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**A RANDOMIZED TRIAL OF IMPLEMENTATION INTENTION AND
INDUSTRIOUSNESS TRAINING FOR EXERCISE INITIATION AND MAINTENANCE**

by

PHUONG VO

THESIS

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

MASTER OF ARTS

2016

MAJOR: PSYCHOLOGY (Cognitive,

Developmental, Social-Personality)

Approved By:

Advisor

Date

DEDICATION

I would like to dedicate this work to my husband, Anh, and my lovely daughter, Tiffany – your unwavering support and unconditional love have been the strongest impetus for what I am doing and for what I will continue to do as we take this journey together.

ACKNOWLEDGMENTS

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A Randomized Trial of Implementation Intention and Industriousness Training for Exercise Initiation and Maintenance

Introduction

The rate of adult obesity in the United States has increased more than two times since 1970, and the rate of child-teen obesity has increased by four times (Flegal, 2010). One of the antecedents of obesity is an inactive lifestyle. Exercise has been known to be associated with increases in both physical and mental health by increasing longevity, preventing risk of obesity, coronary heart disease, and hypertension, and increasing self-esteem and overall quality of life (McAuley & Rudolph, 1995; U.S. Department of Health and Human Services, 2008). Unfortunately, decreasing levels of physical activity can start in children as early as six years of age and continue to decline throughout the life span (Malina, 1996). Research suggests that young adulthood is an opportune time to engage in preventive measures in order to lay the foundation for an active lifestyle (Leslie, Fotheringham, Owen, & Bauman, 2001).

Research on exercise participation has been developed largely through three main theoretical perspectives – social cognitive theory, goals theory, and the Transtheoretical model of change (Patrick & Canevello, 2011). Although research from these perspectives has provided valuable insights into the cognitive processes of exercise behavior initiation and individuals' willingness to change, they ignore the behavioral and dispositional factors that may aid in maintaining these behavioral changes. Further, Bogg and Roberts (2013) suggest that using personality-informed intervention techniques may also provide a complementary target of change that has the potential to improve health status through health-related behaviors.

The current study sought to address this issue by examining implementation intentions and industriousness as potential factors that may enhance physical activity maintenance through an intervention study. First, a review of the conceptual issues in physical activity initiation and

maintenance is discussed. Then, the roles of self-efficacy, implementation intentions, and industriousness in physical activity initiation and maintenance is examined. Finally, the interrelations and independent contributions of self-efficacy, implementation intentions, and industriousness are reviewed in the context of the approach, hypotheses, design, and results of the current study.

Exercise Initiation and Maintenance

Differentiation between exercise initiation and maintenance is important because the psychological processes that determine behavioral initiation and maintenance may not always be the same (Rothman, 2000). Prochaska and DiClemente's Transtheoretical model (TTM; 1983) posits that people experience change through five stages: precontemplation, contemplation, preparation, action, and maintenance. As people move from the precontemplation stage to the maintenance stage, they are moving from not being aware of their need to change (and have no intention of changing) toward making the actual steps toward change and finally maintaining that change for at least six months or more. Even though the TTM designates the difference between the action and maintenance stages based on time span, it is unclear how the psychological processes of change and behavioral action are differentiated in this model. Furthermore, because movement through the stages does not have to be linear and can also be reversed, the ability to initiate a change does not guarantee that it can consistently be maintained during the next six months. Likewise, being able to maintain a behavioral change for six months does not guarantee that the change will continue for an extended period of time (i.e., beyond six months), especially in the face of competing demands. Rothman (2000), therefore, argued that the TTM does not allow for the prediction of the conditions that lead to successful maintenance of a changed behavior because it does not sufficiently specify which factors may cause someone to continue that behavior

as opposed to relapsing. Although behavioral initiation is usually based on positive expectations about future outcomes, Rothman theorized that behavioral maintenance is based on perceived satisfaction with the achieved outcomes, which then allows people to continue working toward monitoring their behavior in order to avoid future relapse. In this sense, the monitoring of behavior and effort itself is crucial in the continuance of the behavior. This monitoring is especially important for physical activity because people have different ways of assessing their satisfaction with physical activity outcomes depending on their ultimate goal, such as losing weight, losing fat, building strength, building muscles, decreasing stress, improving mental concentration, increasing physical fitness, etc. Given that there are various assessments for physical activity satisfaction, as well as the variation in how much change is desired, it is imperative that people continually assess and monitor their own progress and satisfaction with their achieved outcomes in order to achieve behavioral maintenance.

Although some factors may facilitate progress across all stages, other factors may be important for certain stages more than others due to how effective they are in resolving barriers specific to a certain stage (Weinstein, Rothman, & Sutton, 1998). In order for interventions utilizing stage models to work effectively, specific factors that facilitate movement from one stage to the next must be identified and altered. As maintaining exercise behavior is a task that does not fully become automated, thereby requiring continual evaluation and re-evaluation (Milne, Rodgers, Hall & Wilson, 2008), it is posited that increasing skills in behavioral enactment while incorporating dispositional aspects could strengthen the ability to maintain progress.

Self-Efficacy and Health Behavior Initiation and Maintenance

Self-efficacy is one of the dominant social cognition constructs that has garnered considerable research attention in relation to health-related behaviors. Self-efficacy pertains to

individuals' confidence in their ability to enact certain behaviors despite challenges or barriers that may arise (Bandura, 1977). Self-efficacy has been examined in a variety of studies examining health-related behaviors. In a 10-week weight reduction program for women who were at least 15% overweight, researchers found that women who had higher self-efficacy at baseline lost more weight during the treatment period. Similarly, those who had higher self-efficacy at the 6-week follow up also maintained greater weight loss (Bernier & Avard, 1986).

Over a longer time span, however, the effects of self-efficacy on exercise are equivocal. In an eight-week study investigating differential determinants of smoking cessation initiation and maintenance, it was found that initial levels of self-efficacy predicted whether participants were able to quit at the end of the program (Baldwin et al., 2006). However, at the two-month follow up in the study, self-efficacy did not predict whether participants maintained their quit status. In a weight loss trial, Linde, Rothman, Baldwin, and Jeffery (2006) found that self-efficacy was associated with weight loss behaviors, but only during the active treatment period of eight weeks. During the six-month follow up period, not only was self-efficacy found to be uncorrelated with weight loss behaviors, it was also found to have decreased significantly. Franks, Chapman, Duberstein, and Jerant (2009) found that patients who were trained to be more self-efficacious in their ability to manage their chronic disease at home benefited from the training for 6 months. At the one year follow up, however, the researchers found no differences in self-efficacy levels for those who were trained in home, through the phone, or those who received usual care with no self-efficacy training.

With regard to physical activity, self-efficacy can be both a determinant and outcome of exercise behavior and may also be more effective when combined with other constructs (McAuley & Blissmer, 2000). Self-efficacy predicted adoption of vigorous-intensity exercise in both men

and women who were previously sedentary but only predicted maintenance of vigorous-intensity exercise for men who were already initially active (Sallis, Hovell, & Hofstetter, 1992). In a sample of previously sedentary adults, Williams et al. (2008) found that perceived satisfaction with exercise activity and self-efficacy predicted exercise activity maintenance (measured at 6- and 12-month follow-up periods). In an integration of exercise self-efficacy with outcome expectancies, it was found that self-efficacy had both a direct and indirect influence on physical activity via outcome expectancies (White, Wójcicki, & McAuley, 2012).

The combination of self-efficacy and planning was also shown to be predictive of physical activity (Schwarzer et al., 2007). In an intervention study consisting mostly of women participants aged 50-65 years old who had an elevated risk of Type II diabetes, action self-efficacy and action planning were demonstrated to be influential in encouraging participants to adopt exercise activity (Renner, Hankonen, Ghisletta, & Absetz, 2012). The researchers in this intervention delivered the materials and methods through several group counseling sessions where goal-setting, planning, self-monitoring, verbal feedback, and reattribution of previous experiences were emphasized.

The reviewed findings suggest that the role of self-efficacy in the long-term maintenance of a health behavior may be affected by the maintenance of self-efficacy itself. Furthermore, maintenance of self-efficacy may be achieved through other behavioral aspects, such as planning and self-monitoring, which, when combined, may be more influential in maintaining progress or achievement for a particular behavior. A more specific form of planning, known as implementation intentions, may be useful in increasing self-efficacy for a health-related behavior such as exercise, as well as aiding in exercise adoption.

Implementation Intentions and Exercise

Gollwitzer (1993; 1999) posited that creating implementation intentions may aid individuals in enacting changes by providing more specific goals related to their personal situations. According to Gollwitzer, the two phases of behavioral enactment include a motivational phase and a volitional phase. The motivational phase consists of the cognitive processes that contribute to the creation of an intention. The volitional phase involves the actual planning and actions necessary to engage in the behavior. The formation of an intention and the plans to enact the behavior signals the end of deliberation and the start of commitment, thereby setting performance standards (Sheeran, Milne, Webb, & Gollwitzer, 2005).

Because intentions are based on how desirable and feasible individuals perceive the actions to be (Sheeran et al., 2005), an implementation intention enhances this feasibility by enabling individuals to have a plan of where, when, and how to carry out a plan in a certain situation, thereby taking into account the contextual factors of a person's life and goals. The specificity of the steps in implementation intentions makes certain cues to actions readily accessible when needed (Webb & Sheeran, 2007; 2008) and increases commitment and self-regulation for behavioral enactment (Brandstätter, Lengfelder, & Gollwitzer, 2001), such as engaging in exercise activity. Commitment to intentions and planning are embedded within implementation intentions, thereby enabling individuals to exert less effort as there is an availability of relevant cues when specific situations are encountered (Parks-Stamm, Gollwitzer, & Oettingen, 2007; Webb & Sheeran, 2004).

For the initiation of an exercise-related goal, creating specific goals of how, when, and where to perform exercise activities is helpful in that it keeps the information (or reminders) about performing the behavior highly activated and accessible to individuals (Webb & Sheeran, 2007; 2008) even when obstacles or challenges are present, while at the same time inhibiting previous, automatic, or habitual responses (Gollwitzer, 1993; 1999). This inhibition may aid individuals in

successfully regulating their behavior, and the cues from implementation intentions may enhance successful fulfillment of plans. Milne, Orbell, and Sheeran (2002) found that implementation intentions supported initiation of vigorous physical activity in a university student sample during a two-week intervention. Formation of implementation intentions were also found to be effective in helping patients with myocardial infarction maintain moderate-level physical activity six months after rehabilitation (Luszczynska, 2006).

Combining Implementation Intentions with Persistence

Even though implementation intentions can be useful for the initiation of exercise behavior, combining them with dispositional factors, such as personality traits, may increase individuals' overall ability to maintain behavior. Recently, a study of undergraduate students showed that implementation intentions were most effective for goal progress and goal completion for individuals who showed high levels of persistence (Zhang, Chan, & Guan, 2013). The effects in this study were found for both implementation intentions created spontaneously and those formed through laboratory manipulations. Consistent with this finding is the previous finding that individuals who were highly conscientious were more likely to stay with challenging goals that they set for themselves (Barrick, Mount, & Strauss, 1993). These findings suggest that adding the characteristic of persistence to implementation intentions aimed at increasing exercise behavior may increase overall effectiveness to initiate and maintain exercise behavior. Although persistence and overall conscientiousness levels measured in the aforementioned studies referred to dispositional variables, previous research has demonstrated that traits are dynamic and malleable, indicating that they can be changed through time and training (Mischel & Shoda, 1995; Roberts, Walton, & Viechtbauer, 2006). If the creation of implementation intentions may enhance the initiation of action through allowing the exertion of less effort through relevant cues, then the

addition of training in persistence or hard work may lower the overall effort required to maintain the action in the long term.

Learned Industriousness Theory

Based on the concept of hard work and persistence, Eisenberger's learned industriousness theory (1992) posited that the extent to which individuals learn to persist in tasks is based on their past experience of effort. In this sense, effort is defined as an aversive, subjective experience that individuals face when they are mentally and/or physically fatigued or obstructed in some way. How much effort is exerted on a task depends on how aversive the task seems. This pattern of exertion on aversive tasks is dependent on previous tasks and how individuals have learned to apply effort toward them. Individuals who have continually been reinforced for low-effort tasks in the past will continue to exert low effort and to view high-effort tasks as highly aversive. Conversely, individuals who have continually been reinforced for high-effort tasks will continue to exert high effort and view high-effort tasks as less aversive in the future. Individuals who have learned to exert high effort may be more likely to exert high effort in the future, especially because they have learned to lessen the subjective experience of how much effort a task entails. In this sense, repeated exposure and attempts at high-effort tasks also help build individuals' self-efficacy for future behaviors. Some measurements of effort include looking at how long individuals persist in a task that is not tied to a reward or where self-control is necessary to achieve a delayed reward (Eisenberger, 1992).

Because learned industriousness only differentiates between high versus low effort tasks, Eisenberger posited that individuals who tend to persist in previous tasks will generally show more persistence in future tasks across various behavioral domains. Repeated attempts to overcome aversive tasks may lessen the effort it takes to enact the behavior again, thereby making the task

seem less aversive in the future (Eisenberger, 1992). Several researchers (e.g., Boyagain & Nation, 1981; Brandon, Herzog, Juliano, Irvin, Lazev, & Simmons, 2003; Eisenberger, Heerdt, Hamdi, Zimet, & Bruckmeir, 1979; Eisenberger, Kuhlman, & Cotterell, 1992; Hickman, Stromme, & Lippman, 1998) have tested this theory by measuring participants' persistence in several lab tasks and have found that their persistence generalized across other domains of behavior.

In a replication study of learned industriousness conducted by Hickman, Stromme, and Lippman (1998), participants were divided into three groups to receive training on letter anagram tasks, mental math problems, and perceptual identification tasks. The control group received no training on these tasks, the low-effort group received easy problems to complete, and the high-effort group received difficult problems. During these tasks, the participants in the training groups were told that they could pass on a task if it was too difficult. After the training tasks were completed, all participants were given seven pencil mazes to complete and were again allowed to skip any that they could not complete. The results showed that although there were no differences between the control and low-effort training group, participants in both of these groups passed on more mazes than did the participants in the high-effort training group, thereby showing that participants in the high-effort group persisted more on the tasks. The results indicate that participants who had been trained to work on harder problems earlier in the study had more tolerance for persisting on future tasks because persisting at a certain task was no longer as aversive an experience for them.

In a study utilizing the theory of learned industriousness in a smoking cessation intervention program, it was shown that participants who persisted longer on tasks were more likely to maintain their quit status throughout the 12-month follow up period (Brandon et al., 2003). In this study, 144 smokers were tested on their persistence through a mirror-tracing task

consisting of eight trials (two easy and six hard). Participants were able to pass on any trial that they could not solve, and the mean time spent on the hard trials was measured to calculate persistence scores. After assessment on this task, the participants engaged in a smoking cessation therapy group session led by two co-therapists and were asked use the Nicoderm brand transdermal patch for the next eight weeks while recording their smoking behavior during that time. Overall, participants who persisted longer on the mirror-tracing task consistently had higher rates of abstinence throughout the 12 months of follow up, and the results were independent of levels of self-efficacy. This finding indicates that the theory of learned industriousness can be applicable to the maintenance of health-related behaviors and that persistence on difficult tasks may translate to persistence in daily behaviors.

