Co-Investigators on this protocol?
- [ ] Yes → Complete Appendix A1
- [ ] No

Signatures of Co-Investigator(s) are required on Appendix A1.

## 5. Key Personnel

Are there any OSU key personnel on this protocol?
- [ ] Yes → Complete Appendix A1
- [ ] No

Key personnel are defined as individuals who participate in the design, conduct, or reporting of human subjects research. At a minimum, include individuals who recruit or consent participants or who collect study data.

## 6. External Co-Investigator(s) & Key Personnel

Are any external (non-OSU) Investigators or key personnel engaged in the OSU research?
- [ ] Yes
- [ ] No → Go to Question #7

"Engaged" individuals are those who intervene or interact with participants in the context of the research or who will obtain individually identifiable private information for research funded, supervised, or coordinated by OSU. See ORRP Engagement Guidance or contact ORRP for more information.

If Yes → Who will provide approval for these external personnel?
- [ ] OSU IRB → Complete Appendix A2
- [ ] Non-OSU IRB → Provide a copy of the approval(s)
7. ADDITIONAL CONTACT(S)
If further information about this application is needed, specify the contact person(s) if other than the PI (e.g., study or regulatory coordinator, research assistant, etc.).

Name (Last, First, MD): Hau, Ya-Ting
E-mail: Hau.224@osu.edu
Phone: 352-871-3200 or 614-292-5180
Fax: 614-688-3432

All OSU individuals listed on this protocol will have access to information about IRB actions and the completion status of each individual's administrative and training requirements (CITI, COI disclosure). Note: Personal financial information provided in COI disclosures is not included.

8. EDUCATION
Have all OSU investigators and key personnel completed the required web-based course (CITI) in the protection of human research subjects?

☒ Yes
☐ No

Educational requirements (initial and continuing) must be satisfied prior to submitting the application for IRB review. See CITI Training or contact ORRP for more information.

9. FINANCIAL CONFLICT OF INTEREST
Does any OSU investigator (including principal or co-investigator), key personnel, or their immediate family members have a financial interest (including salary or other payments for services, equity interests, or intellectual property rights) that would reasonably appear to be affected by the research, or a financial interest in any entity whose financial interest would reasonably appear to be affected by the research?

☐ Yes
☒ No

All OSU investigators and key personnel must have a current COI disclosure form (updated as necessary for the proposed research) filed before IRB review. Examples of financial interests that must be disclosed include (but are not limited to) consulting fees or honoraria, stocks, stock options or other ownership interests, and patents, copyrights and royalties from such rights. For more information, see Office of Research Compliance COI Overview and COI Form.

10. FUNDING OR OTHER SUPPORT
If the research is federally funded and involves a subcontract to or from another entity, an IRB Authorization Agreement may be required. Contact ORRP for more information.

a. Is the research funded or has funding been requested?

☒ Yes
☐ No

If Yes, Specify sponsor:

Provide a copy of the grant application or funding proposal. The University is required to verify that all funding proposals and grants (new or renewals) have been reviewed by the IRB before funds are awarded.

b. Is any support other than monetary (e.g., drugs, equipment, etc.) being provided for the study?

☐ Yes
☒ No

If Yes, Specify support and provider:

11. OTHER INSTITUTIONAL APPROVALS
Check all that apply and provide applicable documentation. See websites listed below for information on obtaining approvals. IRB review cannot be conducted until required institutional approvals or exemptions are obtained, except as noted.

☒ None
12. LOCATION OF THE RESEARCH

Research to be conducted at locations other than approved performance sites will minimally require a letter of support and may require another IRB's approval if personnel are engaged. See ORRPs Engagement Guidance or contact ORRP for more information.

a. List the specific site(s) at which the OSU research will be conducted (include both domestic and international locations).

<table>
<thead>
<tr>
<th>Location Name (or description)</th>
<th>Address (street, city and state, or country)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSU PAES Building</td>
<td>PAES building, 305 Weel 17th Avenue, Columbus, OH 43210</td>
</tr>
</tbody>
</table>

b. Are all the sites named above on the OSU list of approved research performance sites? ☒ Yes → Go to Question #13

No

If No → ☐ Domestic sites → Provide a letter of support, as applicable
☐ International sites → Complete Appendix U

c. For multi-site research, is the OSU PI the lead investigator or is OSU the lead site? ☐ Yes

No → Go to Question #13

d. Describe the communication between sites that might be relevant to the protection of participants, such as unanticipated problems, interim results, and protocol modifications.

ii. Describe IEB oversight arrangements for each site (i.e., who is providing IRB review and approval). Provide copies of the non-OSU approvals, as applicable. Contact ORRP if requesting OSU be the IRB of record.

13. EXPEDITED REVIEW

Are you requesting Expedited Review? ☒ Yes → Complete Appendix B

☐ No

14. SUMMARY OF THE RESEARCH

Summarize the proposed research using non-technical language that can be readily understood by someone outside the discipline. Explain briefly the research design, procedures to be used, risks and anticipated benefits, and the importance of the knowledge that may reasonably be expected to result. Use complete sentences (limit 300 words).
There is epidemiological evidence for a strong association between obesity and insufficient leisure-time physical activity and low levels of occupational activity in industrialized societies. Physical inactivity has also been linked with risk factors for chronic diseases and health. Women are more likely to be physically inactive and overweight and thus, we need an effective approach using behavioral theories to help sedentary overweight/obese women adopt and maintain regular exercise. Project CHANGE (to be a Confident, Healthy, And Goal-directed Exerciser) is an 8-week intervention that will target constructs from Self-Determination Theory (SDT) and address both behavioral strategies and physical skills. Sedentary overweight/obese women will be recruited from The Ohio State University community and then randomly assigned to standard care group (SC) or SDT-based intervention group (SD). The SC group will receive a supervised and individualized progressive exercise training program (moderate-intensity aerobics and resistance training) for 45 minutes, 2 times per week. The SD group will participate in weekly 1-hour behavioral meetings designed to change psychological mediators for exercise behavior followed by 30-min of supervised and individualized exercise training that will also include elements designed to target SDT variables. At the beginning, mid-point, end of the intervention, and at 1-month follow-up, participants will complete assessments of weight, height, hip and waist circumference, stair-climbing ability, and questionnaires to measure physical activity, depressive symptoms, quality of life, SDT constructs, and other established psychological mediators of exercise, such as self-efficacy, goal setting, and self-regulation. A sub-maximal treadmill test for aerobic fitness and 1 repetition maximal test for muscular strength will be conducted at baseline, post-intervention, and 1-month follow-up. No risks are expected to result from participation. Participants will benefit through learning physical and behavioral skills necessary to maintain regular physical activity in order to enhance physical and mental health in the long run.

15. SCIENTIFIC BACKGROUND & LITERATURE REVIEW

Summarize existing knowledge and previous work that support the expectation of obtaining useful results without undue risk to human subjects. Use complete sentences (limit 100 words).