Industriousness and Exercise Behavior

As industriousness can be learned within constrained contexts and then applied across a range of behaviors, repeated training in this characteristic may lead to more longer-lasting changes in one's overall level of industriousness. An investigation of the lower-order structure of conscientiousness (one of the Big Five personality traits) based on seven major personality scales revealed industriousness as comprising one of the six factors of this higher order trait (Roberts, Chernyshenko, Stark, & Goldberg, 2005). From the Five Factor Model of personality, conscientiousness refers to the propensity to be hard-working, reliable, persevering, and self-disciplined (FFM; McCrae & Costa, 1987). In a meta-analytic study, trait conscientiousness was found to positively correlate with participation in physical activity, and at the facet level, industriousness emerged as one of the strongest predictors of physical activity (Bogg & Roberts, 2004; Hoyt, Rhodes, Hausenblas, & Giacobbi, Jr., 2009). Roberts et al. (2005) posited that lower-order facets have better predictive validity than the global measure of conscientiousness with

regard to particular behaviors, and industriousness provides evidence for this proposition in its relationship with exercise behavior.

People who are industrious are those who tend to be more hard-working, tenacious, resourceful, ambitious, and confident (Roberts, Bogg, Walton, Chernyshenko, & Stark, 2004; Roberts et al., 2005). Individuals who scored higher on industriousness were also found to demonstrate more consistent relations between their exercise intentions and exercise behaviors (Rhodes, Courneya, & Jones, 2005) and to score higher in exercise self-efficacy and use more strategies to engage in exercise behavior change (Bogg, 2008). These findings lend credence to the use of the lower-order facet of industriousness when examining associations with exercise engagement.

The Current Study

As previous research (e.g., Bogg, 2008; Rhodes, Courneya, & Jones, 2005; Hoyt et al., 2009) has suggested industriousness as an important predictor of exercise behavior, it is posited that training for this trait facet could enhance individuals' overall propensity to maintain physical activity despite possible barriers or obstacles. Taking into account Rothman's (2000) framework, implementation intentions may be more relevant to physical activity initiation whereas industriousness may have more pronounced effects on physical activity maintenance. Based on previous findings, it is expected that skills training that promotes awareness and modification of industriousness would be particularly beneficial for exercise behavior maintenance. Implementation intentions could provide an initial framework needed to start exercise while higher levels of industriousness could enable individuals to maintain exercise-related goal progress. To the extent that individuals can be trained to be more industrious in how they approach goals, taking a personality-informed approach to increasing exercise behavior would be expected to enable more

long-term stability in the overall maintenance of exercise goals due to the temporal stability of traits. The current study examined how psychoeducational training through group sessions can increase exercise activity initiation and maintenance by combining implementation intentions and industriousness training through a three-week intervention program and a two-month follow up. Participants were randomized to one of three groups where they were presented with exercise information only, exercise information plus implementation intention training, or exercising information plus implementation intention and industriousness training.

Figure 1 shows a comparison of intervention materials that the three groups received. Participants in each group are given tailored exercise diaries based on topics discussed in their respective group sessions, and all participants receive the same pedometer and handouts on exercise facts and recommendations. Figure 2 shows a model of predicted outcomes (stated below) for each of the three intervention groups at the end of the 3-week tracking period and at the 2-month follow-up.

Hypotheses

Hypothesis 1: The creation and effective use of implementation intentions to make plans for exercise will be beneficial for activity initiation and maintenance in the short term.

Because exercise is something that individuals must be vigilant of, instead of something that is automatically habitual (as it requires the exertion of energy and commitment of time), the process can be enhanced through the creation of implementation intentions as they help create and retain readily accessible cues in the face of obstacles (Gollwitzer, 1993). However, it is unclear how long implementation intentions can help individuals maintain behavior because implementation intentions are still dependent on the deliberate creation of the intention (Milne et al., 2008). Nonetheless, participants in the implementation intention group were expected to

maintain a higher level of activity than the information only group within the three-week intervention time frame and at the two-month follow up.

Hypothesis 2: Adding industriousness training to implementation intention training will enhance not only individuals' abilities to initiate physical activity, but also maintain it over a longer period of time.

As the core characteristics of industriousness include hard work and persistence (Eisenberger, 1992; Roberts et al., 2005), it was expected that participants in the combined implementation intention and industriousness group would be able to maintain the most change in physical activity at the two-month follow up as compared with the control and implementation intention only groups. Participants in the combined group were also expected to have the most change in industriousness scores than the control group and implementation intention group at the two-month follow up.

Hypothesis 3: Increasing industriousness and the ability to create implementation intentions will enable participants to build on their own exercise self-efficacy.

Although the current study does not directly attempt to increase self-efficacy in participants, it was expected that at the end of the three-week tracking period and at the follow up period, participants in the combined implementation intention and industriousness group would have the highest level of self-efficacy changes as compared with the participants in the implementation intention only group, who subsequently would see higher exercise self-efficacy change than participants in the control group. Through consistently setting realistic and achievable goals, it was expected that to the extent that participants increase their exercise behavior and push past their threshold to desired levels, this would help increase their exercise self-efficacy.

Method

Participants

Students 18-24 years old who were currently enrolled at Wayne State University were recruited through several methods: the university online research participation system (i.e., SONA); flyers posted around approved campus buildings, Pipeline/Academica advertisements, and emails sent to registered students once per semester. Participants had to understand and respond to screening questions in English and be able to read at a Grade 6 level. To ensure that regular, moderate to vigorous exercise activity would not negatively affect health, participants had to have adequate health, as assessed by having a body mass index between 18.5 and 29.9 (anyone with a BMI of 30+ is considered obese; National Heart, Lung, & Blood Institute, 2012). Furthermore, participants could not be pregnant nor have any preexisting physical limitations or recent injuries. Participants had to self-identify as someone who was interested in starting an exercise regimen or increasing their (low) level of exercise at the time of the study. They also had to be willing to attempt to maintain an exercise schedule during the three-week intervention period and be willing to participate in the 2-month follow-up period. Participants could not have major cognitive impairments (i.e., assessed by whether they can understand and respond adequately to all screening questions) and must not already be meeting current physical activity recommendations (i.e., at least 150 minutes of moderate-intensity exercise per week, 75 minutes of vigorous-intensity exercise per week, or an equivalent combination of the two) per the U.S. Department of Health and Human Services (USDHHS, 2008). Finally, participants could not have children and must not report consuming more than three (women) and four (men) alcoholic drinks per day (as these factors may interfere with their ability to engage in physical activity and confound study results). If potential participants met all inclusion/exclusion criteria for the study (determined

through the SONA prescreen survey or a phone screen), they were given more details about the study and invited to participate in the study.

All compensation were in the form of amazon.com gift cards. Participants were compensated for their time with a \$20 gift card for the baseline session, a \$10 gift card for the 3-week return, and a \$15 gift card for the 2-month return. Additionally, for each session, participants received an extra \$10 amazon.com gift card as an on-time bonus if they were not more than 15 minutes late for each of their appointments. With the on-time bonus, participants were potentially compensated \$75 for the entire study.

The study was approved by the Wayne State University Institutional Review Board. Consent forms were provided to all participants at the start of the baseline session. They were asked to read the form (which described the topic of the study, time commitment, and basic procedures and assured the voluntary nature of participation) and ask any questions before the session continued. Participants also indicated their willingness (or objection) to be contacted for the two month period on the consent form.

Power

Power analyses conducted via G*Power, 3.1.6 (Faul, Erdfelder, Lang, & Buchner, 2007) for an analysis of covariance (ANCOVA) indicated that 158 participants were needed to detect an effect size of F of 0.25 with alpha error probability at 0.05 and power at $1-B = .80$ with three groups and one covariate. Another power analysis for an analysis of variance (ANOVA) indicated that 159 participants were needed to detect an effect size of F of 0.25 with alpha error probability at 0.05 and power at $1-B = .80$ with three groups. Oversampling by ~25% occurred to account for attrition from the study, thereby making the initial target $N = 200$ (rounded up). However, due to the first round of participants getting defective pedometers that only recorded information for

seven days (instead of 30), additional participants were added to the overall sample goal to make up for data lost from participants who received defective pedometers. The final sample consisted of 132 females and 89 males (N = 221).

Materials

Demographics information. Participants' age, sex, ethnicity, marital status, education, and employment status were obtained at the initial assessment.

Body mass index. Participants' weight (in pounds) and height (in inches) were measured at the beginning of their respective group sessions and a measure of body mass index was computed by using the standard formula: $((\text{weight (lbs)} * 703) / \text{height (in)})^2$.

Contacts form. Participants were asked to provide a current address, two phone numbers, and two email addresses where they may be reached. Additionally, they were asked to list the names, addresses, phone numbers, and/or email addresses of family members and/or close friends who might know how to contact them if the participants cannot be contacted through their personal contact information.

TTM staging measure. Participants indicated their current leisure-time physical activity level and level of readiness to increase physical activity from five choices categorized them as being in the precontemplation (not exercising regularly and does not intend to begin in the next six months), contemplation (not exercising regularly but intends to begin in the next six months), preparation (not exercising regularly but intends to begin in the next 30 days), action (have been exercising regularly, but for less than six months), or maintenance (have been exercising regularly for more than six months) stage (Prochaska & DiClemente, 1983). Guidelines for exercise activity are defined by the National Center for Chronic Disease Prevention and Health Promotion

(NCCDPHP). This measure was used in the screening process to ensure that participants were motivated to initiate or increase their exercise levels.

Industriousness. Five adjectives (lazy, industrious, tenacious, thorough, thrifty) describing the main components of industriousness assessed participants' initial and subsequent levels of industriousness (Roberts et al., 2004). Participants were asked to describe themselves at the present time and rate responses on a 5-point Likert scale (1 = Very uncharacteristic, 5 = Very characteristic; $\alpha = .50-.64$). Industriousness was also assessed using a separate 10-item measure (Chernyshenko, 2003). Participants were asked to rate themselves on a 5-point Likert scale (1 = Disagree strongly, 5 = Agree strongly; $\alpha = .81-.83$) indicating the extent to which they are "someone who: has high standards and works toward them; is satisfied with getting average grades (reversed); [or] goes above and beyond of what is required."

Exercise self-efficacy scale. The 18-item multidimensional exercise self-efficacy scale (Benisovich, Rossi, Norman, & Nigg, 1998) included six subscales that assessed participants' confidence in being able to exercise despite bad weather, inconvenience, negative affect, exercising alone, excuse making, and resistance from others. Participants were asked to rate "how confident [they] are to exercise when other things get in the way" on a 5-point Likert scale (1 = Not at all confident, 5 = Extremely confident; $\alpha = .89-.91$). Example items include, "I don't have access to exercise equipment," "I don't feel like it," and "I am spending time with friends or family who do not exercise."

Exercise outcome expectancies. Eleven items from the multidimensional outcome expectations for exercise scale (Wójcicki, White, & McAuley, 2009) and three items from the outcomes expectancies questionnaire (Waters et al., 2012) assessed positive and negative exercise-related expectations. Example items include: "Exercise will strengthen my bones," "Exercise will

make me more at ease with people,” and “Regular exercise is painful.” Items were rated on a five-point Likert scale (1 = Strongly disagree, 5 = Strongly agree; $\alpha = .69-.73$).

Exercise attitudes. Eight items measured exercise attitudes using bipolar semantic differential adjectives on a 7-point scale (Courneya & Bobick, 2000). The items assess both instrumental (useful–useless, harmful–beneficial, wise–foolish, bad–good) and affective (enjoyable–unenjoyable, boring–interesting, pleasant–unpleasant, stressful–relaxing) components of exercise attitudes ($\alpha = .80-.83$).

Exercise daily diary. Participants were provided with group-tailored exercise booklets to keep track of their exercise activity on a daily basis during the 3-week intervention period. The logs assess the frequency, duration, and type of exercise performed for each day that exercise is performed. Specific to the implementation intention group, the booklet also included space for participants to write their implementation intention (written during the baseline session) for the days that they plan to exercise. Finally, specific to the industriousness group, the booklet contained all of the aforementioned components, as well as two items in which participants are asked to rate how much effort they exerted on their exercises for the day (1 = Very little, 5 = A lot) and how difficult it was for them to perform their exercises that day (1 = Not difficult, 5 = Very difficult). They were directed to complete the scales immediately after exercise on the days that they did complete their exercises.

Pedometers. Participants were given an Ozeri 4x³ sport pedometer as a supplement to the exercise logs to obtain objective measures of exercise activity. Participants’ weight and stride were measured and entered into the pedometer during the baseline session before distribution to each participant. The pedometers measured steps taken throughout the day. The devices automatically reset at midnight and store the information for 30 days. Of the participants for whom pedometer

data were collected, 97 participants wore their pedometers all 21 days, 25 wore them for 20 days, 25 wore them for 19 days, nine wore them for 18 days, 11 wore them for 17 days, and the remaining participants wore them for 16 days or fewer. Due to this discrepancy of participants forgetting to wear their pedometers every single day for the 3-week (i.e., 21 days) tracking period, the total numbers of steps taken for each participant was divided by the number of days that they wore the pedometer to get the average steps per day (i.e., step rate) taken by each participant. This treatment has been suggested as the metric for standardizing pedometer data (Bassett, Troiano, McClain, & Wolff, 2014; McCarthy & Grey, 2015) and has been used across a number of studies (e.g., De Cocker, De Bourdeaudhuij, & Cardon, 2010; Matthiessen, Andersen, Raustorp, Knudsen, & Sørensen, 2015; Van Dyck et al., 2013).

Exercise behavior. The Godin Leisure-Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985) was used to assess the frequency of strenuous, moderate, and mild exercise - (open-ended format), as well as the frequency of engagement in leisure-time activities that “work up a sweat” (choices for this item are “often, sometimes, and never/rarely”). Aside from the individual exercise variables, total exercise scores were also computed by multiplying each reported exercise frequency by its metabolic equivalent (MET) and then summing the totals: (strenuous x 9) + (moderate x 5) + (mild x 2) (Godin, Jobin, & Boullon, 1986).

Procedure

After initial inclusion criteria were verified, participants were randomly assigned (and balanced by sex) to one of the three groups described below. Participants participated in a baseline psychoeducational group session with the principal investigator. Before conducting the baseline psychoeducational sessions, the principal investigator conducted several pilot sessions with colleagues (role-playing as participants) who were informed of the study aims and procedures.

Role players provided feedback on clarity of information and concepts presented, presentation style, treatment fidelity for each specific condition, and comprehensiveness of presentation materials. All baseline sessions were recorded using a camcorder to ensure treatment fidelity; videos of new sessions were reviewed on a monthly basis to detect any possible deviations from protocol for each group; any deviations were adjusted accordingly for following sessions.

The duration of the control group sessions was approximately 90 minutes, and the duration of the experimental group sessions was approximately 120 (due to coverage of extra materials and the extra time allotted for participants to complete implementation intentions in their exercise diaries). For a more thorough description of topics covered during each group session, please refer to Appendices J (information only), K (implementation intention), and L (industriousness training). When participants entered the group session, they were provided the consent form to read, ask questions, and sign. Next, their weight and height were measured (to calculate BMI); stride was also measured for input into their pedometers to ensure accurate step measurements. Participants were then given a packet of assessments and given directions to complete them. After all participants completed their assessments, the camcorder was turned on, and the semi-structured psychoeducational group discussion began. Participants were encouraged to participate in the discussion and ask questions throughout. The number of participants for the group sessions ranged from two to six, due to variability in scheduling and availability (and participant no shows).

During the three-week tracking period, all participants were sent three emails to remind them to continue tracking their physical activity levels through their exercise diaries and consistently wear their pedometers. Aside from reminding participants, emails were tailored according to assigned condition with points of emphasis covered in the baseline session. Emails were sent on the 4th, 11th, and 18th days of the intervention period. Participants returned after

completion of the three-week tracking period to turn in their pedometers and exercise diaries and complete some brief assessments. The 3-week return lasted between 15-20 minutes. Participants returned for a follow up two months after the baseline session to have their weight measured and complete questionnaires similar to the baseline session. The 2-month follow up lasted between 30-45 minutes. The three-week return and two-month follow up sessions were both individual sessions.