According to the National Health and Nutrition Examination Survey (2007-2008), 68.3% of adults are overweight or obese, with 35.5% of women and 32.25% of men obese (BMI ≥ 30). Because women are more likely to be obese, an effective weight management intervention targeting women is necessary. Furthermore, overweight and obesity are strongly associated with diabetes, hypertension, high cholesterol, asthma, arthritis, and poor health status (Mokdad et al., 2013). A recent behavioral weight-loss program combining diet and exercise found that physical activity was the most influential factor predicting 10% weight loss at 24 months (Unick et al., 2010). Effective strategies to promote long-term exercise adherence could be critical for the overweight/obese population, but about 50% of participants who adopt an exercise program stop exercising within six months (Robinson & Rogers, 1994). How to keep individuals adherent to regular exercise is a challenge for researchers and practitioners. When individuals start to exercise, they not only need to learn physical skills to help them perform exercise correctly, but also behavioral skills and supports to foster adherence. Theory-based behavioral interventions to promote PA have been effective (e.g., Kahn, et al., 2002). Thus, PA interventions should target theoretical constructs that have been shown to mediate exercise behaviors (Lippke & Ziegelmeier, 2008). Daci and Ryan’s (1985) Self-Determination Theory proposes that satisfying three basic psychological needs (i.e., autonomy, competence, and relatedness) will foster intrinsic motivation and therefore enhance positive behavior and mental health and the persistence of healthy behavior. Some cross-sectional studies have shown that autonomous motivation is associated with exercise participation (Edmunds & Ntoumanis, 2008; Daley & Duda, 2006; Landry & Solomon, 2004). However, more PA interventions with follow-up are needed to examine the intervention effect on SDT variables and to determine which SDT variables will predict exercise adherence.

16. RESEARCH OBJECTIVES

List the specific scientific or scholarly aims of the research study.

Primary aim:
To examine the effects of an 8-week SDT-based exercise and behavioral intervention, compared to the standard care group, on physical activity, depressive symptoms, quality of life, SDT-based constructs and other physical and psychological variables.

Secondary aims:
To investigate the relationship among changes in physical activity and the psychological variables targeted in the intervention.
- To explore which psychological variables best predict physical activity after the intervention is over.
- To examine the mediating effects among the psychological variables.
17. RESEARCH METHODS & ACTIVITIES

a. Identify and describe all interventions and interactions that are to be performed solely for the research study. Distinguish research (i.e., experimental) activities from non-research activities.

Potential participants will be recruited from The Ohio State University (OSU) community through word of mouth, emails, flyers, health-related newsletters from the College of Education and Human Ecology, from academic classes upon instructor’s approval and from health services such as student health, employee health and staff wellness. Flyers will be posted in various locations on the OSU Campus. Potential participants will be instructed to e-mail or call the co-investigator (Ya-Fing Hsu). When potential participants contact the research team, a research staff will go through an eligibility verification checklist with them. All the communications and gathered information will be confidential. Participation in this study will be on a volunteer basis. An informed consent dealing both the risks and benefits of this study will be administered to all participants prior to any data collection.

The eligible participants will be randomly assigned to a standard care/exercise group (SC) or a SDT-based intervention group (SD). The SC group will receive a supervised and individualized progressive exercise training program (moderate-intensity aerobic and resistance training) for 45 minutes, 2 times per week. The SD group will participate in a weekly one-hour behavioral meeting designed to change psychological mediators for exercise behavior followed by 30 minutes of supervised and individualized exercise training that will also incorporate strategies to target the SDT variables. The duration of the intervention is 8 weeks.

At the beginning, mid-point, end of the intervention and 1-month follow-up, participants will complete assessments of weight, height, hip and waist circumference, and stair-climbing ability, and questionnaires to measure physical activity, depressive symptoms, quality of life, SDT constructs and psychological mediators, such as self-efficacy, goal setting and self-regulation. A sub-maximal treadmill test for aerobic fitness and 1 repetition maximal test for muscular strength will be conducted at the baseline, post-intervention, and 1-month follow-up. All the physical evaluations and exercise training will follow American College of Sport and Medicine testing guidelines for overweight/obese women, which includes checks on blood pressure and heart rate during the treadmill test to ensure safety.

Psychosocial and behavioral assessments:
* Paffenbargar Physical Activity Questionnaire, modified (Paffenbargar et al., 1978; Unick et al., 2010)
* Quality of life questionnaire: SF-36 (Ware 1993)
* Depression questionnaire: GEDQ-10 (Radloff et al., 1977; Andreen et al., 1994)
* Behavioral Regulation Exercise Questionnaire (Mullens et al., 1997; Wilcoz et al., 2006)
* Perceived Autonomy Support for Exercising Setting (Hagger et al., 2007)
* Psychological Needs Satisfaction for Exercise (Wilton et al., 2006)
* Goal Setting and Self-Regulation (Rothman et al., 2002)
* Multidimensional Exercise Self-Efficacy (Rodger et al., 2008)

Physical performance test:
* Stair climbing: functional activity
* Sub-maximal treadmill test: aerobic capacity
* 1 repetition maximal test: muscular strength

b. Check all research activities that apply:

- [] Anesthesia (general or local) or sedation
- [] Magnetic Resonance Imaging (MRI)
- [] Audio, video, digital, or image recordings
- [] Materials that may be considered sensitive, offensive, threatening, or degrading
- [] Biohazards (e.g., dNA, infectious agents, select agents, toxins)
- [] Non-invasive medical procedures (e.g., EKG, Doppler)
- [] Biological sampling (other than blood)
- [] Observation of participants (including field notes)
- [] Blood drawing
- [] Oral history (does not include medical history)
- [] Coordinating Center
- [] Placebo
- [] Data, not publicly available
- [] Pregnancy testing
18. DURATION

Estimate the time required from each participant, including individual interactions, total time commitment, and long-term follow-up, if any.

Screening volunteers for eligibility will take 10 minutes. The baseline evaluation will take 60-90 minutes. Participants will be randomly assigned to either an 8-week standard exercise program or behavioral intervention plus exercise training recommendation. Both groups will participate in 90 minutes of the program per week; the standard group will meet twice per week for 45 minutes per session, and the intervention group will meet once per week for 90 minutes. An evaluation similar to the baseline one will be conducted at mid-point, end-point, and 4-week follow-up. Total time required from each participant will be from 10 hr and 10 min to 18 hr and 10 min over 12-weeks plus time from initial screening.

19. NUMBER OF PARTICIPANTS

The number of participants is defined as the number of individuals who agree to participate (i.e., those who provide consent or whose records are accessed, etc.) even if all do not prove eligible or complete the study. The total number of research participants may be increased only with prior IRB approval.

a. Provide the total number of participants (or number of participant records, specimens, etc.) for whom you are seeking OSU IRB approval. 30

b. Explain how this number was derived (e.g., statistical rationale, attrition rate, etc.).