Group Session Information

Group 1 – Exercise information only. This group was presented with information that defined and described regular physical activity, the benefits of exercise, and basic tips on properly engaging in exercise. Guidelines for prescribing suggested exercises were based on recommendations from the U.S. Department of Health and Human Services (USDHHS, 2008). Consistent with USDHHS recommendations, discussions in this session also focused reducing risk of injury during exercise. This session ended with the distribution of pedometers, and exercise booklets and directions on how to keep track of their exercise over the next three weeks. All participants were instructed to clip their pedometers at the waist. The pedometers also came with a wrist strap in case participants wore clothing that were not conducive to clips (e.g., a dress). Participants were also instructed to wear the pedometers all waking hours (except for when engaging in water-based activities) during the 3-wk tracking period. For more information, please see Appendix J.

Group 2 – Exercise information with implementation intentions. This group discussed all the components from the session for Group 1 but with more emphasis on how to create implementation intentions. Discussions revolved around possible barriers to exercise plans and how to overcome those barriers by making specific plans of when and where to exercise, along

with designating which types of exercises they will perform and for how long (or how many repetitions). Participants were asked to create an implementation intention for any day of the three-week intervention period in which they planned on engaging in exercise (to be written in their exercise diaries) and were guided in creating those implementation intentions during the session. Emphasis was placed on the specificity and feasibility of the implementation intentions created. The implementation intention group sessions ended in a similar fashion as the information only group, with the distribution of pedometers, and exercise booklets and directions on how to keep track of their exercise over the next three weeks. The difference for this condition was that participants were asked to think about their schedule for the next three weeks and write their specific exercise plans for the days that they designated as their exercise days. For more information, please see Appendix K.

Group 3 – Exercise information with implementation intentions and industriousness training. This group discussed the components from the second group's session. Along with emphasizing how to overcome barriers to exercise and creating specific plans, discussion in this group also introduced the relationship between industriousness and exercise to participants and how training themselves to increase in this trait facet may have beneficial effects on exercise behavior and on an overall level in their daily lives. Participants were asked to think about past experiences of tasks that might have been hard for them to perform but that they completed anyway. They were then directed to think about and generate solutions for how they can persevere and complete their planned exercises despite the difficulties they may face. The focus in this session was to encourage participants to identify their threshold for exerting effort toward exercise. The participants were trained to effectively use strategies learned from the session to realistically increase and push past their levels of activity and effort incrementally depending on their own

level of effort for exercise, schedule, commitments, and fitness level. The industriousness training group sessions ended similarly as the implementation intention group, but participants were also encouraged to be realistic about their own level of effort for exercise and plan accordingly. Exercise booklets for participants in this group also contained difficulty (referring to actual complexity of exercises executed) and effort (referring to how much inner resistance they encountered in order to execute their exercises) scales that participants were asked to complete immediately after completing their exercises for their designated exercise days. For more information, please see Appendix L.

Results

Participant Flow

As shown in Figure 1, a total of 1,288 students were screened for the study: 1043 students did not meet the inclusion criteria, and 24 students refused to participate either after being informed of study procedures or due to not attending the baseline session and became unresponsive to contact attempts to reschedule. Of the 221 participants who qualified and participated in the baseline session, nine did not return after the 3-week tracking period (three due to lack of time, one due to illness, two due to personal reasons, and three were unresponsive to contact attempts). There were more dropouts in the experimental groups (four in the implementation intention group and four in the industriousness training group) than in the control group (one), but they did not differ significantly on sex, industriousness, self-efficacy, or exercise. Differences were computed between the implementation intention and industriousness training group but not on the information only group as there was only one participant who dropped out from this group.

Additionally, 12 participants did not return for the 2-month follow up and were unresponsive to contact attempts to reschedule. For the follow up, there were more dropouts in the

industriousness training group (six participants) than in the control (three participants) and implementation intention (three participants) group, but again, they did not differ significantly on sex, industriousness, self-efficacy, or exercise. Overall, the retention rate was 95.93% for the 3-week return and 90.50 % for the 2-month follow up. Intention-to-treat analyses (ITT) were conducted to address missing data for the 3-week return and 2-month follow ups. Following protocol for ITT analysis, for any participant who did not return for follow up, the last value recorded for that participant was then carried forward to the missing time point so that all randomized participants were analyzed for all time points. This is a conservative and less biased approach, as it avoids overestimating the size of the treatment effects due to removal of non-adherent participants while preserving the sample size and statistical power (Gupta, 2011; Heritier, Gebiski, & Keech, 2003; Wertz, 1995). Across all groups, 60% of participants were females; the average age was 20.56 (SD = 2.04). The sample was diverse, with 47.5% who identified as Caucasians/European Americans, 24.4% as Asian Americans, 14% as Other or Mixed, 13.1% as African Americans/Blacks, and .9% as Hispanic/Chicano/Mexican American.

Analyses

Descriptive statistics and correlational analyses were conducted for all variables of interest in the current study. Table 1 shows the means and standard deviations for the study variables at 2-month follow up sessions for each group of participants. Due to the low reliability of the 5-item adjectival industriousness scale, this measure was not included in the analyses, and therefore, data included in the descriptive statistics and correlational data refer to the 10-item industriousness measure. ANOVAs conducted on the baseline measures showed that there was a statistically significant difference among the groups in terms of moderate exercise, $F(2, 218) = 3.16, p = .044$.

The Bonferroni post hoc test indicated that participants in the implementation intention group reported significantly more exercise than participants in the information only group ($p = .043$).

Table 2 shows the correlations of the study variables at baseline and at the 2-month follow up. Consistent with past research, males (coded as 0) reported more engagement in strenuous exercise than females (coded as 1). Contrary to prior research, industriousness was not correlated with any exercise variables at baseline; however, industriousness exhibited a positive relationship with moderate exercise at the 2-month follow up. In the current sample, BMI was not correlated with any exercise variables at baseline or at the 2-month follow up; this may be due to the restricted range of participants who were accepted into the study within a specified BMI range.

ANOVAs were conducted to examine whether there were group differences on all study variables among participants in the three conditions at the 2-month follow up (see Table 1). As shown in Table 1, the only variable that showed a statistically significant difference was the self-efficacy subscale of resistance from others, $F(2, 218) = 3.07, p = .049$. The Bonferroni post hoc test indicated that compared with participants in the information only group, participants in the industriousness training group felt more confident they could engage in exercise even when there was resistance from others ($p = .043$) in terms of their exercise plans. A set of ANCOVAs (see Table 1) were also conducted on all study variable scores to examine group differences when controlling for the respective baseline variables. Similar to the ANCOVA results, the only variable that showed a statistically significant difference was the self-efficacy subscale of resistance from others. The results showed that the effect of group condition remained significant even after the covariate was added, $F(2, 217) = 4.34, p = .014$. Again, the Bonferroni post hoc test indicated that this difference was driven by differences between the information only and the industriousness training group ($p = .012$). Additionally, the ANCOVA for moderate exercise was examined due to

the significant differences in moderate exercise at baseline. The results showed that there were no statistically significant differences among the three groups for moderate exercise at the 2-month follow up even after controlling for initial moderate exercise, $F(2, 217) = 0.72, p = .486$.

Hypothesis 1 was that participants in the implementation intention group would exhibit more exercise behavior than participants in the information only group at the 3-week tracking period and at the 2-month follow up. The independent samples t-tests conducted to test this hypothesis showed that there were no statistically significant differences between the information only group and the implementation intention group with regard to the 3-week average step rate ($t(136) = -1.62, p = .108$), strenuous exercise ($t(145) = -0.44, p = .660$), moderate exercise ($t(145) = -1.64, p = .104$), or mild exercise ($t(145) = -0.29, p = .770$). Although at the 3-week return, the implementation intention training group did have a higher step rate than the information only group, these differences were not statistically significant, as shown from the t-test results. These results show that Hypothesis 1 was not supported.

To examine evidence for Hypotheses 2 and 3, effect sizes were calculated to determine the magnitude of the changes participants experienced within each group between baseline and the 2-month follow up as the intervention was focused on examining improvements in participants depending on their baseline scores. A Cohen's d score of .2 signifies a small effect, .5 signifies a moderate effect, and .8 signifies a large effect (Cohen, 1977). Hypothesis 2 stated that participants in the industriousness training group would exhibit the highest industriousness change score and exercise change scores at the 2-month follow up – this hypothesis was supported. Effect size calculations showed that while participants in both the information only and implementation intention group showed a decline in industriousness, participants in the industriousness group showed an increase in industriousness scores ($d = .151$). The industriousness training group also

showed the greatest increase between baseline and the 2-month follow up for strenuous ($d = .297$), moderate ($d = .312$), and mild exercise ($d = .161$). Participants in the information only and implementation intention group showed expected increases in strenuous and mild exercise, with the implementation intention group exhibiting greater changes than the information only group, but less than the industriousness training group. However, with regard to moderate exercise, participants in the information only group actually showed a greater increase ($d = .242$) than participants in the implementation intention group ($d = .119$). Most likely driven by this difference in moderate exercise, the information only group also showed greater increases in total exercise ($d = .227$) than the implementation intention group ($d = .168$); but again, participants in the industriousness training group showed the most increase ($d = .410$) when total exercise was examined.

Hypothesis 3 suggested that participants in the industriousness training group would exhibit the highest self-efficacy score changes at the 2-month period, followed by the implementation intention group, which is followed by the information only group. This hypothesis was not supported. Participants in the implementation intention group showed the most increase in self-efficacy score ($d = .280$) versus the industriousness ($d = .194$) and the information only ($d = .042$) groups. Given that participants in the implementation intention group were taught to plan their exercises based on their schedule, availability, and other external barriers, it is reasonable that these participants would feel more confident in executing their exercises while finding ways around these barriers. The d -scores for all study variables are shown on Table 1, and a graphical depiction of the d -scores for industriousness, self-efficacy, and exercise are shown on Figure 4.

Discussion

Regular exercise remains one of the top priorities of the nation's Healthy People 2020 initiatives, yet at least 80% of adolescents and adults remain sedentary or underactive (Office of Disease Prevention and Health Promotion, 2016). Creating detailed plans of where, when, and how to exercise has been shown to be effective in helping people execute goal-directed behaviors (Luszczynska, 2006; Milne et al., 2002). However, little is known regarding how the trait facet of industriousness may contribute to exercise-related goals, above and beyond daily planning, as prior research has identified consistent links between this trait facet and regular exercise. The current study addressed this question through a randomized controlled trial testing the effectiveness of implementation intentions and industriousness training using a novel personality-informed framework that also incorporated objective measures of physical activity.

Overall, the findings showed that implementation intentions and industriousness training may be effective methods of helping participants increase their exercise, self-efficacy, and industriousness levels at the 2-month follow up, with participants in the industriousness training group exhibiting slightly larger increases in exercise and self-rated industriousness than both the information only and implementation intention group. These changes were perhaps brought on by participants' realistic assessments of how much effort they have dedicated to exercise in the past (i.e., before their entry into the study) and how much effort they needed to exert to make small changes in reaching their exercise goals. Participants in the industriousness training group were reminded to not only assess external barriers (e.g., bad weather, no time, no exercise partner, etc.), but also to assess their internal barriers (i.e., resistance) to exercise and how much they have to push themselves to initiate and complete an exercise session.

Furthermore, these participants were instructed to recall an experience where they had exerted a lot of effort on a task and how they were able to push past their hard work thresholds to

achieve their target task; participants then generated ideas of how to apply similar strategies to their exercise goals. When asked whether they had the confidence to complete tasks with similar levels of difficulty, participants expressed that they were indeed positive in their ability to complete them (as they have done before), even though they realized these still might not be desirable tasks. In this sense, participants understood the idea that applying effort toward an aversive task may not enhance the desirability of that task but it could reduce the aversiveness of future similar tasks through with repeated experiences – experiences which may simultaneously build their self-efficacy as they push past certain effort thresholds.

According to Eisenberger (1992), for any given task, there is a primary reward value, which is experienced in the immediate context, as well as a secondary reward value, which is experienced beyond the immediate context. And akin to Eisenberger's conceptualization, participants were reminded that with exercise, the primary reward value might be completing a bout of physical activity (a performance goal), while the secondary reward of that task could be overall well-being, improved daily and physical functioning, and a greater sense of self-worth and mental alertness, all of which extends to broader categories of performance. To celebrate incremental accomplishments, participants were also encouraged to build in small rewards that were amenable to their exercise goals. In general, engaging in an activity that competes with other, more salient goals (e.g., academic or social) may not always be rewarding in the short term, but according to Learned Industriousness Theory (Eisenberger, 1992), these repeated experiences may help lessen the aversiveness of the task itself and may enable one to attain a more important secondary reward value in the long term.

Overall, this training in the monitoring of effort and behavioral repetition helped increase levels of industriousness as participants were able to consistently apply their efforts toward

exercise and has the potential to help people build more consistent exercise into their routines. Through the use of implementation intentions, participants were also able to increase their self-efficacy for exercise engagement by creating plans that eschewed certain barriers and enhanced feasibility cues for behavioral enactment. Although the effect sizes for the changes found were considered small by conventional standards, one must take into account the context of the study (Tabachnik & Fidell, 2013) and one of the variables measured being a trait facet. Given that the intervention was a one-time group session, a small effect size that is seen after two months could translate to more significant outcomes in the long-term, especially if booster contacts are incorporated into the intervention.

Aside from the novel findings, the current study also replicated the important roles of self-efficacy and attitudes in exercise behavior. The overall self-efficacy scale showed a strong correlation with only strenuous exercise at the baseline assessment but demonstrated strong relations with both strenuous and moderate exercise at the 2-month follow up. Additionally, exercise attitudes exhibited strong, positive correlations with strenuous, moderate, and mild exercise in both the baseline assessment, as well as in 2-month follow up.

However, a surprising finding was that industriousness was not significantly correlated with any exercise variables at baseline. This finding is inconsistent with previous research that has identified this link (Bogg, 2008; Bogg & Roberts, 2004; Rhodes et al., 2005; Vo & Bogg, 2015). These discrepancies may be due to sampling differences, as prior research has either used a broader range of participants across various age groups or used an undergraduate sample but did not include many exclusion criteria, thereby leading to a broader range of undergraduate students than that used in the current study. It is important to note that participants in the current study comprise a restricted range of students who were inactive or underactive. On the other hand, these

participants already reported high levels of industriousness at baseline. Moreover, because this was a sample of undergraduate and graduate students, we might posit that their hard work and effort might be directed toward more academic and social goals as opposed to health-related goals. These factors overall may have contributed to the nonsignificant relationship between industriousness and exercise. Contrary to baseline relations, correlations at the 2-month follow up did show a positive, significant relationship between industriousness and moderate exercise. Additionally, although nonsignificant, correlations between industriousness and strenuous and mild exercise did show an increase at the 2-month visit. This pattern seems to suggest that participants may be directing more of their efforts at their exercising goals, perhaps by way of monitoring not only their schedule, but also their level of exerted effort toward exercise engagement and persisting in these efforts. Previous research has shown that merely being aware of one's behavior may prompt changes in the desired behavior (Korotitsch & Nelson-Gray, 1999). Perhaps knowing that they will return for follow up sessions to report on their exercise levels kept participants' exercise goals more salient for them and helped to enhance their exercise engagement. Future research might clarify these findings by expanding the intervention to a less restricted sample with a wider age range.

Although prior research has shown significant relations between industriousness and exercise, it is also true that not everyone who is industrious or hardworking necessarily engages in exercise. To the author's knowledge, this is the only study that has bridged the industriousness-exercise link to the theory of learned industriousness to test its effectiveness in increasing exercise through an intervention paradigm for young adults. The findings showed that incorporating industriousness training with information and implementation intentions led to exercise changes that are larger than these training modalities alone.

Limitations

The present research has several limitations to be noted. Because the psychoeducational baseline session was a group session, it was not always possible to schedule the same number of participants in each session due to availability of participants and some participants not attending their scheduled session. Also, because information was delivered verbally during the baseline semi-structured sessions, no two sessions were identical due to the nature of social interaction and the different participants in each group. However, as mentioned, multiple pilot sessions were conducted before running actual sessions, and sessions were recorded to assess and maintain treatment fidelity throughout the duration of the study. All baseline sessions were conducted by one facilitator (i.e., the principal investigator), which helped to maintain consistency of delivery style and content across sessions. Finally, perhaps engagement in a group session might have allowed participants to divert their attention from the information being presented – delivering the content through one-on-one sessions might enable the participants to be more attentive to the psychoeducational session and help them address their exercise goals more specifically. More generally, however, these situations are not outside the realm of typical interventions in practical settings; thus, although these are limitations in the sense that they do not allow strict control over the intervention manipulations, they also mimic real-world situations and are perhaps, more valuable from a practical standpoint.

Another limitation to be noted is that the pedometers only tracked steps taken; thus, the pedometers could not accurately measure exercise if participants engaged in other activities such as strength training, bicycling, swimming, etc. Due to the pedometers not being able to capture the full scope of people's exercise experiences, caution should be taken when interpreting these findings from the pedometer data. This problem is not limited to the particular pedometer used in

the current study but extends to a variety of other physical activity trackers as well, as many tend to either underestimate or overestimate physical activity (Ferguson, Rowlands, Olds, & Maher, 2015).

Implications and Conclusions

Although findings are preliminary, the current study provides insight into another method through which we might examine the process of behavioral maintenance – through personality-targeted intervention frameworks. It may certainly be argued that changes in personality are difficult and that knowledge of an individual’s personality can only be informative – this may be the case when we consider the entire personality system. However, the current findings suggest that it is possible to focus on one specific trait facet and that linking it with a specific behavioral component may augment changes in both the trait facet and behavior. Additionally, knowing how personality traits work in tandem with health-related behavior need not be limited to professionals – helping people to realistically appraise their levels of effort toward a certain behavior may also help them make more effective decisions to reach their health-related goals. This realistic appraisal may allow them to find their threshold for hard work in that area and work toward improving their specific threshold instead of relying on an unrealistic external standard that would likely lead to failure in trying to achieve those standards.

Furthermore, although behavioral intentions have been widely researched in the prediction of behavioral engagement, one noted limitation of intentions is their temporal instability (Ajzen, 2002; 2011), which may subsequently affect levels of planning. Even when people have high, stable motivations to pursue a goal, these motivations do not always lead to stable activities that lead to actual achievement of the goals (Wood & Runger, 2016). On the other hand, if successfully developed, traits provide a level of stability that goes beyond intentions and planning alone, as

traits reflect a more stable tendency toward behaviors, thoughts, and actions and therefore, less likely to fluctuate daily or weekly like intentions do. However, stable does not necessarily mean inflexible – while people maintain high rank-order consistency for traits (Roberts & DelVecchio, 2000), these traits do change over the course of normative development (Caspi & Roberts, 2001).

Although it is arguably more difficult to change trait facets than intentions or self-efficacy, we know that traits are malleable and change as a part of the developmental process, as people undertake more age-graded goals, as well as throughout the lifespan (Caspi & Roberts, 2001; Helson, Jones, & Kwan, 2002; Lüdtke, Roberts, Trautwein, & Nagy, 2011; Srivastava, John, Gosling, & Potter 2003). Particularly, people tend to increase in conscientiousness as they grow older and take on more roles and responsibilities (Srivastava et al., 2003). In this sense, it is possible to play on both the stability and malleability of traits by enhancing changes in industriousness during young adulthood, where increases in conscientiousness tend to peak (Roberts et al., 2006), while linking those changes with a health-promoting behavior, such as exercise, to help enhance and maintain that behavior as a component of one's dispositional tendency. The current study offers some initial evidence that knowledge of traits and their facets can be used for more than just information provision in intervention settings and that certain facets may be intentionally and incrementally honed through these settings to influence health behaviors.

Health behaviors are strongly influenced by developments in one's self-concept and self-regulation (Shepperd, Rothman, & Klein, 2011) – processes that occur most markedly during adolescence and young adulthood. It is also during this time in life that exercise and physical activity show steep declines – a downward slope that continues as people grow older (Cerin, Vandelandotte, Leslie, & Merom, 2008; Davison, Schmalz, & Downs, 2010; Malina, 1996). With regard to health-related behaviors, *maturing out* describes the process whereby college students

reduce their alcohol consumption as they grow older and assume more responsibilities (Bartholow, Sher, & Krull, 2003). Conversely, yet similarly, in training young people to increase their industriousness levels and direct it toward their exercise goals, we might view this as a process of *maturing into* more health-promoting behaviors in the sense that young adults may be encouraged build exercise into their age-graded goals and responsibilities early on. This situated conceptualization of effort and exercise may allow young people to regard regular exercise as an activity that is congruent with, and beneficial for, their adult roles and identities rather than being in conflict with their lifestyles, thereby leading to increased chances of long-term behavioral maintenance.

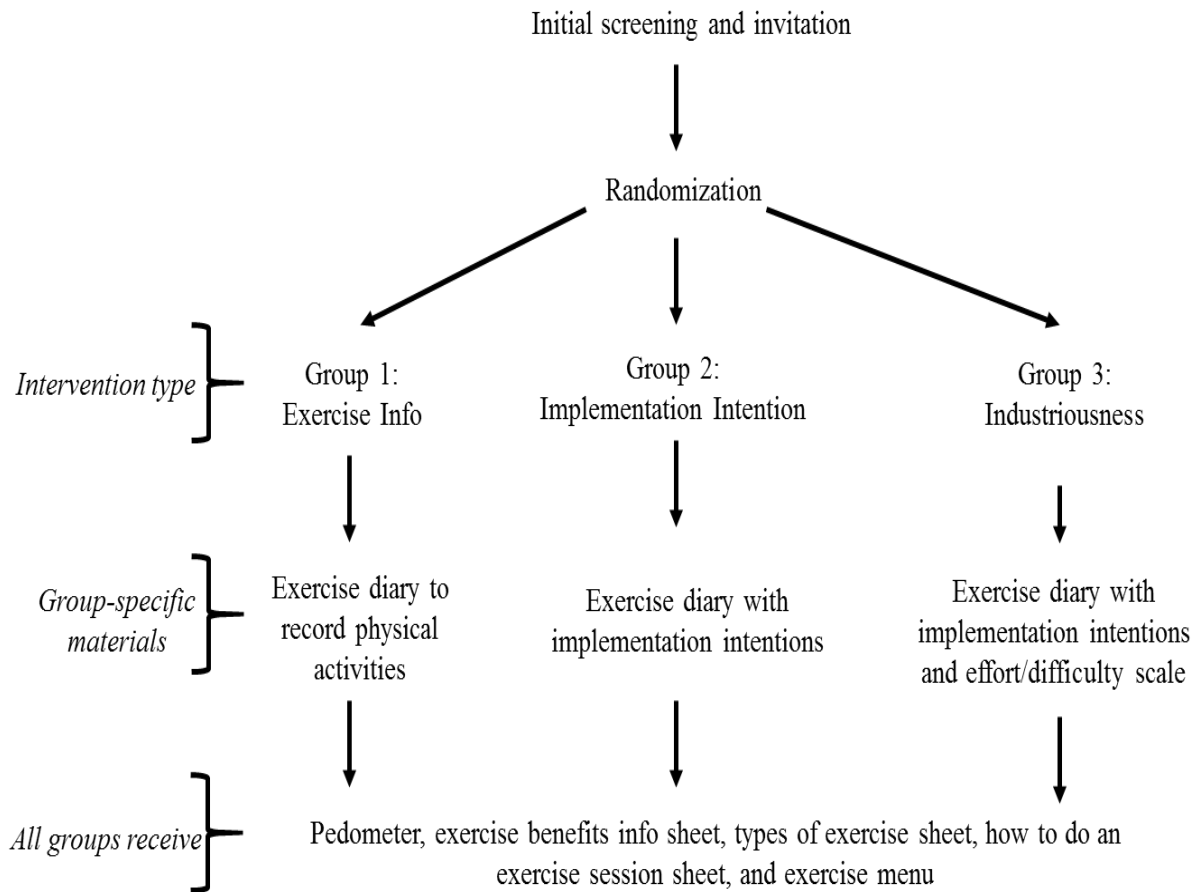
Figure 1. Intervention materials given to each group.

Figure 2. Intervention model predictions.

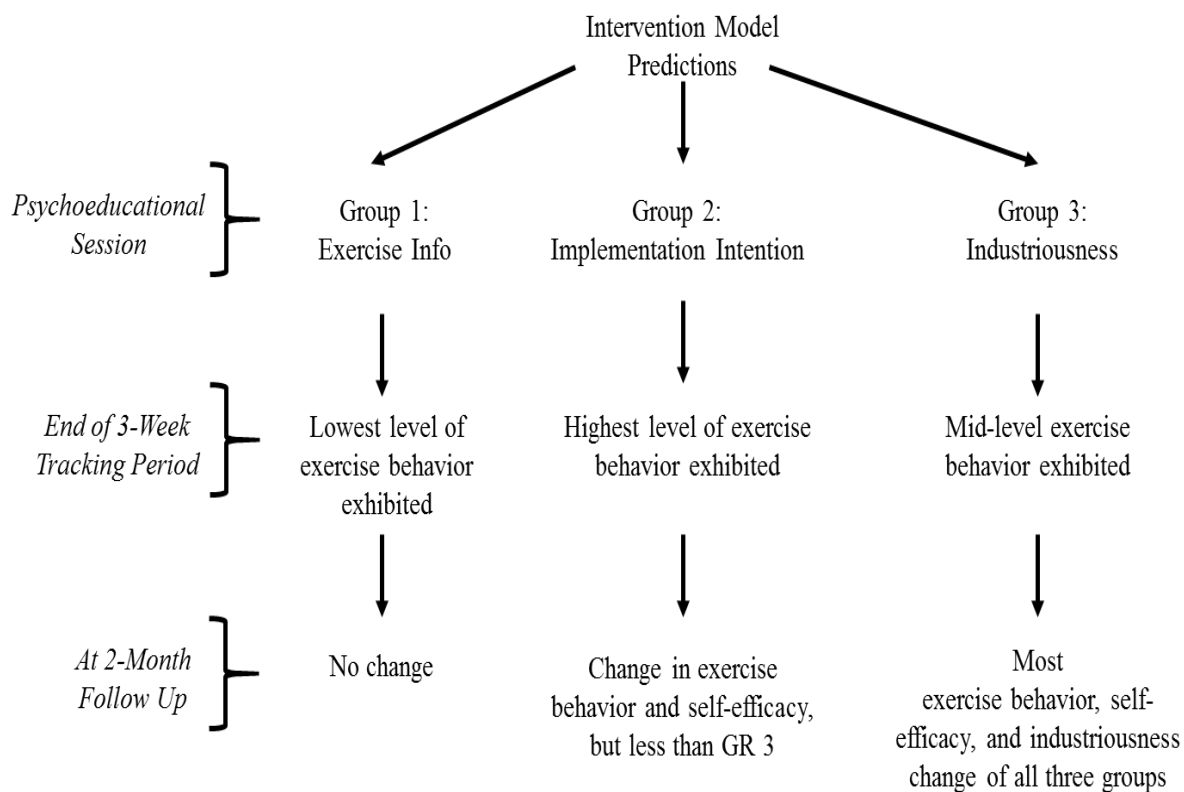


Figure 3. Flow of participants throughout study.

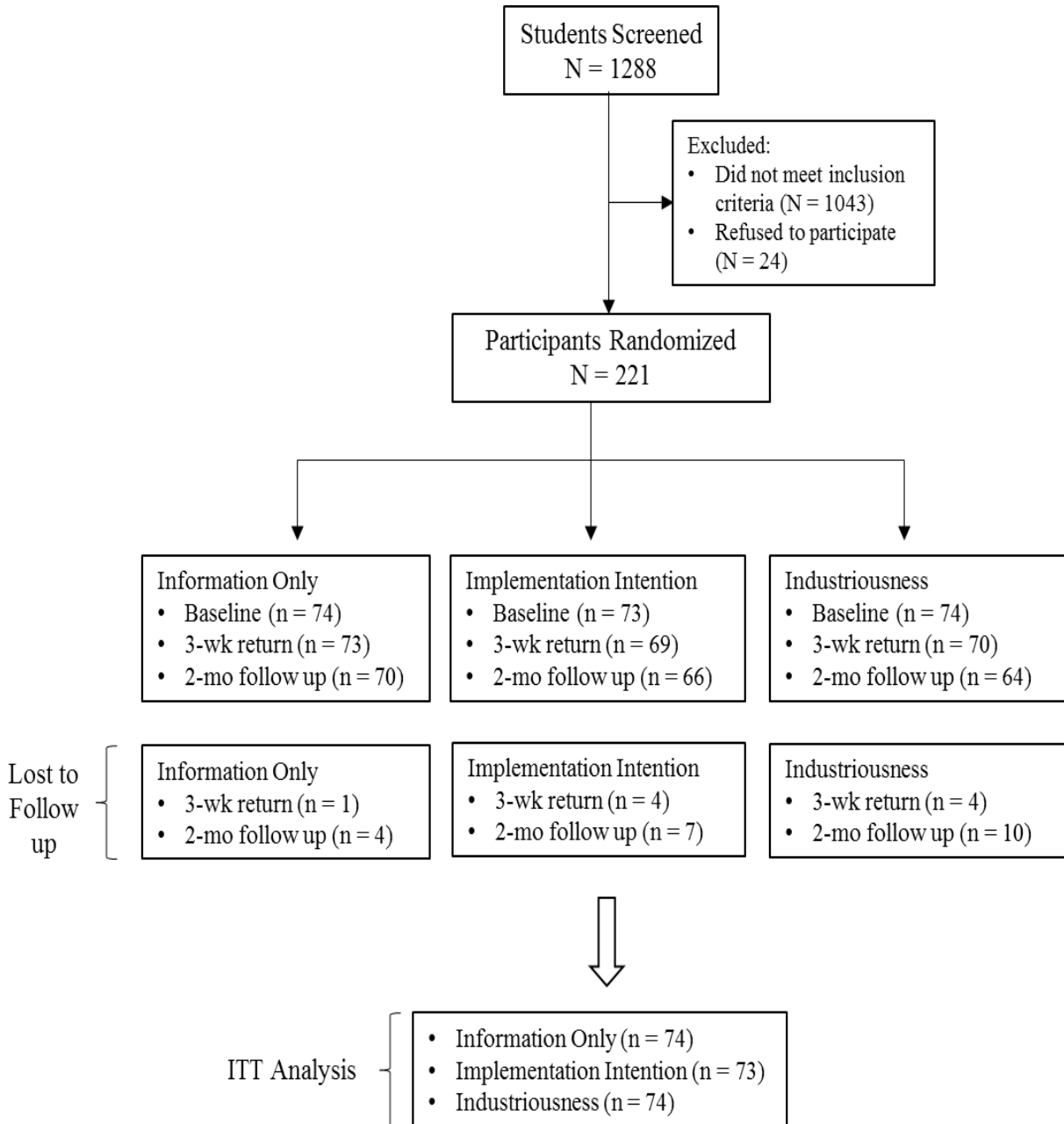


Table 1. Means and standard deviations of study variables across conditions with effect sizes of changes from baseline to follow up and ANOVAs