The required total sample size to provide sufficient power to examine the treatment effect on physical activity and other psychological variables is 22. This sample size was estimated using G-Power Software with ANOVA repeated measure design (within-between interaction) using effect size f = .20, which is the small to medium effect size recommend by Cohen (Cohen, 1992), power (1-β) = .80, number of measurements = 4, correlation among repeated measures = .70 based on a review of the literature, and non-sphericity correction = 1.9. After considering an estimated 30% attrition rate, 30 participants are needed (i.e., N/Satter = 15; N/Standard Cell = 13).

c. Is this a multi-center study? Yes → Indicate the total number of participants to be enrolled across all sites: 
   ☒ No

Form Date: 09/25/09
Version 2.2
30. PARTICIPANT POPULATION

a. Specify the age(s) of the individuals who may participate in the research.
Age(s): 18-45

b. Specify the participant population(s) to be included (check all that apply):
- Adults
- Decisionally Impaired Adults → Complete Appendix M
- Pregnant Women/Fetuses → Complete Appendix K
- Prisoners → Complete Appendix L
- Children (< 18 years) → Complete Appendix J
- Students from Participant Pools (e.g., REP) Specify: Unknown (e.g., research using secondary data/specimens, non-targeted surveys, program protocols)
- Healthy Volunteers
- Neonates (uncertain viability/nonviable) → Complete Appendix K
- Non-English Speaking → Complete Appendix J

c. Describe the characteristics of the population(s) and explain how the nature of the research requires justifies inclusion of the proposed population(s).

Inclusion criteria:
- Sedentary: Purpose of the study is to increase level of physical activity in inactive individuals.
- Overweight/obese (BMI: 25-34.9): The obesity epidemic and disease risk from being overweight/obese and physically inactive warrants programs to address this population.
- Female: Women are more likely than men to be obese and sedentary.
- Medical complications that might affect their ability to carry out physical activity; must pass the revised Physical Activity Readiness Questionnaire (rPAR-Q) (Thomas, Reading, & Shephard, 1992): Program requires exercise training.
- Need to understand and speak English: Program involves lectures, group discussions, and written materials.
- Willing to attend an exercise program and/or group meeting 1-2 times per week for 2 months and be evaluated four times, one of which is 4 weeks after the intervention: Clarifying expectations of involvement may reduce attrition.

Exclusion criteria:
- Smoking: Smoking can confound ability to participate fully in exercise training.
- Pregnancy or planning to get pregnant: Pregnancy can confound ability to fully participate in exercise training (see item 20c).
- Depression: Depression is associated with obesity and physical inactivity and could confound effects of intervention.
- Involvement in any exercise intervention within the past three months: This involvement could confound the effects of our intervention on participants.

d. Are any of the participants likely to be vulnerable to coercion or undue influence? □ Yes □ No

If Yes → Describe additional safeguards to protect participants’ rights and welfare.

e. Will pregnant women be excluded from participation in the research? □ Yes □ No

If Yes → Explain how the nature of the research requires justifies their exclusion. Address means of pregnancy screening.

Because participants will be expected to engage in a planned exercise program for 8 weeks, sedentary pregnant women might not be able to achieve the exercise prescription and moderately vigorous exercise might be medically contraindicated. Therefore, pregnant women will be excluded from this study. Pregnancy will be addressed during the screening process for all potential participants. Potential participants will be asked to self-report if they are currently pregnant or intending to become pregnant during the next 8 months.
31. PARTICIPANT IDENTIFICATION, RECRUITMENT, & SELECTION

a. Provide evidence that you will be able to recruit the necessary number of participants to complete the study.

Based on data from the National Health and Nutrition Examination Survey (NHANES) in 2007-2008, the prevalence of overweight and obesity for adults older than 20 years old was 88.3% which means approximately seven out of ten Americans were considered overweight (BMI ≥ 25) or obese (BMI ≥ 30). Hence, recruitment of the necessary number of participants should not be a big concern.

b. Describe how potential participants will be identified (e.g., advertising, individuals known to investigator, record review, etc.). Explain how investigator(s) will gain access to this population, as applicable.

Potential participants will be recruited through word of mouth, emails, flyers, health-related newsletters from the College of Education and Human Ecology, from academic classes upon instructor’s approval and from health services such as student health, employee health and staff wellness.

c. List the investigator(s) and/or key personnel who will recruit participants and what process will be used to determine participant eligibility.

The co-investigator and key research personnel will recruit study participants. After potential participants contact the research team, a research staff member will go through an eligibility verification check list with them by email, phone or in person. All the gathered information will be confidential.

d. Describe the recruitment process; including the setting in which recruitment will take place. Explain how the process respects potential participants’ privacy. Provide copies of proposed recruitment materials (e.g., ads, flyers, website postings, recruitment letters, and oral/written scripts).

Recruitment will occur in the OSU community. The recruitment will be done through flyers posted around the campus, word of mouth, and emails and health-related newsletter from the College of Education and Human Ecology, academic classes upon the instructor’s approval and from health services. Flyers will be posted in various locations on the OSU Campus. Potential participants will be instructed to e-mail or call the co-investigator (Y-Ting Hsu). The recruitment window will be July through September 2010. Once eligible participants are identified, baseline evaluations will be scheduled when they are available. After the evaluation session, the participants will be randomly assigned to the 3D group or the SC group. Next, the research staff will explain that participants need to wait to enter the intervention until a collection of seven to eight eligible participants are reached. The research staff will keep in contact with the participants periodically after baseline evaluations and report the progress of recruitment and when the next group will begin. A group-based intervention is essential because group cohesion and social support can enhance one of the targeted psychological constructs (i.e., relatedness). There will be two groups of 7 to 8 participants or one group of 15 participants for each condition (3D group and SC group) depending on number of eligible volunteers and recruitment rate over time. Participants can decide not to participate in the project anytime. All information and communication with potential participants will be confidential.

32. INCENTIVES TO PARTICIPATE

Will participants receive compensation or other incentives (e.g., free services, cash payments, gift certificates, parking, classroom credit, travel reimbursement) to participate in the research study? Compensation plans should be pre-rated (not contingent upon study completion) and should consider participant withdrawals, as applicable.

☐ Yes ☐ No

If Yes → Describe the incentive, including the amount and timing of all payments.
### 23. ALTERNATIVES TO STUDY PARTICIPATION

Other than choosing not to participate, list any specific alternatives, including available procedures or treatments that may be advantageous to the subject.

If potential participants fail to pass the inclusion criteria after screening, a general exercise guideline sheet suggested by the CEC will be provided to help them with ideas about how to exercise safely.

### 24. INFORMED CONSENT PROCESS

| a. Indicate the consent process(es) and document(s) to be used in the study. Check all that apply. Provide copies of documents and/or complete relevant appendices, as needed. See Consenti for Research for templates or contact ORRP for more information. |
|-------------------------------|-----------------|-------------------|-----------------|
| ☐ Assent – Form               | ☐ Parental Permission – Form | | |
| ☐ Assent – Verbal Script      | ☐ Parental Permission – Verbal Script → Complete Appendix M2 | | |
| ☑ Informed Consent – Form     | ☐ Translated Consent/Assent – Form(s) → Complete Appendix M1 | Waiver of Alteration of Consent Process → Complete Appendix M2 |
| Informed Consent – Verbal Script → Complete Appendix M2 | Waiver of Consent Documentation → Complete Appendix M2 |
| ☐ Informed Consent – Addendum  | | | |

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<tr>
<th>b. List the investigator(s) and/or key personnel who will obtain consent from participants or their legally authorized representatives.</th>
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<tbody>
<tr>
<td>Janet Buckworth, Principle Investigator</td>
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<td>Ya-Ting Hsu, Co-Investigator</td>
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<th>c. Who will provide consent or permission (i.e. participant, legally authorized representative, parent and/or guardian)?</th>
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<th>d. Describe the consent process. Explain when and where consent will be obtained and how subjects and/or their legally authorized representatives will be provided sufficient opportunity (e.g., waiting period, if any) to consider participation.</th>
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<tr>
<td>Participation in this study will be on a volunteer basis. An informed consent dealing with both the risks and benefits of this study will be administered to all potential participants prior to any data collection. Study participants will be administered the consent form at the beginning of the baseline evaluation meeting. Our research staff, Principal Investigator and Co-Investigator will give the consent form in a private room in the PAEB building, where the participant will read and sign the consent form and have opportunities to ask questions.</td>
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<td>N/A</td>
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<th>e. Explain how the possibility of coercion or undue influence will be minimized in the consent process.</th>
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<td>N/A</td>
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<th>f. Will any other tools (e.g., quizzes, visual aids, information sheets) be used during the consent process to assist participant comprehension?</th>
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<td>Yes → Provide copies of these tools</td>
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<th>g. Will any other consent forms be used (e.g., for clinical procedures such as MRI, surgery, etc. and/or consent forms from other institutions)?</th>
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<tbody>
<tr>
<td>Yes → Provide copies of these forms</td>
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<tr>
<td>No</td>
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</table>
25. PRIVACY OF PARTICIPANTS

a. Describe the provisions to protect the privacy interests of the participants.
   Subjects will be assigned an identification number. A cover sheet with the subject's name, contact information, and ID number will be kept separate from other data sheets. Only the primary investigator and co-investigator will have access to the participant's name and corresponding number assignment. All the data collected will be filed and analyzed according to the ID number only, and data collected could not be used to identify individual participants. Personally identifiable information will not be part of the research including the data analysis. Data will be analyzed and presented by group and not by individual.

b. Does the research require access to personally identifiable private information?
   □ Yes
   □ No

   If Yes → Describe the personally identifiable private information involved in the research. List the information source(s) (e.g., educational records, surveys, medical records, etc.).

26. CONFIDENTIALITY OF DATA

a. Explain how information is handled, including storage, security measures (as necessary), and who will have access to the information. Include both electronic and hard copy records.
   All collected data will be confidential and safely secured in a locked file cabinet, accessible only to investigators and key personnel involved in the study. To further ensure confidentiality and to provide identity safeguards, all participants will be assigned an identification number. Any and all the data collected will be filed and analyzed according to this number. Only the Principal Investigator and the Co-Investigator will have access to the participant's name and corresponding number assignment, which will be kept separately from collected data. Electronic data will be stored in the PI and Co-Investigators' encrypted computers after personally identifying information is removed. Following data analysis, identity records will be destroyed. Publication and presentations from this study will not include the names or reveal the identity of any participation in any other way. Participants will be informed of the procedures that will be taken to ensure confidentiality prior to participation in the study.

b. Explain if any personal or sensitive information that could be potentially damaging to participants (e.g., relating to illegal behaviors, alcohol or drug use, sexual attitudes, mental health, etc.) will be collected.
   □ N/A

c. Will you be obtaining an NIH Certificate of Confidentiality?
   □ Yes → Provide a copy before you begin the research
   □ No

   See OSU HRFP policy Privacy and Confidentiality for more information.

d. Explain any circumstances (ethical or legal) where it would be necessary to break confidentiality.
   □ N/A

e. Indicate what will happen to the identifiable data at the end of the study. Research-related records should be retained for a period of at least three years after the research has been discontinued (i.e., no further data collection, long term follow-up, re-contact, or analysis of identifiable/coded data.)
   □ Identifiers permanently removed from the data and destroyed (de-identified)
   □ Identifiable/coded (linked) data are retained
   □ Identifiable data not collected
27. HIPAA RESEARCH AUTHORIZATION

Will individually identifiable Protected Health Information (PHI) subject to the HIPAA Privacy Rule requirements be accessed, used, or disclosed in the research study?

☑ No

☐ Yes → Check all that apply:
☐ Written Authorization → Provide a copy of the Authorization Form
☐ Partial Waiver (recruitment purposes only) → Complete Appendix N
☐ Full Waiver (entire research study) → Complete Appendix N
☐ Alteration (written documentation) → Complete Appendix N

28. REASONABLY ANTICIPATED BENEFITS

a. List the potential benefits that participants may expect as a result of this research study. State if there are no direct benefits to individual participants. Compensation is not to be considered a benefit.

Following this study, all participants will be given their individual research results, an explanation of the study’s findings and exercise guidelines that may improve their general health. Especially, individuals could potentially benefit from this study through learning physical techniques related to exercise training and behavioral strategies, such as self-monitoring, goal setting, problem solving and relapse prevention, which help to improve exercise adherence.

b. List the potential benefits that society and/or others may expect as a result of this research study.

Society could potentially benefit from this research because our study interventions could identify strategies for health professionals to use for promoting regular exercise habits in overweight/obese sedentary women.

29. RISKS, HARMs, & DECOMFORTS

a. Describe all reasonably expected risks, harms, and/or discomforts that may apply to the research. Consider the range of risks, including physical, psychological, social, legal, and economic. As applicable, discuss severity and likelihood of occurrence.

1. Risk: Breach of confidentiality
   Likelihood of occurrence: very unlikely
   Potential severity of harm/discomfort: Psychological distress from breach of confidentiality could be mild to moderate depending on the participant and the information revealed. Possible long-term consequences are minimal considering the general nature of the information being gathered in this study.

2. Risk: Psychological stress
   Likelihood of occurrence: very unlikely
   Potential severity of harm/discomfort: Psychological distress from responding to questionnaires could be mild to moderate depending on the participant and the information asked. Possible long-term consequences are minimal considering the general nature of the information being gathered in this study.