	Info Only N = 74	Imp Int N = 73	Ind N = 74	ANOVA N = 221	ANCOVA N = 221
	Mean (SD)	Mean (SD)	Mean (SD)	F-value (p)	F-value (p)
	<i>d</i> -score	<i>d</i> -score	<i>d</i> -score	<i>df</i> = 218	<i>df</i> = 217
BMI	24.15 (4.04)	24.32 (3.67)	24.64 (3.67)	0.31 (.733)	0.95 (.390)
	0.3730	0.4820	0.2580	--	--
Industriousness	4.01 (.62)	3.98 (.56)	3.96 (.61)	0.16 (.853)	1.64 (.196)
	-.022	-.268	0.151	--	--
Outcome Expectancies	3.92 (.42)	4.00 (.44)	4.06 (.41)	2.06 (.130)	0.57 (.567)
	0.216	0.187	0.258	--	--
Attitudes	4.11 (.64)	4.20 (.61)	4.14 (.60)	0.37 (.690)	0.30 (.740)
	0.057	0.114	0.018	--	--
SE_Weather	2.79 (1.21)	3.20 (1.14)	3.16 (1.30)	2.55 (.081)	2.73 (.067)
	-.101	0.249	0.036	--	--
SE_Inconvenient	2.75 (.97)	2.92 (.95)	2.76 (1.02)	0.66 (.516)	0.44 (.646)
	0.218	0.303	0.236	--	--
SE_NegAffect	2.77 (1.14)	2.91 (1.17)	2.91 (1.06)	0.34 (.712)	1.08 (.341)
	-.174	0.037	0.094	--	--
SE_Alone	3.80 (.97)	3.75 (1.00)	3.96 (1.01)	0.84 (.432)	0.12 (.892)
	0.154	0.084	-.010	--	--
SE_Excuse	2.05 (.92)	2.16 (.90)	2.05 (.84)	0.44 (.644)	0.28 (.755)
	0.173	0.163	0.106	--	--
SE_Resistance	3.22 (1.02)	3.39 (1.01)	3.63 (.97)	3.07 (.049)	4.34 (.014)
	-.100	0.277	0.310	--	--
SE_FullScale	2.90 (.77)	3.06 (.74)	3.08 (.75)	1.25 (.290)	1.35 (.261)
	0.042	0.280	0.194	--	--
Strenuous Exercise	1.50 (1.55)	1.62 (1.66)	1.61 (1.62)	0.12 (.887)	0.45 (.635)
	0.092	0.114	0.297	--	--
Moderate Exercise	2.14 (1.86)	2.66 (2.01)	2.61 (2.16)	1.51 (.223)	0.72 (.486)
	0.242	0.119	0.312	--	--
Mild Exercise	3.05 (2.84)	3.19 (2.58)	3.48 (2.78)	0.47 (.626)	0.24 (.789)
	0.073	0.082	0.161	--	--
Total Exercise	33.34 (22.60)	37.39 (24.54)	37.95 (24.61)	0.82 (.443)	0.87 (.422)
	0.227	0.168	.410	--	--
3-wk - Avg steps/day	5712.90 (2624.82)	6358.17 (1977.47)	6615.95 (2460.48)	2.59 (.077)	--

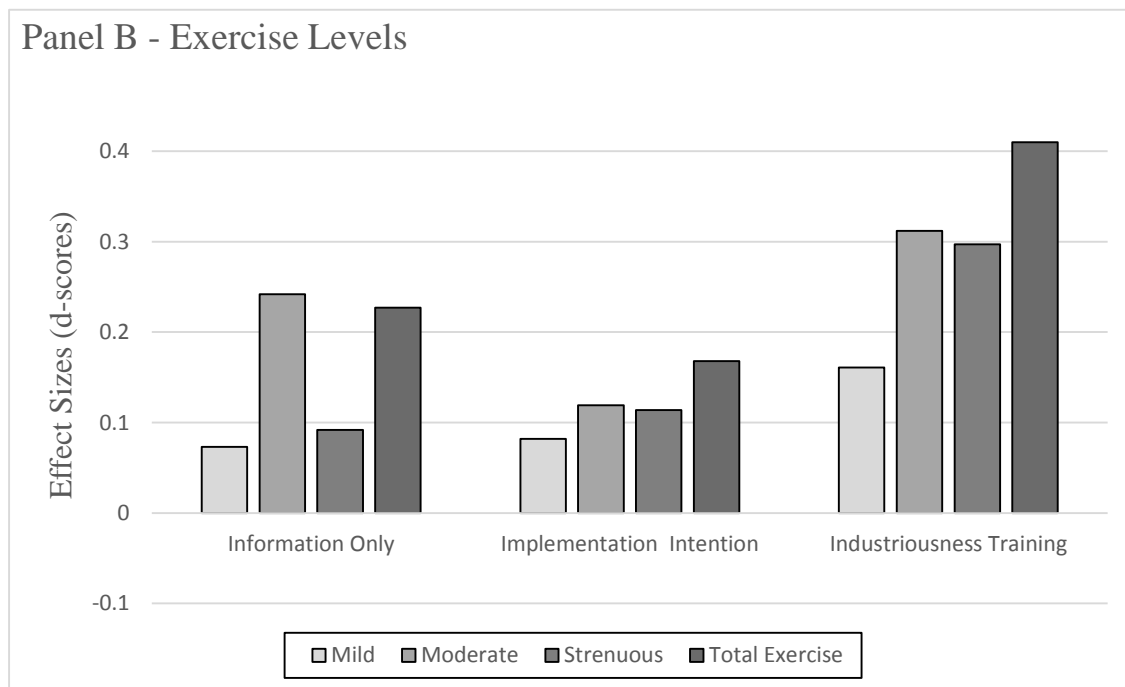
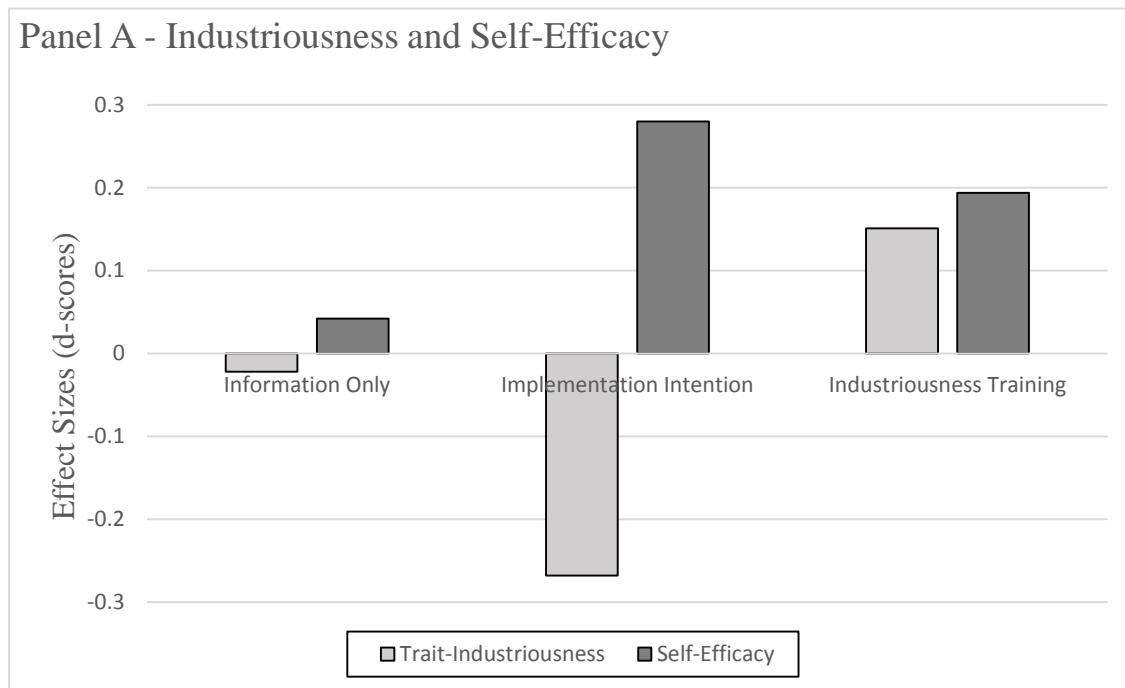
*Means and SDs are for 2-month follow up. Due to some participants losing their pedometers, average steps per days are based on 72 participants for the Control group, 66 participants for the Implementation Intention (Imp Int) group, and 61 participants for the Industriousness (Ind) group. The total N for pedometer data = 199. D-scores refer to within-group differences between scores on these variables at Baseline versus the 2-month follow up. ANOVAs refer to total group differences (significant differences are bolded). SE = Self-efficacy.

Table 2. Correlations among study variables at baseline and at 2-month follow up.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Sex	--	-.14*	-.08	.01	-.07	-.02	-.22**	-.03	-.19**	-.07	-.21**	-.05	-.18**	-.14*	-.06	-.05	.13
2. Age	-.14*	--	.04	.15*	.15*	.01	-.13*	.05	-.02	-.01	.01	-.03	-.04	-.03	.08	.05	.03
3. BMI	-.06	.05	(.98**)	.01	.11	.06	.05	.07	.07	.13	.05	.14*	.11	.12	.00	.03	.09
4. Industriousness	-.06	.09	-.02	(.73**)	.16*	.16*	.02	.09	.13	.13	.09	.17*	.14*	.13	.14*	.10	.17*
5. Outcome Expectancies	-.18**	.13	.15*	.07	(.62**)	.43**	.25**	.14*	.22**	.19**	.20**	.20**	.28**	.25**	.13	.01	.21**
6. Attitudes	-.13	-.02	.04	.23**	.36**	(.56**)	.26**	.27**	.36**	.34**	.29**	.35**	.43**	.22**	.21**	.14*	.27**
7. SE_Weather	-.20**	-.20**	-.02	-.01	.06	.17**	(.60**)	.44**	.54**	.46**	.46**	.48**	.79**	.24**	.22**	.02	.25**
8. SE_Inconvenient	-.08	.03	-.15*	.12	-.03	.23**	.37**	(.52**)	.29**	.46**	.33**	.48**	.68**	.19**	.22**	.04	.22**
9. SE_NegAffect	-.22**	-.09	.03	.06	.04	.22**	.56**	.25**	(.55**)	.42**	.55**	.42**	.75**	.34**	.27**	.05	.34**
10. SE_Alone	-.03	-.06	-.09	.11	.00	.27**	.46**	.50**	.34**	(.49**)	.27**	.63**	.74**	.17*	.07	.04	.14*
11. SE_Excuse	-.23**	.02	-.02	.07	.12	.25**	.36**	.32**	.50**	.31**	(.46**)	.31**	.66**	.37**	.35**	.08	.40**
12. SE_Resistance	-.05	-.10	.02	.06	-.04	.16*	.37**	.36**	.39**	.50**	.23**	(.51**)	.76**	.17*	.12	.03	.16*
13. SE_FullScale	-.19**	-.11	-.06	.10	.03	.31**	.76**	.67**	.72**	.75**	.61**	.68**	(.57**)	.34**	.28**	.06	.34**
14. Strenuous Exercise	-.30**	-.01	.01	.10	.06	.30**	.38**	.15*	.36**	.29**	.39**	.19**	.42**	(.51**)	.27**	.14*	.76**
15. Moderate Exercise	-.04	.13*	-.01	.08	-.00	.16*	.05	.06	.15*	.07	.20**	-.04	.11	.36**	(.39**)	.52**	.76**
16. Mild Exercise	-.08	.09	.08	.04	.13	.14*	.03	.05	.02	.01	.09	-.03	.04	.12	.49**	(.43**)	.62**
17. Total Exercise	-.22**	.08	.03	.11	.08	.29**	.25**	.13	.28**	.20**	.34**	.09	.30**	.77**	.79**	.64**	(.56**)

Note: * $p \leq .05$. ** $p \leq .01$. Correlations below the diagonal refer to baseline measurements, and correlations above the diagonal refer to 2-month follow up measurements. Numbers in parentheses on the diagonal reflect correlations of the respective variables at baseline and the 2-month follow up. SE = Self-efficacy. "Weather" refers to bad weather; "inconvenient" refers to inconvenient to exercise; "NegAffect" refers to negative affect; "Alone" refers to having to exercise alone; "Excuse" refers to making excuses to not exercise; "Resistance" refers to feeling resistance from others with regard to exercising. Males were coded as "0" and females were coded as "1".

Figure 4. Bar charts of effect sizes for industriousness, self-efficacy, and exercise.



APPENDIX A
Demographics

1. Male
 Female
2. Age _____
3. How would you best describe your ethnic or racial background?
 - African American/Black
 - American Indian/Native American
 - Hispanic/Chicano/Mexican American
 - Asian American
 - Caucasian/European American
 - Other (please specify)
4. Marital Status
 - Single
 - In a committed relationship (e.g., boyfriend/girlfriend)
 - Married
 - Separated
 - Divorced
5. If in a relationship, how long have you been in this relationship/marriage? _____
6. Number of marriages _____
7. Number of children _____
8. Age of youngest child _____
9. Please indicate the highest level of education you have completed.
 - Some elementary school
 - Some middle school
 - Some high school
 - High school diploma
 - Some college
 - College B.A. degree
 - Some graduate school
 - Masters degree
 - PhD, JD, MD, EdD, or any other doctoral degree
10. Are you currently employed?
 - Yes, full-time
 - Yes, part-time but want full-time
 - Yes, part-time by choice
 - No, but seeking work
 - No, and not seeking work
 - No, retired

APPENDIX B

Contacts/Close Associates Form

Please print all contact information as clearly as possible:

Your name: _____ / _____ / _____
(first) (middle initial) (last)

Local mailing address:

(street address and apt./unit #, if applicable)

number:

(city) (state) (zip code)

Primary telephone number:

(_____) - _____ - _____

Secondary telephone

(_____) - _____ - _____

Address valid until: ____/____/20__

Permanent mailing address (if different than local address):

(street address and apt./unit #, if applicable)

(city) (state) (zip code)

Primary email address:

_____@_____.

Secondary email address:

_____@_____.

Three Close Associates (friends, family, employers, etc, who will know how to contact you in the event we are unable to contact you directly).

CA # 1 Name: _____ / _____ / _____
(first) (middle initial) (last)

Local mailing address:

(street address and apt./unit #, if applicable)

number:

(city) (state) (zip code)

Primary email address:

_____@_____.

Secondary email address:

_____@_____.

CA #2 Name: _____ / _____ / _____
(first) (middle initial) (last)

Local mailing address:

(street address and apt./unit #, if applicable)

number:

(city) (state) (zip code)

Primary email address:

_____@_____.

Secondary email address:

_____@_____.

CA #3 Name: _____ / _____ / _____
(first) (middle initial) (last)

Local mailing address:

Primary telephone number:

(_____) - _____ - _____

Secondary telephone

(_____) - _____ - _____

Primary telephone number:

(_____) - _____ - _____

Secondary telephone

(_____) - _____ - _____

Primary telephone number:

(street address and apt./unit #, if applicable)

number:
(city) (state) (zip code)

Primary email address:
_____@_____.

Secondary email address:
_____@_____.

(_____) - _____ - _____

Secondary telephone

(_____) - _____ - _____

APPENDIX C**TTM Staging Questionnaire**

The following five statements will assess how much you currently exercise in your leisure time (exercise done outside of work). Regular exercise is *defined two ways*: 1) Any planned *moderate-intensity* physical activity (e.g., brisk walking, jogging, bicycling, swimming, tennis, etc.) performed **five or more days a week for 30 minutes** or more; **OR** 2) any planned *vigorous-intensity* physical activity (e.g., jogging, engaging in heavy yard work, participating in high-impact aerobic dancing, swimming continuous laps, bicycling uphill, etc.) performed **three or more days a week for 25 minutes** or more.

Do you exercise regularly according to either definition above? **Please mark responses on the SCANTRON FORM using the scale below.**

- a. ____ No, and I do not intend to begin exercising regularly in the next 6 months.
- b. ____ No, but I intend to begin exercising regularly in the next 6 months.
- c. ____ No, but I intend to begin exercising regularly in the next 30 days.
- d. ____ Yes, I have been, but for less than 6 months.
- e. ____ Yes, I have been for more than 6 months.

APPENDIX D

Big Five Adjective Checklist

HOW DO YOU SEE YOURSELF IN GENERAL?

Please use this list of common traits to describe yourself as accurately as possible. Describe yourself as you see yourself at the present time, not as you wish to be in the future. Describe yourself as you are *generally or typically*.

After each term, please circle a number indicating the extent to which this term is *characteristic, usual, or typical* of you. **Please mark responses on the SCANTRON FORM using the scale below.**

	Very Uncharacteristic 1(a)	Somewhat Uncharacteristic 2(b)	Neither 3(c)	Somewhat Characteristic 4(d)	Very Characteristic 5(e)
1. Lazy	1	2	3	4	5
2. Industrious	1	2	3	4	5
3. Tenacious	1	2	3	4	5
4. Thorough	1	2	3	4	5
5. Thrifty	1	2	3	4	5

APPENDIX E

How I am in general

Below are characteristics that may or may not apply to you. Please indicate the extent to which **you agree or disagree with the statements.** Please mark responses on the **SCANTRON FORM** using the scale below.

Disagree Strongly 1 (a)	Disagree a little 2 (b)	Neither agree nor disagree 3 (c)	Agree a little 4 (d)	Agree Strongly 5 (e)
-------------------------------	-------------------------------	--	----------------------------	----------------------------

I am someone who...

1. Has high standards and works toward them
2. Goes above and beyond of what is required
3. Does not work as hard as the majority of people around me
4. Invests little effort into my work
5. Demands the highest quality in everything I do
6. Tries to be the best at anything I do
7. Makes every effort to do more than what is expected of me
8. Does what is required, but rarely anything more
9. Thinks setting goals and achieving them is not very important
10. Is satisfied with getting average grades

APPENDIX F

Outcome Expectancies for Exercise

The following items reflect beliefs or expectations about regular exercise or physical activity. Please respond to the following statements marking your answer honestly, and remember to read each question carefully. **Please mark responses on the SCANTRON FORM using the scale below.**

	Strongly disagree 1(a)		Disagree 2(b)		Neutral 3(c)		Agree 4(d)		Strongly agree 5(e)
1	2	3	4	5	Exercise will improve my ability to perform daily activities				
1	2	3	4	5	Exercise will improve my social standing				
1	2	3	4	5	Exercise will strengthen my bones				
1	2	3	4	5	I can hurt myself if I exercise regularly				
1	2	3	4	5	Exercise will increase my muscle strength				
1	2	3	4	5	Exercise will make me more at ease with people				
1	2	3	4	5	Exercise will aid in weight control				
1	2	3	4	5	Regular exercise is painful				
1	2	3	4	5	Exercise will provide companionship				
1	2	3	4	5	Exercise will improve the functioning of my cardiovascular system				
1	2	3	4	5	Exercising regularly makes me feel tired				
1	2	3	4	5	Exercise will increase my mental alertness				
1	2	3	4	5	Exercise will increase my acceptance by others				
1	2	3	4	5	Exercise will give me a sense of personal accomplishment				

APPENDIX G

Exercise Attitudes

Please use the response scales below to answer the following questions about exercise and physical activity. **Please mark responses on the SCANTRON FORM using the scale below.** For me, to participate in regular exercise is:

Unpleasant	a	b	c	d	e	Pleasant
Harmful	a	b	c	d	e	Beneficial
Unenjoyable	a	b	c	d	e	Enjoyable
Foolish	a	b	c	d	e	Wise
Bad	a	b	c	d	e	Good
Boring	a	b	c	d	e	Interesting
Stressful	a	b	c	d	e	Relaxing
Useless	a	b	c	d	e	Useful

APPENDIX H
Self-Efficacy

This section looks at how confident you are to exercise when other things get in the way. Read the following items and mark responses on the SCANTRON FORM using the scale below.

Not at all confident	Somewhat confident	Moderately confident	Very confident	Extremely confident
1(a)	2(b)	3(c)	4(d)	5(e)

I am confident I can participate in regular exercise when:

- | | | | | | |
|---|---|---|---|---|--|
| 1 | 2 | 3 | 4 | 5 | My exercise partner decides not to exercise that day. |
| 1 | 2 | 3 | 4 | 5 | I don't have access to exercise equipment. |
| 1 | 2 | 3 | 4 | 5 | I have to exercise alone. |
| 1 | 2 | 3 | 4 | 5 | I am traveling. |
| 1 | 2 | 3 | 4 | 5 | I am alone. |
| 1 | 2 | 3 | 4 | 5 | My gym is closed. |
| 1 | 2 | 3 | 4 | 5 | I am busy. |
| 1 | 2 | 3 | 4 | 5 | My friends don't want me to exercise. |
| 1 | 2 | 3 | 4 | 5 | I don't feel like it. |
| 1 | 2 | 3 | 4 | 5 | My significant other does not want me to exercise. |
| 1 | 2 | 3 | 4 | 5 | I feel I don't have the time. |
| 1 | 2 | 3 | 4 | 5 | I am spending time with friends or family who do not exercise. |
| 1 | 2 | 3 | 4 | 5 | I am anxious. |
| 1 | 2 | 3 | 4 | 5 | It's raining or snowing. |
| 1 | 2 | 3 | 4 | 5 | I am depressed. |
| 1 | 2 | 3 | 4 | 5 | It's cold outside. |
| 1 | 2 | 3 | 4 | 5 | I am under a lot of stress. |
| 1 | 2 | 3 | 4 | 5 | The roads or sidewalks are snowy. |

APPENDIX I**GLTEQ**

Considering a 7-day period (a week), how many times, on average, do you do the following kinds of exercise for more than 20 minutes during your free time (write on each line the number of times)?

- A. Strenuous exercise (heart beats rapidly, e.g., running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller blading, vigorous swimming, vigorous long-distance bicycling)
_____ # of times
- B. Moderate exercise (not exhausting, e.g., fast walking, baseball, tennis, easy bicycling, volleyball, badminton, easy swimming, alpine (downhill) skiing, social dancing)
_____ # of times
- C. Mild exercise (minimal effort, e.g., yoga, archery, fishing, bowling, horseshoes, golf, easy walking)
_____ # of times

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)? Check only one line.

- ___ Often
___ Sometimes
___ Never/rarely

APPENDIX J**GROUP 1 (Information Only) DISCUSSION OUTLINE**Exercise information only:

- Introduction to study and facilitator
 - o Purpose – how to increase physical activity
 - o Role of facilitator – distribute information and materials and encourage discussion
- Distribution of initial assessment materials to participants (consent forms first)
 - o After participants complete assessment materials, their weight and height will be measured (using a digital scale and tape ruler affixed to discussion room prior to session) to measure participants' BMI
- Agenda for discussion
- Distribution of exercise logs – point them to note paper, but ask to hold off on logs
- Distribution of benefits of physical activity and types of activity sheet
- Discussion of benefits of physical activity (independent of body weight)
 - o PA reduces the risks of:
 - Premature death
 - Diseases such as coronary heart disease, stroke, some cancers, type 2 diabetes, osteoporosis, and obesity
 - PA delivers oxygen and nutrients to your tissues and helps your cardiovascular system work more efficiently
 - Risk factors for disease, such as high blood pressure and high blood cholesterol
 - Depression and loss of cognitive function
 - Injuries or sudden heart attacks
 - o PA helps:
 - Prevent weight gain and control body fat
 - Increases metabolism – even when you are not exercising
 - Increase cognitive function
 - PA stimulates the growth of new brain cells
 - Increase energy and mood
 - PA stimulates various brain chemicals that can leave you feeling happier and more relaxed
 - Improve body composition
 - Improve muscle function (i.e., preserve muscle mass, strength, and power)
 - Improve quality of sleep
 - Improve physical fitness, such as aerobic capacity, and muscle strength and endurance

- Improve functional capacity (the ability to engage in activities needed for daily living)
 - Other benefits:
 - Good way to spend time with family and/or friends
 - Gives you a chance to get outdoors
 - All these benefits helps you to feel more positive about yourself and your life
- Discussion of types of physical activity:
 - Aerobic activity (i.e., endurance or cardio activity)
 - Moving the body's large muscles in a rhythmic manner for a sustained period of time.
 - Examples: brisk walking, running, bicycling, jumping rope, and swimming
 - Muscle-strengthening activity (includes resistance training and lifting weights)
 - Making the body's muscles work or hold against an applied force or weight. Effects are limited to the muscles doing the work
 - Important to work all the major muscle groups of the body: legs, hips, back, abdomen, chest, shoulders, and arms
 - Examples: repetitive actions done with weight machines, free weights, elastic bands, or body weight (e.g., push-ups or chin-ups)
 - Just 20 minutes a day, two times per week, will help tone entire body
 - Give your muscles at least 24 hours to rebuild after a session
 - Bone-strengthening activities (i.e., weight-bearing or weight-loading activity)
 - Produces a force (commonly produced by impact with the ground) on the bones that promotes bone growth and strength
 - Can also be aerobic and muscle strengthening
 - Examples: jumping jacks, running, brisk walking, and weight-lifting exercises
 - Flexibility activities
 - Stretching your muscles to help your body stay limber and improve range of motion of joints and muscles
 - Being flexible gives you more freedom of movement for exercises as well as for your everyday activities
 - Alleviates muscle tension that accompanies stress
- Distribution of PA recommendations and “how-to” sheet
- Discussion of physical activity recommendations
 - 150 minutes of moderate-intensity activity per week, 75 minutes of vigorous-intensity activity per week, or an equivalent combination of the two
- Components of an exercise training session (“how to do an exercise session”)
 - Warm-up – at least 5-10 minutes of light-to-moderate intensity cardiorespiratory and muscular endurance activities

- Conditioning – at least 20-60 minutes of aerobic, resistance, neuromotor, and/or sports activities (exercise bouts of 10 min are acceptable if the individual accumulates at least 20-60 minutes of daily aerobic exercise)
- Cool-down – at least 5-10 minutes of light-to-moderate intensity cardiorespiratory and muscular endurance activities
- Stretching – at least 10 minutes of stretching exercises performed after the warm-up or cool-down phase
- Discussion of how to reduce risk of injuries:
 - Start at your current level of physical fitness and make small, progressive changes in exercise routines to help the body adapt to the additional stresses
 - Protect yourselves by using appropriate gear and sports equipment, looking for safe environments, following rules and policies, and making sensible choices about when, where, and how to be active.
- Distribution of exercise “menu” – discuss examples and adding variety into exercises
- Other tips:
 - Your body gets used to the exercises that you do – change up your routine (maybe every 3-4 weeks) so that your progress does not plateau
 - Choose activities that you enjoy
 - Piece your workout together – you can enjoy benefits even exercising in 10-minute spurts (can do this three times a day to get your overall 30 minutes a day)
- Instruction on how to use the provided exercise logs to track activity levels throughout the 3-week intervention period – remind participants to be very specific in recording their activity levels
- Distribution of pedometers and instruction on how to use – help participants measure their stride
- Instructions on when and where to return exercise logs and pedometers at the termination of the 3-week period (\$10 amazon.com gift card given to participants when materials are returned; a \$10 on-time bonus will also be included)

APPENDIX K**GROUP 2 (Implementation Intention) DISCUSSION OUTLINE**Exercise information with implementation intentions:

- Introduction to study and facilitator
 - o Purpose – how to increase physical activity
 - o Role of facilitator – distribute information and materials and encourage discussion
- Distribution of initial assessment materials to participants (consent forms first)
 - o After participants complete assessment materials, their weight and height will be measured (using a digital scale and tape ruler affixed to discussion room prior to session) to measure participants' BMI
- Agenda for discussion
- Distribution of exercise logs – point them to note paper, but ask to hold off on logs
- Distribution of benefits of physical activity and types of activity sheet
- Discussion of benefits of physical activity (independent of body weight)
 - o PA reduces the risks of:
 - Premature death
 - Diseases such as coronary heart disease, stroke, some cancers, type 2 diabetes, osteoporosis, and obesity
 - PA delivers oxygen and nutrients to your tissues and helps your cardiovascular system work more efficiently
 - Risk factors for disease, such as high blood pressure and high blood cholesterol
 - Depression and loss of cognitive function
 - Injuries or sudden heart attacks
 - o PA helps:
 - Prevent weight gain and control body fat
 - Increases metabolism – even when you are not exercising
 - Increase cognitive function
 - PA stimulates the growth of new brain cells
 - Increase energy and mood
 - PA stimulates various brain chemicals that can leave you feeling happier and more relaxed
 - Improve body composition
 - Improve muscle function (i.e., preserve muscle mass, strength, and power)
 - Improve quality of sleep
 - Improve physical fitness, such as aerobic capacity, and muscle strength and endurance

- Improve functional capacity (the ability to engage in activities needed for daily living)
 - Other benefits:
 - Good way to spend time with family and/or friends
 - Gives you a chance to get outdoors
 - All these benefits helps you to feel more positive about yourself and your life
- Discussion of types of physical activity:
 - Aerobic activity (i.e., endurance or cardio activity)
 - Moving the body's large muscles in a rhythmic manner for a sustained period of time.
 - Examples: brisk walking, running, bicycling, jumping rope, and swimming
 - Muscle-strengthening activity (includes resistance training and lifting weights)
 - Making the body's muscles work or hold against an applied force or weight. Effects are limited to the muscles doing the work
 - Important to work all the major muscle groups of the body: legs, hips, back, abdomen, chest, shoulders, and arms
 - Examples: repetitive actions done with weight machines, free weights, elastic bands, or body weight (e.g., push-ups or chin-ups)
 - Just 20 minutes a day, two times per week, will help tone entire body
 - Give your muscles at least 24 hours to rebuild after a session
 - Bone-strengthening activities (i.e., weight-bearing or weight-loading activity)
 - Produces a force (commonly produced by impact with the ground) on the bones that promotes bone growth and strength
 - Can also be aerobic and muscle strengthening
 - Examples: jumping jacks, running, brisk walking, and weight-lifting exercises
 - Flexibility activities
 - Stretching your muscles to help your body stay limber and improve range of motion of joints and muscles
 - Being flexible gives you more freedom of movement for exercises as well as for your everyday activities
 - Alleviates muscle tension that accompanies stress
- Distribution of PA recommendations and “how-to” sheet
- Discussion of physical activity recommendations
 - 150 minutes of moderate-intensity activity per week, 75 minutes of vigorous-intensity activity per week, or an equivalent combination of the two
- Components of an exercise training session (“how to do an exercise session”)
 - Warm-up – at least 5-10 minutes of light-to-moderate intensity cardiorespiratory and muscular endurance activities

- Conditioning – at least 20-60 minutes of aerobic, resistance, neuromotor, and/or sports activities (exercise bouts of 10 min are acceptable if the individual accumulates at least 20-60 minutes of daily aerobic exercise)
- Cool-down – at least 5-10 minutes of light-to-moderate intensity cardiorespiratory and muscular endurance activities
- Stretching – at least 10 minutes of stretching exercises performed after the warm-up or cool-down phase
- Discussion of how to reduce risk of injuries:
 - Start at your current level of physical fitness and make small, progressive changes in exercise routines to help the body adapt to the additional stresses
 - Protect yourselves by using appropriate gear and sports equipment, looking for safe environments, following rules and policies, and making sensible choices about when, where, and how to be active.
- Distribution of exercise “menu” – discuss examples and adding variety into exercises
- Other tips:
 - Your body gets used to the exercises that you do – change up your routine (maybe every 3-4 weeks) so that your progress does not plateau
 - Choose activities that you enjoy
 - Piece your workout together – you can enjoy benefits even exercising in 10-minute spurts (can do this three times a day to get your overall 30 minutes a day)...