3. Risk: Physical injury or discomfort
   Likelihood of occurrence: injury is unlikely; physical discomfort is possible for physical assignments performed during evaluations and training programs.
   Potential severity of harm/discomfort: Musculoskeletal stress from unaccustomed physical activity may occur after exercise sessions and physical tasks. This discomfort usually subsides as our body adapts to the physical activity. The risks associated with a test for submaximal aerobic capacity and 1 repetition-maximal strength test (the baseline, post-treatment, and follow-up evaluations) are synonymous with those possible during any strenuous physical activity. Apparently healthy adults who will be recruited for this study with a normal health history rarely experience negative physiological effects. All the study personnel have been trained in the OSU Exercise Physiology Lab for administering all measurement procedures. All physiological measurements, including heart rate, blood pressure, are noninvasive techniques associated with minimal risk. The American College of Sport Medicine exercise guidelines for testing and training will be followed. The PAES Building, where data collection will take place, is equipped with an Automatic External Defibrillator (AED) and an Emergency response protocol. There are no long-term risks.
b. Describe how risks, harms, and/or discomforts will be minimized.

Protection for breach of confidentiality: All collected data will be confidential and safely secured in a locked file cabinet, accessible only to individuals involved in the study. To further ensure confidentiality and to provide identity safeguards, all participants will be assigned an identification number. Any and all data collected will be filed and analyzed according to this number. Only the primary investigator and the co-investigator will have access to the participant’s name and corresponding number assignment, which will be kept separately from collected data. All data will be entered into a database on a password protected encrypted personal computer. Following data analysis, identity records will be destroyed. Publication and presentations from this study will not include the name or reveal the identity of any participation in any other way. Participants will be informed of the procedures that will be taken to ensure confidentiality prior to participation in the study.

Protection for risk of psychological stress from responding to questionnaires: All participants will complete questionnaires on a voluntary basis. The co-investigator will emphasize during the pretest, mid-interventions, posttest and follow up sessions that the participant does not have to answer any questions she is not comfortable answering, and can discontinue participation at any time.

Protection for physical injury or discomfort: Appropriate warm-up and cool-down procedure will be applied for each exercise session and evaluations. The procedures for stair climbing, sub-maximal aerobic capacity test, and 1 repetition maximal strength test will be performed by well-trained Exercise Physiology personnel and follow the American College of Sport Medicine exercise testing guidelines. Also, the exercise sessions and any physical evaluations will be held at least 48 hours apart in order to lessen any discomfort and allow enough time for recovery.

30. MONITORING

Does the research involve greater than minimal risk (i.e., are the harms or discomforts described in Question #29 beyond what is ordinarily encountered in daily life or during the performance of routine physical or psychological tests)?

☐ Yes
☒ No

If Yes → Describe the plan to oversee and monitor data collected to ensure participant safety and data integrity. Include the following:

- The information that will be evaluated (e.g., incidence and severity of actual harm compared to that expected);
- Who will perform the monitoring (e.g., investigator, sponsor, or independent monitoring committee);
- Timing of monitoring (e.g., at specific points in time, after a specific number of participants have been enrolled); and
- Decisions to be made as a result of the monitoring process (e.g., provisions to stop the study early for unanticipated problems).

31. ASSESSMENT OF RISKS & BENEFITS

Discuss how risks to participants are reasonable when compared to the anticipated benefits to participants (if any) and the importance of the knowledge that may reasonably be expected to result.

The potential benefits of this study significantly outweigh any risks. The risk of the physical evaluations (sub-maximal aerobic capacity test, 1 repetition maximal strength test and stair climbing tests) and exercises sessions are considered minimal. The investigators’ experience and professional knowledge and the non-invasive nature of each procedure reduce the chance that adverse effects and incidents will occur.

Acute exercise has been shown to be effective in improving psychological states. Long-term exercise not only helps to improve physiologic parameters, including improved blood pressure and lipid profile, but also helps to manage stress, body weight and quality of life. This study will help sedentary overweight/obese women start an individualized exercise training program and learn effective behavioral strategies, such as goal setting and self-monitoring.

Following the study, all participants will be given their individual research results and an explanation of the study’s findings. All the participants will receive 8 weeks of supervised exercise training sessions, including aerobic exercise and weight training. The treatment group will receive the exercises session plus behavioral interventions which address on goal-setting, problem solving, self-monitoring, social support and relapse prevention. The standard care group will receive supervised and individualized exercise training.
32. PARTICIPANT COSTS/REIMBURSEMENTS

a. List any potential costs subjects (or their insurers) will incur as a result of study participation (e.g., parking, study drugs, diagnostic tests, etc.).

Participants may have parking costs if they are not OSU employees or students. However, since we will recruit potential participants in the OSU community, we expect the majority of the participants will not need to pay extra for parking since they usually already have a parking permit.

b. List any costs to participants that will be covered by the research study.
There will be no costs to participants covered by the research study itself.

33. APPLICATION CONTENTS

Indicate the documents being submitted for this research project. Check all appropriate boxes.

☒ Initial Review of Human Subjects Research Application
☒ Appendix A: OSU Co-Investigators & Key Personnel (questions 4 & 5)
☐ Appendix A: External (non-OSU) Co-Investigators & Key Personnel (question 6)
☒ Appendix B: Expedited Review - Initial Review (question 13)
☐ Appendix C: Data Repositories (question 17b)
☐ Appendix D: Deception (question 17b)
☐ Appendix E: Devices (question 17b)
☐ Appendix F: Drugs or Biologics (question 17b)
☐ Appendix G: Genetic Testing (question 17b)
☐ Appendix H: Storage of Biological Materials (question 17b)
☐ Appendix I: Children (question 20b)
☐ Appendix J: Non-English Speaking Participants (questions 20b and 24a)
☐ Appendix K: Pregnant Women/Fetuses/Neonates (question 29b)
☐ Appendix L: Prisons/prisons (question 20b)
☐ Appendix M1: Waiver or Alteration of Consent Process (questions 17b & 24a)
☐ Appendix M2: Waiver of Consent Documentation (question 24a)
☐ Appendix N: Waiver of HIPAA Research Authorization (question 27)
☐ Appendix U: Research in International Settings (question 12)
☐ Appendix V: Radiation (question 17b)
☐ Appendix W: Decisionally Impaired Adults (question 20b)
☒ Consent form(s), Assent Form(s), Permission Form(s), and Verbal Script(s), including translated documents (question 24a)
☐ HIPAA Research Authorization Form(s) (question 27)
☐ Data Collection Form(s) involving protected health information (Appendix N)
☒ Recruitment Materials (e.g., ads, flyers, telephone or other oral script, radio/TV scripts, internet solicitations) (question 21d)
☐ Script(s) or Information Sheet(s), including Debriefing Materials (question 24)
☒ Instruments (e.g., questionnaires or surveys to be completed by participants) (question 17b)
☐ Other Committee Approvals/Letters of Support (questions 11 & 12)
☒ Research Protocol
☐ Complete Grant Application or Funding Proposal
☐ Drug Manufacturer’s Approved Labeling/Investigator’s Drug Brochure (Appendix F)
☐ Device Manufacturer’s Approved Labeling (Appendix E)
Other supporting documentation and/or materials

For Multi-Center Clinical Trials supported by DHHS, the submission will also include:

☐ DHHS-approved Sample Informed Consent Document (if one exists)

☐ DHHS-approved Protocol (if one exists)

☐ 34. ASSURANCE

PRINCIPAL INVESTIGATOR (or Advisor)

I agree to follow all applicable policies and procedures of The Ohio State University and federal, state, and local laws and guidance regarding the protection of human subjects in research, as well as with professional practice standards and generally accepted good research practice guidelines for investigators, including, but not limited to, the following:

- Perform the research as approved by the IRB under the direction of the Principal Investigator (or Advisor) by appropriately trained and qualified personnel with adequate resources;
- Initiate the research after written notification of IRB approval has been received;
- Obtain and document (unless waived) informed consent and HIPAA research authorization from human subjects (or their legally authorized representatives) prior to their involvement in the research using the currently IRB-approved consent form(s) and process;
- Promptly report to the IRB events that may represent unanticipated problems involving risks to subjects or others;
- Provide significant new findings that may relate to the subjects willingness to continue to participate;
- Inform the IRB any proposed changes in the research or informed consent process before changes are implemented, and no changes will be made until approved by the OSU IRB (except where necessary to eliminate apparent immediate hazards to participants);
- Complete and submit a Continuing Review of Human Subjects Research application before the deadline for review at intervals determined by the IRB to be appropriate to the degree of risk (but not less than once per year) to avoid expiration of IRB approval and cessation of all research activities;
- Maintain research-related records (and source documents) in a manner that documents the validity of the research and integrity of the data collected, while protecting the confidentiality of the data and privacy of participants;
- Retain research-related records for audit for a period of at least three years after the research has ended (or longer, according to sponsor or publication requirements) even if I leave the University;
- Contact the Office of Responsible Research Practices for assistance in amending (to request a change in Principal Investigator) or terminating the research if I leave the University or am unavailable to conduct or supervise the research personally (e.g., sabbatical or extended leave);
- Provide a Final Study Report to the IRB when all research activities have ended (including data analysis with individually identifiable or coded private information); and
- Inform all Co-Investigators, research staff, employees, and students assisting in the conduct of the research of their obligations in meeting the above commitments.

I verify that the information provided in this Initial Review of Human Subjects Research application is accurate and complete.

Signature of Principal Investigator (or Advisor) ____________________________

Date ____________________________

Printed name of Principal Investigator (or Advisor) ____________________________

DEPARTMENT CHAIR (or Signatory Official)

As Department Chair (or Signatory Official) for the Principal Investigator, I acknowledge that this research is in keeping with the standards set by our unit and that it has met all Departmental/College requirements for review.

If the PI or any Co-Investigator is also the Department Chair, the signature of the Dean or other appropriate Signatory Official, such as the Associate Dean for Research, must be obtained.

Signature of Department Chair ____________________________

Date ____________________________

Printed name of Department Chair ____________________________
APPENDIX O

The Ohio State University Consent to Participate in Research
The Ohio State University Consent to Participate in Research

Study Title: The effects of a Self-Determination Theory based exercise intervention on physical activity and psychological variables in sedentary overweight or obese women

Principal Investigator: Janet Buckworth, PhD

Sponsor: N/A

- This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate. Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to participate.

- Your participation is voluntary. You may refuse to participate in this study. If you decide to take part in the study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your usual benefits. Your decision will not affect your future relationship with The Ohio State University. If you are a student or employee at Ohio State, your decision will not affect your grades or employment status.

- You may or may not benefit as a result of participating in this study. Also, as explained below, your participation may result in unintended or harmful effects for you that may be minor or may be serious depending on the nature of the research.

- You will be provided with any new information that develops during the study that may affect your decision whether or not to continue to participate. If you decide to participate, you will be asked to sign this form and will receive a copy of the form. You are being asked to consider participating in this study for the reasons explained below.

1. Why is this study being done?
The study is designed to provide information on how to increase exercise participation in overweight or obese women over a period of three months. It is also designed to increase knowledge of health and quality of life benefits from regular exercise. We would like to identify the best strategies to help women adopt and maintain regular physical activity.

2. How many people will take part in this study?
30 healthy sedentary overweight or obese women will be recruited for participation in this study.
3. What will happen if I take part in this study?

You will do everything that is part of participating in Project CHANGE (to being a Confident, Healthy, And Goal-directed Exerciser), which is offered by the OSU Health and Exercise Science program. Project CHANGE includes a 2-month intervention with follow-up one month after the program is over. During this period, you will be assessed four times.

The assessments will be conducted during a single visit at each of the four different time points: the beginning of the intervention (baseline), mid-point, end of the intervention, and 1-month follow-up. Following the baseline assessment, you will be randomly assigned ("like a flip of a coin") to either a standard exercise program or a combination educational and exercise program. Both groups will spend 90 minutes per week getting the intervention during a 2-month training period. The standard exercise group will participate in supervised and individualized exercise sessions (aerobic walking exercise on treadmill and resistance training) for 45 minutes, 2 sessions per week. The combination group will participate in educational counseling for 60 minutes to help develop not only physical skills to perform exercise safely but also behavioral strategies to exercise independently, especially once the training is over. After the educational class, you will spend the next 30 minutes practicing the physical skills you learned in the educational class. The participants of both groups will need to engage in home-based exercise outside of the program in order to meet the recommended public health dosage of physical activity—accumulating moderate intensity physical activity for 150 minutes per week. A log exercise sheet will be provided to record your exercise each week.

At the baseline, mid-point, end of the intervention and 1-month follow-up, you will be asked to complete eight questionnaires, which will take approximately 30-40 minutes. The questionnaires will be evaluating your physical activity participation, quality of life, confidence in and motivation for exercise, mood, and some other psychological factors targeted in the intervention, such as goal setting and perceived support from your trainer. In addition, you will complete a treadmill walking test to evaluate your aerobic fitness, a strength test for your arms and legs, and a functional performance test (stair-climbing test).

For the treadmill test, you will walk at a brisk walking pace, usually at 3.0 mph with incline increasing 2.5% every 2 minutes. The research staff will check your heart rate and blood pressure before, during, and after the test to ensure the testing is safe for you. The test will stop once your heart rate reaches 83% of the age-predicted maximal heart rate (i.e., 220-your age). For the strength tests, we will measure your maximal strength using the chest press and leg press machines. After appropriate warm-up, you will complete 1 repetition of the chest press and leg press 3-5 times to find the maximal weight you can safely lift. For the stair-climbing test, you will be timed as you walk up and down one flight of stairs, trying to complete the task as quickly as you can while still being safe.
The American College of Sport Medicine exercise and testing guidelines will be followed for all the exercise sessions and tests. The PAES Building, where data collection will take place, is equipped with an Automatic External Defibrillator (AED) and an Emergency Response Protocol.

By agreeing to be part of this study, you allow us to collect your responses to the assessments and combine your information with that of other people in Project CHANGE who have agreed to be part of this study. We will analyze your group data to find out if the program is effective and what parts are more important to help with exercise adherence for larger size women who want to be active and healthy.

A table outlining the assessments you will be asked to complete during the course of the study is provided below.