Not always easy to fit exercise into daily life - ask about things that get in the way of exercise plans

- Discussion of barriers to engaging in physical activity and how to overcome them
 - Discuss possible ambivalence of individuals’ desire to engage in exercise, especially taking into account other competing demands
 - Emphasize that failure to initiate or maintain exercise is inevitable and stress that these experiences should not be considered complete failures but as learning experiences instead

Introduce implementation intentions – specific plans of where, how, and when to exercise; we are more likely to follow through with plans if they are specific and realistic.

- Explain what implementation intentions are and how they may help participants overcome barriers and achieve their exercise goals
 - Motivational (e.g., cognitive processes) and volitional (e.g., actual planning and actions to enact behavior) phases

- Formation of an actual intention and the plans to enact the behavior signal the end of deliberation and the start of commitment
 - Enhancement of feasibility of an implementation intention requires specific plans of where, when, and how to execute exercise
 - Provide example implementation intention
- Instruction on how to use the provided exercise logs to track activity levels and create implementation intentions throughout the 3-week intervention period
 - Date all days (first and last days are given to participants)
 - Have participants think about schedule (or look in planners/calendars) for next three weeks and decide which days are exercise days and which are not – remind them to be realistic and that not every day has to be an exercise day.
 - Participants should then complete their implementation intentions for the designated exercise days – remind them of exercise menu to help guide plans if necessary
 - Instruct participants on how to record data on the days they actually exercise – ask them to be very SPECIFIC – remind them that even if they change their exercise plans or did not exercise on the days that they planned to, write in whatever they did nor did not do
 - Distribution of pedometers and instruction on how to use – also help participants measure their stride
 - Instructions on when and where to return exercise logs and pedometers at the termination of the 3-week period (\$10 amazon.com gift card given to participants when materials are returned; a \$10 on-time bonus will also be included)

APPENDIX L**GROUP 3 (Industriousness Training) DISCUSSION OUTLINE**Exercise information with implementation intention and industriousness training:

- Introduction to study and facilitator
 - Purpose – how to increase physical activity
 - Role of facilitator – distribute information and materials and encourage discussion
- Distribution of initial assessment materials to participants (consent forms first)
 - After participants complete assessment materials, their weight and height will be measured (using a digital scale and tape ruler affixed to discussion room prior to session) to measure participants' BMI
- Agenda for discussion
- Distribution of exercise logs – point them to note paper, but ask to hold off on logs
- Distribution of benefits of physical activity and types of activity sheet
- Discussion of benefits of physical activity (independent of body weight)
 - PA reduces the risks of:
 - Premature death
 - Diseases such as coronary heart disease, stroke, some cancers, type 2 diabetes, osteoporosis, and obesity
 - PA delivers oxygen and nutrients to your tissues and helps your cardiovascular system work more efficiently
 - Risk factors for disease, such as high blood pressure and high blood cholesterol
 - Depression and loss of cognitive function
 - Injuries or sudden heart attacks
 - PA helps:
 - Prevent weight gain and control body fat
 - Increases metabolism – even when you are not exercising
 - Increase cognitive function
 - PA stimulates the growth of new brain cells
 - Increase energy and mood
 - PA stimulates various brain chemicals that can leave you feeling happier and more relaxed
 - Improve body composition
 - Improve muscle function (i.e., preserve muscle mass, strength, and power)
 - Improve quality of sleep
 - Improve physical fitness, such as aerobic capacity, and muscle strength and endurance

- Improve functional capacity (the ability to engage in activities needed for daily living)
 - Other benefits:
 - Good way to spend time with family and/or friends
 - Gives you a chance to get outdoors
 - All these benefits helps you to feel more positive about yourself and your life
- Discussion of types of physical activity:
 - Aerobic activity (i.e., endurance or cardio activity)
 - Moving the body's large muscles in a rhythmic manner for a sustained period of time.
 - Examples: brisk walking, running, bicycling, jumping rope, and swimming
 - Muscle-strengthening activity (includes resistance training and lifting weights)
 - Making the body's muscles work or hold against an applied force or weight. Effects are limited to the muscles doing the work
 - Important to work all the major muscle groups of the body: legs, hips, back, abdomen, chest, shoulders, and arms
 - Examples: repetitive actions done with weight machines, free weights, elastic bands, or body weight (e.g., push-ups or chin-ups)
 - Just 20 minutes a day, two times per week, will help tone entire body
 - Give your muscles at least 24 hours to rebuild after a session
 - Bone-strengthening activities (i.e., weight-bearing or weight-loading activity)
 - Produces a force (commonly produced by impact with the ground) on the bones that promotes bone growth and strength
 - Can also be aerobic and muscle strengthening
 - Examples: jumping jacks, running, brisk walking, and weight-lifting exercises
 - Flexibility activities
 - Stretching your muscles to help your body stay limber and improve range of motion of joints and muscles
 - Being flexible gives you more freedom of movement for exercises as well as for your everyday activities
 - Alleviates muscle tension that accompanies stress
- Distribution of PA recommendations and “how-to” sheet
- Discussion of physical activity recommendations
 - 150 minutes of moderate-intensity activity per week, 75 minutes of vigorous-intensity activity per week, or an equivalent combination of the two
- Components of an exercise training session (“how to do an exercise session”)
 - Warm-up – at least 5-10 minutes of light-to-moderate intensity cardiorespiratory and muscular endurance activities

- Conditioning – at least 20-60 minutes of aerobic, resistance, neuromotor, and/or sports activities (exercise bouts of 10 min are acceptable if the individual accumulates at least 20-60 minutes of daily aerobic exercise)
- Cool-down – at least 5-10 minutes of light-to-moderate intensity cardiorespiratory and muscular endurance activities
- Stretching – at least 10 minutes of stretching exercises performed after the warm-up or cool-down phase
- Discussion of how to reduce risk of injuries:
 - Start at your current level of physical fitness and make small, progressive changes in exercise routines to help the body adapt to the additional stresses
 - Protect yourselves by using appropriate gear and sports equipment, looking for safe environments, following rules and policies, and making sensible choices about when, where, and how to be active.
- Distribution of exercise “menu” – discuss examples and adding variety into exercises
- Other tips:
 - Your body gets used to the exercises that you do – change up your routine (maybe every 3-4 weeks) so that your progress does not plateau
 - Choose activities that you enjoy
 - Piece your workout together – you can enjoy benefits even exercising in 10-minute spurts (can do this three times a day to get your overall 30 minutes a day)...

Not always easy to fit exercise into daily life - ask about things that get in the way of exercise plans

- Discussion of barriers to engaging in physical activity and how to overcome them
 - Discuss possible ambivalence of individuals’ desire to engage in exercise, especially taking into account other competing demands
 - Emphasize that failure to initiate or maintain exercise is inevitable and stress that these experiences should not be considered complete failures but as learning experiences instead

Introduce implementation intentions – specific plans of where, how, and when to exercise; we are more likely to follow through with plans if they are specific and realistic.

- Explain what implementation intentions are and how they may help participants overcome barriers and achieve their exercise goals
 - Motivational (e.g., cognitive processes) and volitional (e.g., actual planning and actions to enact behavior) phases

- Formation of an actual intention and the plans to enact the behavior signal the end of deliberation and the start of commitment
 - Enhancement of feasibility of an implementation intention requires specific plans of where, when, and how to execute exercise
- Provide example implementation intention – inform participants that they will create their own later on

Creating implementation intentions is not enough – important to think realistically about commitments, the amount of effort normally put into exercise, and possible obstacles (as discussed)...

- Discussion of industriousness and how to apply learned industriousness to exercise-related goal achievement
 - Individuals who are industrious are those who tend to be more hard-working, tenacious, resourceful, ambitious, and confident
 - Research has shown that people who are more industrious were also more likely to engage in exercise behavior and more likely to follow through with intentions to exercise
 - Regardless of your current level of industriousness, you can employ certain techniques to train yourself to be more industrious, thereby helping you to achieve your exercise-related goals

Knowing level of industrious in some areas, and not others, depending on our previous experiences. Example – studying and preparing for classes/exams. Possible to learn to identify threshold for hard work in terms of exercise – might take trial and error.

- Ask participants to think about past experiences (e.g., previous class that was difficult) that required them to exert a lot of effort and how they were able to accomplish it
 - What kinds of tasks were they?
 - Were they desirable or aversive?
 - How were you rewarded or reinforced for your efforts?
 - Did similar tasks seem easier/harder after completion of the initial task?
 - Did you give up on any tasks that were hard or aversive?
 - What were some strategies you used to overcome previous obstacles in your life?
 - How can you apply these strategies to your exercise goals?

Discuss building increments to get to exercise goals and demonstrating that it can be done – compare education and fitness.

Draw believing/doing model on board and discuss strategies.

- Some recommended strategies:
 - Given your schedule and fitness level, start by creating a realistic exercise goal that you know you can achieve (keep your goals manageable)

- Increase the difficulty of your goals gradually (using implementation intentions) – give yourself small rewards along the way if necessary/desired
 - Identify the threshold for sustained effort where you can still reach your goal.
 - Determine what motivates you to try harder each time and remind yourself of your end goal
 - When you feel the temptation to skip a planned exercise day, tell yourself to try it for “just 10 minutes”
 - Record your level of effort for each day of exercise and refer to them as needed – use the following perceived exertion scale as reference:
 - 1 = no exertion at all (e.g., sitting and doing nothing)
 - 2 = very light (e.g., walking slowly at your own pace for several minutes)
 - 3 = somewhat hard (but still feels OK to continue)
 - 4 = very hard (strenuous)
 - 5 = maximal exertion
- Instruction on how to use the provided exercise logs to track activity levels, create implementation intentions, and record effort levels on exercise days throughout the 3-week intervention period
- Date all days (first and last days are given to participants)
 - Have participants think about schedule (or look in planners/calendars) for next three weeks and decide which days are exercise days and which are not – remind them to be realistic and that not every day has to be an exercise day. Remind participants to think about how much effort they can expend on their designated exercise days and think realistically about them
 - Participants should then complete their implementation intentions for the designated exercise days – remind them of exercise menu to help guide plans if necessary
 - Instruct participants on how to record data on the days they actually exercise – ask them to be very SPECIFIC – remind them that even if they change their exercise plans or did not exercise on the days that they planned to, write in whatever they did nor did not do
 - Point participants to scales and ask them to complete it for each day that they exercised – remind them that these scales (and overall booklet) could be a useful tool for them to see where they are in terms of their effort for exercise and how seeing it could help them reinforce their plans

- Distribution of pedometers and instruction on how to use – also help participants measure their stride
- Instructions on when and where to return exercise logs and pedometers at the termination of the 3-week period (\$10 amazon.com gift card given to participants when materials are returned; a \$10 on-time bonus will also be included)

REFERENCES

- Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology, 32*, 665–683.
doi:10.1111/j.1559-1816.2002.tb00236.x
- Ajzen, I. (2011). Behavioral interventions: Design and evaluation guided by the theory of planned behavior. In M. M. Mark, S. I. Donaldson, & B. Campbell (Eds.), *Social Psychology and Evaluation* (pp. 72–101). New York, NY: Guilford Press).
- Baldwin, A. S., Rothman, A. J., Hertel, A. W., Linde, J. A., Jeffery, R. W., Finch, E. A., & Lando, H. A. (2006). Specifying the determinants of the initiation and maintenance of behavior change: An examination of self-efficacy, satisfaction, and smoking cessation. *Health Psychology, 25*, 626-634. doi:10.1037/0278-6133.25.5.626
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191–215. doi:10.1037/0033-295X.84.2.191
- Barrick, M. R., Mount, M. K., & Strauss, J. P. (1993). Conscientiousness and performance of sales representatives: Test of the mediating effects of goal setting. *Journal of Applied Psychology, 78*, 715-722. doi:10.1037/0021-9010.78.5.715
- Bartholow, B. D., Sher, K. J., & Krull, J. L. (2003). Changes in Heavy Drinking Over the Third Decade of Life as a Function of Collegiate Fraternity and Sorority Involvement: A Prospective, Multilevel Analysis. *Health Psychology, 22*, 616-626. doi:10.1037/0278-6133.22.6.616
- Bassett, D. R., Troiano, R. P., McClain, J. J., & Wolff, D. L. (2014). Accelerometer-based physical activity: Total volume per day and standardized measures. *Medicine and Science in Sports and Exercise, 47*, 833–838. doi:10.1249/MSS.0000000000000468

- Benosovich, S., V., Rossi, J. S., Norman, G. J., & Nigg, C. R. (1998). Development of a multidimensional measure of exercise self-efficacy. *Annals of Behavioral Medicine, 20*, S190.
- Bernier, M., & Avard, J. (1986). Self-efficacy, outcome, and attrition in a weight-reduction program. *Cognitive Therapy and Research, 10*, 319-338. doi:10.1007/BF01173469
- Bogg, T. (2008). Conscientiousness, the transtheoretical model of change, and exercise: A neo-socioanalytic integration of trait and social-cognitive frameworks in the prediction of behavior. *Journal of Personality, 76*, 775–802. doi: 10.1111/j.1467-6494.2008.00504.x
- Bogg, T., & Roberts, B. W. (2004). Conscientiousness and health-related behaviors: A meta-analysis of the leading behavioral contributors to mortality. *Psychological Bulletin, 130*, 887-919. doi: 10.1037/0033-2909.130.6.887
- Bogg, T., & Roberts, B. W. (2013). The case for conscientiousness: Evidence and implications for a personality trait marker of health and longevity. *Annals of Behavioral Medicine, 45*, 278-288. doi:10.1007/s12160-012-9454-6
- Boyagian, L. G., & Nation, J. R. (1981). The effects of force training and reinforcement schedules on human performance. *American Journal of Psychology, 94*, 619-632. doi:10.2307/1422423
- Brandon, T. H., Herzog, T. A., Juliano, L. M., Irvin, J. E., Lazev, A. B., & Simmons, V. N. (2003). Pretreatment task persistence predicts smoking cessation outcome. *Journal of Abnormal Psychology, 112*, 448-456. doi:10.1037/0021-843X.112.3.448
- Brandstätter, V., Lengfelder, A., & Gollwitzer, P. M. (2001). Implementation intentions and efficient action initiation. *Journal of Personality and Social Psychology, 81*, 946-960. doi:10.1037/0022-3514.81.5.946

- Caspi, A., & Roberts, B. W. (2001). Target article: Personality development across the life course: The argument for change and continuity. *Psychological Inquiry*, *12*, 49-66. doi:10.1207/S15327965PLI1202_01
- Cerin, E., Vandelanotte, C., Leslie, E., & Merom, D. (2008). Recreational facilities and leisure-time physical activity: An analysis of moderators and self-efficacy as a mediator. *Health Psychology*, *27*, S126-S135. doi:10.1037/0278-6133.27.2(Suppl.).S126
- Chernyshenko, O. S. (2003, May). Applications of ideal point approaches to scale construction and scoring in personality measurement: The development of a six-faceted measure of conscientiousness. *Dissertation Abstracts International*, *63*, 5556.
- Cohen, J. (1977). *Statistical power analysis for the behavioral sciences*. New York: Academic Press.
- Courneya, K. S., & Bobick, T. M. (2000). Integrating the theory of planned behavior with the processes and stages of change in the exercise domain. *Psychology of Sport and Exercise*, *1*, 41-56. doi:10.1016/S1469-0292(00)00006-6
- Davison, K. K., Schmalz, D. L., & Downs, D. S. (2010). Hop, skip ... no! Explaining adolescent girls' disinclination for physical activity. *Annals of Behavioral Medicine*, *39*, 290-302. doi:10.1007/s12160-010-9180-x
- De Cocker, K. A., De Bourdeaudhuij, I. M., & Cardon, G. M. (2010). The effect of a multi-strategy workplace physical activity intervention promoting pedometer use and step count increase. *Health Education Research*, *25*, 608-619. doi:10.1093/her/cyp052
- Eisenberger, R. (1992). Learned industriousness. *Psychological Review*, *99*, 248-267. doi:10.1037/0033-295X.99.2.248