<table>
<thead>
<tr>
<th>Time</th>
<th>Assessments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>• Questionnaires to measure physical activity, depressive symptoms, quality of life, motivation, and other psychological variables</td>
</tr>
<tr>
<td></td>
<td>• Stair-climbing test</td>
</tr>
<tr>
<td></td>
<td>• Treadmill-walking test</td>
</tr>
<tr>
<td></td>
<td>• Strength test</td>
</tr>
<tr>
<td>Mid-point: 1-month</td>
<td>• Questionnaires to measure physical activity, depressive symptoms, quality of life, motivation, and other psychological variables</td>
</tr>
<tr>
<td></td>
<td>• Stair-climbing test</td>
</tr>
<tr>
<td>End-point: 2-month</td>
<td>• Questionnaires to measure physical activity, depressive symptoms, quality of life, motivation, and other psychological variables</td>
</tr>
<tr>
<td></td>
<td>• Stair-climbing test</td>
</tr>
<tr>
<td></td>
<td>• Treadmill-walking test</td>
</tr>
<tr>
<td></td>
<td>• Strength test</td>
</tr>
<tr>
<td>Follow-up: 3-month</td>
<td>• Questionnaires to measure physical activity, depressive symptoms, quality of life, motivation, and other psychological variables</td>
</tr>
<tr>
<td></td>
<td>• Stair-climbing test</td>
</tr>
<tr>
<td></td>
<td>• Treadmill-walking test</td>
</tr>
<tr>
<td></td>
<td>• Strength test</td>
</tr>
</tbody>
</table>
4. How long will I be in the study?

Project CHANGE includes 2-months of training and 1-month follow-up and four
assessments. Total time required from you if you participate in this study will be from 16
hr and 10 min to 18 hr and 10 min over three months.

In detail, the baseline evaluation will take 60-90 minutes. You will be randomly assigned
to a 2-month standard exercise program or a behavioral intervention plus exercise training.
Both groups will participate in 90 minutes of the program per week; the exercise group
will meet twice per week for 45 minutes per session and the combination group will meet
once per week for 90 minutes. An evaluation similar to the baseline one will be conducted
at mid-point, end-point, and 1-month follow-up.

You may leave the study at any time. If you decide to stop participating in the study,
there will be no penalty to you, and you will not lose any benefits to which you are
otherwise entitled. Your decision will not affect your future relationship with The Ohio
State University.

5. Can I stop being in the study?

You may leave the study at any time. If you decide to stop participating in the study,
there will be no penalty to you, and you will not lose any benefits to which you are
otherwise entitled. Your decision will not affect your future relationship with The Ohio
State University.

6. What risks, side effects or discomforts can I expect from being in the study?

Risks:
For exercise sessions and physical evaluations: minor muscle aches and joint
discomfort are common but usually time-limited. Also, when our body adapts to the
activity, this discomfort usually goes away soon. The risk of serious injury or death during
exercise training is minimal. Even in populations with established heart problems, death
occurs in less than 1 of 10,000 exercise tests, and at a rate of less than 1 per 100,000
hours of exercise training.

For the quality of life and depression questionnaires: possible emotional upset
resulting from questionnaires or fatigue from completing the questionnaires.

7. What benefits can I expect from being in the study?

Benefits:
You will be contributing to society's knowledge of the benefits of exercise for overweight
individuals and how we might develop more effective exercise programs. You will have
the opportunity to receive free individualized and supervised training for a period of 2
months and free fitness assessments at the baseline, end of the intervention, and 1-month
follow-up.
8. What other choices do I have if I do not take part in the study?

You may choose not to participate without penalty or loss of benefits to which you are otherwise entitled.

9. Will my study-related information be kept confidential?

Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law.

Also, your records may be reviewed by the following groups (as applicable to the research):
- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- U.S. Food and Drug Administration;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor supporting the study, their agents or study monitors; and
- Your insurance company (if charges are billed to insurance).

If this study is related to your medical care, your study-related information may be placed in your permanent hospital, clinic, or physician’s office records. Authorized Ohio State University staff not involved in the study may be aware that you are participating in a research study and have access to your information.

You may also be asked to sign a separate Health Insurance Portability and Accountability Act (HIPAA) research authorization form if the study involves the use of your protected health information.

10. What are the costs of taking part in this study?

Participants may have parking costs if they are not OSU employees or students. But there are no other costs related to participation in this study.

11. Will I be paid for taking part in this study?

No, there are no monetary incentives for taking part in this study.
12. What happens if I am injured because I took part in this study?

If you suffer an injury from participating in this study, you should notify the researcher or study doctor immediately, who will determine if you should obtain medical treatment at The Ohio State University Medical Center.

The cost for this treatment will be billed to you or your medical or hospital insurance. The Ohio State University has no funds set aside for the payment of health care expenses for this study.

13. What are my rights if I take part in this study?

If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.

You will be provided with any new information that develops during the course of the research that may affect your decision whether or not to continue participation in the study.

You may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled.

An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

14. Who can answer my questions about the study?

For questions, concerns, or complaints about the study you may contact the Principal Investigator, Dr. Janet Buckworth at 614-292-0757.

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

If you are injured as a result of participating in this study or for questions about a study-related injury, you may contact Dr. Janet Buckworth at 614-292-0757.
Signing the consent form

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

Printed name of subject

Signature of subject

Date and time

Printed name of person authorized to consent for subject (when applicable)

Signature of person authorized to consent for subject (when applicable)

Date and time

Relationship to the subject

AM/PM

Investigator/Research Staff

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

Printed name of person obtaining consent

Signature of person obtaining consent

Date and time

Witness(es) - May be left blank if not required by the IRB

Printed name of witness

Signature of witness

Date and time

Printed name of witness

Signature of witness

Date and time

Printed name of witness

Signature of witness

Date and time

Page 7 of 7    Form date: 09/25/09
APPENDIX P

Biomedical IRB Approval Letter for Initial Review
August 4, 2010

Protocol Number: 2010H0197
Protocol Title: THE EFFECTS OF A SELF-DETERMINATION THEORY BASED EXERCISE INTERVENTION ON PHYSICAL ACTIVITY AND PSYCHOLOGICAL VARIABLES IN SEDENTARY OVERWEIGHT OR OBESE WOMEN, Janet Buckworth, Brian C. Focht, Ya-Ting Hsu, Ann A. O'Connell, School of Physical Activity & Educational Services

Type of Review: Initial Review – expedited
IRB Staff Contact: Carolyn Hagopian
(614) 292-0569
Jhagopian.3@osu.edu

Dear Dr. Buckworth,

The Biomedical Sciences IRB APPROVED BY EXPEDITED REVIEW the above referenced research. The Board was able to provide expedited approval under 45 CFR 46.110(b)(1) because the research meets the applicability criteria and one or more categories of research eligible for expedited review, as indicated below.

Date of IRB Approval: July 21, 2010
Date of IRB Approval Expiration: July 21, 2011
Expedited Review Category: 4

If applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent form and process must be used. Changes in the research (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except where necessary to eliminate apparent immediate hazards to subjects).

This approval is valid for one year from the date of IRB review when approval is granted or modifications are required. The approval will no longer be in effect on the date listed above as the IRB expiration date. A Continuing Review application must be approved within this interval to avoid expiration of IRB approval and cessation of all research activities. A final report must be provided to the IRB and all records relating to the research (including signed consent forms) must be retained and available for audit for at least 3 years after the research has ended.

It is the responsibility of all investigators and research staff to promptly report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

This approval is issued under The Ohio State University's OHRP Federalwide Assurance #000063/8. All forms and procedures can be found on the OHRP website - www.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Karla Zadnik, OD, PhD, Chair
Biomedical Sciences Institutional Review Board
APPENDIX Q

Biomedical IRB Approval Letter for Amendments
September 13, 2010

Protocol Number: 2010H0197
Protocol Title: THE EFFECTS OF A SELF-DETERMINATION THEORY BASED EXERCISE INTERVENTION ON PHYSICAL ACTIVITY AND PSYCHOLOGICAL VARIABLES IN SEDENTARY OVERWEIGHT OR OBESE WOMEN, Janet Buckworth, Brian Carl Focht, Ya-Ting Hsu, Ann A O’Connell, School of Physical Activity & Educational Services

Request for changes dated August 30, 2010 (add key personnel; reduce speed to increase participant satisfaction).

Type of Review: Amendment
Approval Date: September 10, 2010
IRB Staff Contact: Tush Denlinger
(614) 688-3330
denlinder.33@osu.edu

Dear Dr. Buckworth,

The Biomedical Sciences IRB APPROVED the above referenced research.

Note that if applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent forms and process must be used. Changes in the research (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except where necessary to eliminate apparent immediate hazards to subjects).

It is the responsibility of all investigators and research staff to promptly report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

This approval is issued under The Ohio State University’s OHRP Federalwide Assurance #00006378. All forms and procedures can be found on the ORRP website – www.orrp.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Karla Zadnik, OD, PhD, Chair
Biomedical Sciences Institutional Review Board
October 1, 2010

Protocol Number: 2010H0197
Protocol Title: THE EFFECTS OF A SELF-DETERMINATION THEORY BASED EXERCISE INTERVENTION ON PHYSICAL ACTIVITY AND PSYCHOLOGICAL VARIABLES IN SEDENTARY OVERWEIGHT OR OBSESE WOMEN, Janet Buckworth, Brian Focht, Ya-Ting Hsu, Ann O’Connell, School of Physical Activities & Educational Services

Request for changes dated September 23, 2010 (add key personnel Florian, Burkhart, Murakoshi, Bannom, Rosich, and DeBusk)

Type of Review: Amendment - Expedited
Approval Date: September 27, 2010
IRB Staff Contact: Kristen Kalina
(614) 292-5958
Kalina.K@osu.edu

Dear Dr. Buckworth,

The Biomedical Sciences IRB APPROVED the above referenced research.

Note that if applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent form and process must be used. Changes in the research (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except where necessary to eliminate apparent immediate hazards to subjects).

It is the responsibility of all investigators and research staff to promptly report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

This approval is issued under The Ohio State University’s OHRP Federalwide Assurance #00006338. All forms and procedures can be found on the CRRP website — www.orhp.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

[Signature]

Karla Zednik, OD, PhD, Chair
Biomedical Sciences Institutional Review Board

ir-017-03 Approval Amend
Version 05/18/10
December 22, 2010

Protocol Number: 2010H0197
Protocol Title: THE EFFECTS OF A SELF-DETERMINATION THEORY BASED EXERCISE INTERVENTION ON PHYSICAL ACTIVITY AND PSYCHOLOGICAL VARIABLES IN SEDENTARY OVERWEIGHT OR OBSESE WOMEN, Janet Buckworth, Brian Focht, Ya-Ting Hsu, Ann O'Connell, School of Physical Activity & Educational Services

Request for changes dated November 23, 2010 (add process evaluation questionnaires)

Type of Review: Amendment – Expedited
Approval Date: December 20, 2010
IRB Staff Contact: Kristen Kalina
(614) 292-9804
Kalina.K@osu.edu

Dear Dr. Buckworth,

The Biomedical Sciences IRB APPROVED the above referenced research.

Note that if applicable, informed consent (and HIPAA research authorization) must be obtained from subjects or their legally authorized representatives and documented prior to research involvement. The IRB-approved consent form and process must be used. Changes in the research (e.g., recruitment procedures, advertisements, enrollment numbers, etc.) or informed consent process must be approved by the IRB before they are implemented (except where necessary to eliminate apparent immediate hazards to subjects).

It is the responsibility of all investigators and research staff to promptly report to the IRB any serious, unexpected and related adverse events and potential unanticipated problems involving risks to subjects or others.

This approval is issued under The Ohio State University’s OHRP Federalwide Assurance #00006378. All forms and procedures can be found on the OHRP website – www.orrp.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Karla Zadnik, OD, PhD, Chair
Biomedical Sciences Institutional Review Board

lr-017-03 Approval Amend
Version 05/10/10
APPENDIX R

IRB Event Report Determination Letter
March 21, 2011

Protocol Number: 2010H0197
Protocol Title: THE EFFECTS OF A SELF-DETERMINATION THEORY BASED EXERCISE INTERVENTION ON PHYSICAL ACTIVITY AND PSYCHOLOGICAL VARIABLES IN SEDENTARY OVERWEIGHT OR OBESE WOMEN, Janet Buckworth, Brian Carl Focht, Ya-Ting Hsu, Ann A O’Connell, School of Physical Activity and Educational Services

Event Report dated December 9, 2010 (internal event dated 12/9/10). The subject was completing the stair-climbing test when she tripped and fell while briskly walking down the stairs cutting her left lower leg. The subject was taken to the Student Health Center and examined. An X-ray of her leg showed no fracture; the physician sutured the wound and removed the stitches in five days. The subject is willing to stay in the study to complete the follow-up evaluation as able.

Type of Review: Event Report
Date of Review: March 14, 2011
IRB Staff Contact: Becky Lockman
(614) 247-4736
lockman.19@osu.edu

Dear Dr. Buckworth,

The Biomedical Sciences IRB reviewed your response to the Event Report for the above referenced research and determined that the event did constitute an unanticipated problem involving risks to subjects or others. No further information or action is needed.

When the IRB determines that an event is an unanticipated problem involving risks to subjects or others, additional notification will be made in accordance with OSU IRB Policy at http://orrp.osu.edu/irb/osupolicies/documents/IRBReporting.pdf within 30 days.

All IRB policies, forms, and procedures can be found on the ORRP website – www.orrp.osu.edu. Please feel free to contact the IRB staff contact listed above with any questions or concerns.

Karla Zadnik, OD, PhD, Chair
Biomedical Sciences Institutional Review Board