- Eisenberger, R., Heerd, W. A., Hamdi, M., Zimet, S., & Bruckmeir, M. (1979). Transfer of persistence across behaviors. *Journal of Experimental Psychology: Human Learning and Memory*, *5*, 522-530. doi:10.1037/0278-7393.5.5.522
- Eisenberger, R., Kuhlman, D. M., & Cotterell, N. (1992). Effects of social values, effort training, and goal structure on task persistence. *Journal of Research in Personality*, *26*, 258-272. doi:10.1016/0092-6566(92)90043-4
- Faul, F., Erdfelder, E., Lang, A., & Buchner, A. (2007). GPower 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*, 175-191. doi:10.3758/BF03193146
- Ferguson, T., Rowlands, A. V., Olds, T., & Maher, C. (2015). The validity of consumer-level, activity monitors in healthy adults worn in free-living conditions: A cross-sectional study. *The International Journal of Behavioral Nutrition and Physical Activity*, *12*. doi:10.1186/s12966-015-0201-9
- Flegal, K. M. (2010). Prevalence and trends in obesity among US adults, 1999-2008. *JAMA*, *303*, 235-241. doi:10.1001/jama.2009.2014
- Franks, P., Chapman, B., Duberstein, P., & Jerant, A. (2009). Five factor model personality factors moderated the effects of an intervention to enhance chronic disease management self-efficacy. *British Journal of Health Psychology*, *14*, 473-487. doi:10.1348/135910708X360700
- Godin, G., Jobin, J., & Bouillon, J. (1986). Assessment of leisure time exercise behaviour by self-report: A concurrent validity study. *Canadian Journal of Public Health*, *77*, 359-361.
- Godin, G., & Shephard, R. J. (1985). A simple method to assess exercise behavior in the community. *Canadian Journal of Applied Sport Science*, *10*, 141-146.

- Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. *European Review of Social Psychology, 4*, 141-185. doi:10.1080/14792779343000059
- Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist, 54*, 493–503. doi:10.1037/0003-066X.54.7.493
- Gupta, S. K. (2011). Intention-to-treat concept: A review. *Perspectives in Clinical Research, 2*, 109–112. doi: 10.4103/2229-3485.83221
- Helson, R., Jones, C., & Kwan, V. Y. (2002). Personality change over 40 years of adulthood: Hierarchical linear modeling analyses of two longitudinal samples. *Journal of Personality and Social Psychology, 83*, 752-766. doi:10.1037/0022-3514.83.3.752
- Heritier, S. R., Gebiski, V. J., & Keech, A. C. (2003). Inclusion of patients in clinical trial analysis: The intention-to-treat principle. *Medical Journal of Australia, 179*, 438–40.
- Hickman, K. L., Stromme, C., & Lippman, L. G. (1998). Learned industriousness: Replication in principle. *Journal of General Psychology, 125*, 213-217.
doi:10.1080/00221309809595545
- Hoyt, A. L., Rhodes, R. E., Hausenblas, H. A., & Giacobbi, P. R., Jr. (2009). Integrating five-factor model facet-level traits with the theory of planned behavior and exercise. *Psychology of Sport and Exercise, 10*, 565-572. doi: 10.1016/j.psychsport.2009.02.008
- Korotitsch, W. J., & Nelson-Gray, R. O. (1999). An overview of self-monitoring research in assessment and treatment. *Psychological Assessment, 11*, 415-425. doi:10.1037/1040-3590.11.4.415
- Leslie, E., Fotheringham, M. J., Owen, N., & Bauman, A. (2001). Age-related differences in physical activity levels of young adults. *Medicine and Science in Sports and Exercise, 33*, 255-258. doi:10.1097/00005768-200102000-00014

- Linde, J. A., Rothman, A. J., Baldwin, A. S., Jeffery, R. W. (2006). The impact of self-efficacy on behavior change and weight change among overweight participants in a weight loss trial. *Health Psychology, 25*, 282-291. doi:10.1037/0278-6133.25.3.282
- Lüdtke, O., Roberts, B. W., Trautwein, U., & Nagy, G. (2011). A random walk down university avenue: Life paths, life events, and personality trait change at the transition to university life. *Journal of Personality and Social Psychology, 101*, 620-637. doi:10.1037/a0023743
- Luszczynska, A. (2006). An implementation intentions intervention, the use of a planning strategy, and physical activity after myocardial infarction. *Social Science & Medicine, 62*, 900-908. doi:10.1016/j.socscimed.2005.06.043
- Malina, R. M. (1996). Tracking of physical activity and physical fitness across the lifespan. *Research Quarterly for Exercise and Sport, 57*, 48-57. doi:10.1037/e603482007-001
- Matthiessen, J., Andersen, E. W., Raustorp, A., Knudsen, V. K., & Sørensen, M. R. (2015). Reduction in pedometer-determined physical activity in the adult Danish population from 2007 to 2012. *Scandinavian Journal of Public Health, 43*, 525-533. doi:10.1177/1403494815578321
- McAuley, E., & Blissmer, B. (2000). Self-efficacy determinants and consequences of physical activity. *Exercise and Sport Sciences Review, 28*, 85-88.
- McAuley, E., & Rudolph, D. (1995). Physical activity, aging, and psychological well-being. *Journal of Aging and Physical Activity, 3*, 67-96.
- McCarthy, M., & Grey, M. (2015). Motion sensor use for physical activity data: Methodological considerations. *Nursing Research, 64*, 320-327. doi:10.1097/NNR.0000000000000098
- Milne, S., Orbell, S., & Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation

- intentions. *British Journal of Health Psychology*, 7, 163-184.
doi:10.1348/135910702169420
- Milne, M. I., Rodgers, W. M., Hall, C. R., Wilson, P. M. (2008). Starting up or starting over: The role of intentions to increase and maintain the behavior of exercise initiates. *Journal of Sport & Exercise Psychology*, 30, 285-301.
- Mischel, W. & Shoda, Y. (1995). A cognitive-affective system theory of personality: Reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychological Review*, 102, 246-268. doi:10.1037/0033-295X.102.2.246
- National Heart, Lung, and Blood Institute. (2012, July 13). How are overweight and obesity diagnosed? Retrieved from <http://www.nhlbi.nih.gov/health/health-topics/topics/obe/diagnosis.html>
- Office of Disease Prevention and Health Promotion (2016, February 20). *Nutrition, physical activity, and obesity*. Retrieved from <http://www.healthypeople.gov/2020/leading-health-indicators/2020-lhi-topics/Nutrition-Physical-Activity-and-Obesity#2>
- Parks-Stamm, E. J., Gollwitzer, P. M., & Oettingen, G. (2007). Action control by implementation intentions: Effective cue detection and efficient response initiation. *Social Cognition*, 25, 248–266. doi:10.1521/soco.2007.25.2.248
- Patrick, H., & Canevello, A. (2011). Methodological overview of a self-determination theory-based computerized intervention to promote leisure-time physical activity. *Psychology of Sport and Exercise*, 12, 13-19. doi:10.1016/j.psychsport.2010.04.011
- Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change in smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51, 390-395. doi:10.1037/0022-006X.51.3.390

- Renner, B., Ghisletta, P., Hankonen, N., & Absetz, P. (2012). Dynamic psychological and behavioral changes in the adoption and maintenance of exercise. *Health Psychology, 31*, 306-315. doi:10.1037/a0025302
- Rhodes, R. E., Courneya, K. S., & Jones, L. W. (2005). The theory of planned behavior and lower-order personality traits: Interaction effects in the exercise domain. *Personality and Individual Differences, 38*, 251-265. doi: 0.1016/j.paid.2004.04.005
- Roberts, B. W., Bogg, T., Walton, K. E., Chernyshenko, O. S., & Stark, S. E. (2004). A lexical investigation of the lower-order structure of conscientiousness. *Journal of Research in Personality, 38*, 164-178. doi: 10.1016/S0092-6566(03)00065-5
- Roberts, B. W., Chernyshenko, O. S., Stark, S., Goldberg, L. R., (2005). The structure of conscientiousness: An empirical investigation based on seven major personality questionnaires. *Personnel Psychology, 58*, 103-139. doi: 10.1111/j.1744-6570.2005.00301.x
- Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin, 126*, 3-25. doi:10.1037/0033-2909.126.1.3
- Roberts, B. W., Walton, K. E., & Viechtbauer, W. (2006). Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychological Bulletin, 132*, 3-27. doi:10.1037/0033-2909.132.1.1
- Rothman, A. J. (2000). Toward a theory-based analysis of behavioral maintenance. *Health Psychology, 19*, 64-69. doi:10.1037/0278-6133.19.Supp1.64

- Sallis, J. F., Hovell, M. F., & Hofstetter, C. R. (1992). Predictors of adoption and maintenance of vigorous physical activity in men and women. *Preventive Medicine, 21*, 237-251.
doi:10.1016/0091-7435(92)90022-a
- Schwarzer, R., Schüz, B., Ziegelmann, J. P., Lippe, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors: Theory-guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine, 33*, 156-166. doi:10.1007/BF02879897
- Sheeran, P., Milne, S., Webb, T.L., & Gollwitzer, P.M. (2005). Implementation intentions and health behaviors. In M. Conner & P. Norman (Eds.), *Predicting health behavior: Research and practice with social cognition models* (2nd ed., pp. 276–323). Buckingham, UK: Open University Press.
- Shepperd, J. A., Rothman, A. J., & Klein, W. P. (2011). Using self- and identity-regulation to promote health: Promises and challenges. *Self and Identity, 10*, 407-416. doi:10.1080/15298868.2011.577198
- Srivastava, S., John, O. P., Gosling, S. D., & Potter, J. (2003). Development of personality in early and middle adulthood: Set like plaster or persistent change? *Journal of Personality and Social Psychology, 84*, 1041-1053. doi:10.1037/0022-3514.84.5.1041
- Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics (6th ed.)*. Boston, MA: Pearson Education.
- U.S. Department of Health and Human Services. (2008). *2008 physical activity guidelines for Americans*. Washington DC: U.S. Department of Health and Human Services.
- Van Dyck, D., De Greef, K., Deforche, B., Ruige, J., Bouckaert, J., Tudor-Locke, C. E., & ... De Bourdeaudhuij, I. (2013). The relationship between changes in steps/day and health

- outcomes after a pedometer-based physical activity intervention with telephone support in type 2 diabetes patients. *Health Education Research*, 28, 539-545.
doi:10.1093/her/cyt038
- Vo, P. T. & Bogg, T. (2015). Testing Theory of Planned Behavior and Neo-Socioanalytic Theory models of trait activity, industriousness, exercise social cognitions, exercise intentions, and physical activity in a representative U.S. sample. *Frontiers in Psychology*, 6: 1114.
doi: 10.3389/fpsyg.2015.01114
- Waters, A. J., Burgess, A., Hughes, D. L., Jovanovic, J. L., Miller, E. K., Li, Y., & Basen-Engquist, K. M. (2012). Outcome expectancies and expectancy accessibility in exercise behavior. *Journal of Applied Social Psychology*, 42, 414-439. doi:10.1111/j.1559-1816.2011.00894.x
- Webb, T. L., & Sheeran, P. (2004). Identifying good opportunities to act: Implementation intentions and cue discrimination. *European Journal of Social Psychology*, 34, 407–419.
doi:10.1002/ejsp.205
- Webb, T. L., & Sheeran, P. (2007). How do implementation intentions promote goal attainment? A test of component processes. *Journal of Experimental Social Psychology*, 43, 295–302.
doi:10.1016/j.jesp.2006.02.001
- Webb, T. L., & Sheeran, P. (2008). Mechanisms of implementation intention effects: The role of goal intentions, self-efficacy, and accessibility of plan components. *British Journal of Social Psychology*, 47, 373–395. doi:10.1348/014466607X267010
- Weinstein, N. D., Rothman, A. J., & Sutton, S. R. (1998). Stage theories of health behavior: Conceptual and methodological issues. *Health Psychology*, 17, 290-299.
doi:10.1037/0278-6133.17.3.290

- Wertz, R. T. (1995). Intention to treat: Once randomized, always analyzed. *Clinical Aphasiology*, 23, 57–64.
- White, S.M., Wójcicki, T.R., & McAuley, E. (2012). Social cognitive influences on physical activity behavior in middle-aged and older adults. *The Journals of Gerontology, Series B: Psychological Sciences and Social Sciences*, 67, 18–26.
- Williams, D. M., Lewis, B. A., Dunsiger, S., Whiteley, J. A., Papandonatos, G. D., Napolitano, M. A., & ...Marcus, B. H. (2008). Comparing psychosocial predictors of physical activity adoption and maintenance. *Annals of Behavioral Medicine*, 36(2), 186-194.
- Wójcicki, T. R., White, S. M., & McAuley, E. (2009). Assessing outcome expectations in older adults: The multidimensional outcome expectations for exercise scale. *Journal of Gerontology: Psychological Sciences*, 64, 33-40.
- Wood, W., & Rünger, D. (2016). Psychology of habit. *Annual Review of Psychology*, 67, 289-314.
- Zhang, H., Chan, D. K.-S., & Guan, Y. (2013). Plans are more helpful when one perseveres: The moderating role of persistence in the relationship between implementation intentions and goal progress. *Basic and Applied Social Psychology*, 35, 231-240.

ABSTRACT**A RANDOMIZED TRIAL OF IMPLEMENTATION INTENTION AND
INDUSTRIOUSNESS TRAINING FOR EXERCISE INITIATION AND MAINTENANCE**

by

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The current study tested the utility of a personality-informed approach combined with implementation intention formation to increase exercise initiation and maintenance. Participants ($N = 221$) were randomized to one of three research conditions and participated in a baseline psycho-educational group session. Participants returned individually for 3-week and 2-month follow ups. There were no statistically significant differences found among participants with regard to step rate at the end of the 3-week tracking period. However, effect size calculations at the 2-month follow up indicated that participants in the industriousness group showed the most increase in their exercise and industriousness levels while participants in the implementation intention group showed the most increase in levels of self-efficacy. These findings provide initial evidence that industriousness levels could be effectively increased when linked with exercise behavior monitoring and that increases in exercise levels are most pronounced when information and planning methods are combined with realistic appraisals of one's efforts for exercise. The current research suggests that personality-informed frameworks represent a promising intervention modality that may provide useful insight into processes of behavioral maintenance.

AUTOBIOGRAPHICAL STATEMENT

Phuong Vo graduated from Kalamazoo College in 2009 with a Bachelor of Arts, majoring in Psychology and minoring in Anthropology/Sociology. She is currently a doctoral student working with Dr. Tim Bogg in the Cognitive, Developmental, and Social-Personality Psychology area at Wayne State University. Her research focuses on examining health-promoting behavioral initiation and maintenance through a personological perspective. She is also interested in testing interventions to increase exercise, reduce sedentary behavior, and improve diet. Other areas of interest include examinations of how personality traits might interact to influence health behaviors across the lifespan.